Dry Weather and MS4 Analytical and Field Screening Monitoring Procedures Manual

County of San Diego, Department of Public Works
Watershed Protection Program

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I. PURPOSE

This document describes the process and procedures for field site visits and the collection of surface water samples during dry weather flows and investigation procedures for the detection of illicit connections and illegal discharges (IC/ID) to and from the County of San Diego Municipal Separate Storm Sewer System (MS4). This Dry Weather Analytical and Field Screening Monitoring Program (hereinafter Dry Weather Monitoring Program) is required under the Urban Runoff Permit, Order No. R9-2007-0001, NPDES No. CAS0108758, Section D.4.c. The County of San Diego, Department of Public Works (DPW) Watershed Protection Program is responsible for implementing this program. A new requirement of the Permit is an MS4 outfall monitoring program, begun as a pilot program in 2008 and fully implemented in 2009. The purpose of the program is to characterize pollutant discharges from MS4 outfalls and to assess whether these discharges contribute to the water quality problems in the receiving waters and to ascertain the relative urban runoff contribution to the receiving waters.

II. SCOPE

The purpose of this Dry Weather Monitoring Program is to detect and eliminate illicit connections and illegal discharges to the MS4 using geographically widespread dry weather discharge monitoring and follow up investigations. All Watershed Protection Program, Science and Monitoring staff responsible for collecting, analyzing and investigating dry weather flows, shall implement the procedures described below and follow the quality assurance and quality control plan as described in the Dry Weather Monitoring Program Quality Assurance Project Plan (QAPP).

III. TRAINING

All staff conducting activities directly related to the implementation of the Dry Weather Monitoring Program, and the related activities described in this Manual, must receive training prior to their involvement in such activities. Training will consist of: review of safety procedures, use of field sheet including field observations, flow estimation, and field sampling, calibration of field instruments, use of field screening test kits, and procedures for conducting an IC/ID investigation.

IV. DEFINITIONS

Blank Solution - Solution that is free of the analyte(s) of interest. Such a solution would be obtained from the laboratory (reagent grade D.I. water).

Duplicate Sample - Two discrete aliquots collected from the same sample location at the same time.

Field Blank - Laboratory sterilized water (blank solution) that is subjected to all aspects of sample collection, field processing, preservation, transportation, and laboratory handling as an environmental sample.

Grab Samples - A specific location at a given time is represented by a discrete aliquot. The sample is collected all at once and at only one particular point in the sample medium.

Matrix Interference - Also referred to as matrix effects. Matrix interference is a chemical and/or physical interference that impedes the analytical instrumentation in detecting the true value concentration of a target analyte within a sample. One possible source of matrix interference may be caused by contaminants that are co-extracted from the sample and result in a positive or negative bias. The extent of matrix interferences will vary considerably from source to source, depending upon the nature and diversity of the sample matrix.

MS4 - Municipal Separate Storm Sewer System.

Outlier - A datum that appears to deviate markedly from that of other members of the sample in which it occurs.

Quality Assurance (QA) - All those planned or systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

Split Sample - The collection of one discrete aliquot split into two discrete sample aliquots. Each sample is analyzed for the same parameters.

V. BACKGROUND AND SAFETY PRECAUTIONS

Dry weather monitoring will not occur when the sampling environment and/or discharges create hazardous conditions (e.g. diesel spill to a creek) or when there is any rain event > 0.1 inch. Seventy-two (72) hours must pass from the end of the storm event before dry weather monitoring can be resumed. Use the following safety precautions at all times when conducting dry weather monitoring and be sure to heed all warnings and precautionary statements. This program is intended to assess dry weather conditions.

- Do not sample during dangerous conditions such as high winds, lightning storms, or flooding conditions.
- Do not remain in open areas or stand under trees if lightning is occurring in the vicinity.
- Do not enter a conveyance if it is raining. Staff should not be sampling during any rain event. If adverse conditions develop while in the field, return to the vehicle and if necessary return to DPW Headquarters.
- Do not enter confined spaces.
- Wear appropriate attire (i.e. hat, safety boots, gloves, and long pants).
- Be aware of your environment! Watch for: snakes, ticks, bees, poison oak, and stinging nettle (see Appendix 1 for photos).
- Be familiar with Material Safety Data Sheets (MSDS) for all chemicals used in the field and when calibrating instruments. Know the health hazards and emergency medical treatments, and follow proper disposal instructions.
- Keep a first aid kit and fire extinguisher in the vehicle.
- Make sure accident reporting packet with film camera is in the vehicle.
- Park vehicle off road if possible, turn hazard light on, and place orange safety cones out if you are parking near traffic lanes.
- Watch out for traffic along the access road when sampling or making observations.

- Watch your step; the ground may be wet and slippery, steep, or unstable. Rocks may be loose. Do not attempt to climb down unsafe slopes. Return another day.
- Always wear clean disposable gloves when sampling.
- Protect eyes and skin against contact with acids and other preservatives.
- Use a backpack when transporting sample bottles from the sample location back to the ice chest in the vehicle.

Safety Equipment

The following safety equipment is required during dry weather monitoring:

- First aid kit
- Safety glasses
- Hat
- Disposable gloves
- Proper safety boots
- Snake guards
- Safety vests
- Orange traffic cones
- Sun screen
- Insect repellent containing DEET
- Cell phone
- Drinking Water

VI. RESPONSIBLE PERSONNEL

Field Staff

- Calibrate and maintain equipment
- Follow sample collection procedures
- Follow record keeping procedures
- Conduct initial IC/ID investigations

Dry Weather Database Coordinator

- Maintain all electronic and hard copy data received from the laboratory
- Maintain field datasheets in the appropriate binder

Quality Assurance Officer

- Conduct routine QA/QC on analytical data
- Conduct routine QA/QC on field data
- Verify database entries
- Verify instrument calibrations, and upkeep of all required log sheets.

Watershed Coordinators

- Verify sample locations are within County MS4

- Coordinate dates and locations for sampling events
- Enter your specific watersheds' data sheets and follow database entry procedures.
- Lead IC/ID investigations in your specific watershed(s)

VII. EQUIPMENT

The Dry Weather Monitoring Program Manual is required to perform monitoring while in the field. All applicable equipment and supplies needed to implement this program are listed in Appendix 2. The field screening analyses are performed using the following equipment:

- Horiba U-10, 5-parameter probe
- Chemetrics V-2000 Photometer (handheld spectrometer) and CHEMetrix® reagent kits.
- Global Flow Probe, (arrow points downstream with the current).

Equipment Maintenance:

- Field staff will maintain clean and properly functioning equipment at all times.

- The viability of field screening test kit reagents will be assessed periodically by noting the reagent expiration dates on the reagent's package.

- The Horiba U-10 Meter is to be calibrated before each day of use using the AutoCal solution provided by the manufacturer following the procedure in Appendix 3. All calibration results will be documented in the calibration log sheet. Care should be taken to keep calibration solution uncontaminated. Calibration solutions should be changed weekly, and should not be used after the expiration date. Keep waste solutions properly contained! The Horiba U-10 Meter needs to be post-field checked after each day of use using the pH 7 and pH 10 solutions.

- Field meters and cameras must be in proper working order. Make sure that batteries have sufficient voltage to power the equipment for the entire field trip.

- Recharge or replace batteries as necessary. Keep extra batteries in the instrument case. Probes should be inspected, cleaned and reconditioned regularly.

- Clean and rinse all other sampling equipment after returning from the field.

- Sample containers used in the field (e.g. graduated cylinders for sample dilutions, test kit flasks and / or beakers) should be cleaned immediately after use. Rinse three to four times with deionized water. Rinsewater from test kit cleaning must be poured into the waste container.

- Supply of containers used for analytical laboratory analysis should be checked and restocked as needed.

VIII. PROCEDURES

Field Site Visits

1. Introduction

The Dry Weather Monitoring Program is intended to be a tool to detect illicit connections and illegal discharges (IC/ID) into the County of San Diego's MS4. The dry weather analytical monitoring and field screening sampling requirements were clarified during discussions between the Copermittees' Monitoring Workgroup and the San Diego RWQCB. The parties agreed that each Copermittee would collect a grab sample for laboratory analysis at a minimum of 25% of the sites where ponded or flowing water was observed. In addition, the Copermittees were required to perform field screening at each identified station a minimum of one time between May 1st and September 30th of each year. Sample locations should be identified and located each day prior to leaving the DPW facility. Appendix 14 lists all County of San Diego sample locations for the 2012 dry weather season.

Monitoring will not be conducted during any rain event >0.1 inch or within 72 hours of the end of any such rain event, or if local hydrologic conditions indicate that storm flow is still occurring at a site after a rain event. If rain is scattered, check if rainfall occurred within the watershed to be sampled. If staff is in the field and the weather turns to rain, staff should discontinue sampling and return to DPW headquarters. If weather conditions are suspect, verify conditions prior to departure to sampling locations using the following sources:

- Department of Public Works Flood Control Section at (619) 495-5557 (7:00 am - 4:00 pm weekdays).

National Weather Service weather forecasts 24-hour recorded message at (619) 289-1212 or http://www.wrh.noaa.gov/sgx/

2. MS4 Sampling

Targeted Sampling Approach

The targeted sampling approach focuses monitoring efforts on those MS4 outfalls that are most likely to contribute to receiving water problems (e.g., the largest potential pollutant loadings). The Program intends to collect 200 discharge samples from targeted MS4 outfalls in the region. The choice of 200 was based on the realistic number of MS4 outfalls that have water during dry weather and are most likely to contribute to receiving water problems in the region. To fairly distribute the 200 samples across the region, a formula based on population and land area within a watershed management area was used.

Sampling methods

For this program the dry weather sampling period is defined as the period from May 1 (but at least 4 weeks after a 0.2 inch or greater rainfall) through August 1 not including any periods less than 72 hours after a rainfall of 0.1 inch or greater.

Sample Collection

Dry Weather Samples

Random and targeted dry weather samples will be collected as grab samples. **<u>Only</u>** analytes listed in Appendix 15 will be sampled. Dry weather flow in the outlet discharging to receiving water will be measured quantitatively using standard USGS protocols (Rantz, 1982). If the discharge flows are too small to measure with instrumentation, the indirect methods described by USGS may be used to estimate flow (e.g., float method, Manning formula). For each site sampled, a field sheet will be filled out.

3. Field Sheets / Documentation

Field sheet documentation is the most critical aspect to conducting dry weather monitoring. Each site visit must have a Dry Weather Field Monitoring Sheet filled out (Appendix 4) at the time of the site visit and be assigned a unique sample event ID number from the Sample Event ID log sheet (kept in the vehicle or field backpack). All information fields (observations and measurements) on the sheet should be filled in. If a site visit triggers an IC/ID investigation a new field sheet should be filled out and assigned its own unique Sample Event ID Number. The Sample Event ID Number will be obtained from the Dry Weather Sample Event ID Number Table each time a sample is collected. Special care must be taken to insure that each sample event or site visit has a unique number assigned to it. This Sample Event ID Number is the primary reference number in the Dry Weather database for each unique sample and should be recorded on all related documents pertaining to that sample (i.e. Chain of Custody). All documentation should be filled out accurately and neatly.

If a parameter was not measured "N/A" or a cross out line should be placed in the applicable cell. This ensures that the parameter was not overlooked. If a field screening analysis is over-range then "Over Range" should be placed in the applicable cell and re-measure the sample using a dilution (procedure in Appendix 8) and noting the dilution ratio in the "Dilution (Dil.) Factor" cell and the field screening analysis reading in the "Dilution (Dil.) Reading" cell on field sheet. If a measurement was recorded inaccurately, a line should be drawn through the error, correct result noted, and the person responsible for documenting the results should initial and date the correction. This is good practice for correcting any written errors on any documents.

4. Field Observations

Qualitative field observations must be made during each site visit when ponded or flowing water is observed. These observations are intended to provide a general assessment of the site and include variables like weather, odor, water clarity, presence of floatable matter, visible deposits / stains, vegetative coverage and biological status (detailed discussion in Appendix 5). If a location is dry, a datasheet must be filled out noting the lack of water and current weather condition. Evidence of past or present IC/IDs to the MS4 can often be ascertained by careful field observations. Each field screening location should be photographed to provide additional information and documentation of site conditions. In addition to providing important descriptive information, photos serve as an official record of the site visits, a visual record of the condition of the pipes, structures and the surrounding environment, and can assist other staff in locating the site in subsequent visits. At least one photograph should be collected at each site visit. If a site is new, one photograph looking upstream and one looking downstream should be taken.

5. Flow Measurements Procedures

A flow measurement should be made during each site visit where flowing water is observed. Flow measurements can be used to estimate pollutant mass loading, prioritize storm drains for future investigations, or to identify significant changes in flow that may be indicative of an illegal release upstream. Since a majority of sample locations lack a permanent flow measurement installation, several field methods may be employed to estimate flow rate. If water is ponded, take width, length, and depth and record velocity as zero (0).

Velocity-area method
The most practical method for measuring the discharge of a stream is the velocity-area method. This method requires the physical measurement of the cross-sectional area and the velocity of the flowing water. Discharge is determined as the product of the area times the velocity.

Discharge (ft^3/sec) = Velocity (ft/sec) x Depth (ft) x Width (ft)

Using the Global Flow Probe, measure the velocity of the water flow (see flow probe instruction in Appendix 6). Use the measurement marks on the probe to measure the stream width and depth. Note: The probe markings are in tenths of a foot, therefore, you read directly from the markings and do not need to make any conversions. Record results on the datasheet; the Dry Weather database will calculate the discharge flow.

Fill a bottle method
If conducting an IC/ID investigation on an outfall, staff should record information on the diameter of an outfall for the determination of the discharge flow. The rate can be determined by measuring the length of time it takes to fill a 1-Liter bottle. This method is very helpful for low-flow situations.

Partially filled pipe method
Another method for measuring flow is the partially filled pipe method. This method is helpful when you have a substantial flow coming from an outfall. For this method all measurements must be converted to a common unit before calculation (ft, in, or cm). Measure the water depth and inside pipe diameter and apply the following formula using the partially filled pipe formula chart in Table 1.

- Let D = water depth.
- Let d = *inside* pipe diameter
- Calculate D/d.
- Find the tabulated (Ta) value on the partially filled pipe formula chart below using the D/d value. (i.e. if D/d = 0.263 then Ta =0.1623).
- Find the area using the formula
  $a = Ta*d^2$.
- Multiply area (a) by the water velocity.
- Convert to desired value.

*Table 1: Partially Filled Pipe Formula Chart *(Clarify values in first row and column)**

Calculating the Area (a) of the Cross Section of a Circular Pipe Flowing Partially Full										
D = Depth of water d = diameter of the pipe		a = area of water in partially filled pipe Ta = Tabulated Value					Then a = Ta*d2			
D/d	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.0000	0.0013	0.0037	0.0069	0.0105	0.0147	0.0192	0.0242	0.0294	0.0350
0.1	0.0409	0.0470	0.0534	0.0600	0.0668	0.0739	0.0817	0.0885	0.0951	0.1039
0.2	0.1118	0.1199	0.1281	0.1365	0.1440	0.1535	0.1623	0.1711	0.1800	0.1890
0.3	0.1982	0.2074	0.2187	0.2280	0.2355	0.2450	0.2540	0.2642	0.2780	0.2836
0.4	0.2934	0.3032	0.3130	0.3220	0.3328	0.3428	0.3527	0.3627	0.3727	0.3827
0.5	0.3980	0.4030	0.4130	0.4230	0.4330	0.4430	0.4520	0.4620	0.4720	0.4820
0.6	0.4920	0.5020	0.5120	0.5210	0.5310	0.5400	0.5500	0.5590	0.5690	0.5780
0.7	0.5870	0.5960	0.6050	0.6140	0.6230	0.6320	0.6400	0.6490	0.6570	0.6660
0.8	0.6740	0.6810	0.6890	0.6970	0.7040	0.7120	0.7190	0.7250	0.7320	0.7360
0.9	0.7450	0.7500	0.7560	0.7610	0.7660	0.7710	0.7750	0.7790	0.7820	0.7840

6. Sampling Procedures

The permit requires that we perform field screening at each identified station a minimum of one time between May 1st and September 30th of each year if flow or ponded runoff is observed at a dry weather station and there has been at least 72 hours of dry weather. Field screening involves making observations, collecting at least one grab sample (for: nitrate, phosphate, ammonia, and MBAS), measuring water quality properties (for: pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity), recording general information, site descriptions, instantaneous flow estimation, and visual observations on a dry weather field monitoring sheet as stated in the Permit. Do not collect ponded water samples for indicator bacteria after the initial permitted required sample has been completed.

All samples are to be analyzed in the field for the physical and chemical constituents as stated in the Permit and are included in Table 2 below. A grab sample may be brought back to the DPW lab for analysis of nitrate, phosphate, ammonia, and MBAS if time is limited. Sample should be transported on ice. Make a note on the field sheet if this is done (all attempts should be made to do the field measurements at the actual sample site). The analytical laboratory analysis will be conducted at a minimum of 25% of the sites where ponded or flowing water is observed. Table 3 provides a summary of all field screening and analytical laboratory analysis parameters available for the Dry Weather Monitoring Program and for use in site investigations.

Physical Water Quality Properties Collection

Use the Horiba U-10, 5-parameter probe to collect pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity. The Horiba U-10 sensor body must be fully submerged in the water so that all sensors are covered. The sensors should be pointed upstream so that the water flows through and around them. Place sensor in a representative portion of the creek and turn the Horiba on. Wait approximately one (1) minute for the sensors to equilibrate. Also note that you may need to wait up to five minutes with the “Turbidity” mode selected for the turbidity reading to stabilize, especially if the water is cold. This warm-up period is necessary to avoid erroneously high turbidity readings. Start with the conductive measurement and work on through the parameters, taking care to let the values stabilize at each parameter.

In accordance with SWAMP recommendations (SWAMP, 2014), dissolved oxygen measurements with the Horiba U-10 5-parameter probe must be conducted as follows: The D.O. probe must equilibrate for at least 90 s before D.O. is recorded to the nearest 0.1 % saturation or mg/L. If the flow velocity of the creek is slow (i.e. less than 0.50 feet/second), manual stirring must be provided by raising and lowering the probe at a rate of 1 ft/s (0.3m/s) without agitating the water surface (taking care not to lift the sensor out of the water while agitating), in order to obtain a proper D.O. reading (only D.O. is affected by a slow flow velocity). It is recommended that the D.O. be done last if you are at a site with slow flow velocity. If the level of the water is too low and will not cover the sensor, the Horiba measurements can be made in a clean, triple-rinsed beaker or Nalgene bucket. In order to obtain an accurate D.O. reading in the beaker or bucket, the probe needs to be agitated for approximately 30 second at a rate of approximated 1 ft/s prior to and during the reading. The water can be collected with a syringe or clean sample cup (triple-rinsed). Note on the field sheet how the water was collected if the measurements were done in a beaker or bucket.

Field Sample Collection

Grab samples (see below for Oil and Grease grab sample procedure) are to be collected by standing downstream and submerging the sample container immediately below the water surface in the upstream direction, disturbing as little of the bottom material as possible. If practical, collect the sample at about 60% of the stream depth (from the surface) in an area of maximum turbulence (except when sampling for volatile organics). If the water level is very low, collect the water sample using a clean syringe and fill sample container. Note on the field sheet if a syringe was used for sample collection. Avoid sampling the slowly flowing water near the edge of stream, unless intended. For Oil and Grease grab sample collection, fill bottle with water at the water-air interface, and avoid collecting sediments.

Trash Assessment

Trash assessments will be conducted at established Dry Weather and MS4 field screening locations. The Trash Assessment Form (see Appendix 17) will be completed at each location during each monitoring event. Each of the selected locations will be assessed for trash at least once between May 1st and September 30th of each year. For each site, there should be a general consensus among the monitoring team as to the extent of the area to be assessed. The length of the site being assessed should be determined as a channel or shore length. When possible, distinctive site characteristics, such as a large boulder or tree, should be used as starting/finishing length landmarks. The upper boundary of each bank should be used for the width of the monitoring site. This can be determined visibly by either a debris or water line. When determining site boundaries, it is important to remember that the intent of the trash assessment is to determine the trash which has been mobilized or has the potential to be mobilized by water at the defined locations.

Upon arrival at a designated site, a qualitative estimate of the presence of trash should be determined and documented in the top portion of the Trash Assessment Form (Appendix 17). This is a qualitative assessment which should reflect a first impression of the site. There are five categories to describe the amount and extent of trash at each site:

Optimal: On first glance, no trash is visible. Little or no trash (<10 pieces) is evident when the evaluated area is closely examined for litter and debris.
Suboptimal: On first glance, little or no trash is visible. After close inspection, small levels of trash (~10-50 pieces) are evident in the evaluated area.
Marginal: Trash is evident in low to medium levels (~51-100 pieces) on first glance. Evaluated area contains litter and debris. Evidence of site being used by people: scattered cans, bottles, food wrappers, blankets, or clothing are present.
Submarginal: Trash distracts the eye on first glance. Evaluated area contains substantial levels of litter and debris (>100-400 pieces). Evidence of site being used frequently by people: many cans, bottles, food wrappers, blankets, or clothing are present.
Poor: Site is significantly impacted by trash. Evidence of trash accumulation behind a constriction point or evidence of excessive dumping. Evaluated area contains substantial levels of litter and debris (>400 pieces).

Sites will also be evaluated to determine the threat to human health and/or threat to aquatic health. In some cases, sites may pose a threat to both categories. The evaluation of each category is presented as follows:

Threat to Human Health – Site poses a threat to human health via swimming, wading, or walking through the area. Trash and debris has the potential to contain chemicals that may bioaccumulate, transmit dangerous bacteria (e.g. medical waste, diapers, human waste), or has the potential for physical harm (sharps, entanglement, nails, etc.). Comments should be added at the bottom of the field sheet for clarification.

Threats to Aquatic Health – Site poses a threat to aquatic health or wildlife (via contact, ingestion, entanglement, etc.) from the trash and debris present. Trash and debris such as small floatable material that is persistent and can be transported long distances may resemble food and may be ingested. Wire, plastic, fishing line and other material that has the potential for entanglement. Oil and other visible chemicals or chemical containers fall into this category. Comments should be added at the bottom of the field sheet for clarification.

If the quantity of trash falls into the submarginal or poor category, assessments of the type(s) of trash present, the potential trash mobilization route and the potential source will occur. Categories of trash types listed on the form include:

Automotive
Biohazard Waste
Business-Related
Cigarette Butts
Construction
Fabric/Clothing
Food Packaging
Food Waste
Household
Shopping Carts
Toxic
Yard Waste

The types of trash present should be ranked in order of their prevalence (from 1 to 12, where 1 is the most prevalent and 12 is the least prevalent (it is not necessary to go up to 12 if the specific trash categories are not present). Next, the user should try to determine the potential mobilization route for the trash (e.g., dumping, littering, or upstream sources). If the route is unknown, then it may be described as “unable to determine”. Finally, the user should check the potential sources of trash. The form includes the following source categories:

Household
Construction
Commercial
Industrial
School
Transient

Again, if the source is unknown, the form includes the category “unable to determine”. Prior knowledge of the surrounding area will help when making assumptions about the potential route and sources of trash present.

Analytical Laboratory Sample Collection

Samples for analytical laboratory analysis need to be collected in the appropriate containers (see Tables 3 and 4 for container type, holding time and necessary preservative for each analyte). The contracting laboratory will provide the appropriate pre-cleaned sample containers with preservative added (see Appendix 7). Samples are to be collected by standing downstream and at the horizontal and vertical center of the stream/creek flow for a more representative sample of the whole stream. When sampling, make sure the container opening faces upstream. For shallow water (i.e. less than 6-inches deep), it will suffice to fill the bottle from the surface of the stream rather than sample mid-depth. For deeper water, sample mid-depth by leaving the lid on the sample bottle and lowering the bottle to the mid-depth position, then removing the lid and allowing the container to fill. Be sure to firmly screw cap on the container to prevent leakage. If water level is very low, collect the water sample using a clean syringe and fill appropriate sample container. Note on the field sheet if a syringe was used for sample collection. Avoid sampling the slowly flowing water near the edge of stream, unless intended. Store all samples in an ice chest with ice at approximately 4o C until custody is transferred to the analytical laboratory directly or via contracted courier.

Note: Bacteria samples must be delivered to the laboratory within 6 hours of collection.

Table 2: Field Screening Monitoring Parameters

Parameter	Method		Units	Reporting Limit
pH	Glass electrode	Horiba U-10	pH unit	0.1
Conductivity	Alternating 4-electrode		mS/cm	0.001
Turbidity	Light scattering/ absorption		NTU	1
Dissolved oxygen	Membrane/ galvanic cell		mg/L	0.01
Temperature	Thermistor		^{o}C	0.1

Nitrate NO_3^-	Colorimetric	V-2000	mg/L	10.0
Orthophosphate PO_4^{3-}	Colorimetric		mg/L	0.20
MBAS	Colorimetric		mg/L	0.15
MBAS	Colorimetric	Color-wheel	mg/L	0.125
Ammonia NH_4^+	Colorimetric		mg/L	0.05

Table 3: Summary of Field and Laboratory Sampling and Analysis Requirements: Dry Weather Monitoring

Physical and Inorganic Non-Metals	**Permit Requirement?**	**Analytical or Field Method**	Container[1]	Volume (mL)	Preservative (+ 4° C)	Holding Time	Detection Limit(s)
Field Screening Parameters							
Turbidity	Y	Horiba Multiparameter Water Quality Instrument	in situ field measurement			N/A	N/A
pH	Y		in situ field measurement			N/A	N/A
Conductivity	Y		in situ field measurement			N/A	N/A
Temperature	Y		in situ field measurement			N/A	N/A
Dissolved Oxygen	Y		in situ field measurement			N/A	N/A
Ammonia-N	Y	Field Colorimetric[2]	P	250	none	N/A	0.05 mg/L
Dissolved Phosphorous-P	Y		P	250	none	N/A	0.25 mg/L
Nitrate-N	Y		P	250	none	N/A	2.26 mg/L
MBAS	Y	Detergent Test Kit[3]	P	250	none	N/A	0.125 mg/L
Laboratory Analytical Parameters							
Oil and Grease	Y	EPA 1664	G	1000	HCl	28 d	1.0 mg/L
Diazinon	Y	EPA 8081	G	1000	none	7 d	0.05 ug/L
Chlorpyrifos	Y				none		0.05 ug/L
Malathion	N				none		0.05 ug/L
Total Hardness	Y	SM 2340C	P	500	none	6 months	2.0 mg $CaCo_3$/mL
Cadmium (dissolved)	Y	SM 2060	P	500	none	6 months after filtration and preservation w/ HNO_3	5 ug/L
Copper (dissolved)	Y						5 ug/L
Lead (dissolved)	Y						5 ug/L
Zinc (dissolved)	Y						20 ug/L
Coliform, total[4]	Y	MPN - SM 9221C	P (sterile)	100	$Na_2S_2O_3$	6 hours at 4°C	10/20 MPN/100mL
Coliform, fecal[4]	Y	MPN - SM 9221C	P (sterile)				
Enterococcus[4]	Y	MPN - SM 9230B	P (sterile)				

[1]V=VOA / G=Amber Glass / P=Plastic

[2]Analyzed with Chemetrics V-2000 Water Analysis System - an automatic colorimetric method. Ammonia was measured using a Chemetrics colorimetric test kit using a color wheel beginning July 15, 2002.

[3]Analyzed with Chemetrics detergent test kit - visual colorimetric method using a color wheel in 2008; VVR Water Analysis System in 2009.

[4] 3 extra dilutions for total & fecal Coliform Range: 20 to 1.6 million MPN/100mL and 2 extra dilutions for Enterococcus Range: 10 to 160,000 MPN/100mL

Table 4: Summary of Field and Laboratory Sampling and Analysis Requirements: MS4 Monitoring

Physical and Inorganic Non-Metals	**Analytical or Field Method**	Container[1]	Volume (mL)	Holding Time	Target Reporting Limit(s)	Units
Field Screening Parameters						
Turbidity	Horiba Multiparameter Water Quality Instrument	in situ field measurement		N/A	1	NTU
pH		in situ field measurement		N/A	0.1	pH units
Conductivity		in situ field measurement		N/A	0.001	mS/cm
Dissolved Oxygen		in situ field measurement		N/A	0.01	mg/L
Temperature		in situ field measurement		N/A	0.1	oC
Laboratory Analytical Parameters						
Oil and Grease	EPA 1664	G	1000	14 D	5	mg/l
Diazinon	EPA 8081	G	1000	14 D	0.05	ug/l
Chlorpyrifos					0.05	ug/l
Malathion					0.05	ug/l
TDS	SM 2540C	P	100	7 D	20	mg/l
TSS	SM2540D	P	100	7 D	20	mg/l
Ammonia as N	SM 4500	P	500	28 D	0.05	mg/l
Nitrate as N	SM4500NO3E	P	200	48 H	0.1	mg/l
Nitrite as N	SM4500NO2B	P	200	48 H	0.05	mg/l
Total Kjeldahl Nitrogen (TKN)	SM4500C	P	500	28 D	0.1	mg/l
Total Nitrogen (sum of NO3, NO2, TKN)	Calculated	N/A	N/A	N/A	N/A	N/A
Total Phosphorus	SM4500PE	P	250	28 D	0.05	mg/l
Iron	'EPA 200.7/ EPA 6010	P	250	6 M	20	ug/L
Manganese	'EPA 6010, EPA 200.7/EPA 200.8	P	250	6 M	0.001	mg/l
Sulfates	EPA 300.0	P	250	28 D	0.5	mg/l
Chlorides	EPA 300.0, EPA 325.3	P	250	28 D	0.2	mg/l
Selenium	EPA 200.8	P	75	6 M	0.002	mg/l
Aluminum	EPA 200.8	P	250	6 M	0.005	mg/l
Total Hardness	SM 2340C	P	500	6 M	10	mg/l
Cadmium (dissolved)	SM 2060	P	500	6 M	0.001	mg/l
Copper (dissolved)					0.001	mg/l
Lead (dissolved)					0.001	mg/l
Zinc (dissolved)					0.02	mg/l
Coliform, total[4]	MPN - SM 9221B	P (sterile)	100	6 H	20	MPN/100ml
Coliform, fecal[4]	MPN - SM 9221E	P (sterile)			20	
Enterococcus[4]	MPN - SM 9230	P (sterile)			10	

7. Water Sample Analysis

Field Screening Monitoring Procedures

Each site visit is sampled and analyzed for field screening parameters if flow or ponded water is observed. Collect approximately 250 ml of water for field test kit screening analysis. Test kit procedures are described below. Measured field parameters should be checked against the following decision matrix in Figure 1 and action levels shown in Table 4. Please refer to the "Interpretation of Data" section for further discussion. If a particular parameter being measured is outside of range on the field test kit, a dilution should be run to determine the concentration of the parameter. The appropriate method for diluting a sample is described on Appendix 8. Remember to avoid contaminating the sample.

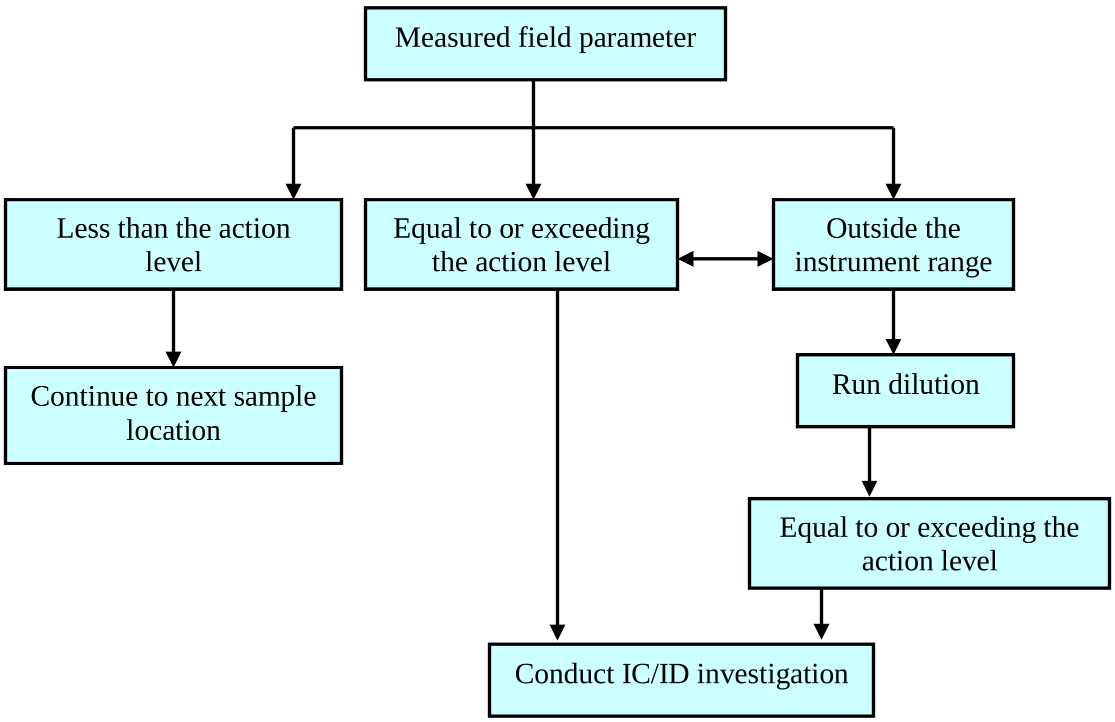

Figure 1: Decision Matrix for Field Screening Analysis

8. QA/QC for Field Analysis

Field Staff should refer to the Dry Weather Monitoring Program Quality Assurance Project Plan (QAPP) for QA/QC procedures and schedules. **Field duplicate samples** should be collected for every ten samples. Collected data should include field test kit data, Horiba data, and laboratory grab samples, on a new field sheet and with a time of five minutes apart from the original sample collection time. When collecting a grab sample for duplicate analysis use two sample containers to collect two discrete aliquots. When collecting a grab sample for split analysis, use one large sample container and split this into two separate aliquots at the field station. To collect a duplicate set of physical parameter readings using the Horiba multi-sensor probe, the sensor should be left in place in the stream and **not moved** once the first set of readings is recorded. The Horiba should be turned off for about 30 seconds and then switched back on to take the second set of readings. **Reagent grade D.I. water blank samples** should be collected for every 20 samples. Collected data should include field test kit data, Horiba data, and laboratory grab samples, on a new field sheet and with a time of five minutes apart from the original sample collection time.

9. Field Screening Test Kit Methods

Dry Weather field screening analyte testing is conducted using a V-2000 water analysis photometer and field test kits. Each test kit contains a sample mixing container, necessary reagent-filled ampoules and an ampoule filled with distilled water for zeroing the hand-held photometer.

Note: Dispose of all spent reagents, reacted samples, and rinsewater solutions into the appropriate waste container stored in the field vehicle.

Nitrate (NO_3)

1. Add 2 ml of sample using syringe into mixing container
2. Dilute to 15 ml mark with D.I. water
3. Pour cadmium packet into mixing container and cover with cap
4. Place in Vortex-Genie (on setting 7 to 8) or shake vigorously by hand for 3 minutes
5. Let stand for two minutes **(Very important step!)**
6. Decant 10ml of the treated sample into a second sample cup, being careful not to transfer any cadmium particles to the sample cup
7. Break ampoule in sample cup to suck up sample, invert several times to mix, and wait 10 minutes for color development
8. Place zeroing ampoule in V-2000, cover with light shield and press the **zero** key
9. Press the **prgm** key, enter **121**, insert ampoule to be tested, cover with light shield and press **meas** key (note; if wait time has elapsed, press the **timer** key to bypass countdown)
10. Read the V-2000 sample value in milligrams/Liter for NO_3 and record in appropriate cell

<u>Test kit</u>: CHEMetrics Catalog K-6933, Vacu-vials refill: CHEMetrics Catalog R-6903.

Orthophosphate (PO_4)

1. Fill mixing container to 25ml mark with sample
2. Add 2 drops of phosphate activator solution A-8500
3. Cap and shake mixing container for 30 seconds until well mixed
4. Break ampoule in mixing container to suck up sample, invert several times to mix, and wait 3 minutes for color development.
5. Place zeroing ampoule in V-2000, cover with light shield and press the **zero** key
6. Press the **prgm** key, enter **159**, insert ampoule to be tested, cover with light shield and press **meas** key (note; if wait time has elapsed, press the **timer** key to bypass countdown)
7. Read the V-2000 sample value in milligrams/Liter for PO_4 and record in appropriate cell.

Test kit: CHEMetrics Catalog K-8513, Vacu-vials refill: CHEMetrics Catalog R-8513, Activator solution: A-8500.

Ammonia (NH_3-N)

1. Fill mixing container to 25ml mark with sample
2. Add drops of the ammonia stabilizer solution A-1500 (see table below for quantity; the higher the conductivity, the greater number of drops needed)

Conductivity (mS/cm)	Number of Drops
Less that 1.0	5
1 .0 to 3.0	10
3.0 to 5.0	15
Greater than 5.0	20

3. Stir with the ampoule for approximately 30 seconds
4. Break ampoule in mixing container to suck up sample, invert several times to mix, and wait 2 minutes for color development.
5. Read sample value using the color comparator in milligrams/Liter for NH_3-N and record in appropriate cell.

Test kit: CHEMetrics Catalog K-1510, Vacu-vials refill: CHEMetrics Catalog R-1510, Activator solution: A-1500.

MBAS, Field Test Kit with Color Wheel

1. Rinse the reaction tube with sample, and then fill it to the 5ml mark with sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip-breaking tool.
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube.
4. Cap the reaction tube and shake it vigorously for **30 seconds.** Allow the tube to stand undisturbed for approximately **one minute.**
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against the side of the reaction tube. The ampoule should draw in fluid only from the organic phase (bottom layer).
7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMet ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMet ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end each time.
9. Place the CHEMet ampoule, flat end downward into the center tube of the comparator. Direct the top of the comparator up toward a source of bright light while viewing from the bottom. Rotate the comparator until the color standard below the CHEMet ampoule shows the closest match. If the color of the CHEMet ampoule is between two color standards, a concentration estimate can be made.

10. A grab sample should be taken and submitted to the analytical laboratory for analysis if the MBAS is above the action level due to a high level of false positives observed with the field test kit.

MBAS, Spectrophotometer

1. Rinse the red-tipped plastic dropper bottle with the sample to be tested, then fill it to the fill line with sample (15ml).
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip-breaking tool.
3. Invert the ampoule and position the open end over the dropper bottle. Snap the upper tip and allow the contents to drain into the dropper bottle.
4. Cap the dropper bottle and shake it vigorously for 30 seconds. NOTE: While shaking the bottle, apply pressure to the red cap with your thumb to ensure that no leaking occurs.
5. Allow the dropper bottle to stand upright and undisturbed for **one minute.** The layers should separate in the dropper bottle. NOTE: During the one-minute wait, gently loosen the screw cap to release the pressure created by the shaking, then re-tighten the cap.
6. After the one-minute wait, remove the red cap from the dropper bottle, then gently (slowly) invert the dropper bottle over a test tube and squeeze the bottle to deliver the chloroform layer **only** into the test tube. Stop squeezing when the dark blue layer can be seen in the tapered tip of the dropper bottle. NOTE: The dark blue liquid remaining in the dropper bottle should be disposed of and the dropper bottle should be rinsed out well for use with the next test.
7. Allow the test tube to stand upright and undisturbed for **four minutes**.
8. Read the test tube in your spectrophotometer. Use the calibration table to obtain test results in ppm (mg/L) LAS.

Test kit: CHEMetrics Catalog K-9403, Instrumental Kit; CHEMetrics Catalog I-2017, Detergents Single-Analyte Photometer (SAM) Kit.

Analytical Laboratory Analysis

1. Introduction

At a minimum of 25% of the sites where ponded or flowing water is observed, grab samples must be collected and submitted to a California Department of Health Services - ELAP certified laboratory for analysis of the constituents stated in Table 4. Be sure to collect necessary samples in the appropriate container provided by the laboratory (Appendix 7). If sample contains a preservative be sure to handle the container appropriately and avoid contaminating sample or spilling preservative. Staff should contact receiving personnel at the laboratory to arrange for the pick-up of sample containers for each week sampling needs (via e-mail, or see FAX order form in Appendix 9). Staff should give the laboratory one-week notice to prepare the required containers.

Samples collected for laboratory analysis should be submitted to the laboratory as soon as possible after collection. Bacteria samples **<u>must be</u>** delivered to the laboratory within **six (6)** hours of collection. The following procedures must be followed for analytical laboratory samples collected for both the Dry Weather and MS4 programs:

1. Fill out the chain of custody (COC) form making sure that all sample containers are correctly labeled. Do a bottle count to make sure no bottles are missing.
2. Carefully pack sample containers in the cooler with ice, making sure samples stay cold. Laboratory staff will check the temperature of samples upon arrival at the lab.
3. Ensure that the samples are transported to the laboratory within the appropriate holding times.
4. Complete the chain of custody form at the laboratory. Be sure and obtain a photocopy of the completed, signed and time/date-stamped COC from laboratory staff.

Note: Do not store food or drinks in the ice chest.

2. Chain of Custody

The chain of custody (COC) form (Appendix 10) is an integral part of the Dry Weather and MS4 Programs. It is essential that this be filled out accurately. A chain of custody form must be filled out when a sample is transferred to another individual or laboratory personnel. Field staff must follow strict sampling and chain of custody protocols when conducting Dry Weather and MS4 analytical monitoring. Proper chain of custody records provide critical documentation in enforcement cases involving illegal discharges.

The completed copy of the COC should remain at DPW Headquarters and filed chronologically in a binder at the desk of the Dry Weather Database Coordinator. The COC is a good reference document when reviewing analytical hard copy data and should be reviewed to ensure that the requested analyses were conducted.

3. QA/QC for laboratory Analysis

Field staff should refer to the Dry Weather and MS4 Monitoring Program Quality Assurance Project Plan for laboratory QA/QC protocols and schedules. Laboratory data will be submitted electronically to the Dry Weather Coordinator and Quality Assurance Officer from the contract laboratory. The Quality Assurance Officer should become familiar with the QA/QC procedures of the lab and review QA/QC results to ensure that there are no issues regarding the quality of data submitted. The laboratory QA/QC results are usually documented on "Sheet 2" of the Excel data spreadsheet.

IC/ID Investigation

1. Introduction

At Dry Weather sites, if a parameter is measured and it is equal to or above the action level, an IC/ID investigation must be conducted (Figure 1). Exceptions are made on a case by case basis using best professional judgment for certain parameters (see IX. Interpretation of Data). If the exceedance involves a field measured parameter, the IC/ID investigation must be conducted / started within two business days. If the exceedance involves an analytical laboratory measured parameter, the IC/ID investigation must be conducted / started within two business days after receiving the laboratory results. Staff shall endeavor to identify the source of the discharge or provide the rationale for why the discharge does not pose a threat to water quality and does not need further investigation. Obvious illicit discharges (i.e. color, odor, or significant exceedances of action levels) shall be investigated immediately.

Dry weather flows will generally be followed from the location where they are first observed in an upstream direction along the conveyance system. The Exceedance of Action Level Process flow chart (see Figure 2) is the process followed during an IC/ID investigation. Prior to returning to an IC/ID investigation, field staff should compile and review available resources including past dry weather monitoring reports, GIS land use maps, MS4 maps, available aerial photographs, and property ownership.

Note: Do not enter or sample on privately owned land or jurisdictions other than unincorporated San Diego County.

The following steps to be taken during an IC/ID investigation (to be conducted by County of San Diego staff only):

1. Proceed upstream in conveyance to trace possible source, collect samples at upstream confluences for chemical analyses. (If tracking a nitrate exceedance, nitrate test strips can be used as a screening tool in determining which flows to follow. If tracking a pH exceedance, use pH test strips instead of Horiba if pH is <5.0 or >10.5.)
2. If possible, trace dry weather flow from conveyance to street / storm drains; if possible collect sample for chemical analysis.
3. If dry weather flow is traced to a facility, collect sample at curb or public right of way and submit for chemical analysis. Document with photos. Notify your supervisor for further instructions.
   Note: Always take GPS coordinates at each new site and fill in a datasheet.
4. If the flow is coming from another jurisdiction make a note and notify your supervisor, so a formal notification in writing can be made to a representative of the relevant jurisdiction, informing them of the situation. County staff will not track flows into other jurisdictions.

Illicit Discharge and Elimination Program (Draft 08/04/2004)
Exceedance of Action Level Process

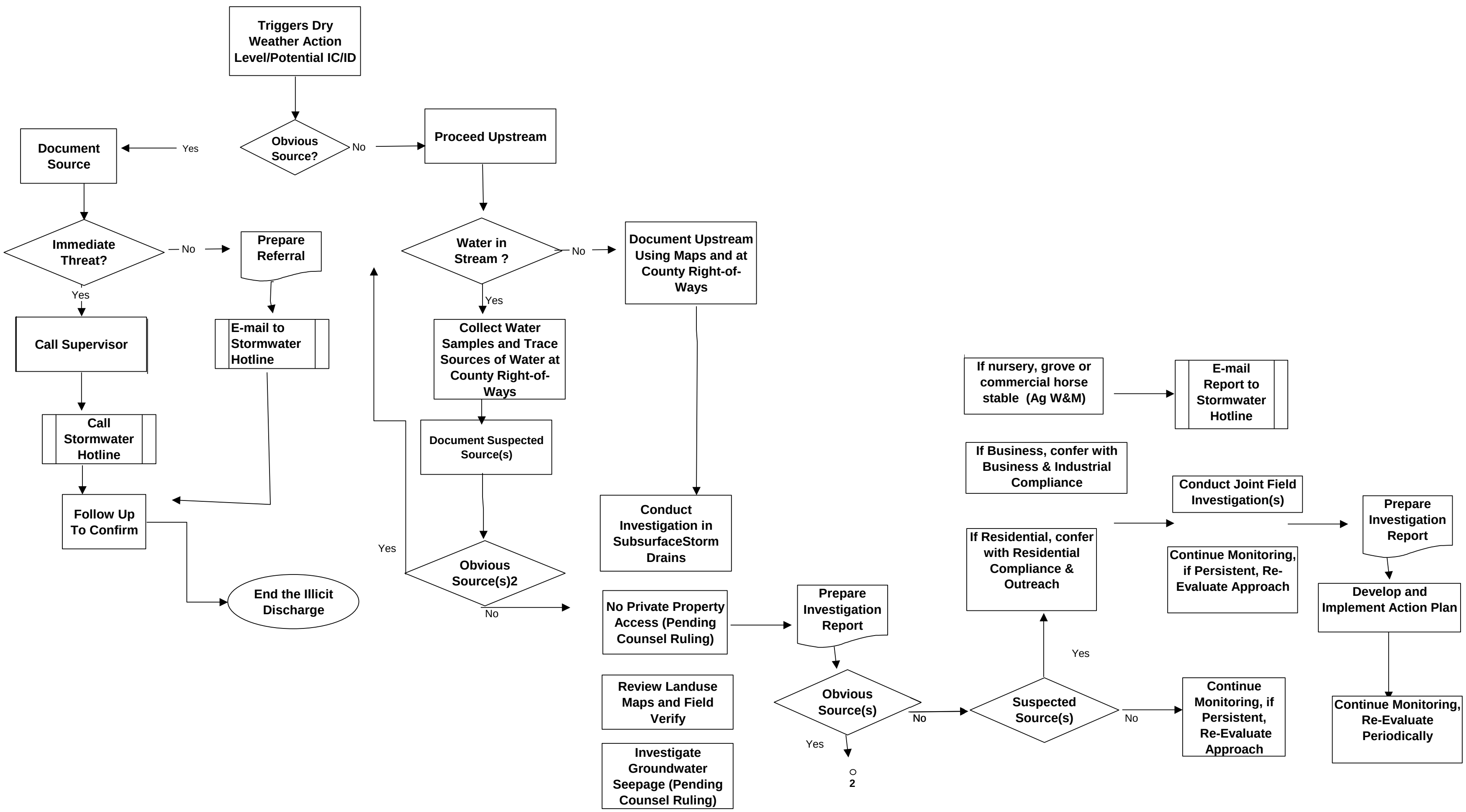

Figure 2: Exceedance of Action Level Process

2. Following Flows

If field staff are initially unable to locate the source of the flow (e.g. the flow is traced to a seep, flow discharges from a pipe, the channel terminates, etc.) consider the following possibilities: first, the flow may originate from a road gutter. Check catch basins and gutters between sites for evidence of flows such as runoff from steam-cleaning operations, car washing, irrigation runoff, etc. There may also be a new or illegal connection to the system, possibly between manholes. Look for areas in the road that have been dug up and re-paved. Also consider checking with the Wastewater Management / Operations and Maintenance Section in DPW for any recent work that may have been done in the area. Finally, look for evidence of recent or past dumping such as wet and / or stained pavement or gutters.

Below Ground Systems
If necessary, contact the Department of Public Works, Road Division for assistance on tracking below ground storm drain systems (Stormwater Strike Team Supervisor for Division 2 (north county) is Anthony Ariosta (760-510-2448) and for Division 1 (south county) George Savage (619-660-5808) and Rick Johnston (619-660-5809)). When tracking flows in below ground systems it may be necessary to follow flows from the outfall or manhole to the next manhole with a junction. Manholes will not always need to be checked if there are no junctions between them. Field staff will record information on the surrounding areas and look for water flowing in gutters and streets. Areas where illegal dumping may typically occur include parking lots and garages behind buildings and warehouses. DO NOT ENTER MANHOLES.

Multiple Outlet Systems
If flow is observed coming from only one outlet, continue tracking from that outlet. If flow is observed coming from more than one outlet, track them one at a time, using visual observations, odors, and/or field screening sampling to determine the order of investigation. It is generally easiest to track the largest flows first, but if they are about the same size, start with the one that is easiest, shortest, or with the least number of junctions, or track those originating from areas with the greatest potential for illegal discharges. (Use nitrate test strips for quick preliminary results for multiple flows.)

3. Post-Investigation Referrals

When an exceedance of a field or analytical parameter has been measured or determined, field staff will conduct the initial IC/ID investigation. Field Staff will follow the procedures outlined in the above sections and illustrated in Figure 2.

Referrals will be based upon the following criteria and best professional judgment:

- If this site was previously investigated for the same parameter and similar levels were observed during previous dry weather sampling years and no source was identified, then discuss site investigation with supervisor to determine future strategies.

- If field staff identifies the source of a discharge, a "Science and Monitoring Referral" document needs to be filled out (see Appendix 12) and send to the supervisor for review. The supervisor will then send the referral to the appropriate responsible party.

- If field staff identify a blocked storm drain culvert, trash/debris/vegetation issue, or other storm drain infrastructure issue, a DPW Road Service Request (see Appendix 13) must be filled out and sent to DPW Roads division (Does not need to go to the supervisor).

- If field staff identifies a trash/debris/vegetation/etc. issue on CalTrans right-of-way, then e-mail the CalTrans point of contact for stormwater, Jay C. Knapp @ 619-688-4255 (jay_c_knapp@dot.ca.gov). In the e-mail include photo of site, location (mile marker if possible), and description of issue and send to the supervisor for review.

Note: If field or laboratory sampling is conducted, appropriate documentation will be completed and submitted to the Dry Weather Database Coordinator (i.e. COC and data field sheets).

IX. INTERPRETATION OF DATA

There are two primary approaches to assist in the interpretation of dry weather monitoring program data. These are (1) the use of numeric action levels (see Table 5), and (2) the use of best professional judgment when interpreting all dry weather water quality data. The numeric action levels were established through the San Diego Copermittees' Dry Weather Monitoring Workgroup in the winter of 2003 and submitted to the RWQCB in April 2003 (bacteria indicators were revised in 2010).

Numeric Action Levels

The use of numeric action levels is the primary approach for interpreting, nitrate, ammonia, orthophosphate, pH, conductivity, MBAS, oil and grease, trace metals, indicator bacteria, and pesticides. If these action levels are exceeded, then a source identification investigation to determine the cause of the elevated levels is necessary unless best professional judgment indicates otherwise.

Best Professional Judgment

The use of best professional judgment is the primary approach for interpreting turbidity and water temperature data, and the secondary approach for interpreting the results of all other field and laboratory analyses. The use of best professional judgment may indicate that results, which either exceed certain action levels or are statistical outliers, may be the result of natural or background factors, and an IC/ID investigation is not warranted.

Conductivity / TDS
If a conductivity exceedance is measured in the field, other factors need to be examined at to determine if an IC/ID investigation is warranted.

1. Does a particular location have a history of exceedances, which previously investigates have found to be due to natural occurrences?
2. Are you in a known high conductivity / TDS area (i.e. Escondido Creek)?

Then staff should note this on the field observation sheet and not conduct an IC/ID investigation. If this scenario does not exist, then an IC/ID investigation is warranted.

Ammonia
If an ammonia exceedance is measured in the field, open a second ampoule and conduct a re-test from the remaining fluid in the mixing container. If the second ampoule also shows an exceedance, immediately collect a new water sample and again test it for ammonia. If this sample still exceeds the action level, then conduct an IC/ID investigation using best professional judgment. Other field parameter and observations need to be examined (best professional judgment) to determine if an IC/ID investigation is warranted.

1. Is the water is ponded or very nearly ponded?
2. Is the dissolved oxygen level low?

If both conditions are met, then nitrate reduction to ammonia may have occurred. A secondary parameter to look at is the nitrate level, if the nitrate concentration is relatively low, then the evidence would point to the chemical reduction of nitrate to ammonia. Staff should note this on the field observation sheet and not conduct an IC/ID investigation. If this scenario does not exist, then an IC/ID investigation is warranted.

pH
If a pH exceedance (pH <6.5 or > 9.0) is measured in the field, other field parameter and observations need to be looked at to determine if an IC/ID investigation is warranted.

1. Are you located in a concrete type conveyance or immediately downstream of a concrete type conveyance?
2. Is the water slowly flowing or very nearly ponded?
3. Is the water temperature is elevated?

   If all three conditions are met, then dissolution of minerals from the concrete conveyance may have occurred. A secondary observation to look for is if there are algae present in the conveyance. Photosynthesis by algae can cause the pH to increase during day light hours. Staff should note these on the field observation sheet and not conduct an IC/ID investigation. If this scenario does not exist, then an IC/ID investigation is warranted.

Phosphate
If an orthophosphate exceedance is measured in the field, other field parameters and observations should to be examined to determine if an IC/ID investigation is warranted.

1. Does a particular location have a history of exceedances?
2. Is the water is ponded or very nearly ponded?
3. Are there fine sediments present?

If all some or all of these conditions are met, the following scenario may exist: phosphate can be adsorbed strongly by fine particles and therefore accumulate with time, leading to an elevated concentration in sediment (Sposito, 1989). When the water is ponded or nearly stagnant, an equilibrium is established between sediment and water, and the concentration of orthophosphate in the water column will increase. Staff should note these conditions on the field observation sheet and not conduct an IC/ID investigation. If this scenario does not exist, then an IC/ID investigation is warranted.

MBAS

The possibility exists for false positives when using the MBAS field test kits. The MBAS field test kit measures anionic surfactants but positive interferences are known to occur with other MBAS species. Although the test does not measure cationic or non-ionic surfactants, cationic detergents and other cationic compounds (e.g. amines) may cause a low bias. Organic sulfonates, sulfates, carboxylates and phenols as well as inorganic thiocyanates may interfere. Nitrate interferes positively; 10 ppm NO3-N reads as approximately 0.2 ppm. Chloride at up to 100 ppm does not interfere significantly. However, higher chloride levels will cause interference. It is also thought that presence of eucalyptus leaves in the water may positively influence MBAS field test kit results. Therefore, water samples high in TDS, Nitrates, or containing eucalyptus leaves may yield falsely increased MBAS results. In such cases, a grab sample should be taken and submitted to the analytical laboratory for analysis.

X. DATA MANAGEMENT

Hard Copy Data

There are two forms that need to be managed. The first form is the Dry Weather (or MS4) field sheet, which contains data collected in the field at each sample site. The second form is the report received from the contract laboratory with the analytical results and chain of custody. Both sets of hard copy data need to be managed appropriately by placing them in the appropriate binders and storing them at the Dry Weather Database Coordinator's desk.

Table 5: 2012 Action Levels for Field Screening and Laboratory Analytical Parameters

Field Screening Analytes	Action Levels[1]	Source/ Notes
pH	<6.5 or >9.0	Basin Plan, w/ allowance for elevated pH due to excessive photosynthesis. Elevated pH is especially problematic in combination with high ammonia
Orthophosphate-P (mg/L)	2.0	USEPA Multi-sector General Permit
Nitrate-N (mg/L)	10.0	Basin Plan, and drinking water standards
Ammonia-N (mg/L)	1.0	Based on Workgroup experience. May also consider unionized ammonia fraction
MBAS (mg/L)	1.0	Basin Plan, w/ allowance based on Workgroup field experience and possible field reagent interferences
Turbidity (NTU)	Best Professional Judgment	WQOs relevant to inland surface waters are not available. Base judgment on channel type and bottom, time since last rain, background levels, and most importantly visual observation (e.g. unusual colors and lack of clarity), and unusual odors.
Temperature (^oC)	Best Professional Judgment	Base judgment on season, air temperature, channel type, shading, etc.
Conductivity (umhos/cm)	Best Professional Judgment	Values > 5,000 umhos/cm may indicate IC/ID however; EC may be highly elevated in some regions due to high-TDS groundwater exfiltration to surface water, mineral dissolution, drought, and seawater intrusion. Normal source ID and discharge elimination work is not effective in these situations. Knowledge of area background conditions is important. Values < 750 may indicate excessive potable water discharge or flushing.

Laboratory Analytes	Action Levels	Source/ Notes
Oil and Grease (mg/L)	15	USEPA Multi-sector General Permit. If a petroleum sheen is observed, the sample should be collected from the water surface. Visual observations may justify immediate investigation.
Diazinon (ug/L)	0.5	Response to diazinon and chlorpyrifos levels above 0.5 ug/L should focus on education and outreach to potential dischargers in the target drainage basin. Highly elevated levels should be investigated aggressively as with other potential IC/IDs.
Chlorpyrifos (ug/L)	0.5	
Dissolved Cadmium (ug/L)	California Toxics Rule	Use California Toxics Rule Table, 1-hour citeria to determine appropriate action level for individual samples. Table provides benchmarks based on hardness and dissolved metals concentration. For example, at 300 mg/L hardness the following action levels would apply: Cd - 14 ppb; Cu - 38 ppb; Pb - 209 ppb; and Zn - 297 ppb.
Dissolved Copper (ug/L)	California Toxics Rule	
Dissolved Lead (ug/L)	California Toxics Rule	
Dissolved Zinc (ug/L)	California Toxics Rule	
Total Coliform (MPN/100mL)	130,000	Action levels are based on upper 80% confidence level of Copermittees 2002-2007 dry weather analytical monitoring data.
Fecal Coliform (MPN/100mL)	13,000	
Enterococcus (MPN/100mL)	7,000	

[1]The referenced action levels should not be the sole criteria for initiating a source identification investigation. Dry Weather monitoring data should be interpreted using a variety of available information including best professional judgment and within-site and between-site sample variability.

1. Field Screening Data

When field staff return to the office, all data from the Dry Weather field sheets should be entered into the Dry Weather Database (refer to Dry Weather Database Instructions, Appendix 11). Data from the MS4 field sheets should be entered into the Special Projects Database. If field staff are unable to enter data for that day, staff should set aside one day during the week to enter data. Field sheets must be entered in a sequential order into the database.

The Quality Assurance Officer should perform routine QA/QC of the data periodically.

2. Analytical Data/Filing

After samples have been submitted to and analyzed by the contract laboratory, the County of San Diego will receive a hard copy, .pdf, and Excel spreadsheet report of the data and a copy of the original Chain of Custody.

The Dry Weather Database Coordinator should create a folder to file the hard copy report data. The folder should be labeled with the following information.

1. Dry Weather Season Year
2. Site ID
3. Sample Event ID Number
4. Date
5. Log Number used by the Contract Laboratory.

Electronic Data

Analytical Data

The contract analytical laboratory will send an electronic copy of the data to the County of San Diego. This data will be in an Excel spreadsheet in the format specified as well in a PDF file. The Dry Weather Database Coordinator will place a hard copy printout in the appropriate binder and maintain the electronic data in the appropriate computer folders and databases.

XI. WASTE MANAGEMENT

Field Staff will store all spent reagents used in the field and during instrument calibration and standardization in an appropriate hazardous waste container. Field staff are to conduct routine calibrations in the laboratory. Staff will use the County of San Diego, Department of General Services laboratory space located at 5555 Overland Ave, Bldg. 6, Suite 6101. The hazardous waste containers must be label with the follow information:

- CAL EPA number
- Date of Storage
- Waste Accumulation Date (Date waste first accumulate)
- Waste Organics
- Waste Metals
- Oil & Water
- Mixed Solvents
- Glass
- Name of Program Responsible for waste storage
- Point of Contact

Every six months, contact Jo Ann Weber (858-495-5317) to arrange for removal of waste.

XII. ADMINISTRATIVE / FISCAL

The Analytical Laboratory Coordinator will receive mailings from the contract laboratory periodically. Each mailing will contain a copy of the chain of custody form for the set of analyses performed, hard copies of data and matching invoices. The Analytical Laboratory Coordinator is to review the invoices to ensure that the data for the analysis stated on each invoice has been received and is correct. After this review is performed, the Analytical Laboratory Coordinator will sign each invoice and write the following on each copy:

The date it was received and verified
Their signature
The BPA code (normally 509669)
Sci. + Mon. Gen.
P 1002993
O 50915
E 52370

T 004.019.001
A 100496

All invoices should approved for payment and signed by Jo Ann Weber. The contract laboratory will provide a "Monthly Invoice" (a list of invoices and amounts billed for each calendar month). If all the invoices and amounts on this list are accurate, the Monthly Invoice and all the individual invoices can be scanned and this file can be forwarded via e-mail to Teresa Brownyard for payment. Jo Ann Weber should be copied on this e-mail. The Invoice Tracking spreadsheet in the computer should be updated accordingly and also attached to the above e-mail..

The hard copies of each invoice should be placed in the 2012 Dry Weather Data three ring binder and electronically scanned and place in the appropriate computer folder.

XIII. CHECK-OUT & CHECK-IN PROCEDURES

All staff must let the supervisor know that they are heading out to the field via email and must check-in upon their return from the field via email or phone. If you are still in the field by 4:00 pm, staff must phone the supervisor to update your status and estimate time back to the office.

XIV. REFERENCES

SWAMP. 2014. *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California.* Version 1.1 updated March-2014. http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/final_collect_water_sed_phys_habitat.pdf

APPENDIX 1

Field Sampling Safety
Things to watch out for

Poison Oak

Stinging Nettle

Deer Tick

Rattle Snake

APPENDIX 2

Equipment and Supplies List

- Clipboard, pens, pencils, Sharpie, or other waterproof pens
- Thomas Guide, MS4 maps, and land use maps
- Digital camera
- Latex gloves, protective eyeglasses or goggles, rubber boots
- Snake guards
- Safety traffic cones and safety vests
- Cooler and ice (if collecting laboratory samples)
- Paper towels, KimWipes, plastic bags
- Sample bottles with preservatives
- Cell phone
- GPS unit
- Portable field test kits, colorimeters, or spectrophotometer and all reagents for these meters (CHEMetrics)
- Multi-parameter probe (Horiba)
- Extra batteries for all meters
- Nitrate and pH test strips (SenSafe)
- Flow measurement equipment (required equipment will depend on method used)
    - Current meter or wristwatch
    - Measuring tape for measuring stream width
    - Folding scale for measuring stream depth
- De-ionized or ultra pure water in squeeze bottles for rinsing, dilutions, etc. (depending on methods used)
- Reagent grade de-ionized (D.I) for sample blanks
- Waste disposal bottles (keep in truck)
- Backpack
- Calculator for determining discharge using the area/velocity method
- Trash bags/bin
- Plastic syringes
- 0.45 micron filters
- Plastic sample cups
- Graduated cylinder
- Sample Event ID log
- List of phone numbers
- County Road Station map and addresses
- Field data sheets
- Pole dipper stick for sampling
- Manhole cover opening tool
- Machete
- Drinking Water
- Hat and sun screen

APPENDIX 2

Horiba U-10 Calibration Procedure and Log Sheet

Instrument Calibration and Frequency

The Horiba U-10 Meter is to be calibrated using the Auto-Calibration procedure described below prior to use in the field each day. Upon return to the lab from the field (post-deployment), the pH 7 and pH 10 solutions will be checked and results recorded. All measurements will be checked against the data quality objectives (DQOs) listed in Table 1. If results are out of the DQO range then probe must be calibrated using the manual two-point calibration methods. Manual two-point calibrations for dissolved oxygen, pH, conductivity and turbidity will be conducted quarterly. Following manual calibration the probe will be checked using the Horiba pH 4 (Autocal) solution and probe condition will be noted. All data will be recorded in the calibration data sheet.

Auto-calibration Procedure (performed daily prior to departure):

1. Fill each Horiba calibration cup with the proper pH solution, according to its label. The pH 4 cup should be filled slightly **over** the fill line.
2. Rinse probe with tap water and blot dry with a clean cloth or Kimwipe.
3. Place probe in Horiba calibration cup containing Horiba pH 4 solution. Allow a **few** minutes for equilibration.
4. Using the MODE key put in MAINT mode then toggle to "S.SET". Using the ↑↓ keys select "A" for Auto-salinity. Press ENT to complete salinity setting.
5. Horiba pH 4 (Autocal) solution. Using the MODE key put in MAINT mode then toggle to AUTO sub-mode. Press ENT to initiate auto-calibration. Readout will automatically return to MEAS mode when completed.
6. Record readouts for all parameters (pH, conductivity, turbidity, dissolved oxygen, temperature, and salinity) in the Daily Calibration Logsheet.
7. Remove the probe from the Horiba pH 4 solution, rinse in tap water, dry and place in the pH 7 solution. Record the pH and temperature values on Daily Calibration Logsheet. Repeat this step with pH 10 solution.
8. Follow the directions below for Zero and Span calibration should the pH values fall outside accepted ranges.
9. Upon return from the field, check the probe using the Horiba pH 7 and pH 10 solutions, record pH and temperature values in the Daily Calibration Logsheet, then rinse probe in tap water and place in a beaker of tap water for short-term storage.

Manual Two-point Calibrations (performed quarterly):

pH Calibration:

pH calibration is done using two standard solutions of different pH values, one for the ZERO calibration, the other for the SPAN calibration. Water Quality objectives for pH in surface waters for the San Diego region are 6.5 to 9.0, therefore it is recommended to use pH 7 and pH10 solutions.

Zero Calibration:

— Use the pH 7 solution (Must use pH7 solution), check temperature of standard.

- Press MODE, select MAINT mode.
- Press MODE again to move the lower cursor to ZERO.
- Press SELECT to move the upper cursor to pH
- Select the appropriate pH value after the readout has stabilized (e.g. enter pH = 6.86 if temp. is 25°C; note that different brands of standard pH solutions may have different pH values at a given temperature; Table 3) using the ↑↓ keys.

To complete pH zero calibration, press ENT. Record this value in the calibration data sheet.

Span Calibration:

- Rinse and dry probe and place in second standard solution (e.g. pH 10).
- Use the MODE key to move the lower cursor to SPAN.
- Check the temperature of the standard solution and select the appropriate pH value after the readout has stabilized using the ↑↓ keys.
- To complete pH span calibration, press ENT. Record this value in calibration data sheet.

Record all data into the logsheet.

Conductivity Calibration:

The Horiba U-10 automatically selects the proper range to measure conductivity. Therefore, manual calibration must be done for all three ranges used by the probe.

Zero calibration:

- Triple rinse probe in DI or distilled water. Shake off excess water and allow to air dry.
- Press MODE and move lower cursor to ZERO.
- Press SELECT and move upper cursor to COND
- Press the ↑↓ keys to set the readout to zero.
- To complete the zero COND calibration, press ENT. Record this value in the calibration data sheet.

Span calibration:

- Triple-rinse and immerse probe in 0.718 mS/cm solution.
- Press MODE and move lower cursor to SPAN
- Use the ↑↓ keys to select 0.718 once readout has stabilized.
- Press ENT to complete the 0.718 mS/cm conductivity calibration. Record this value in the calibration data sheet.
- Repeat the above procedure using the 6.67 mS/cm and 58.7 mS/cm standard solutions.

Note: Shelf life of conductivity solutions is six months. Keep solutions tightly capped. Conductivity standards are “one-shot” solutions – do not reuse the standard (from SWAMP guidelines).

Turbidity calibration:

When doing zero calibration it is crucial that you clean the probe thoroughly.

Zero calibration:

- Triple-rinse probe and shake off excess water droplets immerse probe in DI or distilled water.
- Press MODE and move the lower cursor to ZERO.
- Press SELECT and move upper cursor to TURB.

— Use the ↑↓ keys to select 0.0 once readout has stabilized.
— Press ENT to complete the zero turbidity calibration. Record this value in the calibration data sheet.

Span calibration:
— Triple-rinse and immerse probe in 100 NTU standard solution.
— Press MODE and move lower cursor to SPAN.
— Use the ↑↓ keys to select 100 NTU once the readout has stabilized.
— Press ENT to complete the 100 NTU turbidity calibration. Record this value in the calibration data sheet.

Note: Shelf life of turbidity solutions is six months.

DO calibration:

DO calibration solution for the span calibration must be prepared fresh just before it is used. Add 1L of DI water to the reagent bottle and shake vigorously until the white powder is completely dissolved.

Zero calibration:
— Triple-rinse probe in tap water and immerse it in zero DO standard solution (use larger cup to ensure DO sensor is immersed in the solution). This solution must be prepared immediately before use.
— Press MODE and move the lower cursor to ZERO.
— Press SELECT and move the upper cursor to DO.
— Use the ↑↓ keys to select 0.0 once the readout has stabilized.
— Press ENT to complete the zero DO calibration.

Span calibration:

Fill a container with tap water, close lid and bubble air through it with an aquarium pump to saturate it with dissolved oxygen.

Triple-rinse the probe and immerse it in the container of O2-saturated water.

Make sure the probe is set for freshwater by setting the S.SET Sub-Mode to 0.0%.

Press MODE to move the lower cursor to SPAN.

After the readout has stabilized, slowly move the probe up and down in the water and set the readout value to the appropriate DO value based on the temperature of the water (refer to Table 4: DO saturation at various temperatures).

Press ENT to complete the SPAN calibration for DO. Record in the calibration data sheet.

Table 1:Calibration solutions and values at 25º C.

Parameter	pH 4 (Horiba)	pH7 (Horiba)	pH 7 (YSI)	pH 10 (YSI)
pH	4.01	6.86	7.00	10.00
Conductivity (mS/cm)	4.49		5.87	16.7
Turbidity (NTU)	0		0	0
DO (mg/L)	8.52		0.0 (Zero oxygen)	

Table 2: Data Quality Objectives for Accuracy and Precision

Parameter	Value	+/- ½ unit	+/- ½ unit
pH (± 0.5 units)	4.01*	3.51	4.51
	6.86*	6.36	7.36
	10.0	9.50	10.50
Conductivity	4.49	4.27	4.71
	5.87	5.58	6.16
Turbidity	100	95	105
DO	8.52	8.09	8.95

*Check manufacturers standard reference value.

Table 3: Standard pH values at different temperatures

Temperature (°C)	pH 4 (Horiba)	pH 4 (YSI)	pH 7 (Horiba)	pH 7 (YSI)	pH10 (Horiba)	pH 10 (YSI)
15	4.00	4.00	6.90	7.05		10.12
20	4.00		6.88		10.06	
22	4.00		7.00		10.03	
25	4.01		6.86		10.01	

Table 4: Dissolved Oxygen at Various Temperatures

Temperature (°C)	Dissolved Oxygen (mg/L)	+ 5%	- 5%
15	9.76	10.25	9.27
16	9.56	10.04	9.08
17	9.37	9.84	8.90
18	9.18	9.64	8.72
19	9.01	9.46	8.56
20	8.84	9.28	8.40
21	8.68	9.11	8.25
22	8.53	8.96	8.10
23	8.39	8.81	7.97
24	8.25	8.66	7.84
25	8.11	8.52	7.70
26	7.99	8.39	7.59
27	7.87	8.26	7.48
28	7.75	8.14	7.36
29	7.64	8.02	7.26
30	7.53	7.91	7.15

Horiba U-10 Daily Calibration Log Sheet

PRE-FIELD:

CALIBRATED: BY________ DATE________ TIME_________ METER_____

Calibration		pH*	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (ºC)	Salinity (%)
Auto-Cal Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
pH 7 Solution	Std. Value	7.00					
	Reading						
pH 10 Solution	Std. Value	10.00					
	Reading						

POST-FIELD:

CHECKED: BY________ DATE________ TIME_________ METER_____

Calibration		pH*	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (ºC)	Salinity (%)
Auto-Cal Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
pH 7 Solution	Std. Value	7.00					
	Reading						
pH 10 Solution	Std. Value	10.00					
	Reading						

***pH readings should fall within +/- 0.5 units; all other parameters should fall within +/- 5% of standard values.**
****Horiba pH 7 standard solution**

Horiba U-10 Quarterly Calibration Logsheet

CALIBRATED BY________ DATE________ TIME_________ METER_____

Calibration		pH	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (ºC)	Salinity (%)
1st Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
2nd Solution	Std. Value	7.00	5.87	0			0.31
	Reading						
3rd Solution	Std. Value	10.00	16.7	0			0.99
	Reading						
DO*	0.0 mg/L	N/A	N/A	N/A		N/A	N/A

*Zero DO calibration only.

CHECKED BY________ DATE________ TIME_________ METER_____

Calibration		pH	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (ºC)	Salinity (%)
1st Solution	Std. Value	4.00	4.49	0.0	8.52	@ 22	0.23
	Reading						
2nd Solution	Std. Value	7.00	5.87	0			0.31
	Reading						
3rd Solution	Std. Value	10.00	16.7	0			0.99
	Reading						
DO*	0.0 mg/L	N/A	N/A	N/A		N/A	N/A

*Zero DO calibration only.

Parameter	Value	-5%	+5%
	4.00*	3.90	4.10
	7.00*	6.90	7.10
pH	10.00*	9.90	10.10
	4.49	4.27	4.71
Conductivity	5.87	5.58	6.16
Turbidity	100	95	105
DO	8.52	8.09	8.95

*N/A

APPENDIX 3

Dry Weather Field

COUNTY OF SAN DIEGO
WATERSHED PROTECTION PROGRAM

DEPARTMENT OF PUBLIC WORKS
5201 RUFFIN ROAD, SUITE P
SAN DIEGO, CA 92123

Dry Weather Monitoring Field Datasheet

New Site? ☐ Yes ☐ No ☐ IC/ID Follow-up for______________

GENERAL SITE DESCRIPTION

Site ID		Site Type		Sample Event ID		Sample Event Type	
Location	(NAD 83 decimal degrees to 5th place)					Watershed: Hydrologic Unit	
Date		Time		Latitude	° N	Hydrologic Area	
Field Staff		Thomas Guide		Longitude	° W	Hydrologic Subarea	

QC Sample ☐ None ☐ Original ☐ Duplicate ☐ Blank ☐ Split ☐ Lab Standard

Land Use (Primary) (Check one only) ☐ Residential ☐ Rural Resid. ☐ Commercial ☐ Industrial ☐ Agriculture ☐ Parks ☐ Open

Land Use (Secondary) (Optional, >10%) ☐ Residential ☐ Rural Resid. ☐ Commercial ☐ Industrial ☐ Agr. ☐ Parks ☐ Open ☐ None

Conveyance (Check one only) ☐ Concrete Channel ☐ Natural Creek ☐ Earthen Channel ☐ Manhole ☐ Catch Basin ☐ Outlet ☐ Curb/Gutter

WATER FLOW ☐ Flowing ☐ Ponded ☐ Dry **REFERRED FOR**

GENERAL CONDITION

Weather ☐ Sunny ☐ Partly Cloudy ☐ Overcast ☐ Fog **Last Rain** ☐ > 72 hours ☐ < 72 hours ☐ None ☐ ≤ 0.1 inches

OBSERVATIONS N/A

Odor	☐ None	☐ Musty	☐ Rotten Eggs	☐ Chemical	☐ Sewage	☐ Other
Color	☐ None	☐ Yellow	☐ Brown (Silty)	☐ White (Milky)	☐ Gray	☐ Other
Clarity	☐ Clear	☐ Slightly Cloudy	☐ Opaque			☐ Other
Floatables	☐ None	☐ Trash	☐ Bubbles/Foam	☐ Sheen ☐ Algae	☐ Fecal Matter	☐ Other
Deposit	☐ None	☐ Coarse Particulate	☐ Fine Particulate	☐ Stain	☐ Oily Deposit	☐ Other
Vegetation	☐ None	☐ Limited	☐ Normal	☐ Excessive		☐ Other
Biology	☐ None	☐ Insects ☐ Algae	☐ Snails	☐ Fish ☐ Birds	☐ Cray Fish	☐ Other

FLOW MEASUREMENT N/A

Flowing Creek	Average
Width	ft
Depth	ft
Velocity	ft/sec (enter 0 if water is ponded)
Length of Ponded Area	ft

Evidence of Overland Flow? ☐ Yes ☐ No ☐ Irrigation Runoff ☐ Other ______________

Outlet Diameter ______________ Liters/Second ______________

Leaf Float Distance__________ft Time__________sec

FIELD MEASUREMENT N/A

Horiba Meter: ☐ In Stream ☐ In Bucket ☐ Agitated (DO)

Sample Filtered for Test Kits? ☐ Yes ☐ No
Analytical Lab Sample Collected? ☐ Yes ☐ No

Parameter	Reading	Parameter	Reading	Parameter		1st Reading	Dil. Factor	Dil. Reading	Final
pH (Unit)		DO (mg/L)		Phosphate (PO_4)	mg/L				
Cond. (mS/cm)		Temp (°C)		Nitrate (NO_3)					
Turb. (NTU)		Salinity (%)		Ammonia (NH_3-N)					
				MBAS					

COMMENTS: ____

____

____

Completed by______________

*Sheet*____

COUNTY OF SAN DIEGO
WATERSHED PROTECTION PROGRAM

DEPARTMENT OF PUBLIC WORKS
5201 RUFFIN ROAD, SUITE P
SAN DIEGO, CA 92123

SiteType: DWM (Dry weather monitoring) – For sites that are within dry weather monitoring programs.
A, B, C, D… (IC/ID investigation) – For stations that are aimed at IC/ID follow-up investigations.

EventType: Field Screening
Confirmation
Source ID
Duplicate
Blank
Lab Standard

Action Levels

Field Screening Analyte	Action Level
pH	<6.5 or >9.0
Orthophosphate-P (mg/L)	2.0 (**6.0 PO_4**)
Nitrate-N (mg/L)	10.0 (**44.3 NO_3**)
Ammonia-N (mg/L)	1.0
MBAS	1.0
Turbidity (NTU)	B.P.J.
Temperature (°C)	B.P.J.
Conductivity (µS/cm)	B.P.J.

Laboratory Analyte	Action Level
Oil and Grease (mg/L)	15
Diazinon & Chlorpyrifos (µg/L)	0.5
Dissolved Cd, Cu, Pb, Zn (µg/L)	C.T.R.
Total Coliform (MPN/100 mL)	130,000
Fecal Coliform (MPN/100 mL)	13,000
Enterococcus (MPN/100 mL)	7,000

Watersheds

Hydro. Unit	Watershed
902	Santa Margarita River
903	San Luis Rey River
904	Carlsbad Management Area
905	San Dieguito River
907	San Diego River
909	Sweetwater River
910	Otay River
911	Tijuana River

Land Use Types

1. **Residential**
   Single-family and multi-family homes, mobile home parks, etc.
2. **Rural Residential**
   Single-family homes located in rural areas with lot sizes of approximately 1 to 10 acres. Rural residential estates may have small orchards, fields or small storage buildings associated with the residential dwelling unit, etc.
3. **Commercial**
   Offices, schools, shopping centers, auto dealerships, government/civic centers, cemeteries, churches, libraries, post offices, fire/police stations, military use, jails, prisons, border patrol holding stations, dormitories, hotels, motels, resorts, and casinos, etc.
4. **Agricultural**
   Orchards, vineyards, nurseries, greenhouses, flower fields, dairies, livestock, poultry, equine ranches, row crops and grains, pasture, fallow, etc.
5. **Industrial**
   Shipbuilding, airframe, aircraft manufacturing, industrial parks, manufacturing uses such as lumber, furniture, paper, rubber, stone, clay, and glass; auto repair services/recycling centers; warehousing, wholesale trade; mining, sand and gravel extraction, salt evaporation; junkyard, dumps/landfills; auto wrecking/dismantling and recycling centers, etc.
6. **Parks**
   Recreation areas and centers, neighborhood parks, wildlife and nature preserves, golf courses, accessible sandy areas along the coast or major water bodies allowing swimming and picnicking, etc.
7. **Open**
   Vacant and undeveloped lands, etc.

APPENDIX 4

Directions for filling out the
Dry Weather Field Data Sheet

Before Leaving the Office

1. Make sure that there is an updated list of constant information queried from the Dry Weather Database in the vehicle.
2. Make sure you have a list of Sample Event ID numbers, also kept in the vehicle.

Sampling Procedures

Location Information

When you get to a site, a field sheet should be completed whether or not flowing water is present. This includes dry sites and sites with ponded water. A new field sheet should also be completed for all upstream IC/ID's and duplicate samples.

1. **[Is this a new site? Yes/No]**. If yes be sure to turn the field sheet over and collect the GPS, location, report the land use, construction and conveyance type. If neither land use, construction or conveyance type information is collected this new site will not be identified in the constant information during future queries. Be sure to collect all information. If this is an old site, review the constant information found in the constant information folder to ensure that the GPS, land use, construction and conveyance information is correct. If anything needs changing, record this information on the back of the field sheet.
2. If the sampling event is an IC/ID, be sure to note the parameters being investigated, as this information is recorded in the database.

Flow Observed

1. **[Is flow observed at the site?]** Yes= flowing water, No=no flow or dry, Ponded=A pool of water, or water that does not appear to have any flow.

General Conditions

1. Use this section to report on the current weather conditions at the site. The **[Last Rain]** <72 hours should only be filled out if a very light rain occurred that was less than the 0.1 inch criteria. Sampling will not be conducted if rainfall >0.1" has occurred <72 hours.

Observations

1. This section should be completed only where flowing or ponded water is observed. This section is referring to the in-stream habitat. This includes the vegetation and biology, since we are concerned with how the quality of the water is serving as an indicator for stream health, by either supporting excessive algal growth, or very little biology. For a complete description of each of the observations refer to the attached sheet.

Flow Observations

1. Flow observation should be collected at every site. If the flow is too low to measure using the flow probe (refer to flow probe directions below), use the floating leaf method to estimate the flow. If you have encountered a pipe which is discharging water, you can measure the width of the pipe and count how many liters of water are captured in how many seconds. Be sure that when you use this method, you can capture all the water coming from the pipe in your container.

2. It is also important to note if there is any form of overland flow. This means that flowing water has to be observed discharging to the channel where the samples were collected. If there was, or is any evidence that water may have entered the channel do not check yes. Water has to be observed physically flowing into the channel. You can note in the comments section that overland flow appears to have just occurred. **[Evidence of overland Flow?]** If you do see overland flow, check yes and check whether it is irrigation runoff or other.

Water Sampling (Flow Measurement)

Be sure that all the questions are completed fully in this section.

1. **[Flowing Creek]** Record the creeks' water flow characteristics using the hand-held stick flow meter (FP-101 or FP-201). Record the water's "Width", "Depth", and "Velocity" (see Appendix 6) in the appropriate box on the field sheet using the measurement scale on the side of the stick flow meter (note: the scale is shown in tenths of a foot and not in inches). If the water is ponded record "0" (zero) for the "Velocity" and estimate the "Length" of the pond and record in the appropriate box on the field sheet. If the flow is too slow or small to be measured with the stick flow meter, then a "Leaf Float" estimation can be used to determine the velocity. The leaf float method is conducted by floating a small leaf on top of the water and noting the drift; record "Distance" in feet and "Time" in seconds. The final alternate flow measurement technique is accomplished by recording the time need to fill a container with a known volume.

2. **[Field Measurement]** Measuring the following field screening water quality properties using the Horiba U-10 multimeter: pH, conductivity, turbidity, dissolved oxygen (see Appendix 15), temperature, and salinity. Let readings stabilize before recording all values in the appropriate box on the field sheet.

3. **[Is the sample filtered?]** Sample may be filtered at some sites because of its turbid nature or to remove color interferences. This can affect the field analysis and is important to note.

4. **[Dilution and Parameter?]** If a dilution is run on any parameter you must record the dilution and the parameter on which it was conducted. If this information is not recorded, the value is assumed to be a non-exceedance in the database, except for any follow up sample(s) collected. This is critical for making sense of the data once it is queried from the database.

5. [**Field screening sample collected?**] Check yes or no, if field screening was conducted. (Field screening refers to the use of the field test kits to analyze a water sample, not simply taking Horiba measurements alone).

6. [**Analytical Lab Sample collected?**] Check yes or no, if a lab sample was collected, whether part of an IC/ID, regular field screening or QA/QC. This is the only relationship between what was conducted in the field and the laboratory data submitted by the analytical laboratory. We should be able to query the database for all sites where lab samples were collected and this information should correlate with the lab data.

Comments

The comments section of the field sheet is designed to capture any other relevant information about the site that is not clearly outlined on the field sheet. It can also contain further explanation of sample locations, address information or distinguishing characteristics about a particular site. Observations are an important part to collecting field data and this section should be completed at every site visit. Examples of other comments might by if the water was collected via a syringe or if the Horiba measurements were conducted in a bucket versus in-situ. Also, note if birds or other animals are present or evidence exists that animals were present (manure or foot prints) at the site.

APPENDIX 5

Flow Probe User Instructions

1. The FP111 probe handle is a two-piece rod expandable from 3' to 6'. The FP211 probe handle is a three-piece rod expandable from 5' to 15'. To expand the rod for correct placement in flow, loosen the locking nut on the handle, pull out the top piece, and retighten the nut.

2. Make sure the Flow Probe's propeller turns freely by blowing strongly on the prop. Remove any accumulated debris (e.g.- magnetic sediment). If the propeller still does not turn freely, remove the screw holding the propeller and clear any debris present. Re-attach the propeller with the screw, taking care not to over-tighten the screw.

3. Submerge the probe in the stream and push the reset button to reset the display. The display will read in feet/second units.

4. Point the propeller directly into the flow you wish to measure. Face the arrow inside the prop housing **downstream** (arrow points in the direction of flow). If there's no arrow the raised bump on the outside of the housing should be pointed **into** the flow.

5. For small streams, the probe can be moved **slowly** and smoothly throughout the flow during average velocity measurement. Move the probe smoothly and evenly back and forth from top to bottom of the flow so that the probe stays at each point in the flow for approximately the same amount of time. Keep moving the probe for 20-40 seconds to obtain an accurate average value that accounts for surging. (Move the probe as if you were spray painting and attempting to get an even coat of paint over the entire surface). Do not lift flow meter out of the water (i.e. split stream) while making a measurement, the flow meter with continue to average with a zero flow or out of the water. If measuring a split stream, make separate measurements and calculate the appropriate proportional flow rate.

   The Flow Probe uses true velocity averaging. Pushing the RESET button zeroes the average/minimum/maximum velocities and a running average is started. As long as the probe remains in the flow, the averaging continues. One reading is taken per second, and a continuous average is displayed. For example, after 10 seconds, 10 readings are totaled and then divided by 10 and this average is displayed. Once the average reading becomes steady, the true average velocity of the stream is obtained. Record this value in the proper cell on the field sheet BEFORE removing the probe from the water.

6. Measure/calculate the cross-sectional area of your flow stream in square feet (Note: optional, the database will do this calculation). The average velocity (calculated with the Flow Probe in feet/second) times the cross-sectional area (square feet) equals flow in cubic feet per second (cfs), or Q = V x A.

7. If the propeller gets fouled while measuring flow, clean it until the prop turns freely and start over.

APPENDIX 6

Laboratory Containers (note: size and type of containers may vary from lab to lab)

Bottle	Parameters	Preservative
500 mL Plastic Bottle	Dissolved Cu, Pb, Cd, Zn	None
250 mL plastic Bottle	Dissolved Manganese, Selenium, Aluminum	None
1-Liter Amber Glass	Diazinon Chloropyrifos Malathion	None
500 mL Plastic Bottle	Hardness	None
100 mL Sterile Container	Total Coliform Fecal Coliform *Enterococcus*	Sodium Thiosulfate ($Na_2S_2O_3$)
1-Liter Plastic Bottle	TDS, TSS	None
250 ml plastic Bottle	Nitrate, Nitrite	None
1-Liter Plastic Bottle	TKN	0.5 ml H2SO4
500 mL Plastic Bottle	Total Phosphorus	0.5 ml H2SO4
250 mL plastic Bottle	Total Iron	Acidify to pH<2 with HNO3
250 mL plastic Bottle	Total Manganese	HNO3
250 mL plastic Bottle	Sulfates	None
250 ml plastic Bottle	Chlorides	None
250 mL plastic Bottle	Total Selenium	HNO3
250 mL plastic Bottle	Total Aluminum	HNO3
1-Liter Amber Glass	Oil and Grease	HCL
500 ml plastic Bottle	Ammonia	Acidify to pH<2 with H2SO4
500 ml plastic Bottle	MBAS	None

APPENDIX 7

Sample Dilution Methods

Dilutions in the Field

It may be necessary to run dilutions in the field, to remove interferences such as high salt content or because a particular parameter is over the range of the field test kit. When preparing and running dilutions, the following procedures should apply:

1:1 Dilution
A 1:1 dilution is, one part sample to one part de-ionized water. When the measurement is made multiply the value by two (**2X**). This will give you the true concentration of the sample.

1. Rinse a 200 ml graduated cylinder 2-3 times with de-ionized water.
2. Pour 25 ml of sample into a clean sample cup and dilute the sample with 25 ml of de-ionized water.
3. Stir the solution to ensure complete mixing.
4. Pour the necessary 25 ml into the sample vial and snap the ampoule.

1:2 Dilution
A 1:2 dilution is one part sample to 2 parts de-ionized water. When the measurement is made multiply the value by three (**3X**). This will give you the true concentration of the sample.

1. Rinse a 200 ml graduated cylinder 2-3 times with de-ionized water.
2. Pour 25 ml of sample into a clean sample cup and dilute the sample with 50 ml of de-ionized water.
3. Stir the solution to ensure complete mixing.
4. Pour the necessary 25 ml into the sample vial and snap the ampoule.

If a higher dilution needs to be run, follow the above steps, but increase the volume of de-ionized water and be sure to multiply the measured value by the correct number.

APPENDIX 8

Sample Container Request

Container Request Form

Today's Date: 1/4/2011

Project Manager: Dan Verdon

Sample Matrix: SW **Pickup Date:** 1/7/2011

Client: SAN DIEGO COUNTY

Address: 5201 Ruffin Road, Suite P San Diego, CA 92123

Contact: Kenneth Liddell **PO#:**

Phone No: 858-694-2335 **Fax No:** 858-495-5263

Qty	Type of container	Description	Preservative
15	Plastic	TDS	$4^{o}C$, None
15	Plastic	TKN	$4^{o}C$, 0.5ml H_2SO_4 to pH<2
15	Plastic	Ammonia as N	$4^{o}C$, 0.5ml H_2SO_4 to pH<2
15	Plastic	Nitrite as N	$4^{o}C$, None
15	Plastic	Nitrate as N	$4^{o}C$, None
15	Plastic	Phosphate as P	$4^{o}C$, 0.5ml H_2SO_4 to pH<2
15	Plastic	Ortho-Phosphate	$4^{o}C$, None
15	Plastic	Iron, total	Acidify to pH<2 with HNO3
15	Plastic	Sulfates	$4^{o}C$, None

Note PLEASE INCLUDE SUFFICIENT NUMBER OF COOLERS, THANKS (AT LEAST TWO)

APPENDIX 9

Sample Chain of Custody

Page___ of ___

EnviroMatrix Analytical, Inc.

4340 Viewridge Ave., Ste. A - San Diego, CA 92123 - Phone (858) 560-7717 - Fax (858) 560-7763

CHAIN-OF-CUSTODY RECORD

EMA LOG #:

Client: County of San Diego
Attn: Kenneth Liddell
Samplers(s):
Address: 5201 Ruffin Road, Suite P
San Diego, CA 92123
Phone: (858) 694-2335 Fax: (858) 495-5263
Email: Kenneth.Liddell@sdcounty.ca.gov
Billing Address: same as above

Project ID: Dry Weather Monitoring
Project #: Contract #:

Requested Analysis

ID #	Client Sample ID	Sample Event ID	Sample Date	Sample Time	Sample Matrix	Container # / Type	Oil & Grease	Coliform, □ Total (MTF) □ Fecal (MTF)	Enterococcus, by MTF	Diazinon, Chlorpyrifos and Malathion	MBAS
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Matrix Codes: A = Air, DW = Drinking Water, GW = Groundwater, SW = Storm Water
WW = Wastewater, S = Soil, SED = Sediment, SD = Solid, T = Tissue, O = Oil, L = Liquid

Shipped By: □ Courier □ UPS □ FedEx □ USPS □ Client Drop Off □ Other

[1]**Turn-Around-Time:** □ Same Day □ 24 hr □ 48 hr □ 3 day □ 4 day □ 5 day □ STD (7 day)

[1]**Reporting Requirements:** □ Fax □ PDF □ Excel □ Geotracker/EDF □ Hard Copy □ EDT

[1]**Sample Disposal:** □ By Laboratory □ [2]Return to Client: P/U or Delivery □ Archive

Sample Integrity

Correct Containers: Yes No N/A	Containers Properly Preserved: Yes No N/A
Custody Seals Intact: Yes No N/A	Temp @ Receipt:______________
COC/Labels Agree: Yes No N/A	Sampled By: Client EMA Autosampler

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Signature		Signature
Print		Print
Company:		Company:
Signature		Signature
Print		Print
Company:		Company:
Signature		Signature
Print		Print
Company:		Company:

Project/Sample Comments:

Three (3) extra dilutions for total and fecal coliform. Range: 20 to 1.6 million MPN/100 ml.

Two (2) extra dilutions for Enterococcus. Range: 10 to 160,000 MPN/100 ml.

[1]Additional costs may apply, consult a project manager for details.

[2]EMA reserves the right to return any samples that do not match our waste profile.

NOTE: By relinquishing samples to EMA, Inc., client agrees to pay for the services requested on this COC form and any additional analyses performed on this project. Payment for services is due within 30 days from date of invoice. Samples will be disposed of 7 days after report has been finalized unless otherwise noted. All work is subject to EMA's terms and conditions.

APPENDIX 10

Step By Step Guide To Entering a Dry Weather and MS4
Field Data Sheets into Database

Before Starting

1. Organize the field sheets by sample event ID number.
2. Review each field sheet for accuracy and understanding of the chain of events.

Database Entry Procedures

1. Open the Dry Weather Database
2. Click on [Enter field screening data for a sampling event]
3. Check that your keyboard has **"numbers lock" ON**!!!! (very important)
4. Begin entering data. If a field is not completed on the field sheet leave it blank in the database**. NOTE: When entering the conductivity value convert it to uS/cm. (e.g. 1.23 mS/cm would become 1,230 uS/cm) The database is all in uS/cm.**
5. Once you have completed entering the data for that record, click on "Site ID to scroll to next page.
6. Initial and date the top right hand corner of all entered field data sheets and place them in the 2008 Dry Weather Monitoring field data sheet binder.

Problems you may encounter and how to resolve them:

Problem 1:
You accidentally click the wrong new record button.

If you click the wrong new record button, this problem cannot be corrected. If you meant to click on the TOP new record button, but you clicked the BOTTOM new record button that means you have created a new major event for a record that is actually meant to relate to another major event. This means that when you query the database for all information relevant to one major event the query would not contain the information entered under the new major event.

(e.g. an exceedance for nitrate is observed in the field, a duplicate nitrate sample is collected for laboratory analysis at the original sample location, and you proceed upstream and collect 4 field screening samples. In total there are 5 records related to the one major event created by the first field screening).

Problem 2:
Your computer shuts down on you while you are in the middle of entering a field data sheet. When you return to the database you find that the sample event ID used for that record did not get saved and was consequently deleted during the malfunction.

This means that your sample event ID's will be out of order, (once a sample event ID is deleted it can never be used again). The best thing to do to resolve this is to re-assign the next sample event ID in line found in the Sample Event ID table used in the field. The new number should be placed on the field sheet and the field information should be recorded in the field sample event ID table, prior to the next day of sampling.

APPENDIX 11

Science and Monitoring Referral form

Department of Public Works **Watershed Protection Program** **Science and Monitoring Referral**

Issue:

Requestor: Date of Referral:

Requestor's Phone Number: Sample Site Name:

Check one category only

- ☐ Commercial
- ☐ Residential
- ☐ Industrial
- ☐ Rural Residential
- ☐ Construction
- ☐ Other Jurisdiction
- ☐ Nurseries, Groves, Golf Courses, and Commercial Equestrian

Watershed:

Location / Address:

Thomas Brothers:

Parcel Number(s):

GPS Coordinates: N° Lat. W° Long. (NAD 83).

Brief Description of the Issue:

Additional Information (e.g., maps, photos):

APPENDIX 12

Department of Public Works
Road Service Request form

DEPARTMENT OF PUBLIC WORKS
ROADS SERVICE REQUEST

CONTROL NUMBER ____________

DATE RECEIVED: TBD TIME: TBD ROAD STA: ____________ THOS. BROS: TBD

REQUESTOR: ____________ PHONE (H): ____________ PHONE (W): ____________

ADDRESS: 5201 Ruffin Road, Suite P CITY: San Diego, CA ZIP: 92123

SERVICE LOCATION: TBD

STREETS

- ☐ POTHOLE(S)
- ☐ RAISED OR SUNKEN LATERAL
- ☐ ROCK OR MUD SLIDE
- ☐ SWEEPING REQUEST
- ☐ GLASS OR DEBRIS IN ROADWAY
- ☐ OTHER ____________

DRAINAGE

- ☐ FLOODING
- ☐ BERM REPAIR OR BUILD
- ☐ WATER FLOWS DOWN DRIVEWAY
- ☐ CULVERT/STORM DRAIN PLUGGED
- ☐ DEBRIS/VEGETATION IN CHANNEL
- ☐ OTHER ____________

SIGNS

TYPE OF SIGN: ____________

- ☐ DOWN, POST INTACT
- ☐ DOWN, POST DAMAGED
- ☐ MISSING
- ☐ VANDALIZED
- ☐ LIMITED VISIBILITY
- ☐ OTHER ____________

ROADSIDE

- ☐ TRASH OR DEBRIS REMOVAL
- ☐ TREE/BUSH NEEDS TRIMMING
- ☐ TREE/BRANCHES IN ROAD
- ☐ GRAFFITI REMOVAL
- ☐ LIMITED VISIBILITY
- ☐ OTHER ____________

☐ REQUEST YOU CALL ____________
DATE CALL RETURNED

ADDITIONAL INFORMATION TBD

____

____

DISPOSITION REPORT ____________
NAME OF PERSON TAKING REPORT

____

____

COMPLETION STATUS:

☐ 25% ☐ 50%

☐ 75% ☐ 100%

TBD ____________
DATE COMPLETED NAME OF PERSON COMPLETING REQUEST

APPENDIX 13

Dry Weather Sample Site Location Table for 2012

StationID	Location	Watershed	HSA	Latitude	Longitude	TBPage	TBGrid
CAR01	San Elijo Creek @ La Granada	Carlsbad	904.61	33.02297	-117.22729	1168	A3
CAR02	Escondido Creek @ East County Club Drive	Carlsbad	904.62	33.09901	-117.13047	1129	C6
CAR03	Escondido Creek @ El Camino Del Norte	Carlsbad	904.61	33.04839	-117.22716	1148	A6
CAR04	San Marcos Creek @ Discovery Street	Carlsbad	904.52	33.13046	-117.20045	1128	D2
CAR05	Buena Creek @ Robelini Drive	Carlsbad	904.32	33.17239	-117.20997	1108	C3
CAR06	San Marcos Creek @ Olive Street and Sycamore Drive	Carlsbad	904.53	33.17964	-117.15211	1108	J2
CAR08	Reidy Canyon Creek @ Paso Del Norte	Carlsbad	904.62	33.17810	-117.09193	1109	G2
CAR09	San Elijo Creek @ El Camino Real	Carlsbad	904.61	33.01084	-117.23985	1167	J4
CAR10	Tributary of San Elijo Creek @ San Elijo Road	Carlsbad	904.61	33.02585	-117.21569	1168	C2
CAR12	Reidy Canyon Creek @ Bachelor Lane	Carlsbad	904.62	33.19801	-117.08966	1089	G6
CAR13	Storm Drain Outfall to Lake San Marcos @ End of San Marino Drive	Carlsbad	904.52	33.12012	-117.20997	1128	C3
CAR14	Tributary to Lake San Marcos @ End of El Chico Lane	Carlsbad	904.52	33.11896	-117.20744	1128	C3
CAR15	Jesmond Dene Creek @ Jesmond Dene Heights Road	Carlsbad	904.62	33.17084	-117.10002	1109	F3
OTY03	Dulzura Creek @ Otay Lakes Valley Road	Otay River	910.31	32.63624	-116.88456	1293	G6
OTY04	Olive Vista Creek @ Olive Vista Drive	Otay River	910.33	32.72168	-116.85344	1293	A1
SDG02	Etcheverry Creek @	San Dieguito River	905.41	33.02243	-116.89673	1172	D2

	Highway 67						
SDG03	Santa Maria Creek @ Rangeland Road	San Dieguito River	905.41	33.03379	-116.93608	1151	H7
SDG04	Hatfield Creek @ Magnolia Avenue	San Dieguito River	905.41	33.05258	-116.84492	1153	A4
SDG05	San Dieguito River @ El Apajo (end)	San Dieguito River	905.11	32.99948	-117.20550	1168	D6
SDG07	La Zanja Canyon Creek @ Rancho Santa Fe Farms Road	San Dieguito River	905.11	32.97771	-117.18116	1188	G2
SDG08	Green Valley Creek @ Rancho Bernardo Road	San Dieguito River	905.11	33.01962	-117.11974	1169	E3
SDG09	Felicita Creek @ Quiet Hills Farm Road	San Dieguito River	905.23	33.07326	-117.08373	1149	J2
SDG10	Rockwood Canyon Creek @ San Pasqual Road (also called Guejito Creek or Quejito Creek)	San Dieguito River	905.32	33.09456	-116.96132	1131	E6
SDG12	Storm Drain Channel @ 7th Street (below Collier County Park)	San Dieguito River	905.41	33.04211	-116.86165	1152	H6
SDR01	Chocolate Canyon Creek @ Arnold Way	San Diego River	907.33	32.84127	-116.80540	1233	F5
SDR02	Alpine Creek @ Tavern Road	San Diego River	907.33	32.83192	-116.77528	1234	A6
SDR03	Alpine Creek @ Midway Drive	San Diego River	907.33	32.83879	-116.79011	1233	H6
SDR05	Culvert @ Bradley Avenue and Graves Avenue	San Diego River	907.13	32.81889	-116.95928	1251	F2
SDR07	Forrester Creek @ Greenfield Drive	San Diego River	907.13	32.80826	-116.91151	1252	C3
SDR08	Los Coches Creek @ I-8 Business Route	San Diego River	907.14	32.83599	-116.90040	1232	D7
SDR11	San Diego River @ Channel Road	San Diego River	907.12	32.86473	-116.92755	1232	A2

SDR13	Eucalyptus Hills Creek @ Riverside Drive (Storm Drain Channel)	San Diego River	907.12	32.86204	-116.94466	1231	H3
SDR15	Lindo Lake Outfall @ Petite Lane	San Diego River	907.12	32.85716	-116.91278	1232	C3
SDR16	Los Coches Creek @ Los Coches Road and Ha Hana Road	San Diego River	907.14	32.84004	-116.91346	1232	C6
SDR17	San Vicente Creek @ Willow Road	San Diego River	907.12	32.87565	-116.92145	1232	B1
SDR18	Quail Creek Outfall @ Lakeshore Drive and Lindo Lake	San Diego River	907.12	32.86030	-116.91760	1232	B3
SDR19	Tributary of San Vicente Creek @ San Vicente Road	San Diego River	907.23	33.00561	-116.82115	1173	D4
SDR20	San Vicente Creek @ Wildcat Canyon Road	San Diego River	907.23	32.99628	-116.84387	1173	A5
SDR21	Oak Creek @ Olde Highway 80	San Diego River	907.14	32.84807	-116.86946	1232	H5
SDR22	Tributary of Chocolate Canyon Creek @ Arnold Way	San Diego River	907.33	32.84232	-116.80839	1233	F5
SDR24	Tributary to the San Diego River @ 11633 Woodside Avenue	San Diego River	907.12	32.85504	-116.94268	1231	H4
SDR25	San Vicente Creek @ San Vicente Road	San Diego River	907.23	33.00162	-116.80160	1173	F4
SDR34	Tributary to Los Coches Creek @ 11962 Woodside Avenue	San Diego River	907.14	32.85565	-116.93548	1231	J4
SLR01	Moosa Canyon Creek @ Old River Road	San Luis Rey River	903.12	33.28369	-117.21886	1068	A2
SLR02	Little Gopher Canyon Creek @ Old River Road	San Luis Rey River	903.12	33.26578	-117.23320	1067	J4
SLR04	East Channel Creek @ Hutchinson	San Luis Rey River	903.11	33.24084	-117.24198	1087	H1

	Street and Hidden Lake Lane						
SLR06	Live Oak Creek @ Oak Cliff Drive	San Luis Rey River	903.12	33.33545	-117.18830	1048	E1
SLR08	Moosa Canyon Creek @ Sunday Drive	San Luis Rey River	903.14	33.21497	-117.03338	1090	E4
SLR10	Old 395 Creek @ Old Hwy 395 (below outfall pipe next to pole # P719838)	San Luis Rey River	903.13	33.20425	-117.12894	1089	C5
SLR11	Old 395 Creek @ 29013 Champagne Blvd. (Old Hwy 395)	San Luis Rey River	903.13	33.24022	-117.14607	1069	A7
SLR12	Green Canyon Creek @ Sycamore Drive	San Luis Rey River	903.12	33.33312	-117.23551	1047	H2
SLR14	Ostrich Farm Creek @ Highway 76	San Luis Rey River	903.12	33.29353	-117.22373	1048	A7
SLR15	Moosa Canyon Creek @ End of Betsworth Road	San Luis Rey River	903.13	33.22763	-117.08392	1089	H2
SLR16	San Luis Rey River @ Mission Road (the old bridge)	San Luis Rey River	903.12	33.26052	-117.23836	1067	H5
SLR17	Keyes Creek @ Dunlin Road	San Luis Rey River	903.12	33.32384	-117.15723	1048	H3
SLR18	San Luis Rey River @ Couser Canyon Pass	San Luis Rey River	903.21	33.34040	-117.13124	1029	B7
SLR20	Yuima Creek @ Pala Road (Highway 76)	San Luis Rey River	903.22	33.28840	-116.95981	1051	D7
SLR21	Pauma Creek @ Pala Road (Highway 76)	San Luis Rey River	903.22	33.32370	-116.99665	1050	J2
SLR27	Live Oak Creek @ Highway 76	San Luis Rey River	903.12	33.31514	-117.19418	1048	D4
SLR29	Keys Creek @ Lilac Road	San Luis Rey River	903.12	33.28808	-117.08333	1069	H1
SLR30	Couser Canyon Creek @ Couser Canyon Road	San Luis Rey River	903.12	33.33488	-117.13120	1049	B1
SMG07	Sandia Creek @ Sandia Creek Drive (at USGS station)	Santa Margarita River	902.22	33.42460	-117.24904	997	F3

SMG08	De Luz Creek @ De Luz Road (Mile Marker 8 @ private driveway)	Santa Margarita River	902.21	33.42184	-117.32179	996	G4
SMG09	Santa Margarita River @ SDSU Ecological Reserve Entrance	Santa Margarita River	902.22	33.42839	-117.19561	998	C3
SMG10	Santa Margarita River @ Sandia Creek Drive (one-half mile east of De Luz Road)	Santa Margarita River	902.21	33.40750	-117.25018	997	G5
SWT01	Sweetwater River @ Willow Road	Sweetwater River	909.12	32.65895	-117.04231	1310	F3
SWT02	Long Canyon Creek @ Bonita Road near Acacia Ave.	Sweetwater River	909.12	32.66558	-117.02409	1310	J2
SWT03	Sweetwater River @ Plaza Bonita Road	Sweetwater River	909.12	32.65069	-117.06374	1310	D4
SWT05	San Miguel Creek @ Bonita Road	Sweetwater River	909.12	32.66692	-117.02325	1310	J2
SWT07	Spring Valley Creek @ Quarry Road	Sweetwater River	909.12	32.70114	-117.00927	1291	A4
SWT08	Casa de Oro Creek @ Valencia Street/Kings View Circle	Sweetwater River	909.12	32.73330	-117.00861	1271	A7
SWT09	Spring Valley Creek @ Valencia Street/Kings View Circle	Sweetwater River	909.12	32.73335	-117.00870	1271	A7
SWT10	Jamacha Creek @ Jamacha Road near Willow Glen Drive	Sweetwater River	909.22	32.74445	-116.93002	1272	A5
SWT11	Sweetwater River @ Steele Canyon Road	Sweetwater River	909.22	32.74449	-116.91693	1272	C5
SWT12	Sweetwater River @ Old Bridge	Sweetwater River	909.21	32.73266	-116.94029	1271	J6
SWT13	Tributary of Sweetwater River @ Millar Ranch Road south of Hwy 94	Sweetwater River	909.21	32.73028	-116.93887	1271	J7

SWT14	Helix Street Drainage Next to Hwy 94	Sweetwater River	909.12	32.74968	-117.00087	1271	B5
SWT15	Casa de Oro Creek @ Kenwood Drive and Barbic Court	Sweetwater River	909.12	32.74544	-116.99168	1271	C5
SWT18	Harbison Canyon Creek @ Collier Way near Harbison Canyon Road	Sweetwater River	909.23	32.81511	-116.83599	1253	C2
SWT20	Viejas Creek @ Via Viejas below Private Lake	Sweetwater River	909.26	32.81894	-116.75211	1254	C1
SWT21	North Fork of Sweetwater River @ Tavern Road and Hawk Vista Lane	Sweetwater River	909.26	32.80879	-116.78036	1253	J2
SWT22	Indian Springs Creek @ Highway 94	Sweetwater River	909.21	32.71966	-116.87986	1292	G1
SWT23	Mexican Canyon Creek @ Jamul Road	Sweetwater River	909.21	32.72929	-116.87239	1272	H7
SWT25	Mexican Canyon Creek @ Campo Road near Jamacha Road	Sweetwater River	909.21	32.73968	-116.95245	1271	H6
TIJ01	Cottonwood Creek @ Old Highway 80 (Bridge Crossing)	Tijuana River	911.61	32.78844	-116.49732	430	A6
TIJ02	Pine Valley Creek @ Old Highway 80 and Pine Valley Road	Tijuana River	911.41	32.83776	-116.53725	1237	A5
TIJ04	Campo Creek @ Highway 94	Tijuana River	911.82	32.60939	-116.47421	430	B10

Appendix 15

MS4 Sample Sites for 2012

Name	Location	Lat	Long	Watershed	Analytes
CAR13	Storm Drain Outfall to Lake San Marcos @ End of San Marino Drive	33.12012	-117.20997	904.52	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate)
CAR17	Manhole @ 1501 La Fiesta Lane & La Fiesta Drive	33.12619	-117.20555	904.52	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate)
CAR18	Outfall @ 18337 Aliso Canyon Road	33.05091	-117.18627	904.61	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, Total & Dissolved Selenium, Sulfates, Hardness
CAR19	Manhole @ Aliso Canyon Road (east side of road before Rancho La Cima Drive)	33.04468	-117.18712	904.61	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, Total & Dissolved Selenium, Sulfates, Hardness
CAR20	Manhole @ Via Teramo & Montiel Road	33.12890	-117.10951	904.62	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, Total & Dissolved Selenium, Sulfates, Hardness
CAR21	Outfall @ 1743 Rock Springs Road	33.14578	-117.12003	904.52	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate)
CAR22	Open channel @ 3103 Laurashawn Lane	33.17805	-117.08659	904.62	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, Total & Dissolved Selenium, Sulfates, Hardness
OTY05	Manhole @ Across the street from 3027 Calle Valeria	32.70755	-116.87872	910.32	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), pH, Temperature, Total Iron, Total & Dissolved Manganese, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SDG12	Storm Drain Channel @ 7th Street (below	33.04211	-116.86165	905.41	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total

	Collier County Park)				Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, pH, Temperature, Hardness
SDG13	Outfall @ El Apajo and San Dieguito Road	32.99640	-117.19196	905.11	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS
SDG16	Manhole @ 3797 Via Vuelta & Via De Las Palmas	32.98940	-117.21334	905.11	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS
SDG17	Manhole @ Rancho Diegueno Road & San Dieguito Road	32.98983	-117.19627	905.11	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS
SDG18	Outfall @ End of 4S Ranch Parkway (16106)	33.00302	-117.11605	905.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Chloride, Total & Dissolved Manganese, Sulfates, Hardness
SDG19	Outfall @ Goldentop Road & Thornmint Road	33.01891	-117.10678	905.11	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Chloride, Total & Dissolved Manganese, Sulfates, Hardness, Oil & Grease
SDG20	Manhole @ 2675 Auralie Drive & Brookhurst Lane	33.08702	-117.06166	905.21	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Chloride, Sulfates, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, pH, Temperature, Hardness
SDG21	Outfall @ La Brea Street & Day Street	33.03659	-116.88266	905.41	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Manganese, pH, Temperature, Hardness
SDR13	Eucalyptus Hills Creek @ Riverside Drive (Storm Drain Channel)	32.86204	-116.94466	907.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Diazinon, Chlorpyrifos, Malathion, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR15	Lindo Lake Outfall @ Petite Lane	32.85716	-116.91278	907.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR22	Tributary of Chocolate Canyon Creek @ Arnold Way	32.84232	-116.80839	907.33	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, Total & Dissolved Manganese, pH, Temperature, Hardness
SDR34	Tributary to Los Coches Creek@	32.85565	-116.93548	907.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N

	11962 Woodside Avenue				(Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Oil & Grease, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR35	Storm Drain Channel @ Denny Way (Drains into Forrester Creek)	32.82058	-116.96480	907.13	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR40	Grated outfall @ Pepper Drive & across from Cajone Ave.	32.82065	-116.93332	907.13	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR41	Outfall @ Los Coches Road & Via Diego	32.83999	-116.91324	907.14	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR42	Outfall @ End of Stonybrook Lane	32.82958	-116.89365	907.14	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Dissolved Oxygen, pH, Temperature, Total & Dissolved Selenium, Total & Dissolved Manganese, Hardness
SDR43	Manhole @ Arena Way & just past Hampson Place	33.00809	-116.82055	907.23	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Chloride, Total & Dissolved Manganese, Dissolved Oxygen, pH, Temperature, Sulfates, Hardness
SDR44	Manhole @ Del Amo Road & Arena Way	33.02041	-116.80604	907.23	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Chloride, Total & Dissolved Manganese, Dissolved Oxygen, pH, Temperature, Sulfates, Hardness
SLR35	Manhole @ 149 Mercedes Road	33.38075	-117.23419	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR36	Manhole @ Calavo Road & South Stage Coach Lane	33.35826	-117.23103	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS,

					Chlorides
SLR37	Outfall @ Golf Club Road & Lake Vista Drive	33.28366	-117.21702	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR38	Manhole @ Camino Del Cielo & Del Cielo Oeste	33.29387	-117.20944	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR39	Outfall @ 4650 Dulin Road & the Rancho Monserate Country Club (behind the Club House)	33.31786	-117.16384	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR40	Grate cover @ Old Highway 395 @ Via Alta Mira	33.33051	-117.16227	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR41	Manhole @ Dulin Road & Lake Circle Drive (5004 Dulin Road)	33.32792	-117.15190	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR42	Manhole @ Dulin Road & Avocado Vista Lane (north side of road)	33.33023	-117.15087	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR43	Open Channel @ Circle R Drive (on side of road)	33.26245	-117.13904	903.13	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR44	Manhole @ 29803 Circle R Creek Lane (end of road)	33.25392	-117.15141	903.13	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR45	Outfall @ Lawrence Welk Road (300 feet east of Old Highway 395)	33.23315	-117.14393	903.13	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR46	Outfall @ 27700 Block of Mountain Meadow Road	33.21447	-117.11033	903.13	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR47	Outfall @ 14183 Woods Valley Road & Jensen	33.20484	-117.02384	903.14	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total

	Way				Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR48	Outfall @ 13878 Woods Valley Road	33.20677	-117.03069	903.14	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR49	Outfall @ Valley Center Drive & Sunday Drive	33.21486	-117.03371	903.14	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SLR50	Manhole @ Margarita Lane & Cole Grade Road	33.27466	-117.02392	903.12	Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Chlorides
SMG14	Culvert @ De Luz Road	33.39892	-117.24979	902.21	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Iron, Total & Dissolved Manganese, Sulfates, TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SMG15	Outfall @ Mission Road & Aviation Road	33.37388	-117.25354	902.13	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Iron, Total & Dissolved Manganese, Sulfates, TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SMG16	Outfall @ Beech Street & Mission Road	33.37843	-117.25341	902.13	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Iron, Total & Dissolved Manganese, Sulfates, TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SMG17	Manhole @ Alvarado Street & Vine Street	33.38223	-117.25015	902.13	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Iron, Total & Dissolved Manganese, Sulfates, TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SMG18	Outfall @ North Brandon Road & Mission Road (next to foot bridge)	33.38407	-117.24336	902.13	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Iron, Total & Dissolved Manganese, Sulfates, TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SMG19	Open Channel @ 2908 Rainbow Valley Blvd.	33.42489	-117.14240	902.23	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Iron, Total & Dissolved Manganese, Sulfates, TDS, TSS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Hardness
SWT27	Outfall @ Bonita Road (3800 block)	32.65658	-117.04312	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium,

					Hardness
SWT28	Outfall @ Randy Lane and Bonita Road	32.65228	-117.04958	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT34	Outfall @ Valley Vista Road & Pradera Place	32.65894	-117.04858	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT35	Manhole @ Winnetka Drive & Bram Ave.	32.66959	-117.03014	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT36	Outfall @ 3095 Bonita Woods Drive & Briarwood Road	32.67759	-117.02485	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT37	Manhole @ 5530 Central Ave. (behind property)	32.67112	-117.01172	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT38	Outfall @ End of Wild Oats Lane	32.67393	-117.00341	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT39	Open channel @ Ruxton Ave. & Jamacha Blvd.	32.70758	-117.00589	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Total & Dissolved Selenium, Hardness
SWT40	Outfall @ End of South Barcelona Street	32.72669	-116.98350	909.21	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Diazinon, Chlorpyrifos, Malathion
SWT41	Manhole @ Casa De Oro Blvd. & San Juan Street	32.74838	-116.97778	909.12	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, (Cu, Zn, Cd, Pb (dissolved)), Total & Dissolved Selenium, Hardness
SWT42	Manhole @ 3580 Rancho Diego Circle & Country Way	32.73692	-116.91286	909.21	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Diazinon, Chlorpyrifos, Malathion
SWT43	Outfall @ Channel behind Valhalla High School off Hillsdale Road	32.75674	-116.91961	909.22	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), TDS, Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), Diazinon, Chlorpyrifos, Malathion
TIJ13	Outfall @ Sheridan Road & White Sage Trail	32.61964	-116.46535	911.82	Bacteria (Total Coliform, Fecal Coliform, Enterococcus), Total Nitrogen-N (Nitrate, Nitrite, TKN, Ammonia), Total Phosphate-P (Total Phosphate, Orthophosphate), TSS, TDS

APPENDIX 14

Chart of Maximum Dissolved Oxygen vs. Temperature

Temperature(°C)	DO(mg/l)	Temperature(°C)	DO(mg/l)
0	14.60	23	8.56
1	14.19	24	8.40
2	13.81	25	8.24
3	13.44	26	8.09
4	13.09	27	7.95
5	12.75	28	7.81
6	12.43	29	7.67
7	12.12	30	7.54
8	11.83	31	7.41
9	11.55	32	7.28
10	11.27	33	7.16
11	11.01	34	7.16
12	10.76	35	6.93
13	10.52	36	6.82
14	10.29	37	6.71
15	10.07	38	6.61
16	9.85	39	6.51
17	9.65	40	6.41
18	9.45	41	6.41
19	9.26	42	6.22
20	9.07	43	6.13
21	8.90	44	6.04
22	8.72	45	5.95

*Table from EPA

APPENDIX 15

Trash Assessment Form

2012 Trash Assessment Form

SITE ID: ______________________________ **DATE:** ______________________________

LOCATION: ____________________________ **TIME:** _______________________________

OBSERVER: ____

PREVIOUS TRASH ASSESSMENT RATING (IF APPLICABLE):________________________________

ESTIMATED AREA OF ASSESSMENT L X W (FT):____

Amount and Extent of Trash	
EVALUATION OF TRASH INCLUDES*: ☐ **MS4** ☐ **RECEIVING WATER** ☐ **BOTH**	
☐ **Optimal**	On first glance, no trash visible. Little or no trash (<10 pieces) evident when evaluated area is closely examined for litter and debris.
☐ **Suboptimal**	On first glance, little or no trash visible. After close inspection small levels of trash (~10-50 pieces) evident in evaluated area.
☐ **Marginal**	Trash is evident in low to medium levels (~51-100 pieces) on first glance. Evaluated area contains litter and debris. Evidence of site being used by people: scattered cans, bottles, food wrappers, blankets, or clothing present.
☐ **Submarginal**	Trash distracts the eye on first glance. Evaluated area contains substantial levels of litter and debris (>100- 400) . Evidence of site being used frequently by people: many cans, bottles, food wrappers, blankets, or clothing present.
☐ **Poor**	Site is significantly impacted by trash. Evidence of trash accumulation behind a constriction point or evidence of excessive dumping. Evaluated area contains substantial levels of litter and debris (>400 pieces).

* In areas where receiving water is accessible and adjacent to dry weather site, trash evaluation must include receiving water.

Site Evaluation for Potential Threat to Human Health and/or Aquatic Health (applies to area of assessment)	
☐ **Potential Threat to Human Health**	Site poses a threat to human health via swimming, wading, or walking through the area. Trash and debris has the potential to contain chemicals that may bioaccumulate, transmit dangerous bacteria (e.g. medical waste, diapers, human waste), or has the potential for physical harm (sharps, entanglement, nails, etc…). Comments should be added for clarification. Presence of more than one of, or a combination of the following items: hypodermic needles or other medical waste; used diapers, animal waste, or human feces; any toxic substance such as chemical containers, vehicle batteries, or fluorescent light bulbs. Alternatively high prevalence of any one item (e.g. Greater than 50 items that present a puncture or laceration hazard); or observations of mosquito larvae directly observed in water ponded due to trash. All subject to best professional judgment. Describe potential threat on back of form.
☐ **Potential Threat to Aquatic Health**	Site poses a threat to aquatic health or other wildlife (via contact, ingestion, entanglement, etc...) from the trash and debris present. Trash and debris such as small floatable material that is persistent and can be transported long distances may resemble food and may be ingested. Wire, plastic, fishing line, and other material that has the potential for entanglement. Oil and other visible chemicals or chemical containers falls in this category. Comments should be added for clarification. Large amount* of persistent, buoyant litter such as: hard or soft plastics, balloons, Styrofoam (equivalent to a cup), or

	large amount of settleable, degradable and nontoxic debris; cigarette butts. Presence of more than one of, or a combination of the following items: toxic items such as vehicle batteries, or spray cans; any evidence large clumps of yard waste from landscape maintenance such as yard waste or dumped leaf litter (not naturally occurring). All subject to best professional judgment. Describe potential threat on back of form. *Large amount is defined as 50 pieces or more.

- **Complete the following section for Submarginal, and Poor Evaluations ONLY**

Type	Ranking or Count by Type *	POTENTIAL ROUTE (CHECK UP TO 2)				POTENTIAL SOURCE (CHECK UP TO 2)						
		Dumping	Littering	Upstream	Unable to determine	Household	Construction	Commercial	Industrial	School	Transient	Unable to determine
Automotive												
Biohazard Waste												
Business Related												
Cigarette Butts												
Construction												
Fabric/Clothing												
Food Packaging												
Food Waste												
Household												
Shopping Carts												
Toxic												
Yard Waste												

* Only rank the types of trash PRESENT in evaluated area from 1 through 12 (1 is most prevalent – 12 is least prevalent). DO NOT rank types of trash that are not present in evaluated area.

Comments:____

APPENDIX 16:

Photometer Standard Operating Procedure

V-2000 Photometer Standard Operating Procedure (07/09)

General:

Please refer to the Chemetrics Operator's Manual for the V-2000 Photometer (Mar. 08, Rev. 7) for detailed information. Additional information for specific parameters can be found in individual test kits.

--The V-2000 must be zeroed prior to each series of measurements. Additionally, if the ampoule/vial adapter has been removed or comes loose during operation, the V-2000 should be re-zeroed.

--For best results, always cover the ampoule or vial with the light shield prior to zeroing the instrument, setting a reagent blank value or measuring a sample.

--A 13 mm sealed ampoule containing distilled water is supplied in each Vacu-vials test kit for use as a ZERO ampoule for Vacu-vial test procedures.

Zeroing, Program Selection and Measuring:

1) Install the appropriate sample cell adapter into the photometer
2) Turn the photometer on by pressing the **power** key
3) Insert the ZERO ampoule into the V-2000, cover the ZERO ampoule with the light shield, and press the **zero** key. "Wait" is displayed, then the result is displayed as "0.000".
4) Press the **prgm** key, enter the appropriate program number, then press the **yes** key. The instrument will display the appropriate method name and program number. **NOTE:** If the program number is a three-digit number, the **yes** key does not have to be pressed.
5) Follow the parameter-specific test procedure supplied with the test kit on the sample to be tested and insert the resulting test ampoule into the V-2000. Cover the test ampoule with the light shield.
6) Press the **meas** key. If a color development wait time is specified in the parameter-specific test procedure, the V-2000 will begin to countdown. The V-2000 will automatically proceed to the measure mode when wait time is complete. The instrument will read the test ampoule and display the test result. The test result can either be recorded manually, logged manually or logged automatically. **NOTE:** To bypass the timer feature, simply press the **timer** key. The instrument will immediately initiate measurement mode.

Error Messages:

E11: 420 nm LED failure

E12: 520 nm LED failure

E13: 580 nm LED failure

E14: 610 nm LED failure

E19: LCD driver error

Over-range: Test result is more than 110% above claimed operational range; dilute the sample and repeat the test

Under-range: Test result is less than zero.

Supported Parameters (the two we will use out of the 53 available)*:

Nitrate 3: kit catalog number K-6933; program code **121**; wavelength 520 nm; range (PPM): 5.0-50.0; method: cadmium reduction

Phosphate 2: kit catalog number K-8513; program code **159**; wavelength 610 nm; range (PPM): 0.30-8.00; method: stannous chloride

*as of fall 2008