2009 Urban Watch-First Flush Storm Drain Monitoring Program City of Capitola

Santa Cruz County, California

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Capitola Urban Watch Monitoring Program

PROGRAM OVERVIEW

The Capitola Urban Watch & First Flush monitoring programs were conducted by the Coastal Watershed Council (CWC) for the City of Capitola as part of their NPDES Phase II Storm Water Management Program. The Capitola Urban Watch Program began in 2000, and was repeated in 2002, 2004, 2005, 2006, 2007, 2008 and 2009. The Urban Watch Program started regionally in 1997 as a joint effort between CWC, the City of Monterey, and the Monterey Bay National Marine Sanctuary. While the monitoring stations are often the same for both the Urban Watch and First Flush programs, in 2009 there were a few differences in station selection.

The goals of the Urban Watch-First Flush Program are twofold: First, to serve as a tool for education and outreach to the community regarding the impacts that citizens have on local water quality through urban run-off; and secondly, to collect important water quality data to support environmental management decisions at the local and state levels. These goals are achieved through the participation of trained volunteers who monitor storm drain discharges at selected outflows throughout the program area.

Begun in 2000, the First Flush program involves water quality monitoring at area storm drains at the start of the first significant precipitation event of the hydrologic year. This rain event washes the streets and surrounding areas, flushing the gutters and storm drains of pollutants and debris that has accumulated during the dry season. Teams of volunteers mobilize, often during the middle of the night, which was again the case in 2009, to document field observations, make field measurements and collect samples just as the precipitation begins. These samples are then delivered to a professional lab for analysis of trace metals, nutrients and pathogen indicators.

In the Capitola Urban Watch program, dry-season monitoring typically occurs weekly from June through approximately mid-October or November, commonly ending with the first significant rain. During each weekly water quality monitoring event, CWC staff lead trained teams of volunteers to take field observations and measurements. In addition, samples are collected on a monthly basis for professional laboratory analysis to measure nutrients and pathogen indicators.

Monitoring stations are generally the same for both the First Flush and the Urban Watch programs. Although the First Flush event will be mentioned in passing throughout this report, complete results and summaries of the 2009 First Flush event are produced by CWC's program partner, the Monterey Bay Sanctuary Citizen Watershed Monitoring Network. Reports from previous First Flush events can be downloaded from their website at
http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html.
This report includes the methods and results of the 2009 Capitola Urban Watch Monitoring Program.

PROGRAM DESIGN

Equipment & Parameters

The Urban Watch program consisted of volunteer teams collecting field-measured parameters once weekly at seven monitoring stations. The following field measurements and observations were recorded at each site during each weekly monitoring event: presence of trash, smell or sight of sewage, oil sheen and scum, air and water temperature, electrical conductivity, turbidity, color, detergents, dissolved oxygen and pH. On a monthly basis, samples were collected at each site for laboratory analysis of chlorine, ammonia, nitrate, phosphate, copper and bacterial indicators (total coliform and *E. Coli*). Volunteers also made other notable observations of changes to the environment near the monitoring station, including signs of recent 'pollution' activities or sources, wildlife observations and any other conditions which caught their attention. Table 1 lists additional details about each parameter measured.

Table 1. Water Quality Parameters for the Urban Watch Monitoring Program

Parameter	Possible Sources	Associated Problems	Method/Accuracy
Temperature: Air & Water	Illegal discharges	Affects rates of chemical and biochemical reactions in water; may adversely affect fish	Method – Digital thermometer Accuracy ± 1% full scale Or Bulb Thermometer (Spirit) −5 to 55°C
pH	Aerosols and dust in air, mineral substances, sewer overflows, animal wastes, pesticides & fertilizers, photosynthesis, respiration	Affects chemical and biochemical reactions in water. May interfere with fish and other aquatic life	Method – MacHerey-Nagel pH-Fix 4.5-10.0 color-fixed indicator strips Accuracy ± 0.25 units Min detection: 4.5
Detergent surfactants	Illegal or unintended discharges, car washing, cleaning of screens and grills, leaking sanitary sewers	Can be toxic to many aquatic insects, plants, and fish; can indirectly lower dissolved oxygen available to aquatic life	Method – solvent extraction/ bromphenal blue indicator Accuracy ± 0.1 ppm Min detection: >0.1 ppm
Copper	Illegal discharges into the storm drain system; also can occur naturally in surface waters.	Concentrations over 0.025 parts per million are toxic to most freshwater fish.	Method – EPA 200.8 Inductively Coupled Plasma-Mass Spectrometer PQL (practical quantitation limit: 2 µg/L (ppb)
Chlorine	Illegal or unintended connection or draining of a swimming pool to a storm drain; potable water line leaks	Toxic to aquatic life, can create a "sterile" environment.	Method – DPD Octa-Slide Comparator against color standard. Accuracy ± 10% Min detection: >0.2 ppm
Ammonia	Excreted by animals and from decomposition of plant and animal waste; fertilizers, household cleaners	May contribute to increased growth of undesirable algae and plant life	Method-EPA 350.3 Min detection level: 0.03 ppm
Nitrate	Discharge from treated wastewater and sewer overflows, livestock operations, urban or agricultural fertilizer runoff	Can lead to excessive algal growth, lowering of dissolved oxygen levels and eutrophication	Method - EPA 300, ion chromatography Min detection level: 0.02 ppm
Dissolved Oxygen	Low levels can be caused by excess plant decay, poor water circulation. Associated with warm water temperatures.	Chronically low oxygen affects biological community composition. Low levels of DO cause stress to a number of organisms and fish kills.	YSI 556 multi-meter or LaMotte azide modification of the Winkler method - direct reading titration - range: 0-10 ppm
Orthophosphate	Illegal or unintended discharges, car washing, cleaning of screens and	Can be toxic to many aquatic insects, plants, and fish; can lower dissolved oxygen	Method - EPA 300, ion chromatography Min detection level: 0.02 ppm

	grills, leaking sanitary sewers, fertilizers.	available to aquatic life	
Electrical Conductivity	Discharges high in salts and minerals or metals, water moving through local geology.	Possible agricultural, industrial or municipal wastewater runoff.	Method – Electrode probe module. Accuracy ± 1% Min detection: 10 mS or 10 µS
Parameter	**Possible Sources**	**Associated Problems**	**Method/Accuracy**
E. coli bacteria	Illegal connections to storm drain systems, poorly functioning septic systems, wildlife	Detrimental to human health and marine organisms.	IDEXX Standard Method[1] 9223 b Duplicates within 95% confidence limits
Total coliform	An indicator bacteria that may mean contamination from live-stock, faulty septic system, sewer line failure; wildlife; decaying organic matter	High levels of total coliform must be interpreted to check for fecal coliform presence. Individuals exposed to waters with high total coliform may have greater chance of getting sick.	Multiple tube dilution method produces most probable number of organisms out of 100 ml sample.
Turbidity	Microorganisms, sediment, erosion, other particulates.	Interferes with fish and other aquatic life.	Method – Visual Octa-Slide Viewer Compare to a 5 step "Low/Med/High" turbidity standard slide bar
Color	Dyes or chemicals	Interferes with aquatic Insects	Method – Visual Borger Color System
Odor	Illegal discharges or product of decomposition; "clean" drainage water should have no distinctive odor	Can indicate presence of contaminants.	Method – Scent
Oil sheen	Hydrocarbons such as oil, gasoline, and grease; leaking underground petroleum storage tanks	Toxic to aquatic organisms.	Method – Visual
Trash, sewage, scum	Illegal discharges or illegal dumping	Interferes with fish and other aquatic life.	Method - Visual
Units: ppm – parts per million; mg/L – milli grams per liter; mS – milli Siemens; mS – micro Siemens			

CWC provides and maintains a field monitoring kit for all field-measured parameters recorded by volunteer teams. The kit is manufactured by LaMotte Co. (SSDK 7446) and was designed in collaboration with the City of Ft. Worth, TX. It was developed according to National Pollutant Discharge Elimination System (NPDES) Phase I dry weather monitoring requirements and is designed to detect illegal storm drain connections and discharges. To this pre-assembled kit, CWC has added equipment such as thermometers, Oakton "ECTester" conductivity meters, and pH strips for ease of use by volunteer teams. In 2009 CWC continued the use of a device added during the 2008 Urban Watch monitoring, a YSI 556 multi-meter, which measures temperature, pH, conductivity, salinity, TDS and dissolved oxygen (both total DO and % saturation).

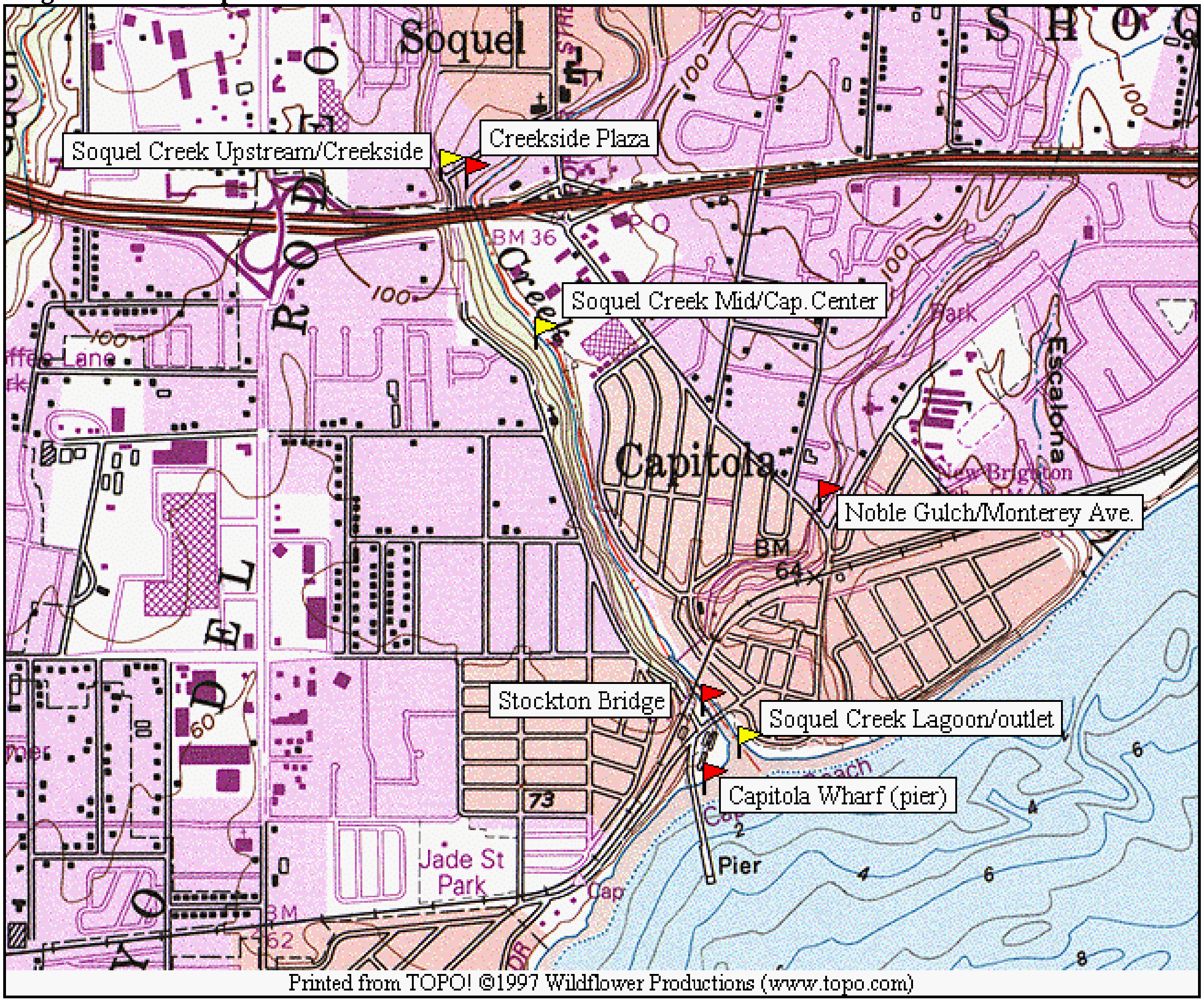
Monitoring Locations

CWC and a representative of the City of Capitola chose three storm drain sampling sites based on drainage basin characteristics and safe access for volunteers and four stream sites chosen to represent the upper, mid and lower reaches of Soquel Creek within the boundaries of the City of Capitola

(Figure 1 and Table 2). For 2009, a site was added to monitor the outlet of the constructed treatment wetlands near the lagoon. The monitoring sites established for this program are referred to as: (1) Creekside Storm Drain, east bank drain behind Creekside plaza parking lot; (2) Monterey Avenue, (Noble Gulch), storm drain from open channel along Monterey Avenue, to the north of the park; (3) Pier, storm drain directly under the Capitola Pier and (4) Soquel Creek Lagoon Outlet, at lower end of lagoon; (5) Wetland outlet, where the wetland discharges back into Soquel Creek; (6) Soquel Creek at Creekside (Upper), midstream sampling just upstream of creekside storm drain; and (7) Soquel Creek-Mid, just upstream from the Capitola Center stormdrain, east bank behind Nob Hill/Longs parking lot.

During the 2008 season two sites, Stockton Bridge (CSD-04) and Monterey Avenue (CSD-08) became inaccessible for monitoring due to construction projects. The Stockton Bridge site had closed access beginning in early September for the purpose of installing a constructed wetland that will incorporate the storm drain runoff. This will, hopefully, improve the quality of the water flowing into the creek at that site. Construction of a new main storm drain began at Monterey Avenue (Noble Gulch) in mid-July. Monitors continued to visit the site for visual inspection and on two occasions (8/6 and 9/4) were able to obtain water samples when afforded access by construction crews. Construction was completed later in the season and the Monterey Avenue site was included in the First Flush monitoring in October.

Figure 1. 2009 Capitola Urban Watch Storm Drain and Stream Locations



Red flags indicate storm drain sites. Yellow flags indicate stream sites.

TABLE 2. Monitoring stations for the 2009 Urban Watch Program

Station Name	Station ID	Land use (Approximate)	Drainage Type (Collection point)	Discharges to:
"Creekside" Storm Drain (SD)	CSD-06	95% residential 5% Open Space	Corrugated concrete pipe	Creek
Creekside Upper (Soquel Creek)	SOQUE-26	Receiving water – mixed land uses	mid-stream collection point	Creek
Soquel Creek @ Lagoon Outlet	SOQUE-22	Receiving water – mixed land uses	concrete and metal weir w/sluice box	Ocean
Monterey Avenue (Noble Gulch)	CSD-08	90% residential 10% Open Space	Surface drainage- samples collected at the entrance to a 65" corrugated metal culvert with ½" asphalt lining	Creek
Pier SD	CSD-09	100% residential	18" corrugated metal culvert in concrete casing (metal 'flap' gate)	Ocean
Soquel Creek @ Nob Hill (Mid)	SOQUE-28	Receiving water – mixed land uses	mid-stream collection point	Creek
Wetland Outlet	SOQUE-27	Wetland and some mixed land use runoff	PVC pipe from wetland to above creek	Creek
Drainage area and land use information supplied by the County of Santa Cruz Public Works Department, 2006. All drains discharge to Soquel Creek, except Pier.				

Day of Week/Time of Day

A total of 19 volunteer dry weather monitoring events occurred, with a distribution over days of the week. The monitoring times during the day varied, but were most frequently during the morning hours due to laboratory arrangements and the availability of staff and volunteer teams.

VOLUNTEER TRAINING

Volunteer preparation

All Urban Watch and First Flush Program volunteers attended one three-hour classroom training and received a minimum of two hours in-field training. Volunteer training sessions followed an established curriculum that CWC regularly uses for training individuals for water quality monitoring. Topics included watershed basics, explanation of parameters to be monitored, monitoring protocols to be used, in-field and chemical safety, background information such as potential sources and negative effects of pollution, and the importance of following safety procedures, including a briefing on safe public encounters.

CWC staff (Nancy Scarborough and Debie Chirco-Macdonald) provided the classroom and field training for the Urban Watch Program, and were assisted by Monterey Bay National Marine Sanctuary staff for the First Flush training. In each instance volunteers were presented with program materials which included: detailed station locations and maps, explanations of monitoring equipment and materials, procedural instructions and test protocols and background information on the subject of urban pollutants. Volunteers demonstrated an understanding of monitoring concepts clean sample collection procedures, test protocols, use of kits and equipment in the field, and safety procedures.

Upon successfully completing the Urban Watch training sessions, volunteers were grouped into teams for monitoring over the duration of the program. A CWC staff person accompanied Urban Watch volunteer teams into the field to each station visit on every monitoring event. Volunteers conducted the monitoring at all stations from June 4 until November 23, 2009.

A total of 19 volunteers and three CWC interns were trained and assigned at least one week per month to monitor during the 2009 program. Field observations and sample collection was completed by each team during their assigned week. Randomized sample collection was achieved by incorporating a flexible monitoring schedule with volunteers, with the day of week and time of day left up to the monitoring team based on volunteers' availability. Volunteers were required to sample during daylight hours, and did so both on weekdays and weekends. A "monitoring event" for a team consisted of the team visiting each monitoring station once within a seven-day period (Monday-Sunday). One data sheet was completed at each station for each of the visits to record site observations (air temperature and trash) whether or not there was flow detected from the storm drain outfall on that occasion.

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

CWC and the Monterey Bay Sanctuary Citizen Watershed Monitoring Network (the Network) jointly prepared a Quality Assurance Project Plan (QAPP) for the Monterey Bay Regional Urban Watch-First Flush Program. This document was approved by the Quality Assurance Officer for the Central Coast Regional Water Quality Control Board (CCRWQCB) on October 8, 2004, and will continue to be in effect as long as the program is maintained by CWC and the Network. QAPP and monitoring protocols are available from CWC upon request. The purpose of the QAPP is to outline the technical aspects of the monitoring program relating to the quality of data, as assured by the implementation of the program described in the document. The QAPP includes required training, sampling methods and procedures, analytical methods, equipment maintenance, documentation protocols, and specific quality control requirements. Per the QAPP protocol, calibration and chain of custody documents are stored at the CWC office. Relative Percent Difference analysis for lab duplicates is included as part of this analysis as well.

A sample of the Quality Assurance/Quality Control (QA/QC) topics included in the QAPP are:

Training (staff and volunteers)

- Monitoring concepts, parameter information
- Sampling methods: Conducting a station visit; Water sample collection; Monitoring equipment & protocols
- Use of standardized data sheets and chain of custody documents
- Safety: chemical, in-field, & public interaction

Equipment maintenance & Programmatic QA/QC Procedures (staff)

- Regular inspection of monitoring equipment and program kits
- Periodic calibration of test equipment
- Monitoring of reagent stores, chemical expiration dates, and waste management.

- Completion of a Standard Operation Procedure for volunteers to use in the field while monitoring.
- Use of regulated monitoring regime and volunteer schedule
- Continued supervision until the trainer is confident in the volunteers' sampling and analysis skills.

Data Quality Management Procedures (staff)

- Training in CWC's Citizen Water Quality MS Access database
- Use of Instrument ID numbers to track equipment used by teams
- Use of Station ID numbers to track monitoring locations
- Maintaining records of equipment calibration
- Periodic review of data entry (field data sheets and lab reports) to assure consistent data entry.
- Processing and analysis of data for report

MONITORING RESULTS

The parameters listed in the following sections were analyzed using a field kit, or at the Santa Cruz County Department of Environmental Health Services (SCCoDEHS) Water Quality Laboratory or at Monterey Bay Analytical Services (MBAS) professional laboratory. Over the period of June 4 until November 23, 2009, monitoring took place at the 7 designated stations 19 times, for a total of 167 samples of the field-based parameters. Water samples were collected for laboratory analysis approximately once a month during this time at stations with flowing water at the time of the visit, for a total of 19 sampling events, and were taken to the County's lab for bacteria and nutrient analysis and to MBAS lab for analysis of copper.

Absence of flow, site inaccessibility, weather conditions and other factors occasionally prevented teams from recording data for all of the parameters on each station visit. "Frequency of exceedance" is the relationship of the number of times the parameter was found to be above the Water Quality Objective or "attention level", out of the total number of times a measurement or observation for that parameter was collected during the program.

For each parameter with an approved criterion or range, the Water Quality Objective (WQO) is noted along with the origin of each WQO. These criteria originate from accepted sources such as the United States Environmental Protection Agency's (US EPA) Water Quality Criteria, the State Water Resources Control Board's (SWRCB) "California Ocean Plan," and the Central Coast Regional Water Quality Control Board's (CCRWQCB) "Basin Plan." The WQOs apply to the surface waters that the urban runoff discharges flow into - not the urban runoff discharges themselves. The comparisons to WQOs are provided for general information only, and exceedances do not indicate regulatory non-compliance for any specific storm drain discharge.

The Monterey Bay Regional Urban Watch-First Flush Program operates in the CCRWQCB region, and therefore also recognizes CCRWQCB's Central Coast Ambient Monitoring Program (CCAMP) which has set non-regulatory criteria for many parameters, based on region-specific conditions or concerns in the form of "attention levels." As these "attention levels" are non-regulatory in nature, they are frequently lower than the regulatory criteria. Detections of pollutants or conditions at the "attention level" are indicators that both human and wildlife health may be compromised, and further investigation may be warranted. CWC refers to both the regulatory and non-regulatory criteria values in this report.

For the purposes of this program, "detection" is any value that is detected by our testing equipment or the lab procedures (i.e., a quantitative result is reported);"exceedance" is any reported value greater than the lowest identified WQO or action level criteria. In the case of parameters without criteria, such as detergent surfactants or chlorine, the minimum detection level of the test kit or tool is considered both a detection and an exceedance, as the presence of either surfactants or chlorine is considered undesirable. Water temperatures above 22^{o}C and pH values out of the normal range (7.0-8.5) are also identified as exceedances, indicating unsatisfactory water quality conditions, based on CCRWQCB "Basin Plan" criteria.

See Table 3 for a summary of mean, minimum, and maximum results of detergents and chlorine for each station; Table 4 for a summary of the frequency and percent of exceedances for field-measured quantitative parameters; Table 5 for frequency and percent values of qualitative measurements; Table 7 for lab results by date; Table 8 for lab results by station and QAPP analysis; and Table 9 for a summary of average, minimum, and maximum results for all parameters. See the Appendix for a consolidated record of the field data in tabular form by station.

I. UW Quantitative Field Parameters

Air Temperature

WQO: None

Water Temperature

Attention level: CCAMP, > 22^{o}C – Cold Freshwater Habitat.

Chlorine

WQO: None (tap water is typically <2 mg/L Cl_2).
Chlorine, as Cl_2 (molecular chlorine) is highly toxic, and it is often used as a disinfectant. In combination with a metal such as sodium it becomes essential for life. Small amounts of chloride (Cl^-) are required for normal cell functions in plant and animal life. High chloride levels can cause human illness and also can affect plant growth. Detections of molecular chlorine in storm drain discharges could be an indicator of industrial wastewaters. Extremely low concentrations may indicate a drinking water discharge from a local source.

Conductivity

WQO: None.
Electrical conductivity is a measure of a substance's ability to conduct an electric current. Pure water is not a good conductor of electricity. Because an electrical current is transported by the ions in solution, the conductivity increases as the concentration of dissolved ions, such as salts and minerals, increases.[1] This current can be measured in microSiemens (µS) or milliSiemens (mS) per cm; 1mS = 1000µS. Conductivity measurements were taken with either the Oakton ECTester low range meter (0–1990 µS) or with the Oakton ECTester high range meter (0-19.90 mS; 0–19,900 µS) to ensure no

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[1] Lenntech Water Treatment & Air Purification Holding B.V: http://www.lenntech.com/water-conductivity.htm

readings would be out of range. The average conductivity in discharging waters at each site is helpful in determining the influx of fresh rainwater during the "First Flush" event.

Detergent Surfactants

WQO: None.

Surfactants and detergents are common contaminants of surface water due to their widespread use in many products used for washing and cleaning operations. Surfactants constitute the most important group of detergent components as they are water-soluble surface-active agents.[2] Detergent products often contain more than surfactants, such as enzymes, bleaches, and dyes. Detergent surfactants are made from a variety of petrochemicals (derived from petroleum) and/or oleochemicals (derived from fats and oils).[3] The presence of detergent surfactants in a storm drain system is a strong indicator of run-off or effluent discharges.

Dissolved Oxygen

Critical exceedance: Outside of the range of 6.5 to 12 mg/L DO

Dissolved oxygen is critical to the survival and wellbeing of aquatic organisms. Chronically depressed oxygen levels affect biological community composition, and are common where plant decay and/or poor water circulation is prevalent. Wide daily ranges of dissolved oxygen concentrations are symptomatic of nuisance algal growth and decay (eutrophication).

pH

WQO: CCRWQCB Basin Plan, >7.0 or <8.5 pH units.

The pH measurement indicates whether a solution is acidic or basic (alkaline), with 7 being neutral, below 7 acidic, and above 7 alkaline or basic. Typical rainwater has a pH of about 5 to 6, which is slightly acidic. When pH ranges too far from neutral it can be harmful to fish and other aquatic life, especially in the acidic range.

Turbidity

WQO: None

Turbidity is the cloudiness or transparency of a fluid caused by suspended particles that are generally invisible to the naked eye. Increased levels of turbidity can negatively affect photoactive processes in the water at varying depths, and can cause harm to fish and other aquatic organisms.

[2] Sigma-Aldrich Co. http://www.sigmaaldrich.com/Brands/Fluka___Riedel_Home/Bioscience/BioChemika_Ultra/Detergents_Surfactants.html

[3] Soap and Detergent Association http://www.sdahq.org/sdalatest/html/soapchemistry2.htm

TABLE 3 Positive Results: Mean, Minimum, Maximum Values for Field Measurements

	Air Temp (°C)			Water Temp (°C)			Chlorine (ppm)		
WQO/Attention level	None			Attention level: >22°C			None		
Minimum detection Limit:	−5			−5			>0.2		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Creekside SD	17.0	14.0	20.5	14.2	10.0	15.5	ND	ND	ND
Creekside Upper	16.9	14.0	21.0	15.3	8.5	17.8	ND	ND	ND
Lagoon Outlet	16.4	13.5	19.5	18.1	9.4	21.1	ND	ND	ND
Monterey Ave. SD	16.4	13.0	19.0	14.2	8.0	20.0	ND	ND	ND
Pier SD	15.1	11.5	18.5	16.4	14.0	19.5	ND	ND	ND
Soquel Creek-Mid	16.6	12.0	21.0	15.4	8.7	17.8	ND	ND	ND
Wetland Outlet	15.9	13.0	22.0	19.2	13.6	20.8	ND	ND	ND

	Electrical Conductivity (uS)			Detergent (ppm)			Dissolved Oxygen (mg/L)		
WQO/Attention level	Attention level: >2000						WQO: ≥7.0		
Minimum detection Limit:	10			>0.1					
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Creekside SD	636	600	680	ND	ND	ND			
Creekside Upper	610	304	830	ND	ND	ND	9.7	7.9	11.8
Lagoon Outlet	4524	608	49360	ND	ND	ND	10.7	8.6	12.8
Monterey Ave. SD	661	600	730	ND	ND	ND			
Pier SD	520	470	610	0.02	ND	0.3			
Soquel Creek-Mid	632	560	831	ND	ND	ND	9.6	8.2	11.6
Wetland Outlet	3099	609	37460	ND	ND	ND	7.4	4.3	9.5

	pH		
WQO/Attention level	WQO: 7.0-8.5		
Minimum detection Limit:	4.5		
	Mean	Min	Max
Creekside SD	6.9	6.5	7.0
Creekside Upper	8.0	7.6	8.2
Lagoon Outlet	7.8	7.0	8.3
Monterey Ave. SD	6.7	6.5	7.0
Pier SD	6.8	6.5	7.0
Soquel Creek-Mid	7.9	7.6	8.2
Wetland Outlet	7.9	6.8	8.2

light grey cells = *Exceeds WQO*

(hatched cells) *DO measured in streams sites only*

ND=non-detection or below the minimum detection limit of the equipment

For calculations of mean and median values, Non-detect (ND) results are treated as 0.5 times the analytical reporting limit (RL).

TABLE 4 Percent and Frequency of Exceedance Values for Field Measurements

	Air Temp (°C)			Water Temp (°C)			Chlorine (ppm)		
	# of Exceedances	Total # samples	% Exceedance	# of Exceedances	Total # samples	% Exceedance	# of Exceedances	Total # samples	% Exceedance
Creekside SD	NA	17	NA	0	19	0	NA	19	NA
Creekside Upper	NA	15	NA	0	17	0	NA	16	NA
Lagoon Outlet	NA	17	NA	0	18	0	NA	18	NA
Monterey Ave. SD	NA	17	NA	0	18	0	NA	18	NA
Pier SD	NA	17	NA	0	16	0	NA	15	NA
Soquel Creek-Mid	NA	15	NA	0	17	0	NA	15	NA
Wetland Outlet	NA	16	NA	0	15	0	NA	14	NA

	Electrical Conductivity (uS)			Detergent (ppm)			Dissolved Oxygen (mg/L)		
	# of Exceedances	Total # samples	% Exceedance	# of Exceedances	Total # samples	% Exceedance	# of Exceedances	Total # samples	% Exceedance
Creekside SD	0	19	0	0	19	0	NA	0	NA
Creekside Upper	0	17	0	0	2	0	0	16	0
Lagoon Outlet	3	17	18	0	17	0	0	17	0
Monterey Ave. SD	0	18	0	0	18	0	NA	0	NA
Pier SD	0	16	0	1	16	6	NA	0	NA
Soquel Creek-Mid	0	17	0	0	2	0	0	16	0
Wetland Outlet	1	15	7	0	4	0	5	15	33

	pH		
	# of Exceedances	Total # samples	% Exceedance
Creekside SD	4	19	21
Creekside Upper	0	17	0
Lagoon Outlet	0	18	0
Monterey Ave. SD	11	18	61
Pier SD	5	16	31
Soquel Creek-Mid	0	17	0
Wetland Outlet	1	15	7

NA=Not Applicable, e.g., no WQO applies but parameter shown to indicate number of monitoring results

II. UW Qualitative Field Parameters

Volunteers were asked to make "presence or absence" observations of the parameters listed below. Detailed descriptions were noted on the field data sheet, and are available upon request. These observations were recorded even when flow was not present and samples were not collected. "Frequency" therefore is the relationship of the number of times the parameter was recorded as other than normal, to the number of times an observation for that parameter was recorded throughout the program. Please see Table 5 for frequency results of qualitative field parameters.

Color

Volunteers matched water samples to a Borger Color System (BCS) booklet used to identify colors in nature. Generally, all samples were found to be transparent (colorless), a pale tan color, or a pale gray color.

Odors

The observation of odor is taken from the sample water collected, and measured away from the monitoring station; volunteers were instructed to determine if the water itself, rather than the general location, emits an odor.

Sewage

The observation of sewage indicates visual evidence or odor of human or other animal feces located in the immediate vicinity of the storm drain.

Surface scum

The observation surface scum, by visual observation, indicates some type of froth on the water's surface in or near the drain outfall. This scum may originate from any number of biological or human induced causes, and no specific information was gathered to indicate the source. These observations are typical of a common iron oxidizing bacteria/fungus, which forms an oily or foamy rust colored area at the water's margin, usually indicating that the stream is being recharged from a groundwater source, and these features are most commonly seen at seeps or springs[4].

Trash

The observation of trash was recorded when unnaturally occurring materials were found at the monitoring station.

[4] "Fairfax County Stormwater Planning Division – Perennial Streams Field Identification Protocol", Fairfax County Public Works and Environmental Services Department
http://www.cblad.virginia.gov/docs/guidance/Perennial_Stream_Doc_Fairfax_NC/FairfaxMethod_May_03.pdf

TABLE 5 Frequency and Percent of Positive Observations	TRASH			SEWAGE			OIL SHEEN		
	Positive Findings	Total # samples	% Positive	Positive Findings	Total # samples	% Positive	Positive Findings	Total # samples	% Positive
Creekside SD	0	18	0	0	18	0	0	18	0
Creekside Upper	3	16	19	0	16	0	10	16	63
Lagoon Outlet	11	17	65	0	17	0	0	17	0
Monterey Ave. SD	3	18	17	6	18	33	13	18	72
Pier SD	14	16	88	3	16	19	0	16	0
Soquel Creek-Mid	5	17	29	3	17	18	3	17	18
Wetland Outlet	3	15	20	0	15	0	1	15	7

	SURFACE SCUM			ODOR			COLOR		
	Positive Findings	Total # samples	% Positive	Positive Findings	Total # samples	% Positive	Positive Findings	Total # samples	% Positive
Creekside SD	2	18	11	0	19	0	2	19	11
Creekside Upper	2	16	13	0	17	0	4	17	24
Lagoon Outlet	10	17	59	0	18	0	3	18	17
Monterey Ave. SD	6	18	33	0	18	0	6	18	33
Pier SD	2	16	13	0	16	0	5	16	31
Soquel Creek-Mid	1	17	6	0	17	0	2	17	12
Wetland Outlet	2	15	13	0	15	0	3	15	20

NA=Not Applicable, e.g., no WQO applies but parameter shown to indicate number of monitoring results

III. UW Laboratory Data

Water samples were collected once per month during the ‘dry’ months of the program, resulting in a total of four monitoring events with lab analyses. These samples were collected when levels of water flow at the monitoring stations allowed for sample collection. Table 6 shows flow levels, measured in centimeters, for all sites on each monitoring date.

Table 6	Water flow at each station (depth in cm)				
	6/4/2009	6/8/2009	6/18/2009	6/27/2009	6/29/2009
Creekside SD		0	0.5	0.8	1
Creekside Upper	22.89	22.5	235	22.4	
Lagoon Outlet	0		0	0.5	0
Monterey Ave. SD	2.8	3.5		2.1	2.6
Pier SD	0		0	0	0
Soquel Creek-Mid	13	15.5		10.1	11.7
Wetland Outlet				1.3	
	7/7/2009	7/11/2009	7/23/2009	7/27/2009	
Creekside SD	0.4		0.4	0.2	
Creekside Upper	22	17.3	2.78		
Lagoon Outlet	0	0.13	3.2		
Monterey Ave. SD	2	1.8	2.2		
Pier SD	0	0.35	0.3		
Soquel Creek-Mid	11.5	11.3	29.5		
Wetland Outlet					
	8/8/2009	8/13/2009	8/18/2009	8/24/2009	8/30/2009
Creekside SD	0.2	0.4	0	0	4
Creekside Upper	17.8	18.8		19	17.1
Lagoon Outlet	2.7	20.3		1.7	0
Monterey Ave. SD	2.1	1.8	1.5	1.5	2
Pier SD	0	1.9	0		2
Soquel Creek-Mid	12.5	9.8	9.2	10.5	5.3
Wetland Outlet			1.2		
	9/11/2009	11/3/2009	11/5/2009	11/8/2009	11/23/2009
Creekside SD	0	0	0.2	0.7	0.1
Creekside Upper	18.4		31.6	40.1	
Lagoon Outlet	0	22	0		0
Monterey Ave. SD	0.9		3.5	4.8	3.2
Pier SD	0	0.2	0.2	0.2	0.2
Soquel Creek-Mid	13.1	30	40.6	39.6	41.2
Wetland Outlet					

Once the samples were collected, they were iced and delivered to Santa Cruz County Department of Environmental Health Services Water Quality Laboratory to be tested for bacteria (*E.coli*, total coliform) and nutrients (nitrate, orthophosphate, and ammonia). Another set of samples were taken to Monterey Bay Analytical Services to be tested for copper. Please see Table 7 for lab results listed by date and Table 8 for lab results listed by station with mean, minimum, and maximum values.

Bacteria:

***E. Coli* & Total Coliform**

CRWQCB Basin Plan -CCAMP:

E. coli – Attention level: No single sample shall exceed 235 MPN/100ml.

Total coliform – Attention level: No single sample shall exceed 10,000 MPN – Marine Water Contact Recreation.

Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of warm- and cold- blooded animals. They aid in the digestion of food. A specific subgroup of this collection is the fecal coliform bacteria, the most common member being *Escherichia coli* (*E. coli*). These organisms may be separated from the total coliform group by their ability to grow at elevated temperatures and are a specific kind of fecal coliform bacteria that live in the intestines of warm-blooded vertebrates.

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other animals. At the time this occurred, the source water may have also been contaminated by pathogens or disease-producing bacteria or viruses which can also exist in fecal material. The test for total coliform is a broad measure of all forms of coliform bacteria present in human and other mammalian waste, while the analysis for *E. coli* is to determine the presence of the more specific fecal coliforms. The presence of bacteria in water is expressed in the unit "Most Probable Number" of bacteria colonies in 100 milliliters of water: MPN/100mL.

Nutrients:

Nitrate nitrogen (NO_3)

CCRWQCB CCAMP Attention Level >2.25 mg/L (ppm) NO_3

Nitrogen is one of the most abundant of earth's elements. About 80 percent of the air we breathe is nitrogen. It may exist in many forms, including in the free state as nitrogen gas (N_2), nitrite (NO_2), ammonia (NH_3), and nitrate (NO_3), of concern here. Organic nitrogen is found in the cells of all living beings as a major component of proteins and is continually recycled by plants and animals. Nitrogen is a nutrient that occurs naturally in streams and is essential for plants and animals in an aquatic ecosystem. Problems occur when large amounts of nitrogen are introduced into the stream ecosystem, where it can cause excessive algal growth, depleting the available oxygen in the stream that fish and other aquatic organisms depend upon. Left unchecked, excessive algal and plant growth can lead to eutrophication.

Nitrate is common in lawn and garden fertilizer used in residential neighborhoods (a sometimes overlooked but significant source) as well as in agricultural fertilizer, and elevated nitrate levels can result from water seeping through soil containing nitrate-bearing minerals. Nitrate is also one of the products of decomposition of animal and human wastes. In the process of decomposition, raw manure undergoes a chemical change and among the end products is nitrate nitrogen.

When nitrate occurs in a fresh water body at a concentration above the attention level, it is considered evidence of pollution from septic tank fields, cesspools, animal agricultural operations, or fertilizer runoff from agricultural or urban land uses. Where groundwater is known to contain little or no nitrate nitrogen naturally, significant increases are a probable indication of pollution.

Ammonia (NH_3)

WQO: CCAMP-US EPA <0.025mg/L (ppm) NH_3

Ammonia (NH_3) is the elemental nitrogen concentration within the ammonia (NH_3) present in the sampled water. Ammonia is excreted by animals and produced during decomposition of plants and animal waste. Its natural breakdown thus returns nitrogen to the aquatic system. It is rapidly oxidized in natural water systems by bacterial groups that produce nitrite (NO_2) and nitrate (NO_3), which are then used as nutrients by plants; therefore ammonia is an additional source of nitrogen as a nutrient which may contribute to the expanded growth of undesirable algae and other forms of plant growth that may overload the natural system. The unionized form of ammonia (NH_3) is the preferred nitrogen-containing nutrient for plant growth but is toxic to animals, causing lower reproduction and growth, or death to fish and other aquatic life.

Ammonia nitrogen is present in various concentrations in many surface and ground water supplies and is sometimes accepted as chemical evidence of pollution when encountered in natural waters. The main uses of ammonia are in the production of fertilizers, explosives and polymers and it is also an ingredient in certain household cleaners.[4]

Orthophosphate (PO_4-P)

CCRWQCB CCAMP Attention level of > 0.12 mg/L orthophosphate as P

Phosphorus is necessary for growth of plants and animals. Phosphorus in elemental form (P) is very toxic and is subject to bioaccumulation. Phosphates (PO_4) are formed from this element. Phosphates exist in three forms: orthophosphate, metaphosphate (or polyphosphate) and organically bound phosphate. Ortho forms are produced by natural processes and are found in sewage. Phosphates will stimulate the growth of plankton and aquatic plants providing food for fish. However, if an excess of phosphate enters the waterway, algae and aquatic plants may grow excessively, choke up the waterway and use up large amounts of oxygen: a condition known as eutrophication.

Metals:

Copper

WQO: USEPA-CA <22.8µg/L (based on Soquel Creek mean hardness value 286 mg/L ($CaCO_3$)
CCRWQCB Basin Plan < 30 µg/L for cold and warm water fish habitat.

Copper is a mineral element; however it is used in many industrial applications, and is a common urban runoff pollutant, with a wide range of sources in urban environments. Surface runoff and stormwater flows pick up copper and zinc from brake and tire wear, vehicle wash wastewater, and building materials.

TABLE: 7 Nutrient/Bacteria Indicators/Copper Lab Results by Date						
Station	NH_3 ppm	NO_3 ppm	PO_4-P ppm	E. Coli MPN/100mL	T. coli MPN/100mL	CU ppb
WQO	<0.025 ppm	<2.25	<0.12	<235	<10,000	<22.8
Monitoring Date: 6/8/2009						
Creekside SD	ND	25.09	ND	30	3255	ND
Creekside Upper	ND	ND	ND	197	2098	ND
Lagoon Outlet	0.24	ND	ND	269	2247	ND
Monterey Ave. SD	0.10	1.81	ND	683	2142	ND
Pier SD	ND	6.83	ND	63	3873	ND
Soquel Creek (Mid)	ND	ND	ND	132	1450	ND
Wetland Outlet	ND	0.37	ND	160	2243	ND
Monitoring Date: 7/7/2009						
Creekside SD	ND	7.24	ND	<5	19863	ND
Creekside Upper	ND	ND	ND	109	2613	
Lagoon Outlet	0.05	ND	ND	272	1935	
Monterey Ave. SD	ND	2.12	ND	886	9804	ND
Pier SD	ND	2.50	ND	146	24196	6
Soquel Creek (Mid)	ND	ND	0.12	173	2247	
Wetland Outlet	ND	1.30	ND	41	8164	
Monitoring Date: 8/13/2009						
Creekside SD	ND	24.05	ND	20	1333	ND
Creekside Upper	ND	ND	0.10	148	2909	ND
Lagoon Outlet	ND	ND	ND	605	2481	ND
Monterey Ave. SD	ND	2.11	ND	1918	12033	ND
Pier SD	NA	NA	NA	NA	NA	NA
Soquel Creek (Mid)	ND	ND	ND	98	3076	ND
Wetland Outlet	ND	0.53	ND	20	1126	ND
Monitoring Date: 11/5/2009						
Creekside SD	ND	26.05	ND	4106	48840	8
Creekside Upper	ND	ND	ND	142	2359	ND
Lagoon Outlet	ND	ND	ND	1565	12033	343
Monterey Ave. SD	ND	4.41	ND	4106	6488	ND
Pier SD	ND	5.06	ND	132	>24196	ND
Soquel Creek (Mid)	ND	ND	ND	109	1076	ND
Wetland Outlet	NA	NA	NA	NA	NA	NA
WQO=water quality objective; NA=Not Applicable as no sample taken (low flow)						
Grey cells=exceedance						

TABLE 8	Lab results for Monthly Bacteria, Nutrient and Copper by Station						
		NH_3	NO_3	PO_4-P	E. Coli	Total Coliform	Cu (ug/L)
Station Name	Date	ppm	ppm	ppm	MPN/100mL	MPN/100mL	ppb
WQO		<0.025	<2.25	<0.12	<235	<10,000	<22.8
Creekside SD	6/8/2009	ND	25.09	ND	30	3255	ND
Creekside SD	7/7/2009	ND	7.24	ND	<5	19863	ND
Creekside SD	8/13/2009	ND	24.05	ND	20	1333	ND
Creekside SD	11/5/2009	ND	26.05	ND	4106	48840	8
Creekside Upper	6/8/2009	ND	ND	ND	197	2098	ND
Creekside Upper	7/7/2009	ND	ND	ND	109	2613	
Creekside Upper	8/13/2009	ND	ND	0.10	148	2909	ND
Creekside Upper	11/5/2009	ND	ND	ND	142	2359	ND
Lagoon Outlet	6/8/2009	0.24	ND	ND	269	2247	ND
Lagoon Outlet	7/7/2009	0.05	ND	ND	272	1935	
Lagoon Outlet	8/13/2009	ND	ND	ND	605	2481	ND
Lagoon Outlet	11/5/2009	ND	ND	ND	1565	12033	343
Monterey Ave. SD	6/8/2009	0.10	1.81	ND	683	2142	ND
Monterey Ave. SD	7/7/2009	ND	2.12	ND	886	9804	ND
Monterey Ave. SD	8/13/2009	ND	2.11	ND	1918	12033	ND
Monterey Ave. SD	11/5/2009	ND	4.41	ND	4106	6488	ND
Pier SD	6/8/2009	ND	6.83	ND	63	3873	ND
Pier SD	7/7/2009	ND	2.50	ND	146	24196	6
Pier SD	11/5/2009	ND	5.06	ND	132	>24196	ND
Soquel Creek (Mid)	6/8/2009	ND	ND	ND	132	1450	ND
Soquel Creek (Mid)	7/7/2009	ND	ND	0.12	173	2247	
Soquel Creek (Mid)	8/13/2009	ND	ND	ND	98	3076	ND
Soquel Creek (Mid)	11/5/2009	ND	ND	ND	109	1076	ND
Wetland Outlet	6/8/2009	ND	0.37	ND	160	2243	ND
Wetland Outlet	7/7/2009	ND	1.30	ND	41	8164	
Wetland Outlet	8/13/2009	ND	0.53	ND	20	1126	ND
Total tests		26	26	26	26	26	22
Minimum		ND	ND	ND	<5	1076	ND
Maximum		0.24	26.05	0.12	4106	48840	343
Median		0.02	0.45	0.00	147	2761	ND
Mean		0.03	4.23	0.01	620	7849	18
Total Exceedances		3	8	1	9	6	1
Percent Exceedances		12%	31%	4%	35%	23%	5%
Lab QA							
Field Blanks							
Field Blank	6/8/2009	ND	ND	ND	<5	<5	
Field Blank	7/7/2009	ND	ND	ND	<5	<5	ND
Field Blank	8/13/2009	ND	ND	ND	<5	<5	ND
Field Blank	11/5/2009	ND	ND	ND	<5	<5	ND
Duplicates							
Dupe	6/8/2009	ND	ND	ND	169	169	ND
Dupe	7/7/2009	ND	1.50	ND	733	17329	ND
Dupe	8/13/2009	ND	2.33	ND	2143	9804	ND
Dupe	11/5/2009	0.01	4.26	ND	6488	12997	ND

Table 8 & 9 Notes:
ND=Below detection limit of test
Grey cell=Exceedance of WQO or Attention level
Note: For calculations of mean and median values, Non-detect (ND) results are treated as 0.5 times the analytical reporting limit (RL).

TABLE 9 Summary of Results for All Stations

	Trash	Sewage	Oil Sheen	Scum	Odor	Color
Total tests	117	117	117	117	120	120
Minimum	F	F	F	F	F	Colorless
Maximum	T	T	T	T	T	Lt. Grey
Median	N/A	N/A	N/A	N/A	N/A	N/A
Mean	N/A	NA	NA	NA	NA	NA
Total Exceed.	39	12	27	25	0	0
% Exceedances	33%	10%	23%	21%	0%	0%

	Air Temp ˚C	H2O Temp ˚C	Cl ppm	Elec. Cond. uS	Det. ppm	DO mg/L	pH
WQO/Attn Level:	N/A	<22˚	2	<2000	None	6.5-12	7.0-8.5
Total tests	114	120	115	119	78	64	120
Minimum	11.5	8	ND	304	ND	4.25	6.5
Maximum	22	21.08	0.2	49360	0.3	12.83	8.3
Median	16.3	16.0	ND	622	0.0	9.62	7.63
Mean	16.2	16.0	ND	1486	0.0	9.42	7.41
Total Exceed.	NA	0	0	4	1	5	21
% Exceedances	NA	0%	0%	3%	ND	8%	18%

	NH3 ppm	NO3 ppm	PO4-P ppm	E. Coli MPN/ 100mL	Total Col MPN/ 100mL	Cu ppb
WQO/Attn Level:	<0.025	<2.25	<0.12	<235	<10,000	<22.8
Total tests	26	26	26	26	26	22
Minimum	ND	ND	ND	<5	<5	ND
Maximum	0.24	26.05	0.12	6488	48840	343
Median	0.02	0.45	0.00	147	2761	2
Mean	0.03	4.23	0.01	620	7849	18.0
Total Exceed.	3	8	1	9	6	1
% Exceedances	12%	31%	4%	35%	23%	5%

**All instances of oil sheen were determined to be of biological, not petrol-based, origin.*

IV. First Flush Event

A separate report including discussion and analysis of results from all cities in the CWC 2008 First Flush Program will be made available to the public and sent to local area governments and agencies. The results of previous First Flush events are available by contacting Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Watershed Monitoring Network at (831-883-9303). Reports can also be downloaded from the Internet at: http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html. Table 10 below also summarizes the First Flush results for those sites in the City of Capitola.

Table 10 Capitola First Flush 2009

	Flow	Trash	Sewage	Oil Sheen	Scum	Water Temp	Elec. Cond.	pH	Calcium
Units	H/M/L					˚C	uS	units	mg/L
WQO/Attn Level:	N/A	N/A	N/A	N/A	N/A	<22˚	<2000	7.0-8.5	
Auto Plaza	High	N	N	N	Y	14.8	40	7.17	3.0
Capitola Center	High	N	N	N	Y	15.0	48		2.7
Monterey Ave. SD						11.5	169		13.6
Pier SD	Moderate	Y	N	N	N	13.9	130		6.8
Lagoon Outlet	High	N	N	N	Y	14.9	607	7.7	
Creekside Upper						14.1	351	8.21	50.0
Soquel Creek (Mid)	High	N	N	N		14.41	205	7.89	22.0

	E. coli	Total Coliform	Enterococci	Hardness (as CaCO3)	Mg	NO3	o-Phosphate-P	TSS	Urea-N
Units	#/100ml	#/100ml	MPN/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L
WQO/Attn Level:	<235	<10,000				<2.25	<0.12		
Auto Plaza	16027	113035	20640	8.0	0.5	0.7	0.18	83	99
Capitola Center	7973	48392	2765	7.0	0.5	0.9	0.17	65	28
Monterey Ave. SD	68602	241960	72198	52.7	4.6	2.5	0.14	629	94
Pier SD	8431	55883	8506	26.7	2.4	1.4	0.15	128	123
Lagoon Outlet									
Creekside Upper	7894	68667	1849	191.0	16.0	1.1	0.20	123	NA
Soquel Creek (Mid)	5510	48392	822	85.0	7.2	1.2	0.20	43	NA

Shaded values = exceed WQO or Attention Level

URBAN WATCH DISCUSSION

The 2009 Urban Watch season for the City of Capitola had a total of 19 dates on which teams visited stations, totaling 125 individual station visits. This was an increase from the 102 station visits during 2008, and the same as the 125 station visits during 2007. Monitoring site availability, lack of flow and an occasional equipment problem resulted in some parameters not being monitored at every station on every visit. The following section summarizes the results, grouped by parameter and then by station.

Discharge at Monitoring Stations

Of the six stations visited from June through November 2009, three exhibited enough flow to measure water quality conditions throughout the entire course of the program. Flow was detected at the Creekside Upper, Monterey Avenue SD and Soquel Creek-Mid sites during every station visit, as the streams stations carry perennial base flows and the storm drains derive flow from groundwater or unknown surface sources. The Creekside SD station exhibited flow 12 of 17 times from June through November; the Lagoon Outlet exhibited flow 12 of 15 times; the Pier SD: 7 out of 15 times and the Wetland Outlet: 2 out of 2 times. Of the 125 station visits, there were a total of 75 in which measurable flow was produced for field measurements. In 2008, 88 of the 102 station visits found measurable flow.

Parameter Detections

The WQOs used in this report apply to the surface waters that the urban runoff discharges flow into– not the urban runoff discharges themselves. The following comparisons to WQOs are provided for general information only, and exceedances do not indicate regulatory non-compliance for any specific storm drain discharge.

- **Air temperature** has no WQO; **Water temperature** never exceeded the attention level of 22°C.
- **Chlorine** was detected in only 1 of 116 measurements, at Creekside Upper on 11/23/2009.
- **Detergent surfactants** were detected only once in 79 measurements; 0.3 ppm at the Pier SD station on 8/8/2009. There is no official WQO for detergents. This is a percentage of 1.3% of all samples testing positive, compared with 46% of samples in 2008 and 41% in 2007. This year, detergent measurements were below the detection limit (0.1 ppm) in 78 out of 79 tests.
- **Dissolved Oxygen,** measured at the stream sites but not at the storm drain sites, was found to be below the WQO in 8% of measurements (5 out of 64). The Wetland Outlet accounted for all five of those measurements. Since all samples were taken in the daylight it is possible that nighttime levels may have been lower.
- Field measurements of **pH** were outside of the CRWQCB Basin Plan WQO (7.0 – 8.5) in 18% of samples (21 of 120), with all exceedances below the WQO range. 20 of these 21 measurements where pH measurements fell below 7.0, the lower WQO limit, were at stormdrain sites. This indicates relatively good pH in Soquel Creek waters. The average pH for all samples was 7.41, with a minimum of 6.5 and a maximum of 8.3.
- From the **qualitative observations** made in the field, no distinct **odor**, or intense **color** was detected during any station visit. Other visual observations include the following:

- **Oil sheen** was recorded in 23% of visits (27 of 117). Creekside Upper and Monterey Ave SD had the most regular occurrences of oil sheen observed. These may be from natural bacterial breakdown of organic matter as opposed to an anthropogenic source. In 2008, oil sheen was observed on 15% of visits.
- **Sewage,** either observed by sight or smell, was recorded in 12% of visits (12 of 117). Six occurrences were at Monterey Ave SD, and three each at Pier SD and Soquel Creek-Mid. One of several possible sources of sewage is the presence of birds often noted at stations, both in and over the water.
- Volunteers reported findings of **surface scum** at 21% (25 of 117) of station visits. Most, however, were associated with areas of high algae, as field teams observed an orange residue typical of a common iron-oxidizing bacteria/fungus, which forms an oily or foamy rust- colored area at the water's margin. 10 of the 25 positive surface scum observations were at the Lagoon Outlet.
- **Trash** was observed at all of the monitoring stations except Creekside SD. In total 33% of station visits (39 of 117) had positive trash observations. In 2008 that figure was 55%, which was about double the 2007 figure. Observed trash consisted mostly of food wrappers, paper and plastic packaging, drink containers, yard clippings, and cigarette butts. The Pier SD and Lagoon Outlet stations exhibited the highest frequency of trash.

Laboratory samples were collected on four different dates: 6/8, 7/7, 8/13 and 11/5/2009. Nitrate, phosphate, *E. Coli* and total coliform had 26 samples each; Copper was sampled 22 times:

- Results for analysis of **total coliform** bacteria ranged from <5 (non-detectable) to 48840 MPN/100mL, with an average of 7849 MPN/100mL. It is noteworthy that the median of the analyses was 2761. With small data sets such as this (i.e., a total of 26 tests), the median is a much better indicator than the average value, as extremely large or small values bias the average. 23% of the samples (6 of 26) exceeded the 10,000 MPN/mL WQO and five of those six were at storm drain stations; as the sixth was a Lagoon Outlet sample, none were directly from Soquel Creek.

- Lab results for ***E. coli*** bacteria ranged from <5 (non-detectable) to 6488 MPN/100ml, with an average of 620 and a median of 147 MPN/100mL. 35% (9 of 26) samples exceeded the WQO of 235 MPN/100mL. As with total coliform, of the samples exceeding the WQO, none came directly from Soquel Creek. By comparison, in 2008, 35% (7 of 20) of samples exceeded the WQO, with a maximum of 2481, a minimum of <5, and an average of 419 MPN/100mL. In 2007, 57% of samples were in exceedance of the WQO, which at that time was 400MPN/100mL.

- **Ammonia (NH_3)** results showed 12% of samples (3 of 26) in exceedance of the 0.025 ppm NH_3 WQO. The Lagoon Outlet accounted for two of these samples, with one as high as 0.24 ppm NH_3; Monterey Ave SD was the third. In 2008, 25% of all samples exceeded the WQO.

- **Nitrate (NO_3)** results exceeded the WQO of 2.25 ppm NO_3 in 31% of samples (8 of 26). The average level was 4.23 ppm NO_3 but the median value was 0.45 NO_3 ppm. The high average was inflated due to extremely high results at the Creekside SD station, where three of the four samples exceeded 24 NO_3 ppm, more than 100 times the WQO. In 2008, 25% (3 of 12) samples exceeded the WQO, and again all of the high values came from Creekside SD. However, 2009 levels at Creekside were much higher than in 2008, where levels were more in the range of 4 to 6 ppm NO_3. Averages in past years were 2.85 ppm NO_3 in 2007 and 3.44 ppm NO_3 in 2006.

- **Orthophosphate** results showed only two detectable levels. Of those two, only one exceeded the WQO of 0.12 ppm PO_4-P, for a 4% exceedance (1 of 26). That lone sample was taken from the Soquel Creek-Mid site, on 7/7/2009. This is consistent with results from 2006, 2007 and 2008, with each year having 2, 0, 1 samples above the WQO, respectively.

- Out of 22 **copper** samples, only three measured above the non-detect level, and only one sample was found to be in excess of the WQO of 22.8 ppm Cu: the Lagoon Outlet station measured 343 ppm Cu on 11/5/2009. In 2008, 50% of samples (10 of 20) showed detections of copper.

Station Summaries

- **Creekside SD:** Exceedances include elevated levels of nitrate on each of the four sample dates, and elevated levels of bacteria indicators. Other notable results include low pH and the occasional presence of surface scum. In 2008, 3 of 4 nitrate samples from this station exceeded the WQO, but 2 of the 4 ammonia tests also exceeded the WQO. In 2009, zero of four ammonia samples from this station exceeded the WQO.

- **Creekside Upper:** No lab samples for this station exceeded the applicable WQOs for each constituent. Of field parameters measured and observed, only trash (19% of field visits) and surface scum (13% of field visits) were noted.

- **Lagoon Outlet:** Electrical conductivity exceeded the WQO for 18% of measurements (3 of 17), and trash was observed 65% of the time, and surface scum 59% of the time. Ammonia levels exceeded the WQO for two of four samples. Total coliform exceeded the WQO for one of four samples, and notably, all four *E. Coli* samples exceeded the WQO.

- **Monterey Ave:** The most notable field parameter for this station was that pH measurements were below the WQO 61% of the time (11 of 18 measurements). Trash (17%), sewage (33%), oil (72%) and surface scum (33%) were also observed with regular frequency. Nitrate exceeded the WQO for one of four samples, and for one of four total coliform samples, and for all four *E. Coli* samples.

- **Pier SD:** For field parameters at this station, detergent exceeded the WQO on one of sixteen measurements (6%), pH was below the WQO range in five of sixteen measurements (31%), and regular observations of trash (88%), sewage (19%) and surface scum (13%) were noted. Nitrate levels exceeded the WQO in all three samples, and in two of three total coliform samples.

- **Soquel Creek Mid:** Field observations included trash (29%), sewage (18%), oil sheen (18%) and surface scum (6%). Phosphates were the only lab constituent measured above the WQO (0.12 ppm PO_4-P on 7/7/2009).

- **Wetland Outlet:** Field parameters observed at this station include: trash (20%), oil sheen (7%) and surface scum (13%). No lab analytes exceeded the WQOs.

CONCLUSIONS AND RECOMMENDATIONS

The 2009 Capitola Urban Watch program generated the data in this report, which is a useful addition to the historical values developed over the years, and mobilized, educated and engaged key volunteers from the community. Volunteer teams learned about non-point source pollution and generated key data in accordance with scientific protocols. This partnership of scientific exploration and community engagement is a partnership that bodes well for the City's efforts to reduce the impacts of urban runoff and improve overall water quality.

Key concerns based on lab results include elevated levels of nitrate, regularly found at Creekside SD and Pier SD; high levels of *E. Coli* consistently found at the Lagoon Outlet and Monterey Avenue SD sites; and elevated total coliform levels regularly measured at *all* storm drain sites. When looking at WQOs it is important to remember that they apply to the receiving waters, rather than the discharge itself. For example, a storm drain outfall which discharges into a creek might have elevated levels of any given constituent, but once that discharge enters the receiving waters (i.e., the creek or river) it is likely diluted, provided the creek water has lower levels of that constituent. This comment is offered as a reminder, but not as a negation of the alarm of elevated levels of contaminants, as stated.

Field parameters exceeding WQOs include electrical conductivity, but only at the Lagoon Outlet station. This is likely due to the introduction of seawater at the sampling station, as the salinity elevates conductivity measurements. Water temperature, chlorine and detergents were rarely or never recorded above WQOs. Occasionally, pH levels are lower than the WQO range (7.0 to 8.5), but most values were near the lower end of that range, and no levels were below 6.5. Trash continued to be a regular observation by field teams, noticed 33% of the time, and 88% at the Pier SD station. Oil sheen was observed 23% of the time, mostly at Creekside Upper and Monterey Avenue SD stations. Surface scum was observed at all stations (21% of total visits), and most regularly at the Lagoon Outlet station (59%). Odor and color were always within ideal ranges.

Where water quality parameters are within stated WQOs, it is likely the partial result of the City's education, outreach and other efforts toward reducing and eliminating non-point source pollution. In the cases where WQOs are exceeded, the City's efforts are likely preventing even higher levels of pollution at these stations and other areas. A particular challenge is educating visitors to the village, as opportunities for shaping behavior are limited. As in the past, the City is encouraged to focus on visible signage with educational messages and instructions, and strategic placement of waste bins for these audiences.

For residents of Capitola, the City has more opportunities for changing behavior, including the outreach and education efforts the City and CWC have partnered on. Volunteer water quality monitoring programs, such Urban Watch, First Flush and Snapshot Day, produce valuable data and engage members of the community who take an active interest in water quality. CWC utilizes our on-line CWC Data Portal to publish these results, extending the reach beyond those volunteers who collected samples and recorded field measurements. The Google Earth-based mapping database is designed to engage the community and make data easy and fun to access. CWC also has an on-line Stewardship Toolkit, also a map-based platform, that allows users to find specific examples of measures they can take around their home or business to reduce storm water quantity and improve storm water quality. In an effort to create a fun and engaging on-line community, CWC is encouraging users to post stories and photos of what they are doing to make a difference. The

Stewardship Toolkit fits neatly within CWC's three focus areas of education, monitoring and stewardship, and offers an opportunity for citizens to focus on the positive and really learn about answers their question: "what can I do?"

CWC will continue to partner with the City, into the summer months of 2010, in water quality monitoring to study the effectiveness of the constructed wetlands near the lagoon on Soquel Creek. This is yet another opportunity to engage members of the public and CWC staff look forward to the closure of the lagoon in early summer to resume monitoring. CWC has also been hosting, with cooperation from the City of Capitola, a series of free environmental films. We intend to continue this monthly series, and hope to include mini-lectures in the coming months, to share results from monitoring programs, and efforts by CWC and its partners to protect and preserve coastal watersheds.

Key recommendations include: 1) continue water quality monitoring at the selected stations, as monitoring results demonstrate the need for continued public outreach for urban runoff control within the city limits as well as in nearby areas; 2) continue outreach programs targeting local populations and visitors to the City, such as strategic signage in the City limits, environmental film and lecture series, efficient utilization of social media networks and new media (e.g., CWC Stewardship Toolkit), implementation of school-based stormwater education programs, and expansion of the public's participation in existing monitoring programs; (3) collaborate with the County of Santa Cruz and cities in the region to collectively fund monitoring and education efforts related to NPDES permit requirements, achieving efficiency in funding and sharing of success stories and challenges. CWC welcomes the opportunity to work with the City on pursuing these recommendations, as our unique local knowledge and science focus enable for a collaborative partnership, as shown during Urban Watch and other programs.

Soquel Creek is a key natural asset to the community, and to the larger region. The City of Capitola is acknowledged for its leadership and efforts in striving to not just reduce, but eliminate non-point source pollution in the creek. The approach of partnering with other organizations and engaging the community is an excellent example for other communities to follow. Benefits of the Urban Watch program include improved water quality, improved habitat for aquatic and marine life, fewer instances of beach closures and incidences of nuisance from pollution, less litter and a more inviting setting, a more educated and active citizenry, scientific data for decision-making, greater visibility for the City's non-point source pollution efforts, and preservation of a critical watershed that sustains the local and regional economy and quality of life. CWC wishes to share a sincere thanks to City of Capitola staff and leadership for the opportunity to partner in the 2009 Urban Watch program, and we hope to build upon this close relationship far into the future.

SOURCES

Central Coast Ambient Monitoring Program, Central Coast Regional Water Quality Control Board: www.ccamp.org

CHEMetrics, Inc., 4295 Catlett Road, Calverton, VA 20138. 1.800.356.3072. http://www.chemetrics.com/analytes/ammonia.html

Katznelson, R. PhD, State Water Resources Control Board, State of California. Personal communication.

Peters, Steve. Water Quality Specialist, Santa Cruz Department of Environmental Health Services, Santa Cruz County, CA. Personal communication.

State Water Resources Control Board (SWRCB), 2000. Measurements of conductivity/salinity, IP-3.3(EC). In: Watershed monitoring guidance: A Compendium of Information Papers and Standard Operating Procedures. Division of Water Quality, SWRCB, Sacramento, Ca. Sect 3.3: 10-2000

US Environmental Protection Agency (US EPA). 2000. Ambient water quality criteria recommendations: Rivers and streams in nutrient Ecoregion III. EPA 822-B-00-015. Washington, DC. (http://www.epa.gov/waterscience/criteria/nutrient/ecoregions/rivers/

U.S. Environmental Protection Agency, Office of Water, Aquatic Life Ambient Freshwater Quality Criteria - Copper, 2007 Revision, EPA-822-R-07-001 (February 2007), http://epa.gov/waterscience/criteria/copper/

USGS Chesapeake Bay, Chesapeake Bay River Input Monitoring Program: http://va.water.usgs.gov/chesbay/RIMP/waterchem.html

Water Quality Control Plan for the Central Coastal Basin, California Regional Water Quality Control Board, Central Coast Region, 1994 (see: http://www.waterboards.ca.gov/centralcoast/BasinPlan/BP_text/chapter_3/Chapter3.htm)

Water Quality Limit Tables, CA Regional Water Quality Control Board, 2008 http://www.waterboards.ca.gov/centralvalley/water_issues/water_quality_standards_limits/water_quality_goals/limit_tables_2008.xls