



Monterey Bay Sanctuary Citizen Watershed Monitoring  
Network

# Urban Watch Report 2009



Prepared for  
**The City of Pacific Grove, California**

This program was administered in partnership with the  
City of Pacific Grove, Monterey Bay Sanctuary Foundation and the  
Monterey Bay National Marine Sanctuary

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## **Introduction/Overview**

The Urban Watch Program is a dry season monitoring program in which citizen volunteers monitor urban runoff flowing from storm drain outfalls. The program began in 1997 as a collaborative effort between the City of Monterey, Monterey Bay Sanctuary Citizen Watershed Monitoring Network and the Coastal Watershed Council. Currently the Cities of Capitola, Monterey and Pacific Grove have Urban Watch Programs. The Urban Watch program has two purposes:

- to collect valuable, reliable data to be used for management decisions by local jurisdictions.
- to educate the public about how humans impact water quality in the marine environment.

This year, the Urban Watch program monitored four main sites in the City of Pacific Grove (Table 1):

- HopkinsMon: at Hopkins Marine Station, on the beach closest to the Monterey Bay Aquarium.
- Greenwood Park: located north of Central Avenue between 12<sup>th</sup> & 13<sup>th</sup> Streets.
- Congress: on Congress Avenue across the street from the Pacific Grove High School football field.
- Pico, on Sunset Drive north of Pico Street, between Pico and Arena.

Lover's Point and 8<sup>th</sup> Street are additional outfalls where flow is diverted to the sanitary sewer during the dry season. These outfalls were checked each sampling week and if significantly flowing, were monitored and the city was notified. Lover's Point was monitored on two weekend days, June 28<sup>th</sup> and July 25<sup>th</sup>, when water was flowing a bit more than usual; 8<sup>th</sup> Street was not monitored at all due to lack of flow.

HopkinsPG is another outfall on the beach at the Hopkins Marine Station, farthest from the Monterey Bay Aquarium. This site had water flowing only two days all summer, September 28<sup>th</sup> and 29<sup>th</sup>.

**Table 1: Site Identification**

<b>Site ID</b>	<b>Site Name</b>	<b>Drainage Area</b>
CENTR-31	Greenwood Park	250 Acres, 90% residential and 10% commercial
PGSD-01	8 <sup>th</sup> Street	35 Acres 100% residential
PGSD-03	Lover's Point	222 Acres, 90% residential and 10% commercial
PGSD-04	Pico	131 Acres, 100% residential
PGSD-06	Congress	37 Acres, 90% residential and 10% commercial
PGSD-08	HopkinsPG	
PGSD-09	HopkinsMon	

This year, 18 volunteers participated with seven returning volunteers from previous years. During the monitoring season (June 8th – September 29th), volunteers donated over 360 hours of their time to conduct monitoring. This time is valued at \$8,204.40 based on the 2007 rate for the state of California<sup>1</sup>.

In addition to monitoring, two Backyard to Bay events were held on August 29<sup>th</sup> and September 5<sup>th</sup>. These events provided education about the storm drain system and human causes of polluted runoff flowing into the ocean. Subjects of the Backyard to Bay events included “What is a Watershed?” and “Preparing for the First Flush.”

## **Methods**

Trained volunteers conducted monitoring four times each month (twice a week, every-other week). At each site, volunteers recorded field measurements for air and water temperature, electrical conductivity, pH, flow width, depth, and pipe wetted width. Volunteers also recorded visual observations: presence of trash at the site, presence of oil sheen, scum or bubbles, and if there was sewage present (sighted or smelled). Volunteers then collected water samples to be processed at a central location for detergents, chlorine, ammonia, orthophosphate, color, odor and turbidity using a LaMotte Storm Drain Test Kit and Hanna ammonia and orthophosphate photometers. Bacteria samples were collected once a month and analyzed at the Monterey Bay Analytical Services Laboratory for total coliform, *E. coli* and enterococcus.

All protocols and requirements of the state approved Quality Assurance Project Plan were implemented. The Hanna ammonia and orthophosphate photometers were checked at the lab on July 8<sup>th</sup> and again on September 15<sup>th</sup> to ensure accuracy.

Volunteers were trained on May 28<sup>th</sup> after which sanctuary staff monitored with each team for the next several weeks to ensure they were proficient with the different tests. Each Urban Watch team was assigned one week per month and asked to monitor twice in that week. Monitoring days were random; one team often monitored in the morning during the workweek, another usually sampled after 5:00pm on weekdays and weekends. On sampling days, teams would usually split into two groups to collect field measurements and water samples, then meet back at a central location to process samples.

Upstream sampling was conducted in the Greenwood Park drainage on August 5<sup>th</sup> and October 1<sup>st</sup> due to repeatedly high bacteria results in 2009 as well as in previous years. Samples were collected and tested at the Santa Cruz County Environmental Health Services (SCCEHS) lab for bacteria and analyzed using the Polymerase Chain Reaction (PCR). On August 5<sup>th</sup> samples were taken to the SCCEHS and tested for bacteria and PCR from the Greenwood Park site only. Due to a strong positive signal of human specific bacteriodes, additional sampling was

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<sup>1</sup> [http://www.independentsector.org/programs/research/volunteer\\_time.html](http://www.independentsector.org/programs/research/volunteer_time.html)

conducted on October 1<sup>st</sup>. The samples were collected at three sites in the drainage: near the top, middle and again at the downstream site at Greenwood Park.

Monthly summaries were provided to the volunteers and Pacific Grove Public Works officials to ensure timely notification of the volunteers' findings (see Appendix 1 for all monthly summaries). A tabular listing of all results can be found in Appendix 2.

The First Flush (first major rainstorm of the winter season) marks the end of the Urban Watch monitoring season. In 2009 the First Flush occurred on October 13<sup>th</sup> ultimately concluding the Urban Watch season.

## **Results**

Volunteers monitored a total of 20 times from June 9<sup>th</sup> – September 29<sup>th</sup>. Results are compared to the Water Quality Objectives (WQO) established by the Central Coast Basin Plan, Central Coast Ambient Monitoring Program (CCAMP), and the EPA Ambient Water Quality Criteria (Table 2).

**Table 2. Water Quality Objectives**

<b>Parameter (reporting units)</b>	<b>Water Quality Objectives</b>	<b>Source of Objective</b>
pH	Not lower than 6.5 or greater than 8.5	Central Coast Basin Plan
Water Temperature (°C)	Not more than 22 Basin Plan Objective for	Central Coast Basin Plan
Orthophosphate as P	Not to exceed 0.12 (ppm)	Central Coast Ambient Monitoring Program (CCAMP)
Ammonia- free NH <sub>3</sub>	Not to exceed 0.025 ppm	Central Coast Basin Plan
<i>E. coli</i>	Not to exceed 400 (MPN/100ml)	EPA Ambient Water Quality Criteria
Enterococcus	Not to exceed 104 (MPN/100ml)	EPA Ambient Water Quality Criteria

## **Hopkins**

There are two outfalls located side by side on the beach at the Hopkins Marine Station between the Boatworks building and the Monterey Bay Aquarium.

HopkinsMon is the outfall closest to the Monterey Bay Aquarium that drains areas of Monterey and Pacific Grove and was flowing each sampling day except September 16<sup>th</sup>.

HopkinsMon results for the 2009 Urban Watch monitoring season are (Figure 1):

- This site was sampled 17 times throughout the season.
- Total ammonia was relatively low and did not exceed the WQO for free ammonia on any of the sampling dates<sup>2</sup>. The two highest readings for total ammonia were 1.22 ppm on July 23<sup>rd</sup> and 2.14 ppm on September 2<sup>nd</sup>.
- Detergents were detected three times (July 20<sup>th</sup>, 23<sup>rd</sup> and August 5<sup>th</sup>) the highest result was 2.0 ppm on July 20<sup>th</sup>.
- Orthophosphate concentrations all exceeded the WQO of 0.12 ppm, with a high concentration of 0.47 ppm on August 4<sup>th</sup>. The season average was 0.35 mg/L. Due to repeated high measurements upstream sampling was done throughout the summer, see Appendix 3 for a list of sampling dates and results.
- Chlorine was consistently not detected (<0.2 ppm).
- The average temperature was 16.1 °C.
- The average conductivity was 1.7 mS.
- Trash was reported on all but two sampling days. Trash consisted of plastic water bottles, food wrappers/ bags, plastic bags, styrofoam cups, plastic labels, styrofoam peanuts, plastic strapping, a basketball, broken glass, candy wrappers, beer cans, plastic cups, and cigarette butts.
- Sewage was smelled on September 4<sup>th</sup>, and very slight bubbles or scum were reported on July 23<sup>rd</sup> and August 17<sup>th</sup>. No oil sheen was recorded.
- Bacteria sampling during June and July 2009 was conducted on weekends however access to the marine station (private property) was restricted during that time. Therefore bacteria samples were collected from HopkinsMon only in August and September. Results from bacteria testing showed levels for *E. coli* lower than the WQO on August 26<sup>th</sup>, and above the WQO for both *E. coli* and enterococcus on September 28<sup>th</sup>(Table 3).

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<sup>2</sup> Ammonia values are reported as total ammonia (NH<sub>3</sub>-N). When these values are converted to free ammonia (NH<sub>3</sub>) (the toxic form of ammonia) none of the values exceeded the water quality objective of 0.025ppm NH<sub>3</sub>

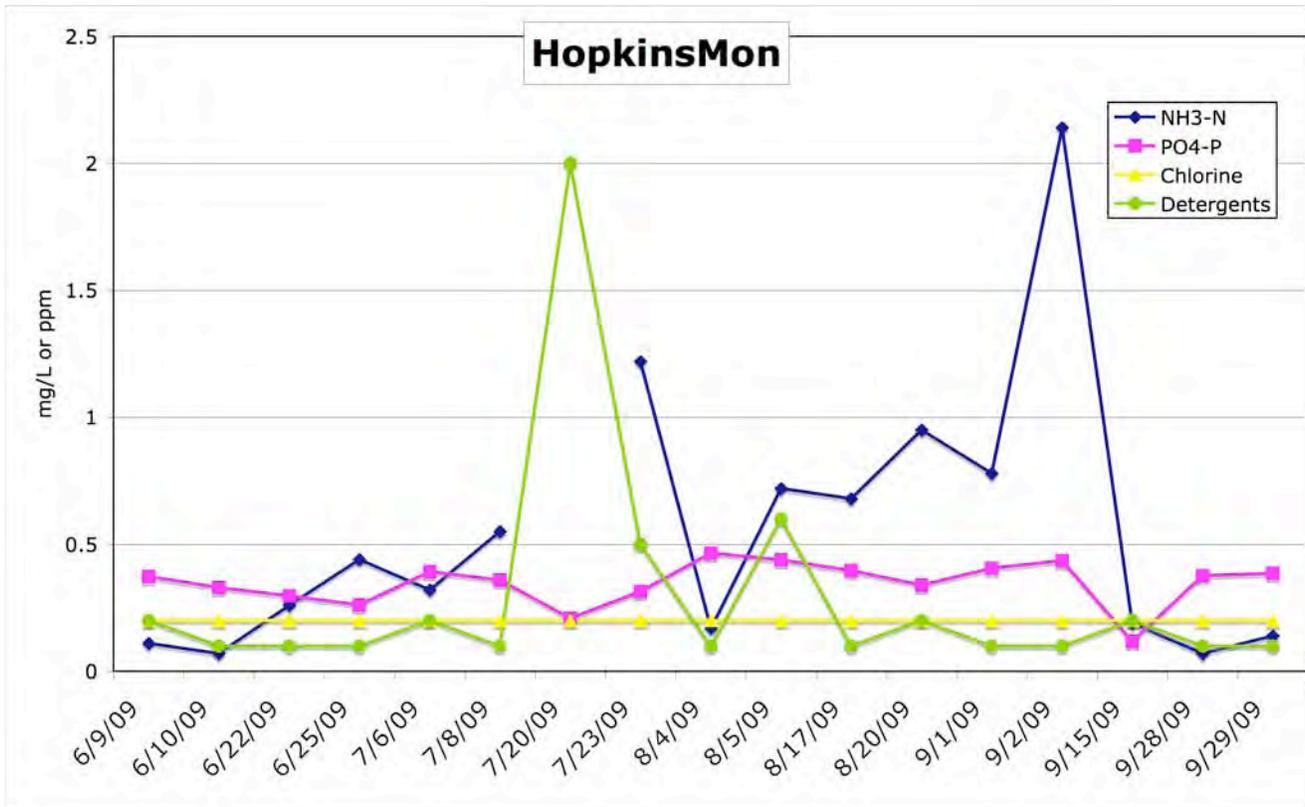


Figure 1: Seasonal trends for analytes at HopkinsMon, 2009.

HopkinsPG is the farthest west outfall that drains a small area of Pacific Grove and was dry on all sampling days except for September 28<sup>th</sup> and 29<sup>th</sup>.

HopkinsPG results for the 2009 Urban Watch monitoring season are:

- Total ammonia results were below the WQO for both days<sup>3</sup>.
- Detergents were not detected (<0.1 ppm) both days
- Orthophosphate results were above the WQO on both days, with concentrations of 0.31 ppm for September 28<sup>th</sup> and 0.26 ppm on September 29<sup>th</sup>. The season average was 0.29 mg/L.
- Chlorine was not detected (<0.2 ppm) both days.
- The average temperature was 17.6 °C.
- The average conductivity was 1.0 mS.
- Trash was not observed at this site.
- Sewage and surface scum were not observed at this site.
- Bacteria samples were collected on September 28<sup>th</sup>. Results showed concentrations of *E. coli* and enterococcus above the WQO.

<sup>3</sup> Ammonia values are reported as total ammonia (NH3-N). When these values are converted to ammonia (NH3)-the toxic form of ammonia-none of the values exceeded the water quality objective of 0.025ppm NH3.

## **Greenwood**

The Greenwood Park site is at the corner of Central Avenue and 13<sup>th</sup>.

Results for the 2009 Urban Watch monitoring season are (Figure 2):

- This site was sampled 20 times.
- Total ammonia had some significant spikes, the most notable was on the last sampling day, September 29<sup>th</sup> (these results are not included on the graph because their inclusion skewed the scale for the rest of the testing dates). On September 29<sup>th</sup>, the total ammonia levels were 9.96 ppm. While the rest of the season's free ammonia levels were not above the WQO<sup>4</sup>, the levels on September 29<sup>th</sup> exceeded the WQO with a result of 0.031 ppm free ammonia.
- Detergents were not detected (<0.1ppm) all season except for two days. The highest concentration was measured on September 29<sup>th</sup> with a result of 3.0 ppm (these results are not included on the graph because their inclusion skewed the scale for the rest of the testing dates).
- Orthophosphates had a spike on September 29<sup>th</sup>, with a result of 2.75 ppm (these results are not included on the graph because their inclusion skewed the scale for the rest of the testing dates). While all results for the monitoring season were over the WQO, this was dramatically over the season average of 0.39 ppm.
- Chlorine was consistently not detected (<0.2 ppm).
- The average temperature was 15.7 °C.
- The average conductivity was 1.7 mS.
- Trash was noted on all sampling days except June 28<sup>th</sup>. Trash consisted of soda cans, styrofoam, a tic-tac container, straws, plastic garbage bags, cigarette butts, mylar snack bags, plastic condiment bags, cardboard, styrofoam peanuts, candy wrappers, LOTS of small balloons, tennis ball, plastic filament, and a popsicle stick.
- Sewage smell was noted on June 9<sup>th</sup> and a commonly occurring surface scum usually described as small bubbles was noted on: June 9<sup>th</sup>, July 6<sup>th</sup>, July 23<sup>rd</sup>, September 1<sup>st</sup> and September 29<sup>th</sup>.
- Oily sheen was noted on September 15<sup>th</sup> and the Pacific Grove Fire Department was called to clean up the area. On September 16<sup>th</sup> a couple of residual oily patches were also evident. The source was never determined.
- Bacteria samples at Greenwood Park were taken on June 28<sup>th</sup>, July 25<sup>th</sup>, August 26<sup>th</sup>, and September 28<sup>th</sup>. All samples were over the WQO for both *E. coli* and enterococcus (Table 2).

Additional bacterial testing was conducted on August 5<sup>th</sup> and October 1<sup>st</sup> for source tracking:

- On August 5<sup>th</sup> a sample was collected at the Greenwood Park site and was tested for coliform bacteria as well as analyzed using the Polymerase Chain Reaction (PCR) analysis to detect human specific bacteroides. A sample was collected at 8:00 AM, the water at the site appeared very brown and cloudy.

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<sup>4</sup> Ammonia values are reported as total ammonia (NH<sub>3</sub>-N). When these values are converted to ammonia (NH<sub>3</sub>)-the toxic form of ammonia-none of the values exceeded the water quality objective of 0.025ppm NH<sub>3</sub>.

Upon returning at 10:35 AM, the water had cleared and a second sample was collected for comparison of coliform concentrations. Both samples had results of >24,196 MPN/ 100mL. The second sample collected at 10:35 AM was subsequently run for PCR analysis, which showed a strong signal for human specific bacteroides (Table 4).

- Another round of samples was taken on October 1<sup>st</sup>. Three samples were collected at the top, middle and bottom of the drainage. The most upstream site in this drainage, at David and Terry, was checked but there wasn't enough water to sample. The next site downstream was sampled.

1. Most upstream site: in the alley between Sinex and Gibson behind 472 Gibson;
2. Mid-drainage: at the intersection of 14<sup>th</sup> and Junipero Streets.
3. Most downstream site: at Greenwood Park (Urban Watch site)

The Greenwood Park (downstream site) and the 14<sup>th</sup> and Junipero site (mid-drainage) samples tested positive for human specific bacteroides. The alley site between Gibson and Sinex (upstream site) was negative (Table 4).

**Table 4. PCR results for Greenwood Park sampling on August 5<sup>th</sup> and October 1<sup>st</sup>.**

SITE	DATE	<i>E. coli</i> , MPN/100/ml	NG HUMAN FECES/100ml
Greenwood Park	08/05/09	>24,196	3750
Greenwood Park	10/01/09	>24,192	122,551
14th & Junipero	10/01/09	2,851	2,719
Alley b/t Sinex & Gibson	10/01/09	158	<0.3

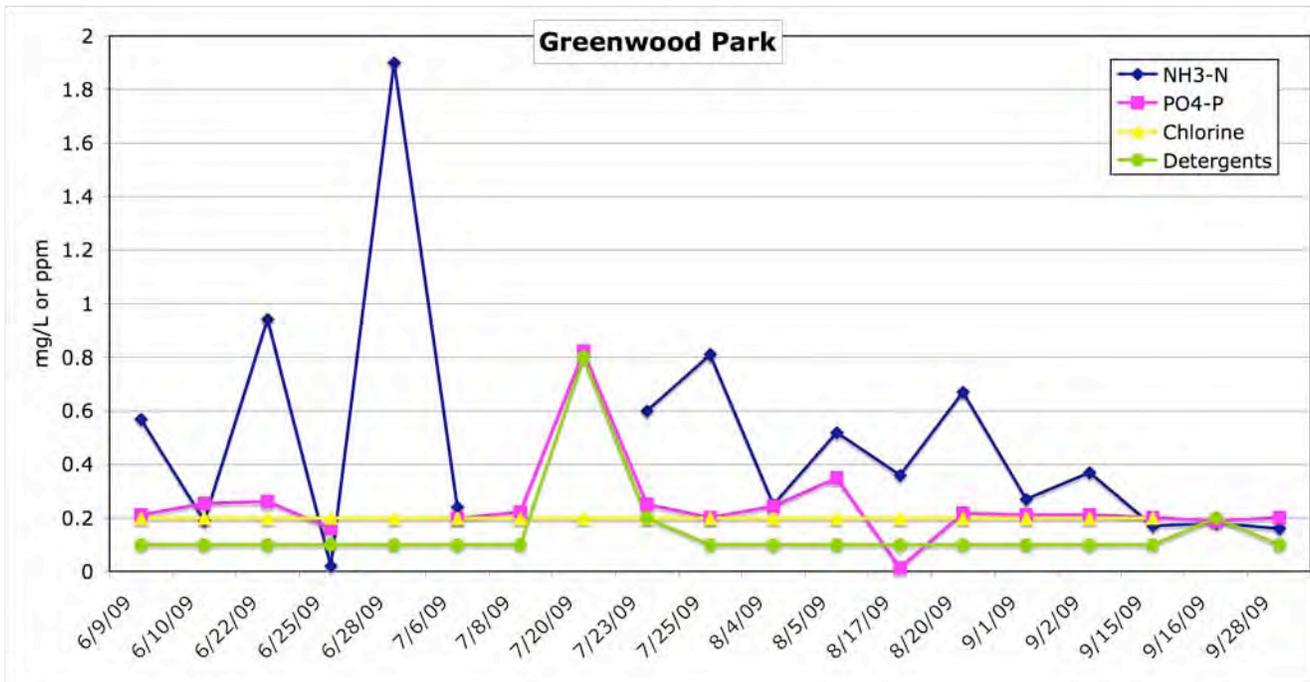


Figure 2. Seasonal trends for analytes at Greenwood Park, 2009.

### **8<sup>th</sup> Street**

The 8<sup>th</sup> Street outfall is at the foot of 8<sup>th</sup> street on the ocean side of the recreation trail. This site is part of the Pacific Grove Diversion Project where dry weather urban runoff flows are diverted into the sanitary sewer system. In order to alert the City to possible diversion system leaks, we drove by this site each sampling day. It was never flowing and therefore not monitored all summer.

### **Lover's Point**

This outfall is also part of the Pacific Grove Diversion Project where dry weather urban runoff flows are diverted into the sanitary sewer system. Over the summer months, it dribbled such a small amount of flow that it was only sampled twice all summer; once on June 28<sup>th</sup> and again on July 25<sup>th</sup>.

Results for the 2009 Urban Watch monitoring season are:

- Total ammonia results were 0.65 and 0.53 ppm on June 28<sup>th</sup> and July 25<sup>th</sup> respectively. All results were under the WQO for free ammonia<sup>5</sup>.
- Detergent results were not detected (<0.1 ppm).
- Orthophosphate results were above the WQO for both sampling days. Results were 0.20 ppm on June 28<sup>th</sup> and 0.18 ppm on July 25<sup>th</sup>.
- Chlorine results were not detected (<0.2 ppm).
- The average water temperature was 16.9 °C.
- The average conductivity was 1.0 mS.
- Trash was found at the site both days but there was no sewage or surface scum. Trash consisted of aluminum cans, aerosol cans, and wrappers.
- Bacteria samples were collected at Lover's Point on June 28<sup>th</sup> and July 25<sup>th</sup>. Results showed low *E. coli* and enterococcus levels below the WQO for June 28<sup>th</sup> and above the WQO for both *E. coli* and enterococcus on July 25<sup>th</sup> (Table 3).

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<sup>5</sup> Ammonia values are reported as total ammonia (NH<sub>3</sub>-N). When these values are converted to free ammonia (NH<sub>3</sub>) (the toxic form of ammonia) none of the values exceeded the water quality objective of 0.025ppm NH<sub>3</sub>

## **Pico**

Pico is located along Sunset Blvd. between Arena and Pico Streets.

Results for the 2009 Urban Watch monitoring season are (Figure 3):

- This site was sampled 20 times.
- Total ammonia had a few notable spikes one on June 9<sup>th</sup> with a result of 0.32 ppm and on July 23<sup>rd</sup> with a result of 0.43 ppm. Neither of these results exceeded the WQO for free ammonia<sup>6</sup>.
- Detergent concentrations were not detected (<0.1ppm) except for a slight increase ( <0.2 ppm) on September 28<sup>th</sup>.
- Orthophosphate results were highest on the first day of sampling, June 9<sup>th</sup>, with a result of 0.55 ppm. For the remainder of the season results remained above the WQO in 13 of the 20 sampling days. The season average for orthophosphate was 0.15 mg/L.
- Chlorine was consistently not detected (<0.2 ppm).
- The average water temperature was 15.6 °C.
- The average conductivity was 1.5 mS.
- Trash was recorded ten times and usually consisted of: cigarette butts, styrofoam peanuts, lip balm, tin foil, paper, one dead bird, candy wrapper, and styrofoam pieces.
- There was no sewage smell reported the entire season; oil sheen was never detected; scum or bubbles were reported eight times.
- Bacteria samples were taken on June 28<sup>th</sup>, July 25<sup>th</sup>, August 26<sup>th</sup>, and September 28<sup>th</sup>. Results show that *E. coli* was below the WQO for the June, July and September dates but above the WQO for August; enterococcus was above the WQO for all samples collected (Table 3).

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<sup>6</sup> Ammonia values are reported as total ammonia (NH<sub>3</sub>-N). When these values are converted to free ammonia (NH<sub>3</sub>) (the toxic form of ammonia) none of the values exceeded the water quality objective of 0.025ppm NH<sub>3</sub>

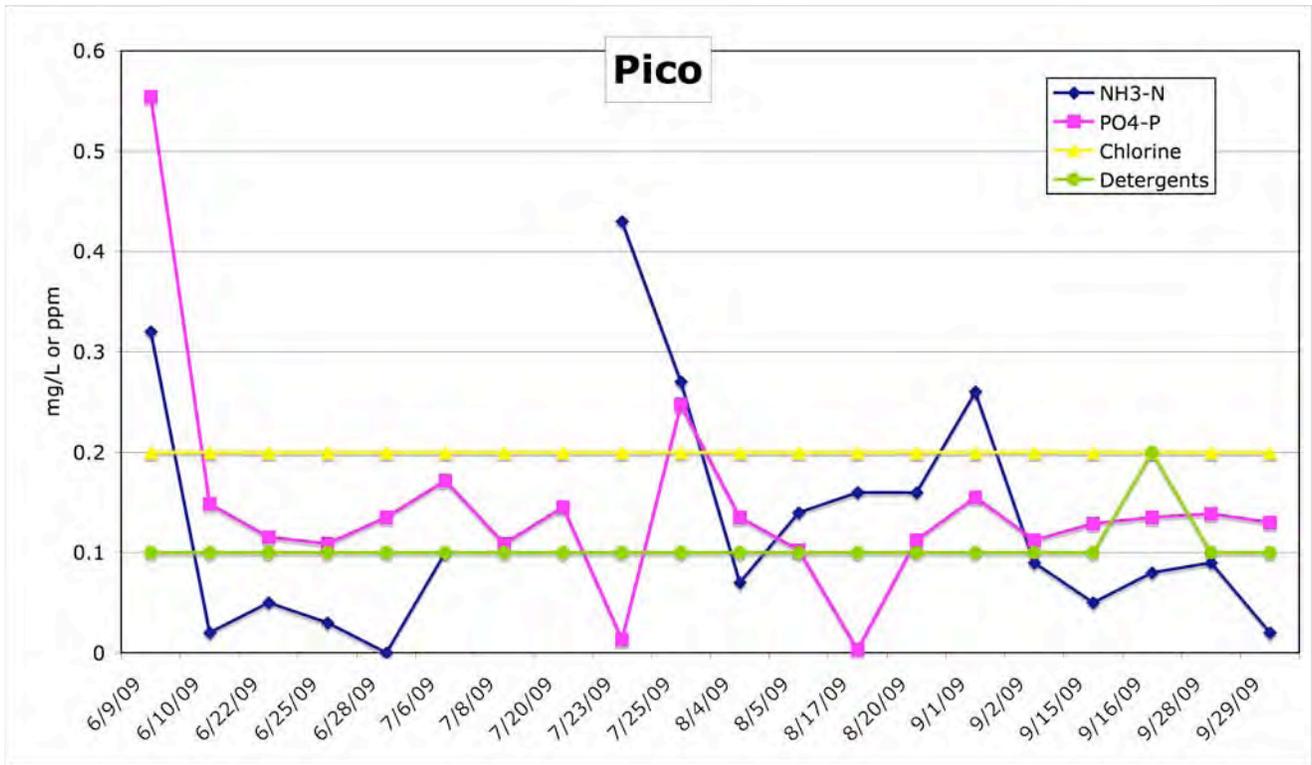


Figure 3. Seasonal trends for analytes at Pico, 2009.

## **Congress**

The Congress site is located just west of the Pacific Grove High School's football field.

Results for the 2009 Urban Watch monitoring season are (Figure 4):

- This site was sampled 19 times throughout the season.
- Total ammonia levels were all below the WQO but they did show two spikes on July 25<sup>th</sup> with a result of 2.32 ppm and on August 20<sup>th</sup> with a result of 2.62 ppm. The results did not exceed the WQO for free ammonia<sup>7</sup>.
- Detergents were not detected (<0.1 ppm) all season except for a slight increase (<0.2 ppm) on September 28<sup>th</sup>.
- Orthophosphate levels were over the WQO most of the season. The highest orthophosphate result was 0.23 ppm on September 28<sup>th</sup>. The season average was 0.14 mg/L.
- Chlorine was not detected (<0.2 ppm) for the majority of the season except for August 16<sup>th</sup> when the concentration was 0.4 ppm, and on September 16<sup>th</sup> when concentration was 0.8 ppm.
- The average water temperature was 17.4 °C.
- The average conductivity was 1.9 mS.
- Trash was found on twelve of the eighteen sampling days. Trash consisted of: plastic grocery bags, a whiskey bottle, nylon rope, wire tie, paper, large plastic bag, chew toy, plastic strapping, aluminum can, and safety glasses.
- Sewage was never sighted or smelled, surface scum was noted on six of the sampling days.
- Bacteria samples were taken at Congress on July 25<sup>th</sup>, August 26<sup>th</sup> and September 28<sup>th</sup>. Results from those samples showed that *E. coli* and enterococcus were above the WQO for all sampling dates (Table 3).

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<sup>7</sup> Ammonia values are reported as total ammonia (NH<sub>3</sub>-N). When these values are converted to free ammonia (NH<sub>3</sub>) (the toxic form of ammonia) none of the values exceeded the water quality objective of 0.025ppm NH<sub>3</sub>

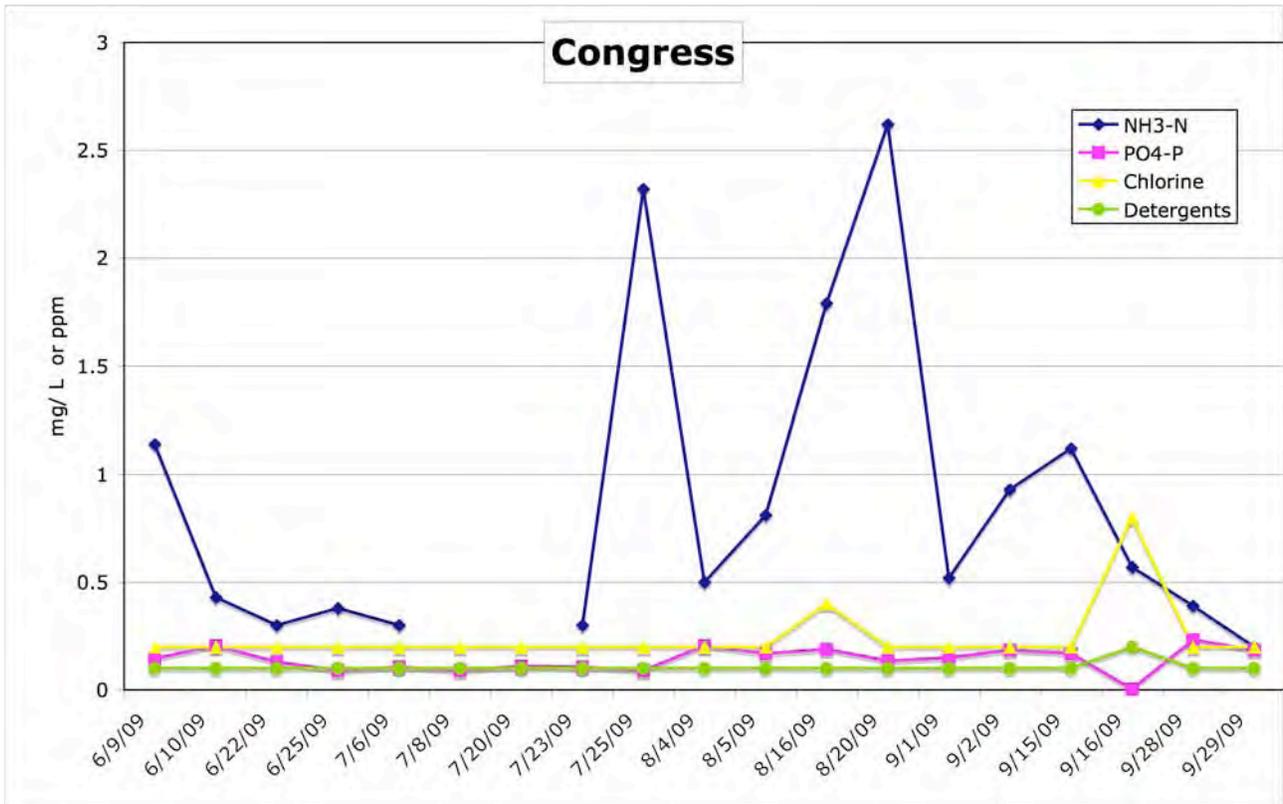


Figure 4. Seasonal trends for analytes at Congress, 2009.

## **Backyard to Bay**

This year, as in 2008, staff held two Backyard to Bay events. These events are designed to help educate the public about urban runoff, recruit new volunteers to the Urban Watch and First Flush Programs, and to build awareness of the impacts of common pollutants to our natural world. In order to better exemplify urban runoff, the watershed model was used as well as the Monterey Bay Begins On Your Street brochure. Additional materials were available including storm drain posters. This year, the two events were held at the Monterey Bay Aquarium's Hovden Way in Monterey and at Lover's Point in Pacific Grove. The Backyard to Bay at the Monterey Bay Aquarium had more visitors from out of the area (Fresno, Turlock, and Bakersfield areas) while the Lover's Point Backyard to Bay had overwhelmingly more locals. Approximately 100 people learned about urban runoff and preparing their homes and neighborhoods for the First Flu

**Table 3. 2009 Monthly Bacteria Concentrations (MPN/100ml)**

	<b>6/28/09</b>	<b>7/25/09</b>	<b>8/26/09<sup>s</sup></b>	<b>09/28/09</b>
<b>HopkinsMon</b>				
Total Coliform	No access	No access	9,804	34,660
E. coli	No access	No access	10	612
enterococcus				6,896
<b>HopkinsPG</b>				
Total Coliform	No access	No access	No flow	12,030
E. coli	No access	No access	No flow	626
enterococcus				1,008
<b>Greenwood</b>				
Total Coliform	>4,838	24,192	>24,196	31,060
E. coli	1,986	10,462	15,531	4,500
enterococcus	1,345	24,192		874
<b>Lover's Point</b>				
Total Coliform	>4,838	8,664	No flow	No flow
E. coli	7	749	No flow	No flow
enterococcus	13	904		
<b>Pico</b>				
Total Coliform	>4,838	8,664	>24,196	2,878
E. coli	225	345	3,873	126
enterococcus	158	199		930
<b>Congress</b>				
Total Coliform		1,785	5,172	1733
E. coli		909	1,137	201
enterococcus		109		4028

<sup>s</sup> Lab error, they did not conduct analysis for enterococcus on this date.

## **Conclusion**

Over all, the 2009 Urban Watch season was very successful. The outfalls were monitored by the volunteers twice each week throughout the season. Most outfalls consistently had non-detect values for detergents and chlorine. All total ammonia concentrations, when converted to the toxic form of ammonia, were below the WQO except in one instance on September 29<sup>th</sup> at Greenwood Park. The two biggest problems in all monitored drainages is the amount of trash and bacteria levels at all outfalls, but most problematic at Greenwood Park.

Because of the history of high *E. coli* concentrations at the Greenwood Park site, the City funded additional PCR analysis at that site. When the initial results indicated a strong presence of human bacteriodes, more monitoring was conducted upstream at the top of the drainage, middle drainage and again at the bottom of the drainage at the Greenwood Park site. Those results indicated a strong signal of human bacteriodes in the middle and bottom of the drainage. It appears that there is a source of human sewage infiltrating the storm drain system in this area which requires locating and mitigating the source. This can be done with more PCR analysis or through other means such as running a camera up the lines to look for sources. Conducting PCR analysis at each site may be warranted in order to rule out human sewage as a potential source of the elevated bacteria concentrations found at all monitored sites.

A success story is the reduction in chlorine detections at the Congress outfall. After several years of measuring elevated chlorine concentrations, due to the swimming pool at the high school, those levels were primarily non-detect except for two occasions in which they were slightly elevated.

Future efforts should target sources of trash at all monitored outfalls. A study of the types of trash and potential upstream sources should be initiated. For example, at the Greenwood Park site, it is common to see a significant amount of Styrofoam packing material. This easily travels downstream and either gets filtered out in the diversion system or, when not diverted, ends up in the sanctuary where marine animals can mistake it as a food source. There are businesses upstream of this site that should be educated about not unpacking boxes on sidewalks where these materials can be released.

The Urban Watch program helps to fulfill the Minimum Control Measures for public participation set forth by the Monterey Regional Stormwater Management Program. It also provides bi-weekly results on the quality of dry weather urban runoff flowing in to the Monterey Bay National Marine Sanctuary.

The Urban Watch Program educates and informs local citizens about urban runoff and its' affects on marine organisms. During the 2009 season, eighteen volunteers dedicated 360 hours to help with the collection and testing of urban runoff. The majority of 2009 volunteers were new to the Urban Watch Program. These volunteers help to spread the word about this valuable program that the City of

Pacific Grove funds as well as the effects of urban runoff on the Monterey Bay National Marine Sanctuary.

To improve this program, we'd like to have storm drain maps of each drainage available to the volunteers so that they can more effectively track potential sources when high detections are encountered. Having the maps would have been helpful on the last day of sampling when results at Greenwood Park were extremely high for ammonia, orthophosphate and detergents. We don't expect the volunteers to pull manhole covers, but rather drive around the area looking for potential sources of pollution flowing down the street.

We would like to thank our dedicated volunteers for their time monitoring the quality of urban runoff in Pacific Grove. Their commitment is crucial to the success of this program and in helping the City of Pacific Grove to understand the quality and challenges in reducing the amount of urban runoff pollution entering the Monterey Bay National Marine Sanctuary. We are grateful to the City of Pacific Grove for continuing to fund and support this important program.

## **Appendix 1: 2009 Urban Watch Monthly Summaries**



Monterey Bay Sanctuary Citizen Watershed Monitoring Network  
**Pacific Grove Urban Watch '09**

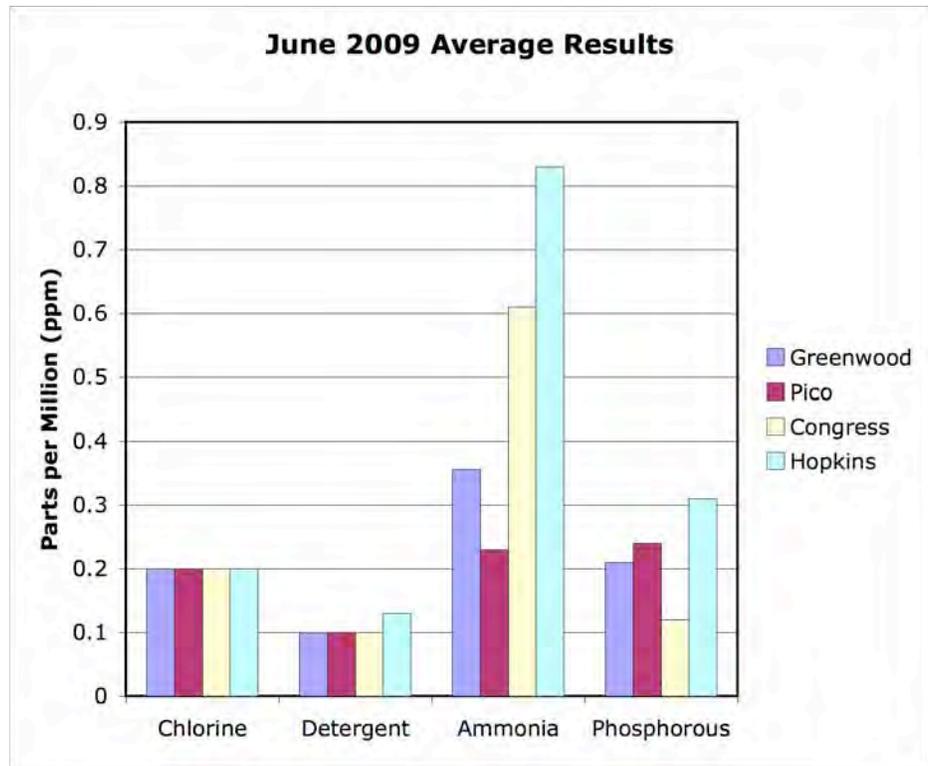
*June Fast Facts*

**Number of volunteers: 13**  
**Number of volunteer hours: 130**  
**Total season volunteer hours: 130**  
**Monitoring Dates: June 9<sup>th</sup>, 10<sup>th</sup>, 22<sup>nd</sup>, and 25<sup>th</sup>**

**Average Detections for June (ppm)**

Site	Chlorine	Detergent	Ammonia	Orthophosphate
Greenwood	0.20	0.10	0.36	0.21
Pico	0.20	0.10	0.23	0.24
Congress	0.20	0.10	0.61	0.12
Hopkins	0.20	0.13	0.83	0.31

xx Indicates exceedance of CCAMP Water Quality Objective  
 xx Indicates no exceedance of CCAMP Water Quality Objective



MRSWMP Monitoring happened on June 28<sup>th</sup>. Thanks to everyone that came out and helped us sample!

Our next MRSWMP Monitoring will be on July 25<sup>th</sup>- mark your calendars!

**Trash / Cleanup:** This month, we picked up several plastic bags, bottles, wrappers, styrofoam peanuts, cigarette butts, and one container of lip balm. Thank you for helping keep less litter from entering the Monterey Bay Sanctuary!

For more information, contact Lisa Emanuelson, Volunteer Monitoring Coordinator  
 (831) 647-4227 or [Lisa.Emanuelson@noaa.gov](mailto:Lisa.Emanuelson@noaa.gov)



# Monterey Bay Sanctuary Citizen Watershed Monitoring Network Pacific Grove Urban Watch '09

## July Fast Facts

Number of volunteers: 13  
 Number of volunteer hours: 65  
 Total season volunteer hours: 130  
 Monitoring Dates: July 6<sup>th</sup>, 8<sup>th</sup>, 20<sup>th</sup>, and 23<sup>rd</sup>

## Average Detections for July (ppm)

Site	Chlorine	Detergent	Ammonia	Orthophosphate
Greenwood	0.20	0.30	0.42	0.36
Pico	0.20	0.10	0.27	0.11
Congress	0.20	0.10	0.30	0.10
Hopkins	0.20	0.70	0.70	0.32

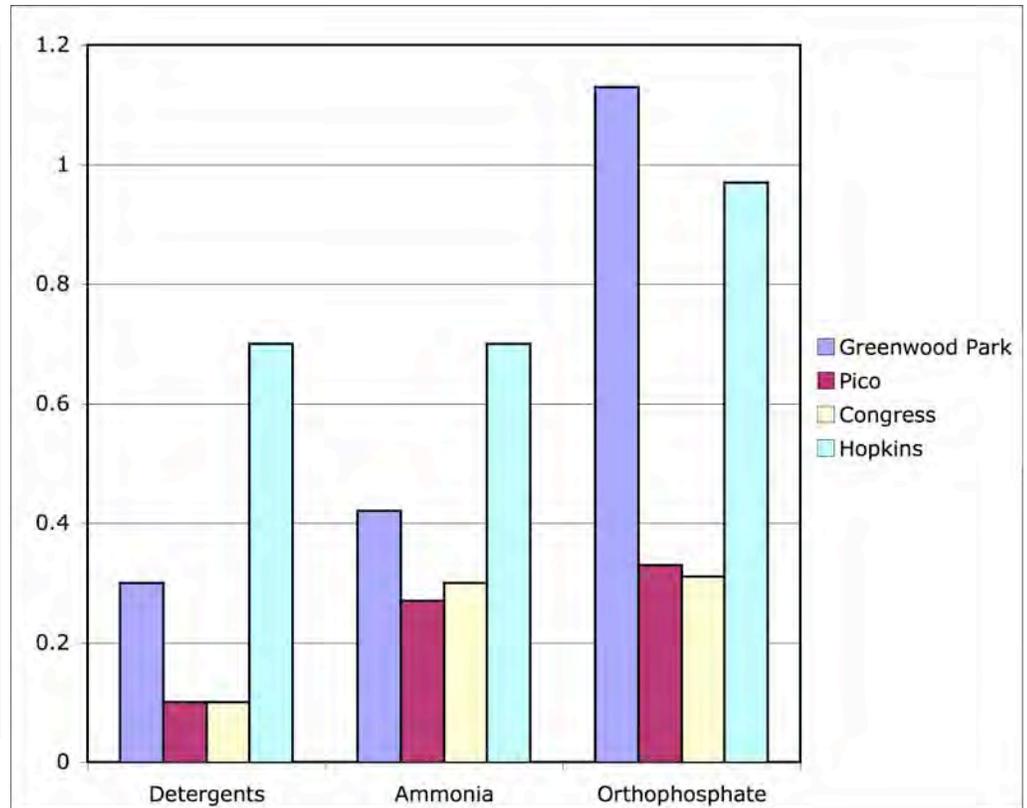
xx Indicates exceedance of CCAMP Water Quality Objective

xx Indicates no exceedance of CCAMP Water Quality Objective

### Ammonia Meter Troubles

As many of you are aware we were having troubles with the ammonia meters. Most of the troubles appear to be worked out due to the purchase of a new meter. Please remember to drop the reagents in vertically from above, and line up the arrow on the lid to the mark on the cuvet.

Thanks!



Our second MRSWMP Monitoring happened on July 25<sup>th</sup>. Thanks to everyone that came out and helped us sample!

For more information, contact Lisa Emanuelson, Volunteer Monitoring Coordinator  
(831) 647-4227 or [Lisa.Emanuelson@noaa.gov](mailto:Lisa.Emanuelson@noaa.gov)



# Monterey Bay Sanctuary Citizen Watershed Monitoring Network Pacific Grove Urban Watch '09

## August Fast Facts

Number of volunteers: 10  
 Number of volunteer hours: 50  
 Total season volunteer hours: 245  
 Monitoring Dates: August 4<sup>th</sup>, 5<sup>th</sup>, 17<sup>th</sup> and 20<sup>th</sup>

### Average Detections for August (ppm)

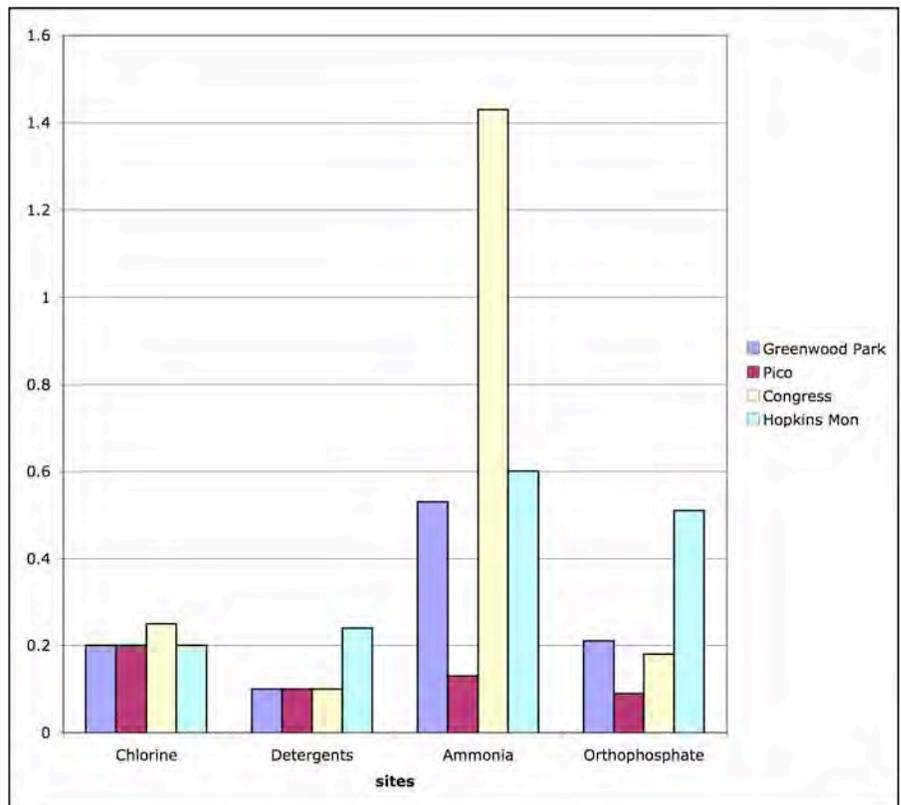
Site	Chlorine	Detergent	Ammonia	Orthophosphate
Greenwood	0.20	0.10	0.53	0.21
Pico	0.20	0.10	0.13	0.09
Congress	0.25	0.10	1.43	0.18
Hopkins	0.20	0.24	0.60	0.51

xx Indicates exceedance of CCAMP Water Quality Objective

xx Indicates no exceedance of CCAMP Water Quality Objective

### August issues

Due to repeated high levels of orthophosphate in the HopkinsMon drainage, we worked with the Cities of Monterey and Pacific Grove to identify potential upstream sources. More monitoring continues as well as communication with property owners and landscapers in this drainage.



We are getting ready for First Flush- contact Lisa Emanuelson if you are interested in bring on a First Flush team!

For more information, contact Lisa Emanuelson, Volunteer Monitoring Coordinator (831) 647-4227 or [Lisa.Emanuelson@noaa.gov](mailto:Lisa.Emanuelson@noaa.gov)



# Monterey Bay Sanctuary Citizen Watershed Monitoring Network Pacific Grove Urban Watch '09

## September Fast Facts

Number of volunteers: 19  
 Number of volunteer hours: 115 !!  
 Total season volunteer hours: 360 !!  
 Monitoring Dates: Sept. 1<sup>st</sup>, 2<sup>nd</sup>, 15<sup>th</sup>, 16<sup>th</sup>, 28<sup>th</sup> & 29<sup>th</sup>

### Average Detections for September (ppm)

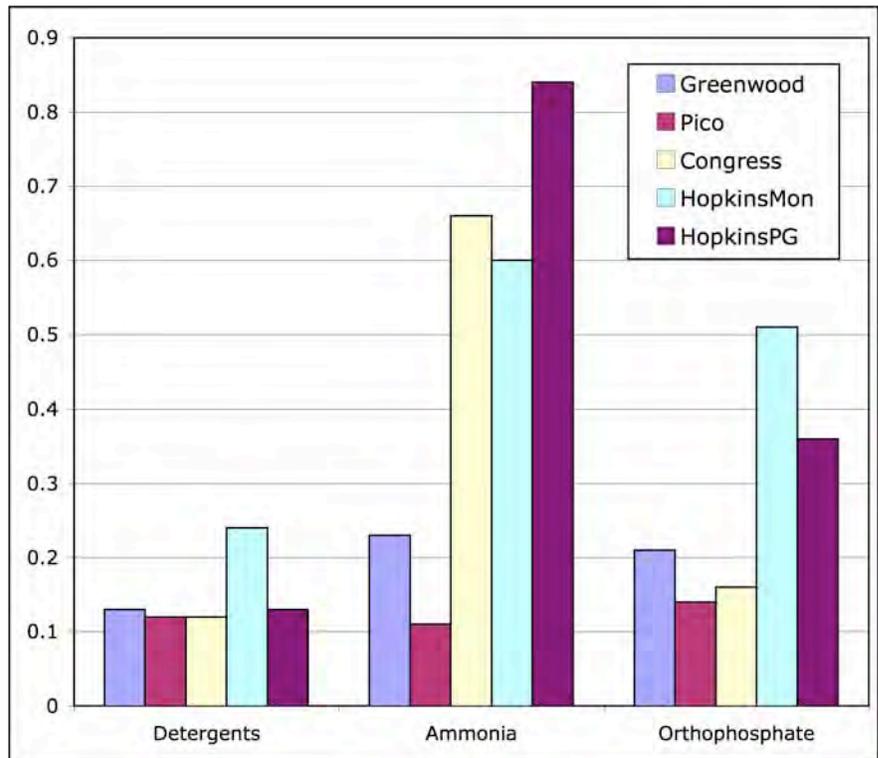
Site	Chlorine	Detergent	Ammonia	Orthophosphate
Greenwood	0.20	0.13	0.23	0.21
Pico	0.20	0.12	0.11	0.14
Congress	0.20	0.12	0.66	0.16
HopkinsMon	0.20	0.24	0.60	0.51
HopkinsPG	0.20	0.13	0.84	0.36

xx Indicates exceedance of CCAMP Water Quality Objective  
xx Indicates no exceedance of CCAMP Water Quality Objective

#### September issues

This was the first time ALL summer that we have seen water flowing in the HopkinsPG pipe. Keep in mind that the results are from one sample only.

First Flush training happened on September 17<sup>th</sup>. The Dry Run occurred on September 19<sup>th</sup> for Santa Cruz and Monterey Counties and on September 20<sup>th</sup> for San Mateo County.



We still need more volunteers for **First Flush**,  
 contact Lisa Emanuelson , Volunteer Monitoring Coordinator  
 to volunteer for a team  
**(831) 647-4227 or Lisa.Emanuelson@noaa.gov**

**Appendix 2: Tabular Results.** Yellow highlight represents exceedance of WQO or action level.

StationID	Date	Time	Trash	Sewage	OilSheen	Scum	Chlorine	Color	Conduct.	Detergnts	NH3-N	pH	PO4-P	Wtr T	Air T
CENTR-31	6/9/09	11:00 AM	TRUE	TRUE	FALSE	TRUE	0.2	91	2	0.1	0.57	7.5	0.21	15.8	18.5
CENTR-31	6/10/09	11:55 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	1.8	0.1	0.19	7	0.25	16.0	18.7
CENTR-31	6/22/09	6:25 PM	TRUE	FALSE	FALSE	FALSE	0.2	92	1.8	0.1	0.94	7.5	0.26	16.1	16.5
CENTR-31	6/25/09	6:20 PM	TRUE	FALSE	FALSE	FALSE	0.2	92	1730	0.1	0.02	7	0.16	15.9	14.4
CENTR-31	6/28/09	9:50 AM	FALSE	FALSE	FALSE	TRUE	0.2	93	1.5	0.1	1.9	7		16.0	17.3
CENTR-31	7/6/09	3:20 PM	TRUE	FALSE	FALSE	TRUE	0.2	93	1560	0.1	0.24	6.5	0.20	16.4	18.1
CENTR-31	7/8/09	2:37 PM	TRUE	FALSE	FALSE	FALSE	0.2	92	1.9	0.1	nm *	6.5	0.22	17.1	18.4
CENTR-31	7/20/09	4:13 PM	TRUE	FALSE	FALSE	FALSE	0.2	94	1.8	0.8	nm *	7	0.82	16.6	15.4
CENTR-31	7/23/09	5:00 PM	TRUE	FALSE	FALSE	TRUE	0.2	36	1.8	0.2	0.6	7	0.25	15.8	14.2
CENTR-31	7/25/09	9:40 AM	TRUE	FALSE	TRUE	TRUE	0.2	91	1.8	0.1	0.81	6.5	0.20	15.8	13.0
CENTR-31	8/4/09	12:50 PM	TRUE	FALSE	FALSE	FALSE	0.2	36	1.8	0.1	0.25	7	0.24	17.4	19.5
CENTR-31	8/5/09	10:30 AM	TRUE	FALSE	FALSE	FALSE	0.2	36	1600	0.1	0.52	6.5	0.35	16.7	14.3
CENTR-31	8/17/09	6:11 PM	TRUE	FALSE	FALSE	FALSE	0.2	93	2.1	0.1	0.36	6.5	0.01	16.6	15.1
CENTR-31	8/20/09	6:06 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	2.1	0.1	0.67	7	0.22	16.7	16.3
CENTR-31	9/1/09	10:40 AM	TRUE	FALSE	FALSE	TRUE	0.2	36	1.9	0.1	0.27	6.5	0.21	16.4	14.7
CENTR-31	9/2/09	2:40 PM	TRUE	FALSE	FALSE	FALSE	0.2	92	1600	0.1	0.37	6.5	0.21	17.3	22.0
CENTR-31	9/15/09	6:08 PM	TRUE	FALSE	TRUE	FALSE	0.2	93	1720	0.1	0.17	6.5	0.20	17.1	16.3
CENTR-31	9/16/09	5:45 PM	TRUE	FALSE	TRUE	FALSE	0.2	120	1670	0.2	0.18	7	0.19	17.5	14.8
CENTR-31	9/28/09	1:45 PM	TRUE	FALSE	FALSE	TRUE	0.2	106	1780	0.1	0.16	6.5	0.20	16.4	14.8
CENTR-31	9/29/09	1:41 PM	TRUE	FALSE	FALSE	FALSE	0.2	101	1590	3.0	9.96	7	2.75	16.7	17.5
PGSD-01	7/25/09	10:12 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	1150	0.1	0.4	6.5		15.5	14.0
PGSD-03	6/28/09	10:15 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	0.9	0.1	0.65	7.5	0.20	17.9	23.0
PGSD-03	7/25/09	9:55 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	1	0.1	0.53	7	0.18	15.9	15.2
PGSD-04	6/9/09	11:30 AM	FALSE	FALSE	FALSE	FALSE	0.2	55	2.1	0.1	0.32	7	0.55	15.2	18.8
PGSD-04	6/10/09	11:30 AM	TRUE	FALSE	FALSE	TRUE	0.2	93	1.7	0.1	0.02	7.5	0.15	15.6	17.5
PGSD-04	6/22/09	5:59 PM	FALSE	FALSE	FALSE	FALSE	0.2	91	480	0.1	0.05	7	0.12	14.7	23.2
PGSD-04	6/25/09	6:34 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	1530	0.1	0.03	7	0.11	14.5	16.5
PGSD-04	6/28/09	10:15 AM	FALSE	FALSE	FALSE	TRUE	0.2	91	1.7	0.1	0	6.5	0.14	15.6	16.1
PGSD-04	7/6/09	2:22 PM	TRUE	FALSE	FALSE	TRUE	0.2	93	0.9	0.1	0.1	6.5	0.17	16.2	17.9
PGSD-04	7/8/09	3:00 PM	FALSE	FALSE	FALSE	FALSE	0.2	92	16	0.1	nm *	6.5	0.11	15.9	18.0
PGSD-04	7/20/09	4:45 PM	FALSE	FALSE	FALSE	FALSE	0.2	36		0.1	nm *	6.5	0.15	15.1	15.7
PGSD-04	7/23/09	5:56 PM	FALSE	FALSE	FALSE	FALSE	0.2	36	1.9	0.1	0.43	6.5	0.01	14.6	13.7
PGSD-04	7/25/09	9:35 AM	FALSE	FALSE	FALSE	TRUE	0.2	48	1590	0.1	0.27	7	0.25	14.5	16.5
PGSD-04	8/4/09	12:30 PM	TRUE	FALSE	FALSE	FALSE	0.2	36	1.5	0.1	0.07	6.5	0.14	15.4	17.4
PGSD-04	8/5/09	10:25 AM	TRUE	FALSE	FALSE	FALSE	0	91	1.9	0.1	0.14	6.5	0.10	16.2	17.0
PGSD-04	8/17/09	5:55 PM	TRUE	FALSE	FALSE	TRUE	0.1	93	1310	0.1	0.16	6.5	0.00	15.6	15.8
PGSD-04	8/20/09	5:55 PM	FALSE	FALSE	FALSE	FALSE	0.2	91	1.3	0.1	0.16	6.5	0.11	15.8	17.0
PGSD-04	9/1/09	10:56 AM	TRUE	FALSE	FALSE	FALSE	0.2	36	1.7	0.1	0.26	6.5	0.16	15.7	15.8
PGSD-04	9/2/09	2:45 PM	TRUE	FALSE	FALSE	FALSE	0.2	92	1.4	0.1	0.09	7	0.11	16.2	18.0
PGSD-04	9/15/09	5:45 PM	TRUE	FALSE	FALSE	TRUE	0.2	93	1320	0.1	0.05	6.5	0.13	16.0	20.0
PGSD-04	9/16/09	5:40 PM	FALSE	FALSE	FALSE	TRUE	0.2	91	1330	0.2	0.08	6.5	0.14	16.4	20.9

StationID	Date	Time	Trash	Sewage	OilSheen	Scum	Chlorine	Color	Conduct.	Detergnts	NH3-N	pH	PO4-P	Wtr T	Air T
PGSD-04	9/28/09	1:56 PM	TRUE	FALSE	FALSE	TRUE	0.2	106	1370	0.1	0.09	7	0.14	15.7	15.7
PGSD-04	9/29/09	1:15 PM	FALSE	FALSE	FALSE	TRUE	0.2	97	1250	0.1	0.02	6.5	0.13	14.0	15.8
PGSD-06	6/9/09	11:48 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	2.8	0.1	1.14	7	0.15	16.6	19.4
PGSD-06	6/10/09	11:53 AM	FALSE	FALSE	FALSE	TRUE	0.2	93	2.8	0.1	0.43	7.5	0.20	16.9	18.3
PGSD-06	6/22/09	6:25 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	2.1	0.1	0.3	7.5	0.13	17.0	20.5
PGSD-06	6/25/09	7:00 PM	FALSE	FALSE	FALSE	FALSE	0.2	93	2.3	0.1	0.38	7.5	0.09	16.4	16.5
PGSD-06	7/6/09	2:40 PM	TRUE	FALSE	FALSE	FALSE	0.2	93	2.5	0.1	0.3	7	0.11	18.4	18.2
PGSD-06	7/8/09	3:15 PM	FALSE	FALSE	FALSE	FALSE	0.2	91	2.7	0.1	nm*	7	0.09	18.4	17.6
PGSD-06	7/20/09	4:33 PM	TRUE	FALSE	FALSE	TRUE	0.2	36	2.3	0.1	nm *	7	0.11	17.9	14.7
PGSD-06	7/23/09	5:45 PM	TRUE	FALSE	FALSE	FALSE	0.2	36	2.7	0.1	0.3	6.5	0.11	17.9	15.7
PGSD-06	7/25/09	10:35 AM	FALSE	FALSE	FALSE	TRUE	0.2	92	250	0.1	2.32	7	0.09	17.2	17.2
PGSD-06	8/4/09	12:50 PM	TRUE	FALSE	FALSE	TRUE	0.2	36	2.6	0.1	0.5	6.5	0.20	17.1	17.7
PGSD-06	8/5/09	10:46 AM	TRUE	FALSE	FALSE	TRUE	0.2	92	2.3	0.1	0.81	7	0.17	18.5	15.6
PGSD-06	8/16/09	6:00 PM	TRUE	FALSE	FALSE	FALSE	0.4	93	2.3	0.1	1.79	6.5	0.19	18.5	15.1
PGSD-06	8/20/09	6:15 PM	FALSE	FALSE	FALSE	FALSE	0.2	91	2	0.1	2.62	6.5	0.14	18.4	19.3
PGSD-06	9/1/09	11:20 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	2.6	0.1	0.52	6.5	0.15	18.3	16.3
PGSD-06	9/2/09	2:25 PM	FALSE	FALSE	FALSE	FALSE	0.2	92	2.3	0.1	0.93	6.5	0.18	19.0	22.3
PGSD-06	9/15/09	6:00 PM	TRUE	FALSE	FALSE	TRUE	0.2	93	1950	0.1	1.12	7	0.17	8.6	21.0
PGSD-06	9/16/09	6:00 PM	TRUE	FALSE	FALSE	FALSE	0.8	92	9999	0.2	0.57	7	0.00	18.9	17.1
PGSD-06	9/28/09	1:24 PM	TRUE	FALSE	FALSE	TRUE	0.2	106	1970	0.1	0.39	7.25	0.23	17.9	15.4
PGSD-06	9/29/09	1:30 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	1890	0.1	0.2	6.5	0.18	17.4	16.0
PGSD-08	9/28/09	2:25 PM	FALSE	FALSE	FALSE	FALSE	0.2	106	820	0.1	0.12	7	0.31	16.4	16.6
PGSD-08	9/29/09	1:09 PM	FALSE	FALSE	FALSE	FALSE	0.2	92	1040	0.1	0.02	7.25	0.26	17.6	18.7
PGSD-09	6/9/09	10:30 AM	TRUE	FALSE	FALSE	FALSE	0.2	91	1.2	0.2	0.11	6.5	0.37	17.4	19.0
PGSD-09	6/10/09	11:30 AM	TRUE	FALSE	FALSE	FALSE	0.2	93	2.6	0.1	0.07	7	0.33	16.2	17.8
PGSD-09	6/22/09	6:00 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	2.3	0.1	0.26	7.5	0.30	16.7	18.3
PGSD-09	6/25/09	5:55 PM	TRUE	FALSE	FALSE	FALSE	0.2	93	2.8	0.1	0.44	7	0.26	16.1	16.4
PGSD-09	7/6/09	2:20 PM	TRUE	FALSE	FALSE	FALSE	0.2	93	1740	0.2	0.32	7	0.39	17.4	20.8
PGSD-09	7/8/09	2:35 PM	TRUE	FALSE	FALSE	FALSE	0.2	92	1.6	0.1	0.55	7	0.36	17.1	20.4
PGSD-09	7/20/09	3:53 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	1.6	2	nm*	7	0.21	16.9	19.3
PGSD-09	7/23/09	4:44 PM	TRUE	FALSE	FALSE	TRUE	0.2	93	1.8	0.5	1.22	7	0.31	16.2	17.5
PGSD-09	8/4/09	12:20 PM	TRUE	TRUE	FALSE	FALSE	0.2	36	1.8	0.1	0.17	7	0.47	17.4	20.2
PGSD-09	8/5/09	10:18 AM	FALSE	FALSE	FALSE	FALSE	0.2	36	1270	0.6	0.72	6.5	0.44	17.7	16.3
PGSD-09	8/17/09	5:52 PM	TRUE	FALSE	FALSE	TRUE	0.2	93	280	0.1	0.68	7	0.40	17.1	15.9
PGSD-09	8/20/09	5:42 PM	TRUE	FALSE	FALSE	FALSE	0.2	91	3.8	0.2	0.95	7	0.34	18.4	18.4
PGSD-09	9/1/09	10:20 AM	TRUE	FALSE	FALSE	FALSE	0.2	36	1.8	0.1	0.78	7	0.41	16.5	17.0
PGSD-09	9/2/09	2:20 PM	FALSE	FALSE	FALSE	FALSE	0.2	93	1370	0.1	2.14	7.5	0.44	18.0	23.6
PGSD-09	9/15/09	5:44 PM	TRUE	TRUE	FALSE	FALSE	0.2	93	1320	0.2	0.19	6.5	0.12	18.2	18.0
PGSD-09	9/28/09	1:20 PM	TRUE	FALSE	FALSE	FALSE	0.2	106	1410	0.1	0.07	6.5	0.38	16.9	15.6
PGSD-09	9/29/09	1:09 PM	FALSE	FALSE	FALSE	FALSE	0.2	91	1650	0.1	0.14	6.5	0.39	15.6	17.9

\* nm= no meter

### **Appendix 3- HopkinsMon upstream sampling results**

High orthophosphate results at the HopkinsMon outfall (PGSD-09) during the Urban Watch program prompted upstream source tracking in the drainage. A total of five upstream tracking days were conducted from July to November, 2009.

The first collection basin sampled was at the corner of Eardley and Ocean View (PA03-C1) where a nearly constant trickle of water was observed at varying times of the day. Early morning observations revealed slightly more flow which when tested had orthophosphate concentrations above the Water Quality Objective (WQO), which are not discharge standards but receiving water standards (Table 1 & Figure 1). City of Pacific Grove staff were contacted and assisted in determining sources of flow. This drainage includes areas in both Pacific Grove and Monterey, the area in question resides in the City of Monterey, and Monterey staff continued to assist with tracking.

The highest concentrations found during the upstream monitoring came from an inlet (PA03-DI4) which originated in a french drain at the base of a slope covered with lawn at Carl's Jr. on the corner of David and Lighthouse (Table 1 & Figure 1). The City of Monterey contacted the property manager and business owner to discuss the runoff issue in August 2009. Results continued to be above the WQO for both the inlet at the front of the property (PA03-DI4) and at the end of the drive through lane (PA03-CO3). Due to continued high orthophosphate results, City of Monterey staff requested the business owner cease fertilizing the lawn area which is immediately adjacent to the sampling point.

Sampling was also conducted above Lighthouse Ave. in the curb drains at Carrows along Lighthouse between David and Eardley (PA03-CO1 and PA03-CO2). One high concentration was detected in that runoff. City of Monterey staff determined that both curb drains originate in a french drain at the base of the stairs that lead from Lighthouse Avenue to the lobby. This area of Monterey and Pacific Grove is notorious for groundwater seepage, which may be infiltrating into the curb drains in this area, possibly combining with exterior wash water to result in higher orthophosphate concentrations. Later testing of the area adjacent to Carrows resulted in extremely low orthophosphate concentrations (Table 1 & Figure 1).

Further source tracking is warranted in this drainage.

**Table 1- Upstream Sampling Dates and Results**  
**WQO= 0.12 mg/L**

Date	Time	Location	Result mg/L
7/6/09	5:30 PM	PGSD-09	0.33
7/6/09	5:30 PM	PA03-C1	0.39
8/4/09	8:54 AM	PA03-C1	0.52
8/4/09	9:18 AM	PA03-DI3	1.30
8/4/09	9:35 AM	PA03-DI5	0.46
8/14/09		PA03-CO1	0.10
8/14/09		PA03-CO2	0.49
10/2/09	8:50 AM	PA03-C1	0.47
10/2/09	9:00 AM	PA03-DI4	1.14
10/2/09	9:00 AM	PA03-CO2	0.39
10/2/09	9:10 AM	PA03-CO3	0.40
11/6/09	9:00 AM	PA03-C1	0.36
11/6/09		PA03-CO2	0.08
11/6/09		PA03-DI3	Dry/ no flow
11/6/09		PA03-DI4	Dry/ no flow
11/6/09		PA03-DI5	Dry/ no flow

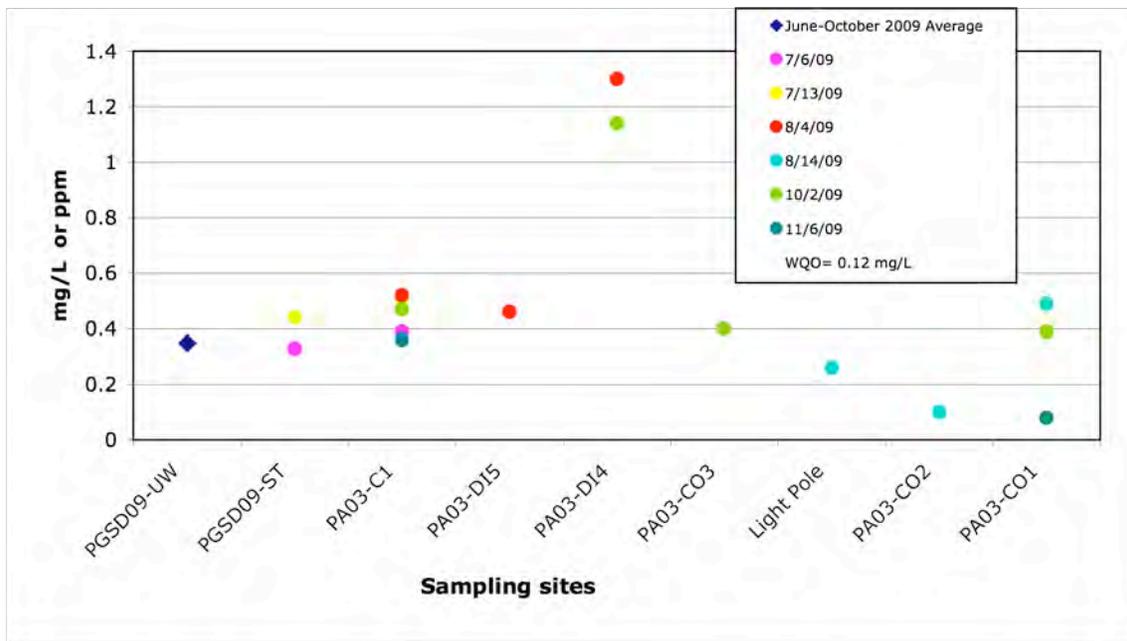
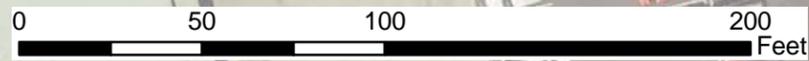


Figure 1. Orthophosphate as P concentrations at the sampled sites. The PGSD09-UW site is an average of all Urban Watch results for the 2009 season. This is the same site as the PGSD09-ST, which are the source tracking results.

# CARL'S JR/KNOB HILL STORM MONITORING



1 inch = 50 feet



**Legend**

- Private Storm Structures
- Private Storm Drain
- City of Monterey Storm Drain

