City Of Capitola
2010 First Flush Program
Draft Report

Prepared for:

City of Capitola
Department of Public Works

Prepared by:

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Introduction

As part of a regional effort throughout the Monterey Bay area, the Coastal Watershed Council (CWC) conducted the 2010 First Flush Program in Santa Cruz County in the fall of 2010. As CWC's program partner, the Monterey Bay National Marine Sanctuary conducted similar activities in Monterey and San Mateo Counties. CWC's work was partially funded by contracts with the City of Capitola, County of Santa Cruz and City of Santa Cruz (City). This report covers First Flush monitoring in the City of Capitola.

First Flush activities for the City of Capitola included:

- Classroom training of volunteers
- Dry Run event for volunteer teams to visit sites and conduct dry weather water quality monitoring
- First Flush water quality monitoring during the first significant rainfall of the 2010-11 wet season

Four urban storm drain sites and three Soquel Creek sites were monitored for the City of Capitola and are referred to as:

1. "Auto Plaza" - storm drain directly under Highway 1 overpass at Porter Street, behind Creekside Plaza;
2. "Monterey Avenue (Noble Gulch)" - storm drain from open channel along Monterey Avenue, to the north of the park;
3. "Capitola Center" - storm drain, along east bank of Soquel Creek, behind Nob Hill/CVS parking lot;
4. "Capitola Pier" storm drain discharging directly under the Capitola Wharf;
5. "Soquel Creek – Upstream", collected from midstream, just upstream of Creekside storm drain behind Creekside Plaza;
6. "Soquel Creek-Mid", just upstream from the Capitola Center storm drain, collected from east bank behind Nob Hill/CVS parking lot; and
7. "Soquel Creek - Lagoon Outlet", at lower end of lagoon.

Several other storm drain sites outside of the City limits were monitored for other funding partners in Santa Cruz County.

Rationale for Program: Pollutants have become abundant within the environment, often due to human activities. This includes everyday activities such as performing lawn care, washing clothes with detergents, and driving motor vehicles. Pollutants collect on local street surfaces, sidewalks, driveways, rooftops and other impermeable surfaces, as well as in yards, parks and beaches throughout the year. During the lengthy dry season common for our regional climate, there are no storms to "rinse away" these contaminants. The result of these several months of dry weather is a significant build-up of pollutants, which are then "flushed" into storm drains, creeks, rivers and the Monterey Bay during the first heavy rains of the wet season. The First Flush Program aims to gather data about the amount of pollution entering local waters during this onset of the rainy season.

Results are communicated to the general public and to local leaders through a variety of means, including this report. It is hoped that this program will foster more informed efforts to prevent pollution and protect the natural resources this region relies on for tourism, jobs,

overall economy, and quality of life for residents. The First Flush Program also represents an efficient way for local jurisdictions to meet a portion of their USEPA National Pollution Discharge Elimination System (NPDES) and MS4 General Permit requirements. Public education and outreach is an integral part of the First Flush program. Volunteers such as those trained by CWC engage in citizen science and help spread the news about stormwater runoff throughout their communities. While citizen science efforts such as the First Flush Program are important for generating valuable water quality data, they also represent an opportunity to educate and inspire the public to become more environmentally aware and to act as responsible stewards of our unique natural resources.

Since 2000, the First Flush Program has trained citizen volunteers from San Mateo, Santa Cruz and Monterey Counties to collect water samples and conduct water quality assessments during the first significant rain event of the season. Volunteers are trained to perform basic field water quality tests including pH, electrical conductivity, transparency and water temperature. They also receive training in collecting water samples for delivery to laboratories for analysis of nutrients (nitrate and orthophosphate), bacteria (*Escherichia coli*, total coliform and enterococcus), metals (copper, lead and zinc), total suspended solids and hardness. All CWC trainings for water quality monitoring focus on imparting to volunteer teams the knowledge and skill required to follow quality assurance protocols consistent with USEPA or State Water Resources Control Board standards. All training stresses the importance of volunteer safety above all other considerations.

The involvement of trained citizen volunteers provides benefits to the funding agencies in terms of human resource cost savings and skilled monitoring personnel. This is especially valuable during events such as First Flush that are time sensitive, as the water quality monitoring must be done immediately upon the onset of the first winter storm, regardless of what time of day or night that occurs.

Methods

Training

Prior to First Flush, volunteers were trained in the classroom on field monitoring techniques, including how to use a conductivity meter, pH strips, transparency tube, and thermometer, and how to properly collect and preserve water samples for laboratory analysis using appropriate containers, while wearing nitrile gloves. During a follow-up training, volunteers went out to their sites and performed field tests and collected water samples. Known as the First Flush Dry Run, this second training serves several purposes. One is to familiarize volunteers with their team members so they form a unified team, and more importantly to give them the opportunity to visit their monitoring site(s) in daylight and during good weather. This is an important safety measure as the First Flush storm often comes during the night, and the familiarity volunteer teams gain during the Dry Run prepares them to visit their site(s) when conditions are wet and possibly dark. In addition, as the Dry Run generates valid data, the results offer a comparison between pollutant concentrations in the dry weather flows and the flows during the First Flush storm.

Volunteers in Santa Cruz County received the classroom training on September 7, 2010 and Dry Run training on September 11, 2010. A separate training was held on September 10, 2010 for twenty-five Cabrillo College students. Monterey County volunteers received their trainings on September 16 and 18, 2010. For the seven City of Capitola sites, CWC had

twenty-three trained volunteers prepared; for the event, thirteen volunteers participated in the actual event.

The same equipment and protocols were used for both the Dry Run and First Flush events. Field measurements and observations were performed during the Dry Run at the following sites: Monterey Avenue, Capitola Pier and Soquel Creek – upstream; the Auto Plaza and Capitola Center sites were dry and no field measurements were performed at Soquel Creek – midstream and Lagoon due to CWC staff and volunteer scheduling conflicts. Sample collection for laboratory analysis, field measurements and observations were performed during the First Flush event at all sites.

Monitoring

Having completed classroom and Dry Run training, volunteer teams were prepared for the arrival of the First Flush storm. CWC staff monitored the offshore storms through the U.S. Naval Research Laboratory in Monterey to anticipate when the first significant rainfall would occur in the Santa Cruz region. Using a phone tree, CWC staff then mobilized team leaders who activated all volunteers to meet on-site. Upon seeing that the rain was sheeting off of the street at their site, volunteer teams began monitoring activities.

The First Flush event typically includes a time series collection of water samples for laboratory analysis and field measurements, conducted at 30 minute intervals for up to three sets of data and water sample collection over the first hour of significant runoff. This is intended to cover multiple points along the rising limb of the rainfall/runoff hydrograph, to capture the heaviest pollution load and highest concentrations of measured constituents. For City sites, two time series water samples for laboratory analysis were collected from storm drain sites, at "time zero" and 60 minutes, and a single sample was collected from creek sites. Field measurements and visual observations were conducted during all three time series (time zero, 30 minutes, and 60 minutes) at the storm drain sites and one time at the creek sites.

Field measurements included the following: conductivity was measured using an Oakton EC Tester; water temperature was measured using a spirit bulb or digital thermometer; pH was measured using Macherey-Nagel non-bleeding pH strips, and transparency was measured using 120 cm transparency tubes. Physical observations such as indications of trash, odor, bubbles, scum, and oil sheen were also recorded on the field data sheets.

For storm drain discharges, samples were collected for laboratory analysis of nitrate, orthophosphate, *E. coli,* enterococcus, total coliform, copper, hardness and total suspended solids (TSS). Urea analysis also was performed for the time zero storm drain samples only. Creek samples were analyzed for nutrients and bacteria, but not for copper, TSS or urea. All collected water samples were analyzed as individual grab samples rather than as a composite of samples.

Data Analysis

Lab results were compared to ambient water quality standards to provide an indication of relative pollutant levels. These standards apply only to ambient concentrations within "receiving waters", i.e., a stream, lake, or ocean—they do not apply directly to end-of-pipe applications such as storm drain discharges. Nonetheless, absent any other standard, they provide some means of comparison for the results. Metals results were compared to the

Central Coast Basin Plan Water Quality Objectives (WQOs) for the protection of aquatic life. Nitrate, orthophosphate, and total suspended solids (TSS) results were compared with the Central Coast Ambient Monitoring Program's (CCAMPs) attention levels. These attention levels indicate receiving water concentrations at which pollutants may impact cold-water fish or human health. Again, both the Basin Plan water quality objectives and CCAMP attention levels are established for receiving waters and *not* for end of pipe discharges. Dilution via mixing with ambient water usually occurs in the receiving waters within a short distance of each storm drain outfall.

Water Quality Objectives (WQOs) and Method Detection Limits (MDLs) are noted in Table 1 for each constituent. The MDL is the minimum concentration that a laboratory procedure can detect for a given analyte. For "non-detect" results, the data point is placed on the graph at zero, although the actual value is in fact nominally at some level between zero and the MDL.

Table 1: Regulatory Objectives * and Method Detection Limits (MDL)

Parameter	Water Quality Objective/Attention Level	Method Detection Limit (MDL)	Source of WQO/AL
Nitrate as N (NO_3-N)	**not to exceed 2.25 mg/L**	**0.1 mg/L**	**CCAMP Attention Level**
Orthophosphate as P (PO_4-P)	**not exceed 0.12 mg/L**	**0.05 mg/L**	**CCAMP Attention Level**
E.coli	**not to exceed 235 MPN/100mL**	**1 MPN/100mL**	**CCRWQCB Basin Plan**
Total Coliform	**Not to exceed 10,000 MPN/100mL**	**1 MPN/100mL**	**CCRWQCB Basin Plan**
Enterococcus	**not to exceed 104 MPN/10 mL**	**1 MPN/100mL**	**CCRWQCB Basin Plan**
Copper (Cu)	**<30 µg/L**	**4 µg/L**	**CCRWQCB Basin Plan**
Lead (Pb)	**<30 µg/L**	**5 µg/L**	**CCRWQCB Basin Plan**
Zinc (Zn)	**<200 µg/L**	**10 µg/L**	**CCRWQCB Basin Plan**
Total suspended solids (TSS)	**<500 mg/L**	**5 mg/L**	**CCAMP Attention Level**
Water temperature	**no more than 22ºC**	**N/A**	**Basic Plan Objective for Cold Water Fish**
pH	**no lower than 6.5 and no greater than 8.5**	**N/A**	**CCRWQCB Basin Plan**

*(Urea, Conductivity, Magnesium, Calcium, and Calcium Carbonate ($CaCO_3$) do not have a specific WQO or Attention Level).

Results/Discussion

The Dry Run field was held on Saturday, September 11, 2010. Field measurements and observations were recorded at two storm drains and one creek site. No samples were collected.

The 2010 First Flush event in the City of Capitola occurred on October 17, 2010, during a slow-moving storm of cold, unstable air that approached from the North. First Flush teams

were able to monitor a total of fifteen sites across Santa Cruz County, starting around approximately 12:30 PM, including four storm drain and three creek sites within the City.

The ranges of results obtained for each monitoring constituent are shown for both the Dry Run and First Flush in Table 2. Table 3 then shows the specific results for each constituent at each site.

For each parameter monitored, this section also includes a brief narrative summary and a plot showing the results for that parameter. All plots chart the results of the four storm drain and three creek sites in the City of Capitola, as well as a line indicating the water quality objective or attention level, for easy comparison of results to these useful values. The data labeled as "Time Series 1" are results from the samples collected upon arrival at the site; "Time Series 3" results are those samples collected one hour later.

Table 2: Range of results for 2010 Monitoring Events

Parameter	Dry Run - Storm Drains	Dry Run 2010 - Creek Sites
Nitrate as N (NO_3-N)	NA	NA
Orthophosphate as P (PO_4-P)	NA	NA
Urea	NA	NA
E.coli	NA	NA
Total coliform	NA	NA
Enterococcus	NA	NA
Copper (Cu)	NA	NA
Total suspended solids (TSS)	NA	NA
Hardness as $CaCO_3$	NA	NA
Calcium	NA	NA
Magnesium (Mg)	NA	NA
Water temperature	13.5-20.3 °C	15.02 °C
pH	7	7.15
Conductivity	540-740 µS	783 µS
Parameter	**First Flush 2010 - Storm Drains**	**First Flush 2010 - Creek Sites**
Nitrate as N (NO_3-N)	0.43 to 0.64 mg/L	ND to 0.29 mg/L
Orthophosphate as P (PO_4-P)	0.07 to 0.66 mg/L	0.05 to 0.17 mg/L
Urea	55 to 834 µg/L	NA
E.coli	100 to 27,600 MPN/100mL	100 to 16,600 MPN/100mL
Total Coliform	15,000 to 77,000 MPN/100mL	1,500 to 98,000 MPN/100mL
Enterococcus	2,400 to 41,100 MPN/100mL	100 to 8,400 MPN/100mL
Copper (Cu)	9 to 76 µg/L	NA
Total suspended solids (TSS)	17 to 135 mg/L	NA
Hardness as $CaCO_3$	38 to 200 µg/L	NA
Calcium	11 to 47 mg/L	NA
Magnesium (Mg)	2 to 20 µg/L	NA
Water temperature	10.0 to 16.5 °C	13.8 to 15.4 °C
pH	6.0 to 7.0	8.0 to 8.17
Conductivity	20 to 620 µS	577 to 821 µS

Table 3 City of Capitola First Flush 2010 - Summary of Results

		Station ID	CSD-03	CSD-03	CSD-03	CSD-05	CSD-05	CSD-05	CSD-08	CSD-08	CSD-08	CSD-09	CSD-09	CSD-09	SOQUE-26	SOQUE-28	SOQUE-22
			Auto Plaza	Auto Plaza	Auto Plaza	Capitola Center	Capitola Center	Capitola Center	Monterey Ave.	Monterey Ave.	Monterey Ave.	Capitola Pier	Capitola Pier	Capitola Pier	Soquel Creek - Upstream	Soquel Creek - Mid	Soquel Creek - Lagoon Outlet
Parameter	**Units**	**WQO/AL:**	**Time Series 1**	**Time Series 2**	**Time Series 3**	**Time Series 1**	**Time Series 2**	**Time Series 3**	**Time Series 1**	**Time Series 2**	**Time Series 3**	**Time Series 1**	**Time Series 2**	**Time Series 3**	**Time Series 1**	**Time Series 1**	**Time Series 1**
Nitrate-N (NO_3-N)	mg/L	<2.25	0.53		0.63	0.49		0.61	0.47		0.62	0.43		0.64	0.13	0.29	ND
Orthophosphate-P (PO_4-P)	mg/L	<0.12	0.66	N/A	0.66	0.30	N/A	0.27	0.09	N/A	0.07	0.22	N/A	0.14	0.17	0.05	0.09
Urea-N	ug/L	N/A	725	N/A	N/A	223	N/A	N/A	55	N/A	N/A	834	N/A		N/A	N/A	N/A
E. coli	MPN/100mL	<235	4,900	N/A	5,400	306	N/A	100	27,600	N/A	6,400	521	N/A	306	13,800	16,600	100
Total Coliform	MPN/100mL	<10,000	55,000	N/A	77,000	34,500	N/A	23,800	77,000	N/A	34,500	15,000	N/A	43,700	48,800	98,000	1,500
Enterococci	MPN/100mL	<104	38,700	N/A	16,600	4,200	N/A	2,400	41,100	N/A	11,100	3,700	N/A	2,900	8,300	8,400	100
Copper (Cu)	ug/L	<30	68	N/A	70	38	N/A	49	9	N/A	9	76	N/A	64	N/A	N/A	N/A
Total Suspended Solids (TSS)	mg/L	<500	29	N/A	17	41	N/A	23	88	N/A	21	135	N/A	19	N/A	N/A	N/A
Hardness (as CaCO3)	mg/L	N/A	38	N/A	45	58	N/A	38	200	N/A	191	44	N/A	75	N/A	N/A	N/A
Calcium	mg/L	N/A	12	N/A	13	20	N/A	12	47	N/A	45	11	N/A	17	N/A	N/A	N/A
Magnesium (Mg)	mg/L	N/A	2	N/A	3	2	N/A	2	20	N/A	19	4	N/A	8	N/A	N/A	N/A
Sewage	Y/N	N/A	Y	N	N	N	N	N	N	N	N	N	N	N	N/A	N/A	N/A
Oil Sheen	Y/N	N/A	N/A	N	N	N	N	N	N	N	N	N	N	N	N/A	N/A	N/A
Scum	Y/N	N/A	Y	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y	N/A
Water Temp	˚C	<22˚	15.7	15.8	15.4	15.7	16.2	N/A	10.0	15.0	15.0	15.6	16.1	16.5	13.8	14.35	15.4
Electrical Conductivity	uS	<2000	120	200	220	190	20	N/A	620	600	620	240	280	410	750	577	821
pH	units	6.5-8.5	6.5	6	6.5	6.5	6.5	N/A	7	7	7	6.5	6.25	6.5	8.17	8	8.06
Transparency	cm	N/A	22.8	18.8	23.2	11	8	N/A	19	30.04	34.6	8.8	8.75	11.75	N/A	N/A	N/A

Shaded values = Exceedence of WQO or Attention Level

* Copper WQO is Hardness dependent

Nutrients

Nitrogen and phosphorous are the two key nutrients which are essential for plant growth, but which at high levels in aquatic systems can cause excessive algae growth and eventually eutrophication.

Normally nitrate is not found in elevated concentrations within aquatic environments unless there is an anthropogenic source. Elevated nitrate levels can cause algal blooms which in turn impact water quality, most notably via decreased dissolved oxygen levels as the algae decay. Sources of nitrate may include runoff from fertilized lawns, farms, and construction sites, as well as leakage from septic systems and sanitary sewers. The CCAMP attention level for nitrate (NO_3-N) is 2.25 mg/L. The analytical laboratory's method detection limit (MDL) is 0.1 mg/L.

During First Flush none of the City sites monitored were higher than the attention level for nitrate. Storm drain nitrate concentrations were highly consistent from site to site, and in all cases the storm drain concentrations were higher than those measured in the creek samples.

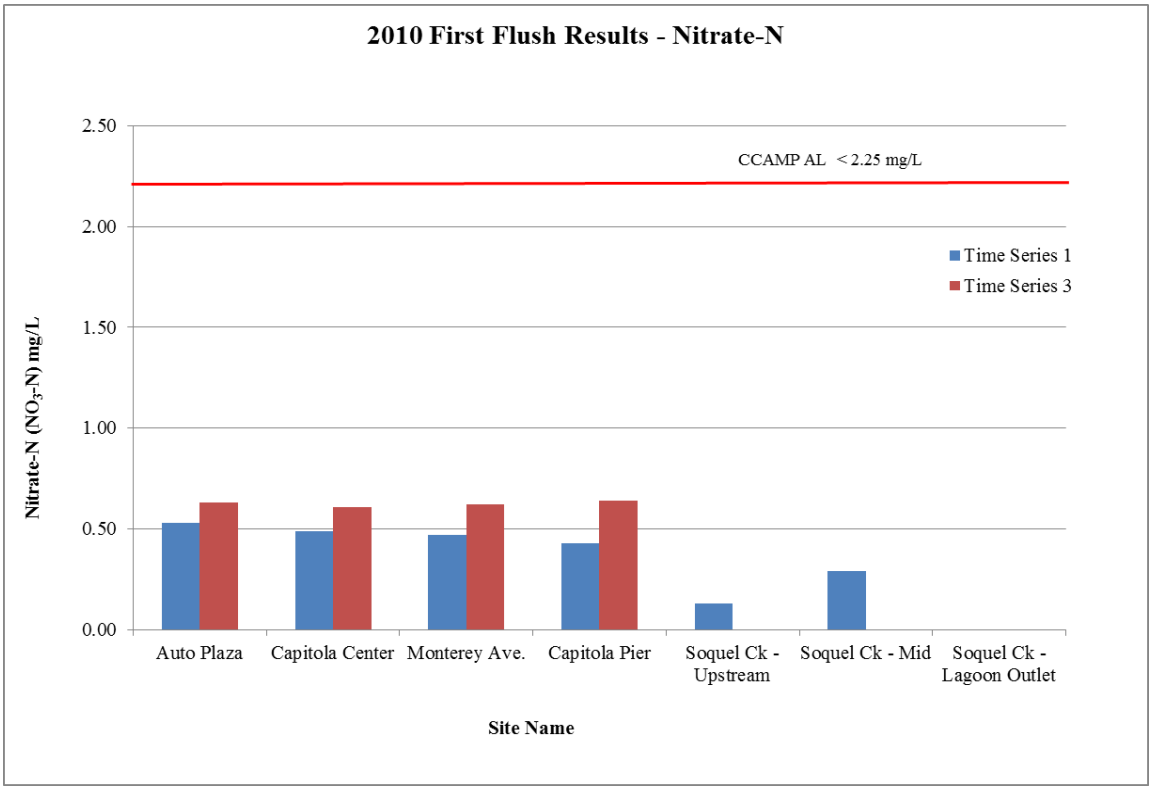

Figure 1: City of Capitola First Flush Results: Nitrate as Nitrogen at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains and Soquel Creek: Upstream, Mid and Lagoon Outlet sites.

Similar to nitrate, phosphate is also a necessary nutrient for plant growth, and is rarely found in elevated levels in the environment unless there is an anthropogenic source. The CCAMP attention level for orthophosphate (PO_4-P) is 0.12 mg/L. The laboratory analytical MDL is 0.05 mg/L. Samples taken at Auto Plaza, Capitola Center, Capitola Pier and Soquel Creek-upstream exceeded the CCAMP attention level, as shown in Figure 2. The Monterey Ave. storm drain site was the only one with orthophosphate levels below the attention level, with levels similar to those found in the Soquel Creek samples.

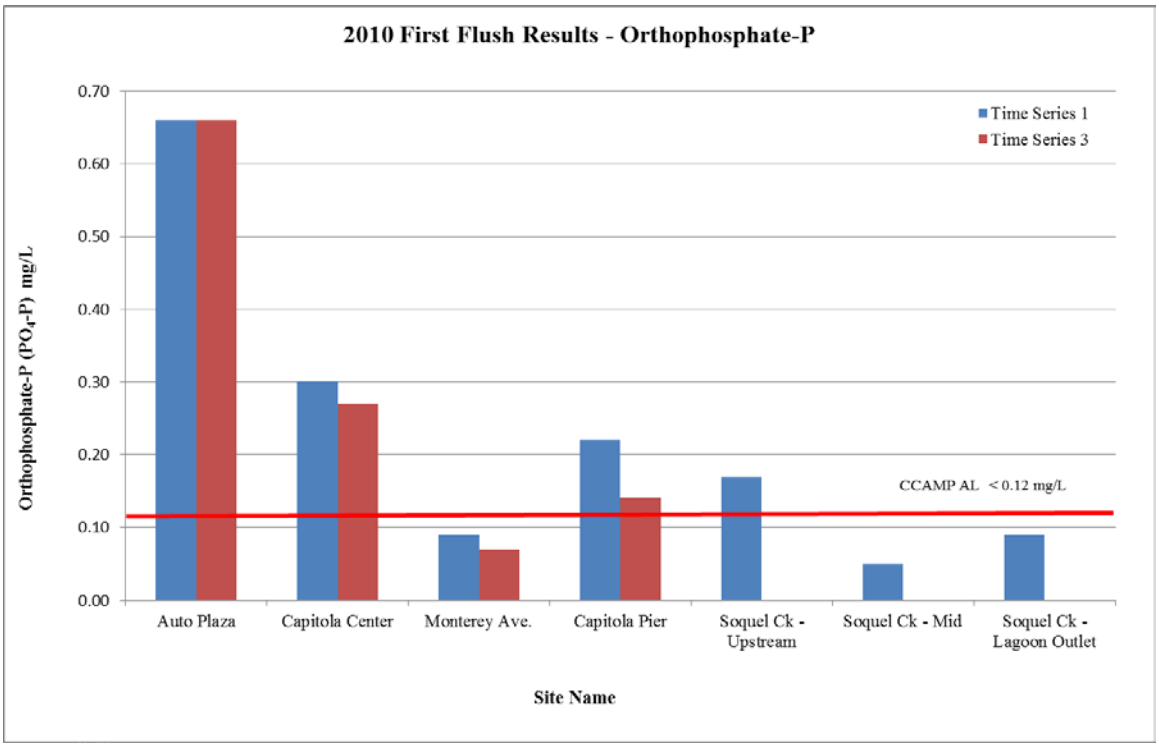

Figure 2: City of Capitola First Flush Results: Orthophosphate as Phosphate at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains and Soquel Creek: Upstream, Mid and Lagoon Outlet sites.

Urea is an organic compound containing nitrogen. It is one of the compounds found in nature as part of the nitrogen cycle. Mammals metabolize nitrogen into urea and excrete it in urine. The toxicity of urea and ammonia in aquatic systems depends on the pH, temperature and salinity, which control its form and availability. There are no CCAMP attention levels specifically for urea or ammonia. Urea, not ammonia, was measured during First Flush, with an analytical MDL of 0.05 µg/L. Figure 3 shows the urea results for First Flush; urea was measured at the storm drain sites during the first time series only. The results indicate considerable variation from site to site.

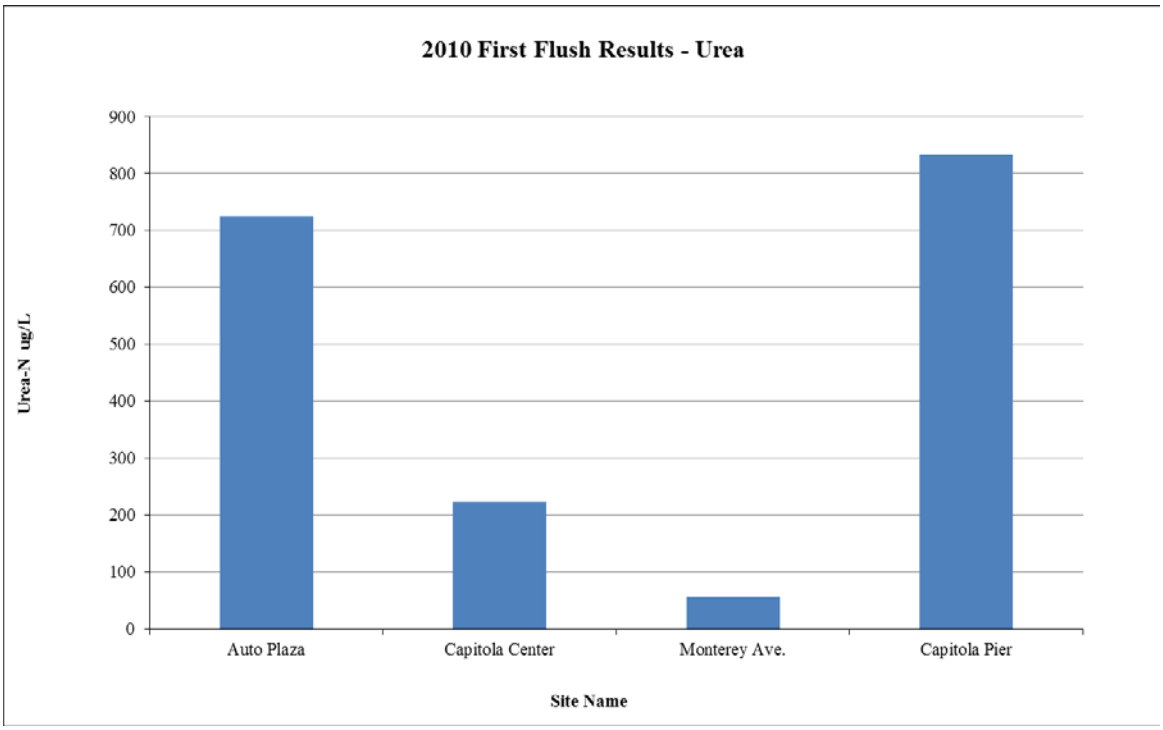

Figure 3: City of Capitola First Flush Results: Urea as Nitrogen at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains. Urea was not analyzed for the creek sites. There is no established WQO for urea.

Bacteria

Bacteria are microscopic, single-celled organisms that are ubiquitous throughout the environment and have essential functions within watersheds, including functioning as decomposers by breaking down plant and animal remains. While many bacteria perform beneficial functions in healthy natural systems, some forms of bacteria cause disease in humans and other organisms. *E.coli* and enterococcus are each common types of bacteria whose presence at elevated levels suggests the possible presence of disease-causing bacteria. As such, stormwater professionals and public health officials consider these to be "indicator" bacteria, and measure them during events such as First Flush.

The Basin Plan Water Quality Objective for *E.coli* is 235 MPN/100mL and the laboratory analytical MDL is 1 MPN/100mL. For total coliform, the WQO is 10,000 MPN/100mL and the laboratory analytical MDL is 1 MPN/100mL For enterococcus, the WQO is 104 MPN/100mL and the analytical MDL is 1 MPN/100mL.

Results for *E.coli* (Figure 4) show that all samples in Time Series 1, except for Soquel Creek-Lagoon Outlet, exceeded the WQO during the First Flush. During Time Series 3 the Auto Plaza, Monterey Avenue and Capitola Pier sites exceeded the WQO for *E.coli*.

Total coliform (Figure 5) and Enterococcus results (Figure 6) show that samples at all sites, with the exception of Soquel Creek-Lagoon Outlet, exceeded the WQO during the First Flush. The highest levels overall for *E. coli* and enterococcus were found at the Monterey Ave. storm drain site.

These levels are generally consistent with urban runoff discharge data throughout the U.S. The more highly elevated bacteria levels indicate possible contributions to stormwater from potential sources such as leaky sewage pipes or septic systems, fecal waste from pets, feces from birds and other wild animals, and/or runoff from livestock areas.

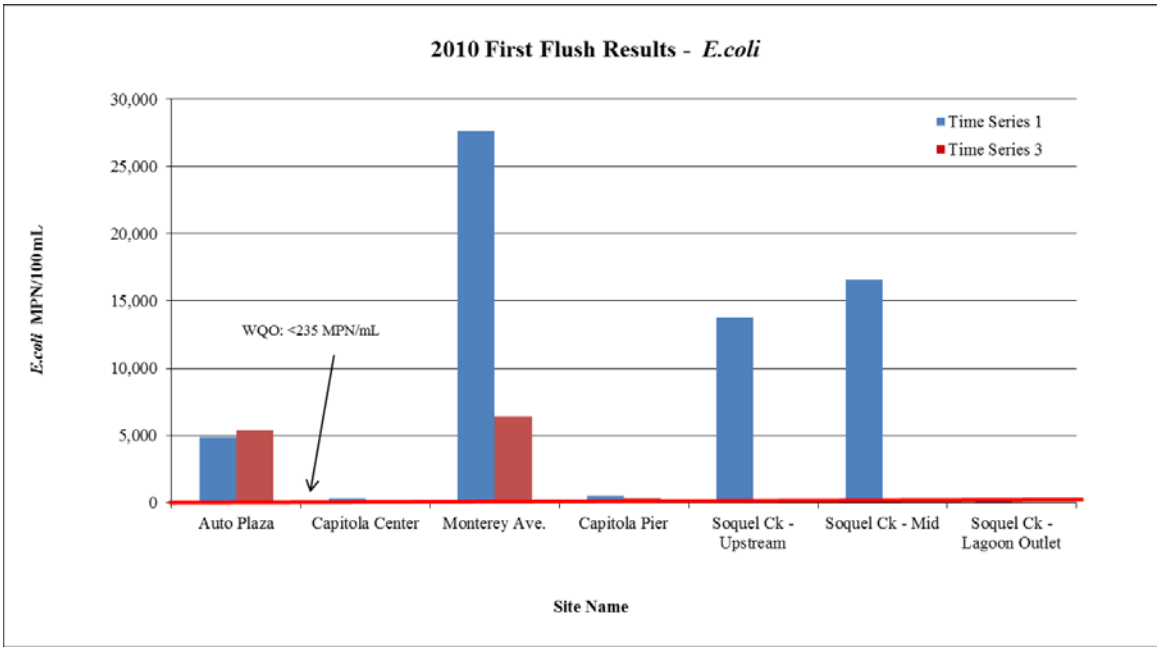

Figure 4: City of Capitola First Flush Results: *E.coli* levels at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains and Soquel Creek: Upstream, Mid and Lagoon Outlet sites.

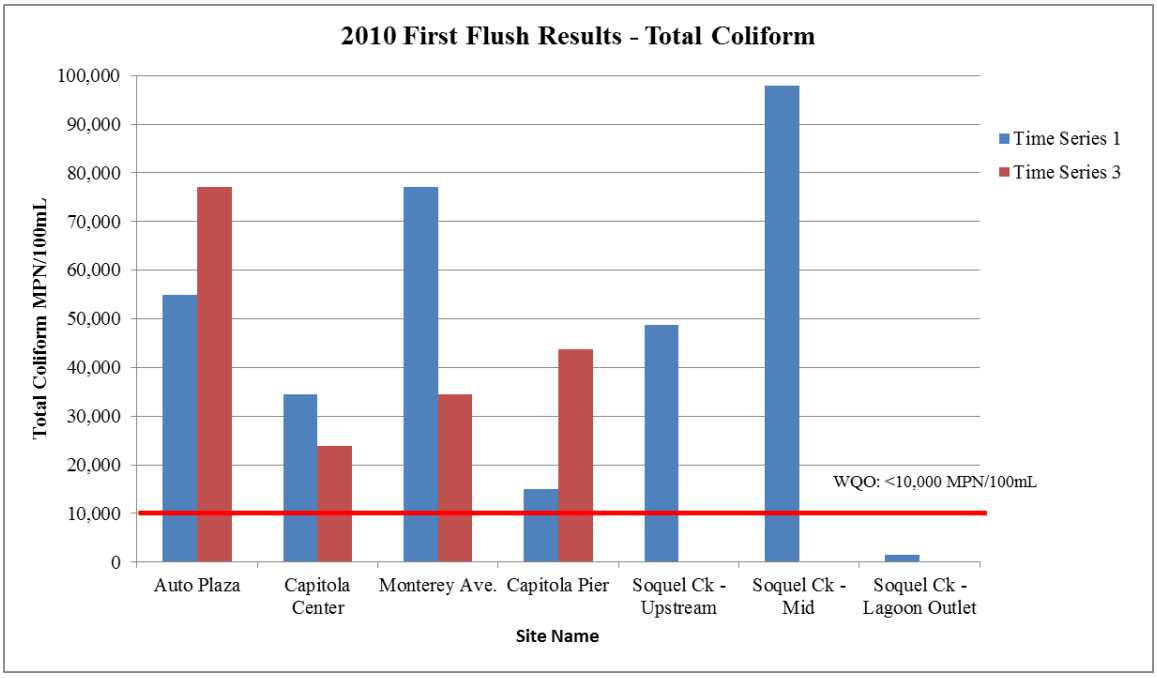

Figure 5: City of Capitola First Flush Results: total coliform levels at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains and Soquel Creek: Upstream, Mid and Lagoon Outlet sites.

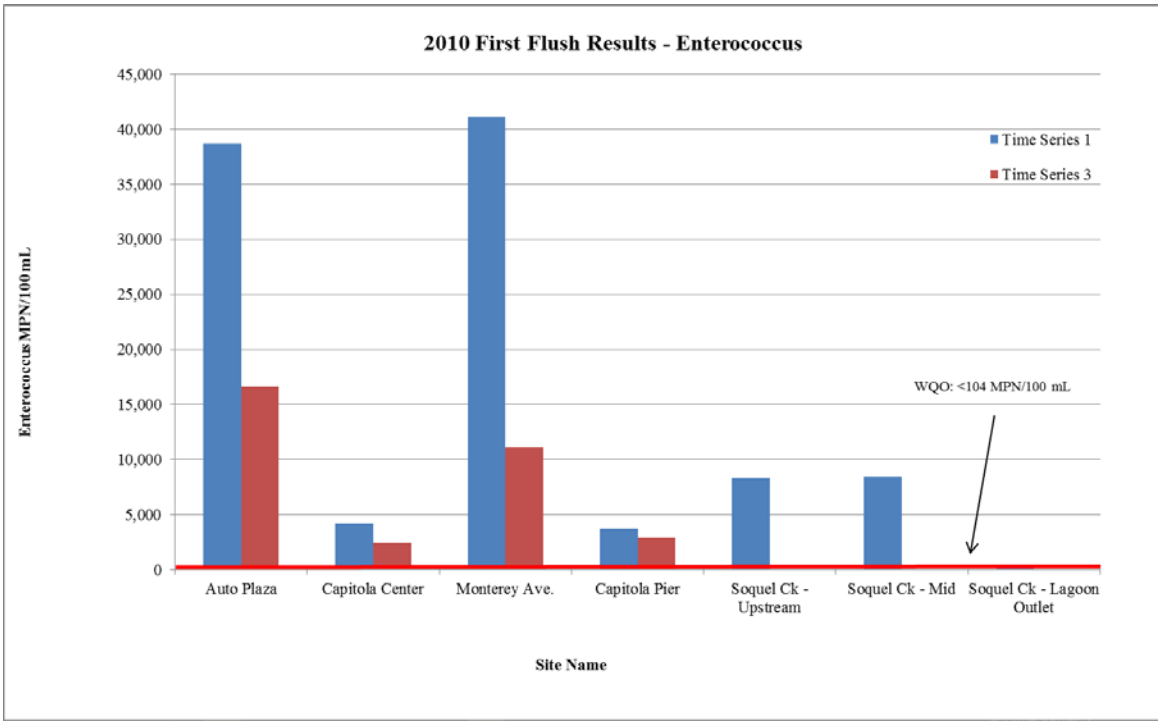

Figure 6: City of Capitola First Flush Results: Enterococcus levels at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains and Soquel Creek: Upstream, Mid and Lagoon Outlet sites.

Copper

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

The Basin Plan Water Quality Objective for copper is <30 ug/L. The laboratory analytical MDL is 4 µg/L. Figure 7 shows the copper results for the First Flush.

During the First Flush samples taken at Auto Plaza, Capitola Center and Capitola Pier exceeded the Basin Plan WQO during both time series. The Monterey Ave. site was the only storm drain site with copper concentrations below the WQO. Copper was not analyzed for the creek sites.

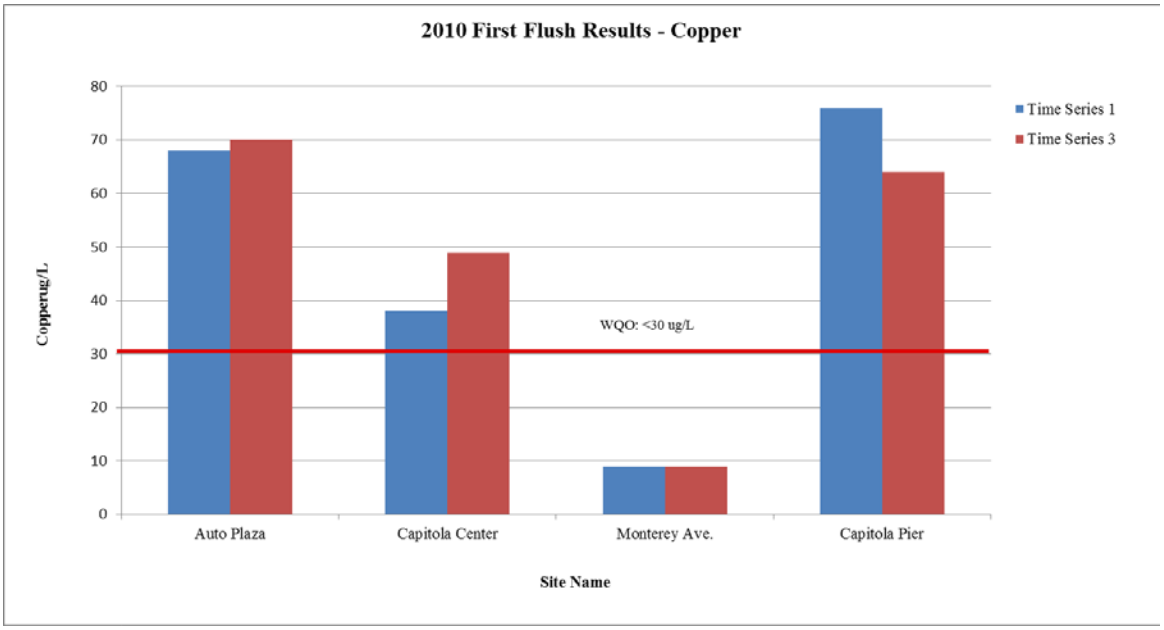

Figure 7: City of Capitola First Flush Results: Copper levels at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains. Copper was not analyzed for the creek sites.

Total Suspended Solids

Suspended solids derive from particulate matter that can include plankton, algae, organic detritus, and inorganic sand, silt and clay particles. There are many sources of solids within the urban environment, including soil erosion and particulate matter generated by both natural and anthropogenic processes. Certain toxic compounds, including some commonly-used urban pesticides, adsorb to the surface of solid particles, making elevated total solids levels a concern for watershed health. During First Flush, hardness and total suspended solids (TSS) were measured. For TSS, the CCAMP attention level is 500 mg/L; the analytical MDL is 5 mg/L. Figure 8 shows the TSS results for First Flush.

There were no exceedances of the CCAMP attention level for TSS during the First Flush. TSS was not analyzed for the creek sites.

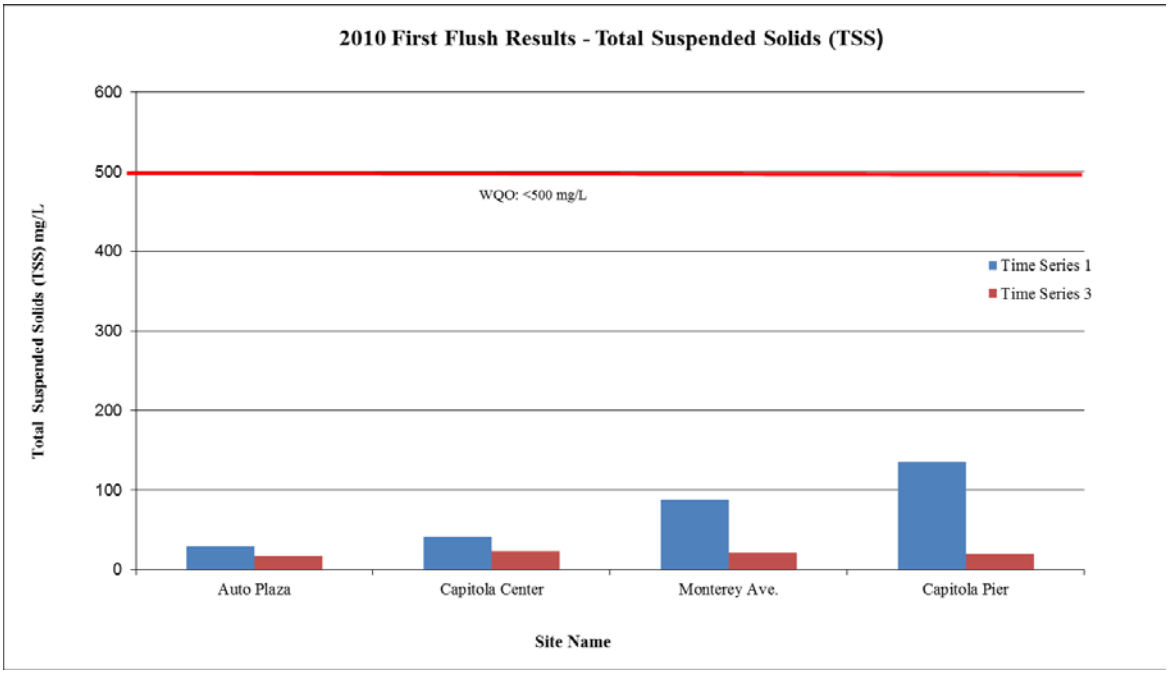

Figure 8: City of Capitola First Flush Results: TSS levels at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains. TSS was not analyzed for the creek sites.

Hardness

Hardness is measured analytically as the sum of calcium and magnesium, and is used to help interpret the Basin Plan water quality objectives for metals. Calcium is abundant naturally in rocks and soil throughout much of the earth, and is a vital mineral in animal and plant cellular, metabolic and nervous system functions. Magnesium is necessary for photosynthesis and basic cell functions for living organisms and is found in both fresh and salt water. Sources of magnesium include fertilizers, water softeners and soaps/detergents . No Basin Plan, CCAMP or other attention levels exist for calcium, magnesium, or hardness; the MDL is 1 µg/L. Figure 9 shows the hardness results for First Flush. Hardness was substantially higher at the Monterey Ave. site than at the other storm drain sites. Hardness was not analyzed for the creek sites.

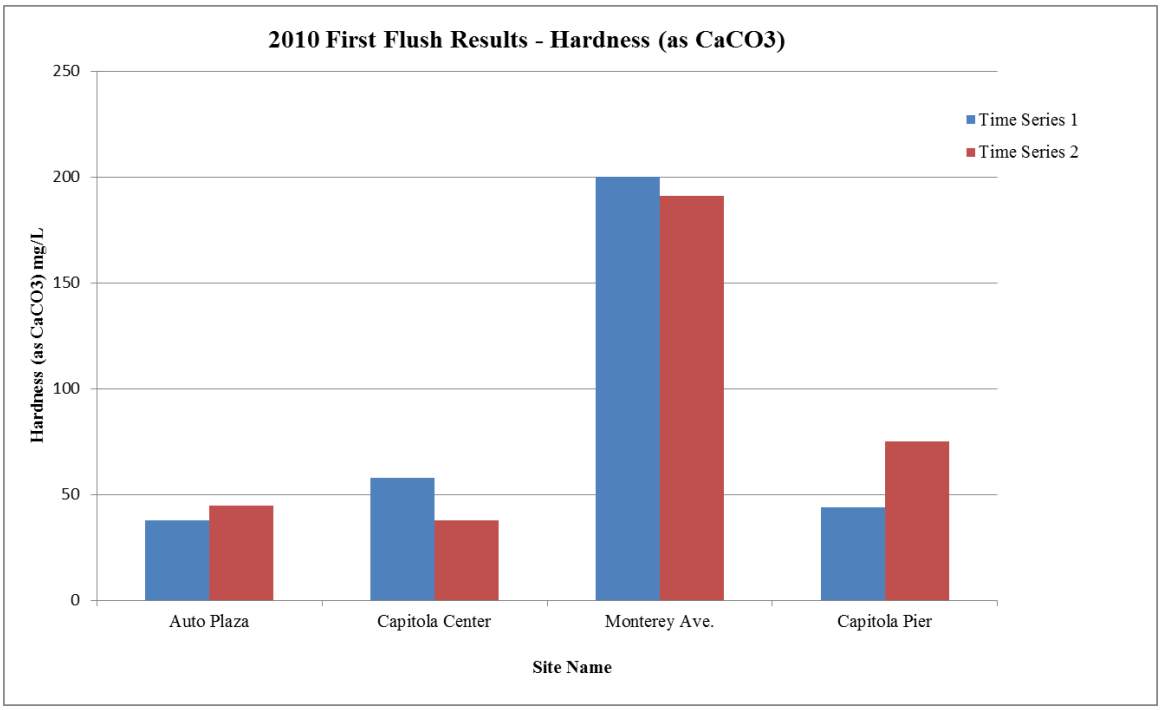

Figure 9: City of Capitola First Flush Results: Hardness levels at Auto Plaza, Capitola Center, Monterey Avenue & Capitola Pier storm drains. Hardness was not analyzed for the creek sites.

Visual Observations

At each of the seven sites monitored during 2010 First Flush Program, volunteers observed and recorded whether there was any trash, sewage (sited or smelled), oil sheen, or scum present. Trash was sighted during the First Flush event at Auto Plaza, Monterey Avenue and Pier storm drains, as well as the Soquel Creek - Upstream site. Only Auto Plaza had sewage smell detected and no oil sheen was observed at any of the sites. Scum was present during all three time series at Auto Plaza and Monterey Avenue storm drain sites and at the Soquel Creek - Upstream and - Midstream sites.

Flow levels at the Auto Plaza, Capitola Center and Monterey Avenue storm drain sites were recorded as “high,” “moderate” and “low” with flow levels decreasing over time. Flow levels at the creek sites were recorded as “moderate” at the Upstream and Midstream sites and “high” at the Lagoon Outlet (downstream).

Conclusions

This report summarizes the results for the 2010 First Flush Program conducted in fall 2010 for the City of Capitola. Laboratory analyses and field measurements were performed for the First Flush event; only field measurements were performed for the Dry Run. Exceedances of water quality objectives or attention levels were documented for nutrients (both nitrate and orthophosphate), bacteria (*E.coli*, total coliform and enterococcus) and copper. These results indicate a mixed message about nutrients, which historically have been measured at excessive levels in this region. While the levels of phosphate exceeded the water quality objective at the Auto Plaza, Capitola Center, Capitola Pier and Soquel Creek – Upstream sites, nitrate levels were well within safe levels at all sites during the First Flush.

For pathogen indicators, both types of indicator bacteria were measured at levels that were an order of magnitude greater than the water quality objectives at most sites. For *E.coli* levels well above the WQO were found at the Auto Plaza, Monterey Avenue, and Soquel Creek – Upstream and - Midstream sites. The Capitola Center and Capitola Pier sites also exceeded the WQO but at a lesser magnitude. Enterococcus and total coliform exceedances were found at all storm drain sites and Soquel Creek – Upstream and - Midstream sites. There were no exceedances of either type of indicator bacteria at the Soquel Creek – Lagoon Outlet site.

Copper results show that the Auto Plaza and Capitola Pier sites exceeded the WQO of <30µg/L for copper during the third time series. Based upon hardness values in the Soquel Creek, copper results at the three creeks sites were well below the WQO of <30 µg/L.

While it is essential to note that Water Quality Objectives (WQOs) apply only to receiving waters (such as named creeks, rivers, and the Bay), and not directly to urban runoff discharges, comparisons of urban runoff monitoring results to WQOs can be used to identify potential areas of concern. However, while a storm drain outfall that discharges into a creek might have elevated levels of a given constituent, once the discharge enters the receiving waters (i.e., creek, river, lake or ocean) it may be diluted, provided the receiving water has lower levels of that constituent.

The City's approach of partnering with other organizations and engaging local residents is an excellent example for other communities to follow. Potential benefits of the First Flush program include improved water quality, improved habitat for aquatic and marine life, fewer instances of beach postings and closures, fewer incidences of nuisance from pollution, less litter and a more inviting setting, a more educated and active citizenry, scientific data for decision-making, greater visibility for the County's non-point source pollution prevention efforts, and preservation of critical watersheds that sustain the local and regional economy and quality of life.