

2003 Urban Watch Monitoring Program City of Pacific Grove, California

June – October 2003

Program Administered by:

Tamara Doan, Coastal Watershed Council and
Bridget Hoover, Monterey Bay Sanctuary Citizen Monitoring Network

For:

The City of Pacific Grove Public Works Department
Steve Leiker, City of Pacific Grove Public Works Department

Report prepared by:

Robin Lee, Monterey Bay Sanctuary Citizen Monitoring Network
Bridget Hoover, Monterey Bay Sanctuary Citizen Monitoring Network
and Tamara C. Doan, Coastal Watershed Council

City of Pacific Grove Urban Watch Monitoring Program

I. PROGRAM OVERVIEW

The City of Pacific Grove Urban Watch storm drain-monitoring program was initiated in June 1999 and is a collaborative effort between the Coastal Watershed Council, the City of Pacific Grove, and the Water Quality Protection Program of the Monterey Bay National Marine Sanctuary.

The purpose of this project is twofold. First is to serve as a tool for education and outreach to the general community regarding the impacts that the citizens have on local water quality, which helps to fulfill the educational, public outreach and monitoring requirements of Pacific Grove's Phase II National Pollution Discharge Elimination System (NPDES) storm water discharge permit. And secondly, to collect useful data to support local environmental management decisions. This is accomplished through the use of trained volunteers to monitor dry-season storm drain discharges at selected outfalls from June through October of each monitoring year.

Pacific Grove is located on the Monterey Peninsula and is considered a built out community. Most storm water runoff from impervious surface cover is conveyed under ground through a closed storm water system. The PG storm water system also collects and discharges runoff from the City of Monterey and Monterey County. Working with staff from the City of Pacific Grove Public Works Department, the Coastal Watershed Council and the Monterey Bay National Marine Sanctuary (MBNMS), six sampling sites were selected based on drainage basin and safe access for volunteers (Figure 1).

The six sampling sites are outfalls of the municipal separate storm water system (MS4) of Pacific Grove. The six sampling sites from east to west are referred to as

- (1) **8th and Ocean (PGSD1)** located at the intersection of Oceanview Blvd and 8th Street;
- (2) **Central & 13th (PGSD2)** located at 13th Street and Central Avenue;
- (3) **Lover's Point (PGSD3)** at Forest Ave.;
- (4) **Pico (PGSD4)** on Sunset Drive, near Asilomar, between Arena Ave. and Pico Ave. directly across from the house with orange door at 1745 Sunset and Oceanview Blvd.;
- (5) ***Asilomar (PGSD5)** on Oceanview Blvd near the Asilomar Convention Center under the bridge at the last turnoff before passing the golf course;
*The Asilomar site was not monitored during dry weather this season, as it is believed the consistent relatively high flows at the site causes dilution of targeted pollutants relative to the test kit used, making field detections questionable.
- (6) **Congress (PGSD6)**, located approximately 300 yards south of the intersection of Congress and Sunset Blvd. on the west side of the Pacific Grove High School sport field.

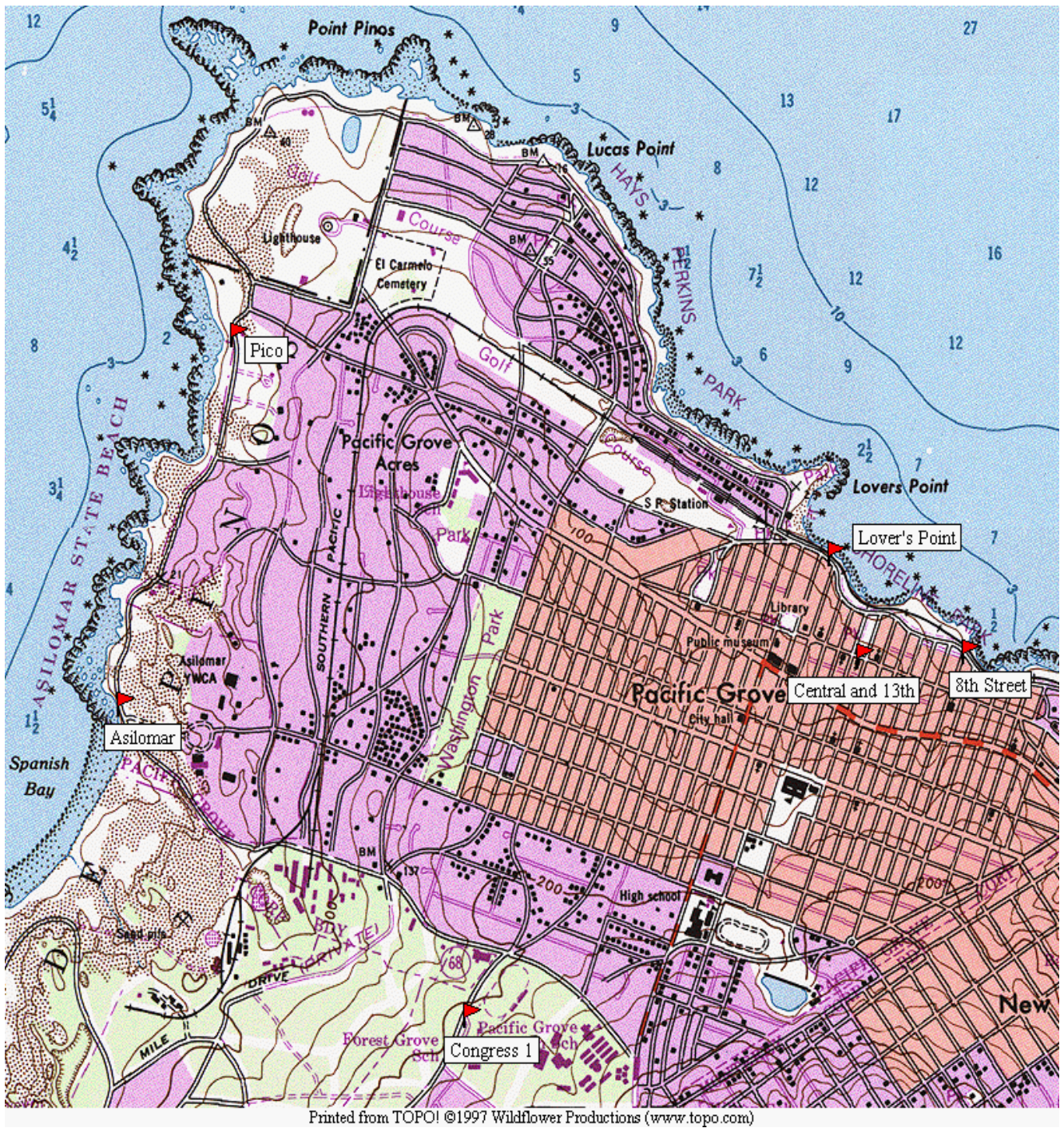


Figure 1. Locations of monitoring sites in the Pacific Grove Urban Watch Program

II. PROGRAM DESIGN

The program used the storm drain monitoring kit manufactured by the LaMotte Company (SSDK 7446) and designed in association with the City of Ft. Worth, Texas. The Urban Watch monitoring kit is designed to provide a method for volunteers to monitor dry-season storm drain discharges to identify common urban pollutants and contaminants within the study area. The kit 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, we added an Oakton 'ECTestr' conductivity meter and replaced the Oakton 'pHTestr' meter with pH strips for ease of use by volunteers. Testing for phenols was discontinued this year as its presence has not been detected in previous monitoring seasons. Biweekly testing for total coliform and *Escherichia coli* (*E. coli*) was initiated this year.

Following a one-day training, volunteers were instructed to conduct sampling on a biweekly schedule. Volunteers were divided into two teams with three to four members each. Volunteers conducted sampling twice within a one-week period on two separate days. Parameters monitored included detergents, ammonia nitrogen, chlorine, copper, turbidity, pH, conductivity, water and air temperature, as well as the odor, and color of the water. Volunteers also noted if there was oil sheen, sewage, trash, and surface scum present as well as any other observations of note. Table 1 includes information on each of the parameters monitored and method used for monitoring.

Samples were randomized through a flexible biweekly schedule with the volunteers. Scheduling of field time was left up to the monitoring teams.

The Urban Watch Program culminates with the First Flush monitoring wherein the volunteers capture water samples from the storm drains monitored for the Urban Watch program during the first significant rain of the year. This rain washes the streets and cleans the gutters and storm drains of collected materials and pollutants that accumulate throughout the dry-season. Infield measurements of water temperature, conductivity, pH, and an assessment of transparency are taken by volunteers at the site, and samples are collected and sent to a professional lab where analysis for nitrate, orthophosphate, zinc, copper, lead, total coliform, *E. coli*, total dissolved solids, and total suspended solids are performed. The results are compared to the Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. These action levels are not for regulatory purposes. Rather, they provide guidance on potential impacts to the health of the marine ecosystem. First Flush reports can be downloaded from the Internet at <http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html>

III. VOLUNTEER TRAINING

Tamara Doan, Program Manager for the Coastal Watershed Council along with Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Monitoring Network and Maris Sidenstecker, Water Quality Education Consultant for the city of Monterey, provided a three-hour training for volunteers on June 5th, 2003 with several “hands on” field trainings throughout the first month of monitoring. Topics included monitoring concepts, sampling procedures, the meaning of each parameter monitored, use of kits in the field, and safety procedures.

Volunteers were placed in teams according to general skill level, interest and time availability. An experienced monitor, Robin Lee or Bridget Hoover, went out with each team until they felt that the groups had an understanding of the sampling and analytical skills outlined in the training packet given to them. Two experienced monitors were chosen as Team Leaders to help coordinate volunteer scheduling, and provide feedback to Ms. Lee or Ms. Hoover.

IV. QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The Quality Assurance/Quality Control (QA/QC) program included the following components:

- Training on monitoring concepts, safety, sampling methods, and hands-on use of equipment.
- Training in use of data sheets and data entry for volunteers.
- Periodic calibration of test equipment, calibration records are available.
- Use of Instrument ID numbers to track equipment used by teams
- Monitoring of reagent stores and expiration dates, waste management.
- Periodic review of data sheets to determine inconsistency in data entry.
- Continued supervision until the trainer was confident in the volunteers’ sampling and analysis skills.
- CWC prepared a Standard Operation Procedure for volunteers to use in the field while monitoring.
- Processing and analysis of data for report.

**Table 1: Water Quality Parameters
Urban Watch Monitoring Program**

Parameter	Possible Sources	Associated Problems	Method/Accuracy
Temperature	Illegal discharges	Affects rates of chemical and biochemical reactions in water.	Method - Digital thermometer Accuracy - 1% full scale
Turbidity	Microorganisms, Sediment, erosion	Interferes with fish and other aquatic life	Method - Visual Octa-Slide Viewer against turbidity standard slide bar
pH	Aerosols and dust in air, Mineral substances, sewer overflows, animal wastes, pesticides & fertilizers, photosynthesis	Interferes 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 lower dissolved oxygen available to aquatic life	Method - solvent extraction/ bromphenal blue indicator Accuracy ± 0.1 ppm Min detection: >0.1 ppm
Copper	Illegal discharge 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-Diethyldithiocarbonate Octa-Slide Comparator against color standard. Accuracy± 10%. Min detection: >0.0ppm
Chlorine	Illegal or unintended connection to a storm drain or draining of a swimming pool	Toxic to aquatic life, can create a "sterile" environment	Method – DPD Octa-Slide Comparator against color standard. Accuracy ± 10% Min detection: >0.2ppm
Ammonia Nitrogen	Illegal connections to Storm drain systems, poorly functioning septic systems, wildlife	At certain concentrations can be toxic to aquatic organisms	LaMotte Code 5864 Color-Ruler against a color standard Min detection: >0.1ppm
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 µS
Color	Dyes or chemicals	Interferes with aquatic Insects	Method - Visual Borger Color System
Odor	Illegal discharge 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 discharge or illegal dumping	Interferes with fish and other aquatic life	Method - Visual

V. RESULTS

Results are presented by sampling site. The parameters described below were analyzed by volunteers in the field using the LaMotte kit described above and the results are presented here by station location. Over the period of June through October 2003, storm drain monitoring took place at the five sites twenty times; a total of 100 individual monitoring events occurred. Volunteer availability and other influencing factors were taken into consideration throughout the program and not every parameter was tested on every site visit. Sampling for *E. coli* occurred independent of storm drain monitoring. Sampling for *E. coli* occurred 8 times at each site except for PGSD4, where 6 samples were collected for a total of 28 sample results. Please see Appendix 1 for Summary Tables 1-5, which provide averages, minimum-maximum values, and frequency of parameters encountered. Appendix 2 presents all raw data collected in the field. Monitoring protocols are available upon request.

Day of Week/Time of Day

Volunteer monitoring occurred all days of the week except for Saturday for the 2003 program. The most common monitoring days were Tuesday and Wednesday: 1 on Sunday (5%), 2 on Monday (10 %), 6 on Tuesday (30 %), 6 on Wednesday (30 %), 4 on Thursday (20 %), 1 on Friday (5%) and 0 on Saturday. The monitoring times varied; however, they were consistently in the afternoon hours for 19 of the 20 times recorded. The only morning monitoring times were 10:30 to 11:20 AM on 7/20/2003 and the latest was 6:58 PM on 10/21/2003. Most of the monitoring events occurred between 5:00 and 7:00 PM. The late afternoon monitoring times occurred frequently as many of the volunteers had jobs.

E. Coli

E. coli sampling was initiated during the 2003-monitoring season. Eight samples were collected independent of the Urban Watch collection times, however some were collected on the same day at different times (7/16, 7/23, 9/11). Robin Hayes processed the samples at the Monterey Regional Water Pollution Control Agency's sewage treatment plant's laboratory using Standard Methods 9223B. The samples were collected on 6/25/2003, 7/16/2003, 7/23/2003, 8/5/2003, 8/18/2003, 9/11/2003, 9/22/2003, and 10/14/2003.

Urban Watch Observation Information and Monitoring Results

PGSD 1 (8th Street)

PGSD1 is a storm drain ocean outfall at 8th Street and Oceanview Blvd. This outfall is a 24-inch diameter concrete pipe. This is the most easterly of the sample sites (fig. 1) Runoff into the 8th Street storm water system is from a 100% residential area of high (29.0 DU/Ac) and medium (17.4 DU/Ac) densities. The flow from this outfall during the dry season was usually low, barely a trickle, except for several occasions where there were indications of higher flow from water stains in and around the pipe. The site was visited a total of 20 times for storm drain monitoring and eight times for *E. coli* sampling.

8th Street Monitoring Results

Detergents

The lowest detergent reading detectable is <0.1 parts per million (ppm). Values less than the lowest detectable concentration were entered into the data tables as 0.05 to give a quantitative entry. There were 19 samples tested for detergent from the 8th Street sampling site. Of those, 11 tested positive for detergent with values greater than or equal to 0.10 ppm, or 58 % of the samples tested. The maximum result for a positive detergent reading was 2.5 ppm and the minimum value was 0.2 ppm, giving an average result of 0.65 ppm. The median was 0.3 ppm.

Ammonia Nitrogen

The lowest ammonia reading detectable by the kit is <0.1 ppm. This reading was entered into the data tables as 0.05 to give a quantitative entry. Ammonia nitrogen values greater than 0.05 ppm were detected in 5 of the 20 samples tested, or 25% of samples. The results for ammonia ranged from 0.2 to 2 ppm. Four of the five samples had concentrations of 1 ppm or less. One sample had a concentration of 2 ppm, which occurred on 10/8/2003. The average result for the 5 positive samples was 0.7 ppm and the median was 0.25 ppm.

Copper

Copper was not detected at this site during the monitoring period

Chlorine

Chlorine was not detected at this site during the monitoring period

Turbidity

Turbidity is measured as high, medium or low. Nineteen measurements for the site were in the low range, and one in the median range on 10/8/2003.

Odor

No unusual odors were detected.

Color

Volunteers matched water samples to a Borger Color System (BCS) booklet used to identify colors in nature. 19 samples had clear colors (BCS 93); one sample reported BCS 60 on 10/8/2003, which had a brown color.

Flow (or Discharge from outfall: a 24-inch diameter concrete pipe)

Flow was measured in 20 of 20 observations. Measurements ranged from 2.5 centimeters on 6/17/2003 to 0.1 centimeters on 9/24/2003. Flow depth on the last sampling date of 10/21/2003 was 0.2 centimeters. The average depth was 0.86 centimeters and the median 0.76 centimeters. Widths ranged from 12 centimeters (7/20/2003) to 44 centimeters (6/17/2003). The average width was 17.95 centimeters and the median 16 centimeters.

Air Temperature

Air temperature ranged between 25.6° Celsius on 7/20/2003 to 15.10° C on 10/21/2003. Temperature on 6/17/2003 was 16.3°C. with a warming trend occurring until 9/11/2003 when the

temperature was 24.0°C. The average temperature was 19.25°C and the median was 18.5 degrees C.

Water Temperature

Water temperature ranged from 15.5° C on 10/21/2003 to 20.3°C on 8/11/2003. The average temperature was 18.7°C and the median temperature 18.95°C.

Conductivity

Conductivity measurements were taken with the Oakton ECTestr meter (0-1990 micro Siemen (µS)) and with the Oakton ECTester meter (0-19.90 milli Siemen (mS)). All conductivity values are reported in µS and ranged between 1500 µS to 2800 µS. The average for conductivity was 2206 µS and the median 2300 µS. An increase of conductivity was detected between 6/17/2003 with a reading of 1900 to the highest conductivity readings on 8/11/2003 (2800) and 8/15/2003 (2600). After August 15th, the readings ranged from 2500 to 2100 µS. Generally speaking, conductivity increased with a decrease in flow.

pH

pH values were 7 and 7.5. Seven of the 20 measurements had a pH of 7 (35 %). The average value was a pH of 7.3 and the median value with a pH of 7.5.

Trash

Trash was recorded in the data tables as a 1 for its presence and a 0 for its absence. Trash was reported on 12 of the 20 site visits (60 %). The most common materials found were plastic and styrofoam.

Sewage

No sewage smells were noted.

Surface scum

Surface scum was detected 2 times on 7/1/2003 and 7/3/2003.

Oil sheen

Oil sheen was detected one time on 7/29/2003. Very light oil sheen was noted.

Additional Data

Bacteria monitoring

Samples were collected at PGSD1 and analyzed for E.coli bacteria. The sample results ranged from 200 MPN/100 ml (8/18/2003) to 2560 MPN/100 ml (10/14/2003). The average result was 1331 MPN/100 ml and the median 1260 MPN/100 ml.

PGSD2 (Central and 13th)

The PGSD2 storm water outfall is located at Greenwood Park on the north side of Central Ave. at 13th Street, west of the 8th Street outfall. The outfall is a 54-inch in diameter concrete pipe with a wooden weir. The storm water discharges from the storm water system into Greenwood Park, flowing into a eucalyptus lined creek bed for approximately 300 yards before discharging into the ocean. Flows from the storm drain outfall were fairly constant with periodic increases. The Greenwood Park storm water system receives runoff from an area that is 90% residential and 10% commercial. The residential areas are high (29.0 DU/Ac) and medium densities (17.4 DU/Ac). The site was visited 20 times for storm drain monitoring and eight times for *E. coli* sampling.

Central and 13th Monitoring Results

Detergents

20 samples were tested for detergent. Nine of the 20 samples had results greater than 0.05 ppm (45%) with a range of 0.2 ppm to 0.5 ppm. The average for the nine positive detergent samples was 0.3 ppm and the median 0.3 ppm.

Chlorine

The lowest detectable limit for the chlorine test is <0.2 ppm. Values of <0.2 ppm were recorded as 0.1 ppm to give a quantitative measurement. Two of the 20 samples had results greater than 0.2 ppm (10%). On 7/20/2003 a result of 0.4 ppm chlorine was reported and on 9/10/2003 a result of 0.2 ppm.

Copper

Copper was not detected at the site during the monitoring period.

Ammonia Nitrogen

Samples that yielded results of < 0.1 ppm were recorded as 0.05 ppm to give a quantitative measure. Five of the 20 samples collected had values of greater than 0.1 ppm (25 %) and ranged from 0.1 ppm to 4.0 ppm (10/21/2003). The average of the positive results is 0.94 ppm and the median 0.25 ppm.

Turbidity

Turbidity was measured in ranges of low, medium and high. All 20 samples collected were in the low range.

Odor

All 20 samples registered 0 for odor.

Color

All 20 samples registered clear (BCS 93) for color.

Flow (or **Discharge** from outfall: a 54-inch in diameter concrete pipe with a wooden weir.) Flow depth was measured at 19 of the 20 site visits. No flow depth measurements were taken on 7/3/2003. Flow depth's ranged from 0.2 to 13 centimeters. A 13 centimeter reading was recorded on 7/20/2003. This measurement was taken behind the weir that exists at the outfall. All 18 of the other measurements were taken in front of weir and ranged from 0.2 to 1.5 centimeters. The average depth of the 18 measurements taken in front of the weir was 0.76 centimeters and the median was 0.5 centimeters. Width ranged from 30 centimeters to 73 centimeters. The average width was 51 centimeters and the median 54 centimeters. The measurements taken on 7/20/2003 were disregarded due to the location at which they were taken at the outfall. Flow was fairly constant.

Air Temperature

At 20 site visits, the temperatures ranged from 15.1° C (10/21/2003) to 23.4° C (9/11/2003). The average temperature was 18.35 °C and the median temperature was 18.1°C. Fifteen temperature values were documented between 15°C to 19°C (95%). Five temperature values were documented between 21°C. to 20.4°C (5%). The warmest temperatures occurred in September with values of 21°C and 23.4°C.

Water Temperature

Water temperatures ranged between 15.5°C (10/21/2003) to 19.4°C (7/20/2003). The average temperature was 17.4°C and the median temperature was 17.5°C. Thirteen of the 20 water temperature values were between 17°C to 18.8°C (65%).

Conductivity

Twenty conductivity measurements ranged between 1490 µS (7/3/2003) and 2000 µS (10/8/2003). The average reading was 1687 µS and the median reading was 1700 µS. Six of the 20 readings were between 1700 µS and 1720 µS (30 %). Twelve of the 20 readings were between 1700 µS and 2000 µS (60%).

pH

Twenty pH readings were taken. Seven of the 20 readings registered a pH of 7 (35%). Thirteen of the 20 readings registered a pH of 7.5 (65%). The average pH reading was 7.3 and the median pH reading 7.5.

Trash

Trash was reported on all 20 site visits. The most common materials found were Styrofoam packing materials, plastics and paper.

Sewage

No presence of sewage was detected in the 20 site visits.

Oil Sheen

No oil sheen was detected in the 20 site visits.

Surface scum

Surface scum was detected in 7 of the 20 site visits in the form of white or brown bubbles (35%). Surface scum was reported in 4 site visits in a row from 9/23/2003 to 10/20/2003. These bubbles tended to collect behind the weir at the mouth of the outfall.

Additional Data

Bacteria monitoring

Samples were collected at PGSD2 and analyzed for E.coli bacteria. The sample results ranged from >2,400 MPN/100 ml (6/25/2003) to >24,000 MPN/100 ml (7/16/2003). The average reading was 10,010 MPN/100 ml. The median number was 8170 MPN/100 ml. Upstream monitoring was conducted in this drainage due to the very high bacteria concentrations. No sources were detected, but the bacteria concentrations were very high throughout the drainage. Rain events forced the monitoring to cease.

PGSD 3 (Lover's Point)

PGSD 3 is a storm water ocean outfall located on a bluff southeast of the main beach at Lover's Point Park (fig. 1). The outfall is a 54-inch diameter concrete pipe. The Lover's Point storm water system collects runoff from an area that is 90% residential and 10% commercial. The residential areas are high (29.0 DU/Ac) and medium density (17.4 DU/Ac). This is the longest storm water collection line in Pacific Grove at 4800 feet in length. Twenty site visits were conducted and eight *E. coli* samples were collected.

Lover's Point Monitoring Results

Detergent

Detergent tests were conducted on all 20 samples.. Seven out of 20 values tested positive for detergent and ranged from 0.2 ppm to 0.6 ppm (35 %). The average of the result was .27 ppm. The median result 0.2 ppm.

Chlorine

Nineteen of the 20 test results for chlorine were non-detectable. One result had a concentration of 0.2 ppm on 9/10/2003.

Copper

Copper was not detected at this site during the monitoring period.

Ammonia Nitrogen

Three of the 20 test results reported concentrations of 0.1 ppm (15 %). The positive values for ammonia occurred on 6/17/2003, 7/1/2003, and 8/15 /2003.

Turbidity

Turbidity was measured in ranges of low, medium and high. All 20 samples collected were in the low range.

Odor

No odor was detected in the 20 samples collected.

Color

All 20 samples registered clear (BCS 93) for color.

Flow (or Discharge from outfall: a 54-inch diameter concrete pipe)

Depth of 20 measurements ranged from 0.5 centimeters to 2 centimeters. The average reading was 1.07 centimeters and the median reading 1.0 centimeter. 75% of the measurements ranged from 1 to 2 centimeters. Flow width measurements ranged from 0.5 centimeters to 27.5 centimeters. The average measurement was 23.5 and the median 25.25 centimeters.

Air Temperature

Air temperatures ranged from 14.8°C to 26.3°C. The median air temperature air was 17.7°C. The average air temperature was 18.4°C. The maximum air temperature of 26.3°C. occurred on 9/11/2003. The coolest temperature of 14.8°C was recorded on the last sampling date of 10/21/2003.

Water Temperature

The water temperature ranged from 16.9°C. to 19.7°C. The average water temperature was 18.4°C; the median water temperature was 18.5°C. The maximum water temperature of 19.7 occurred on 8/15/2003. The lowest water temperature of 16.9°C was reported on the last sampling date of 10/21/2003.

Conductivity

Conductivity measurements ranged from 1700 µS to 2600 µS. The median conductivity measurement was 1900 µS. The average conductivity measurement was 1989µS. The highest reading occurred on 10/20/2003.

Lover's Point pH

Sixteen of 20 pH measurements taken reported 7.5 (80%). Three readings were 7 (15%) and one reading was a pH of 8 on 9/23/2003 (5 %). This was the only pH measurement greater than 7.5 of the five sample sites. The average reading was pH 7.45 and the median reading pH 7.5.

Trash

Thirteen of the 20 site visits reported trash at the outfall. The most common material cited was paper with some plastics and cans.

Sewage

No presence of sewage was reported.

Oil Sheen

No presence of oil sheen was reported.

Point Surface Scum

Surface scum was reported as “bubbles” on 10/9/2003.

Additional Data

Bacteria monitoring

Samples were collected at PGSD3 and analyzed for E.coli bacteria. E. coli results ranged from 1090 to 39,900 MPN/100 ml. The average result was 8472 MPN/100 ml. The median was 3006 MPN/100 ml. The highest reading of 39,900 MPN/100 ml occurred on 8/5/2003. The lowest reading of 1090 MPN/100 ml occurred on 6/25/2003. Upstream monitoring of this drainage began in late October. Five sets of samples were collected. Because of frequent rain showers and the high variability of bacteria, the upstream monitoring was stopped on November 12th.

PGSD 4 (Pico)

PGSD 4 is a storm water ocean out fall located on the west side of Sunset Drive, 60 feet north of Pico Street. The outfall is a 40-inch diameter concrete pipe. The Pico storm outfall is a 40-inch diameter concrete pipe system receives storm water runoff from a 100% residential area of low density (5.4 DU/Ac). Twenty site visits were conducted during the 2003 sampling season. Six samples were collected for *E. coli* analysis.

Pico Monitoring Results

Detergents

Twenty samples were tested for detergents. Four of the 20 samples tested positive for detergents (20%). The positive results occurred in the first 12 sampling days of the season. Positive results ranged from 0.1 ppm to 0.2 ppm and occurred on 6/19 (0.2 ppm), 7/13 (0.2 ppm), 7/16 (0.2 ppm) and 8/27 (0.1 ppm). The average result of the four positive tests was 0.175 ppm and the median 0.2 ppm.

Chlorine

There were no positive chlorine values for this site during the 2003 monitoring season.

Copper

There were no positive copper values for this site during the 2003 monitoring season.

Ammonia

There were three positive values for ammonia during the 2003 monitoring season. Positive results occurred on 6/19 (0.1 ppm), 7/1 (0.1 ppm), and 8/27 (0.1 ppm). The average result for the positive measurements was 0.1 ppm and the median 0.1 ppm.

Turbidity

All 20 turbidity tests registered in the low range.

Odor

There was no odor detected for all 20 samples.

Color

All 20 samples registered clear (BCS 93) for color.

Flow (or Discharge from outfall: a 40-inch diameter concrete pipe)

Twenty flow depth measurements were taken and ranged from 0.2 centimeters (8/11-15/2003) to 1.5 centimeters (7/29/2003). The average was 0.67 centimeters and the median 0.578 centimeters. Flow widths ranged from eight centimeters (8/26 /2003) to 24 centimeters (three different occasions). The average width was 19.35 centimeters and the median 22 centimeters.

Air Temperature

Twenty air temperatures were taken and ranged from 14.4°C (10/19/2003) to 26.1°C (7/16/2003). The average temperature was 19.16°C and the median was 18.5°C.

Water Temperature

Twenty water temperature measurements were taken and ranged from 13.8°C (10/9/2003) to 20.1°C (8/26/2003). The average temperature was 16.38°C and the median temperature was 16.5°C.

Conductivity

Twenty conductivity measurements were taken and ranged from 900 µS (10/9/2003) to 1550 µS (6/19/2003). The average conductivity measurement was 1229 µS and the median measurement 1150 µS.

pH

Eighteen of the 20 pH readings had measurements of 7.0 (90%). Two of the 20 pH measurements were 7.5 (10%) and occurred on 7/1/2003 and 7/3/2003. The average measurement was pH 7.45. The median measurement was pH 7.0.

Trash

Trash was observed at 4 site visits. Trash consisted of a soda can, plastic, a metal sign and a shotgun shell.

Sewage

No sewage was detected.

Oil Sheen

No oil sheen was detected.

Surface Scum

Surface scum was detected as white foam on 8/26 and 8/27.

Additional Data

Bacteria monitoring

Six samples were collected at PGSD3 and analyzed for E.coli bacteria. The results ranged from 9 MPN/100 ml to 146 MPN/100 ml. The average was 60 MPN/100 ml. The median was 57 MPN/100 ml. No samples were collected on 8/18 and 9/22.

PGSD 5 (Asilomar)

The Asilomar site was not visited during the 2003 monitoring season.

PGSD 6 (Congress)

PGSD 6 storm drain outfall is located on north side of Congress Avenue across from the Pacific Grove high school sports field. The outfall is approximately 500 feet from the intersection of Congress Avenue and Sunset Drive and is a 24 inch concrete pipe. Below the outfall is a stream channel running through a wooded area called Rip Van Winkle Open Space. The Congress storm drain system receives runoff from an area that is approximately 100% commercial (Country Club Gate Commercial Area) and institutional (Pacific Grove High School, Forest Grove School). Twenty site visits were conducted.

Congress Monitoring Results

Detergent

Two of the 20 samples tested positive for detergents (10%). Positive results occurred on 7/16 (1.2 ppm) and on 9/11 (0.2 ppm). The average test result for the positive results was 0.7 ppm.

Chlorine

Positive results for chlorine occurred on 8/27 through to the end of the monitoring season on 10/21/2003. Nine of the 20 samples tested positive with results ranging from 0.2 ppm to 1.0 ppm (45%). The average of the positive result was 0.56 ppm and the median 0.6 ppm. The source of the chlorine contamination was traced to a swimming pool at Pacific Grove high school. The source of the leak was reported to the Monterey County Health Department, who then required the Pacific Grove School District fix the contamination problem within 60 days. The situation was corrected.

Copper

Copper was not detected in any of the 20 samples.

Ammonia Nitrogen

Seven of the 20 samples tested positive for ammonia (35%). The positive ammonia results ranged from 0.1 to 0.5 ppm. The highest reading of 0.5 ppm occurred on 10/21/2003. The median of the 7 positive values was 0.1 ppm and the average was 0.2 ppm.

Turbidity

All 20 samples were in the low range for turbidity.

Odor

None of the 20 samples tested positive for odor.

Color

All 20 samples registered clear (BCS 93) for color.

Flow (or Discharge from outfall: a 24 inch concrete pipe)

Nineteen depth measurements were taken at 20 site visits. The measurements ranged from 0.25 (10/20-21/2003) centimeters to 1.5 centimeters (7/1/2003). The average measurement was 0.63 centimeters and the median measurement 0.5 centimeters. Twenty width measurements were taken at 20 site visits. The measurements range from 10 centimeters (7/16/2003) to 15 centimeters (6/17/2003). The average flow width was 11.96 centimeters and the median measurement was 12 centimeters.

Air Temperature

Twenty air temperatures were taken and ranged from 13.9°C. (10/21/2003) to 24.5°C (9/11/2003). The average temperature was 18.6°C. and the median temperature was 18.15°C.

Water Temperature

Twenty water temperatures were taken and ranged from 17°C. (6/17/2003) to 22.5°C (9/11/2003). The average temperature was 19.8°C, and the median temperature was 20.2°C.

Conductivity

Twenty conductivity measurements were taken and ranged from 1000 µS (10/9/2003) to 2300 µS (6/19/2003, 7/30/2003). The average measurement was 1850 µS and the median measurement 1800 µS.

pH

Eighteen of the 20 pH measurements registered 7.5 (90%). Two measurements of pH 7 were reported on 6/17/2003 and 7/16/2003.

Trash

Eighteen of the 20 site visits reported the presence of trash. The most common materials found were paper and plastic.

Sewage

No sewage was detected.

Oil Sheen

No oil sheen was detected.

Surface Scum

Six of the 20 site visits reported the presence of surface scum (30%) as brown foam (1 time) and white scum (5 times).

Additional Data

Bacteria monitoring

Eight samples were collected at PGSD6 and analyzed for *E. coli* bacteria. The results ranged from 5 MPN/100 ml to 2400 MPN/100 ml. The average result was 374 MPN/100 ml and the median was 101 MPN/100 ml. The highest reading of 2400 MPN/100 ml occurred on 6/25/2003. The lowest reading of five MPN/100 ml occurred on 9/11/2003. The low *E. coli* concentrations in the late summer were probably due to the chlorine-contaminated water flowing from late August through October.

VI. First Flush Event

The First Flush monitoring event occurred on Friday, October 31, 2003, and was held in the cities of Monterey, Pacific Grove, Santa Cruz and on November 3rd in Half Moon Bay. Storm drain outfalls were monitored by volunteers for conductivity, water temperature, pH, transparency, and samples were sent to various laboratories for analysis of nitrate, orthophosphate, zinc, copper, lead, total coliform, *E. coli*, total dissolved solids (TDS), and total suspended solids (TSS). The results were compared to the Central Coast Ambient Monitoring Program's (CCAMP) Action Levels. These action levels are not for regulatory purposes; rather they provide guidance on potential impacts to the health of the marine ecosystem.

A separate report entitled *First Flush Report: October 31, 2003* has been written for the 2003 First Flush monitoring event and was sent to local area governments and agencies as well as posted for public access at <http://www.mbnms.nos.noaa.gov/monitoringnetwork/events.html>. The data will be made available to all interested organizations, and will be used to assess the pollutant load in the waters flowing into the Monterey Bay National Marine Sanctuary. The results of First Flush are available by contacting Bridget Hoover, Coordinator of the Monterey Bay Sanctuary Citizen Watershed Monitoring Network at (831) 883-9303.

DISCUSSION

Results from the 2003 Urban Watch Program data will be discussed below on a parameter-by-parameter basis. This year's Urban Watch Program data showed that detergent surfactants and ammonia nitrogen continued to be the most common pollutants detected. As well, copper was once again not detected in the range of the test kit used, and will probably not be monitored in the future unless a test with a lower detection limit can be identified.

Chlorine

Chlorine was detected at Central and 13th Streets (two out of 20 site visits), Lover's Point (one out of 20 site visits) and Congress (nine of 20 site visits) for a total of 12 positive results for all 5 sites monitored (12%). This is a substantial increase from last year when just one site tested positive for chlorine (Lover's Point). The highest chlorine result at Central and 13th streets was 0.4 ppm, at Lover's Point 0.2 ppm and at Congress 1.0 ppm. The 9 positive chlorine values at Congress had an average of 0.3 ppm where the source was traced to a leaking swimming pool at Pacific Grove High School, which has since been repaired. Chlorine is a strong oxidizer and probably affected (lowered) ammonia and detergent values from 8/27/2003 to 10/21/2003. It probably resulted in the reduced number of *E. coli* that was identified in the system in the early part of the summer.

Detergents

Detergent surfactants have consistently been detected in the storm drains monitored in this program for all monitoring years. Detergents were again found frequently throughout this year's program at 8th Street (11 of 19 site visits), Central & 13th (9 of 20 site visits) Lover's Point (7 of 20 site visits) and Congress (11 of 20 site visits) for a total of 42 positive results, down from last year's 48 positive results. Eighth Street and Congress shared the two highest concentration detections of detergents (2.5 ppm, 1.2 ppm) for the 2003 monitoring period. Eighth Street had the highest average value of 0.65 ppm while Congress showed an average of 0.14 ppm. The low Congress average may be due to the chlorine oxidizing the detergent. The remaining 35 detections varied, falling between 0.10 ppm to 0.60 ppm with averages ranging from 0.18 to 0.3 ppm. Detergent concentrations may be a result of washing autos and/or commercial equipment outdoors, or illicit sewer connection.

Detergents are a significant inhibitor to fish health. In concentrations as low as 2.0 ppm, detergents can cause fish to absorb double the amount of chemicals they would normally absorb. All detergents destroy the external mucus layers that protect the fish from bacteria and parasites. Detergents can also cause severe damage to fish gills. Detergent concentrations as low as 5 ppm will kill fish eggs; when detergent concentrations near 15 ppm most fish die.

Ammonia Nitrogen

Ammonia Nitrogen was detected in 21 samples tested (21%) and concentrations varied from 0.1 to 4.0 ppm. This was down from 28 percent last year. At 8th Street, five of 20 samples tested positive for ammonia, at Central 3 of 20, Lover's Point 3 of 20, Pico 3 of 20, and Congress 7 of 20. The highest concentration reported (4.0 ppm) was at the Central & 13th site on 7/20/2003.

Central and 13th had the highest average of 0.94 ppm followed by 8th Street with 0.70 ppm. Central also had the highest reading of 4.0 ppm in 2002. Eighth Street had a reading of 2.0 ppm on 10/8/2003 and 1.0 ppm on 8/15/2003. According to the Santa Cruz County Department of Environmental Health Services as much as 0.5 ppm of Ammonium Nitrogen can be expected in the environment as background levels, and detections above 0.50 should be looked at more carefully (Peters 2001). Excessive ammonia concentrations are toxic to aquatic life. (CHEMetrics, Inc.: webpage)

Low-level ammonia nitrogen may be present in water naturally as a result of the biological decay of plant and animal matter. Higher concentrations may be found in raw sewage and industrial effluents (CHEMetrics, Inc.: webpage). Since there was not a consistently high concentration of ammonia in the samples taken, it can be implied that the maximum values of 4.0 ppm and 2.0 ppm may be from fertilizer runoff or other sources and not from leakage of sanitary sewer lines. Also, the land uses in the areas of 8th Street and Central and 13th are mostly high and medium density residential. This precludes contamination from industries or wastewater treatment plants. Ammonia is a component of fertilizer. Ammonia results at the outfalls are more than likely a result of runoff containing fertilizer applied to playing fields, yards and landscaped areas.

E. Coli

E. coli results ranged from < 10 MPN/100 ml at Congress to 39,900 MPN/100 ml at Lover's Point. Lover's Point had the highest average for *E. coli* at 8472 MPN/100 ml followed by Central and 13th with 8,170 MPN/100 ml. Lover's Point had a spike in *E. coli* concentration of 39,900 MPN/100 ml. The average result at Lover's Point was 8,472 MPN/100 ml. Eighth Street had the next highest average of 1260 MPN/100 ml, Congress with an average of 101 MPN/100 ml and Pico with an average of 60 MPN/100 ml. The source of the *E. coli* bacteria has not been determined. Central and 13th had the highest average for ammonia of 0.94 ppm followed by 8th Street with an average of 0.70 ppm. However, Lover's Point had one of the lowest ammonia averages of 0.10 ppm. Since there is not a real strong correlation between *E. coli* and the presence of ammonia (indicating contamination from sewage or animal feces), it is difficult to ascertain the source of the *E. coli*.

Conductivity

In the 2003 Urban Watch season, conductivity values ranged from 900 μ S to 2800 μ S for all sites throughout the program. Eighth Street had the highest average of 2206 μ S, followed by Lover's Point with 1189 μ S; Congress with 1851 μ S, Central & 13th with 1687 μ S and Pico with 1229 μ S. It should be noted that 8th Street had the lowest flow of all the sites monitored and drains an area of high and medium density development. The low flows may have concentrated the total dissolved solids resulting in high conductivity.

Conductivity is a measure of the free ions in the water and reflects the ability of the water to conduct electrical current. Measuring conductivity gives an indication of the amount of total

dissolved solids (TDS) in the water, such as salts, sugars, mineral, and acids.¹ Conductivity is measured for the Urban Watch program in milli and micro Siemens (mS, μ S), with a temperature compensated meters. Collection of conductivity measurements in the Urban Watch program serves to characterize the baseline values for each specific drainage, and allows detection of significant changes (Katznelson pers. comm. 1/17/02). The average value of conductivity from each site was used in the First Flush event to establish the presence of increased quantities of rainwater in the flow (a significant change from baseline) and triggered sample collection at each site.

Sewage Odor

A sewage odor was only one detected one time during the 2003-monitoring season as compared to five from the 2002 monitoring season. Five of those from last year were detected at Central and 13th outfall. The City of Pacific Grove undertook a program to rehabilitate the sewer lines near 8th Street and Central and 13th. This work is attributed to preventing sewage backups into the storm drain system during the 2003 monitoring season.

CONCLUSIONS

The 2003 Pacific Grove Urban Watch Monitoring Program continued to use the Urban Watch kit, first used in the City of Pacific Grove in 1999. The Urban Watch kit was developed for use by volunteers to monitor dry-weather storm drain flow. The kit is easy to use and provides consistent data throughout the monitoring period. It is recommended that project organizers develop a relationship with a certified lab to periodically run QA/QC checks on the tests. The tests should also be reviewed to determine if the detection limits are sufficient to provide the information necessary to assess water quality and if there are any other parameters that should be incorporated.

It is highly recommended that bacteria monitoring be formally included in the ongoing monitoring at least periodically throughout the sampling program. This would involve the presence of the PG coordinator, training of volunteers in proper sample collection, and a delivery schedule with the labs involved. It has been shown by the exploratory bacteria monitoring done in this year's program that further investigation is needed to identify sources and that throughout the program that this ongoing monitoring has aided the City in detecting pollutants and in identifying their sources.

The data results continue to show the need for a targeted public outreach program for urban runoff control within the city limits as well as in the neighborhoods that feed these drainages. The Network, through an agreement with the City of Pacific Grove visited every restaurant in the city and spoke to them about urban runoff. Each restaurant was given a "Best Management Practices" video and poster along with brochures for all their employees. They were asked to complete a survey to assess the value of the educational materials. All of the responses indicated

¹ 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

that they did learn some valuable new information. One employee wrote that ‘they now dump the mop water down the toilet instead of in the alley’. This project was completed in May 2003. The restaurant survey and outreach program conducted by the cities of Monterey and Pacific Grove with the Sanctuary in 1998 and repeated this year in Pacific Grove, is a good step towards this goal. Other ideas include working with local newspapers to publish weekly monitoring results from the storm drain monitoring program, and collaborating with the Chamber of Commerce and other business associations to promote clean water practices.

The data results identify four sites as areas of concern in this program: 8th Street, Central & 13th, Lover’s Point and Congress. They all reported repeated “hits” for detergent, ammonia and chlorine. A study is recommended to understand the relationship of these parameters to one another and the other constituents monitored by the program. This may shed light on how the parameters may be related, where they may originate, and their effect on water quality.

The bacteria monitoring was a valuable addition to this year’s program. The Urban Watch bacteria results identified two sub-drainages that were significantly higher in bacteria than the other three drainages during the low flow season. This led to upstream monitoring in each of the drainages to try to locate potential sources. In the Greenwood Park drainage, the bacteria concentrations were very high at the upper most manhole in Pacific Grove. So the investigation moved into Monterey where the storm drain system continued upstream. Rain interfered with the investigation and the monitoring stopped for the season. Bacteria monitoring should be continued after in the future monitoring seasons to try and locate the source of the high *E. coli* concentrations. The same situation occurred in the Lover’s Point drainage. -When the rains began, the already variable *E. coli* concentrations became too difficult to interpret.

Additionally, additional analysis of First Flush parameters is recommended. First Flush parameters are completely different from Urban Watch monitoring; therefore, it is important to measure those parameters during the dry weather (i.e.: copper, zinc, lead, nitrate, and orthophosphate) to determine whether these pollutants are present year round or just during the first significant rain of the season. We recommend quarterly monitoring for these parameters throughout the Urban Watch program’s monitoring season if resources can be made available.

In conclusion, the fifth season of Urban Watch in Pacific Grove was very successful. The two teams of volunteers were reliable, very committed and truly interested in the quality of water flowing from their town into the Sanctuary. Many of the volunteers return year after year for this program and do want to see it grow and become more useful to the decision makers. It was very satisfying for them to be the ones to detect the chlorinated water discharge at the Congress outfall. They monitored the situation, brought it to the attention of the City and County Health Department. Because of this monitoring program, the situation was corrected before there was a significant environmental impact.

Having these types of programs, where the local citizens can become involved in their city and contribute to the improvement of water quality, are very important. They are not only collecting data, they are setting examples for their neighbors and everyone that stops by to ask what they

are doing when they are in the field working. This program should continue for a sixth year, and it should be tailored to meet the needs of the City, community, and environment.

Sources

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