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Dry Weather Monitoring

September 26th, 2004 &

First Flush Monitoring Report

October 16th and 17th, 2004

In the Cities of
El Granada, Half Moon Bay, Santa Cruz, Capitola, Seaside, Monterey, and Pacific Grove, CA

Made Possible by:
Monterey Bay National Marine Sanctuary, Cities of Monterey, Pacific Grove, Seaside, Santa Cruz, and Capitola, Coastal Watershed Council, Monterey Bay Sanctuary Foundation, Monterey Regional Water Pollution Control Agency, Monterey County Water Resources Agency, Gulf of the Farallones National Marine Sanctuary

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Executive Summary

Volunteer monitoring has been collecting valuable data in the Monterey Bay since 1997, when the unique programs entitled Urban Watch and First Flush were first initiated. Together, these programs are filling a gap in monitoring data by sampling the quality of water in storm drains, a potential source of water pollution that is sometimes overlooked by traditional programs. The Urban Watch program measures pollutant concentrations in dry season storm drain outflow, and the First Flush program compliments Urban Watch by measuring pollutant concentrations from the same locations as Urban Watch, but during the first storm of the year that generates significant runoff. Central Coast Ambient Monitoring Program (CCAMP) "action levels" in this report are referred to as a general source of comparison for sample results. These action levels are set for receiving waters (ie: once the drainage has mixed with ocean, creek or lake water), not effluent from storm drains. No studies have been completed to determine what dilution factor should be used at each of these sites to determine a true comparison. Ultimately, these programs will provide a feedback mechanism for measuring long-term effectiveness of urban runoff control efforts.

This year, in preparation for the First Flush event, a single dry weather monitoring event, took place on Sunday, September 26, 2004 in Half Moon Bay, Santa Cruz, Capitola, Monterey, and Pacific Grove. Fourteen of the 23 sites had water flowing to monitor. This event provided training for the volunteers, while samples were collected for the same analysis as First Flush to determine the concentrations of pollutants in the runoff prior to the first rains.

Dry Weather Range of Results[1]

♦ conductivity (520 – 2700 µS)	♦ Escherichia coli (*E. coli)* (20 – 48,383 MPN/100ml)
♦ water temperature (14.5°C – 26.5°C)	♦ total zinc (10 – 306 µg/l)
♦ pH (7.0 – 8.5)	♦ total copper (15 – 70 µg/l)
♦ nitrate as N (0.06 – 4.33 mg-N/l)	♦ total lead (2.5 – 21 µg/l)
♦ orthophosphate as P (0.025 – 1.74 mg-P/l)	♦ total suspended solids (TSS) (2.5 – 241 mg/l)
♦ total coliform (201 - >48,384 MPN/100 ml)	♦ total dissolved solids (TDS) (318 –3590 mg/l)

On October 16th the First Flush event occurred in Monterey, Pacific Grove and Seaside. The volunteers were on site and sampling towards the end of the first wave of precipitation at about 11:30 PM. A second storm arriving from the north mobilized the teams in El Granada, Half Moon Bay, Santa Cruz and Capitola on Sunday, October 17th. They mobilized and began monitoring in Half Moon Bay about 5 PM and Santa Cruz and Capitola teams about 6 PM. In total, sixty-four volunteers monitored twenty-three storm drain outfalls (see Attachment 4 for the storm hydrograph).

First Flush Range of Results[1]

♦ conductivity (100 – 2200 µS)	♦ Escherichia coli (*E. coli)* (100 – >241,920 MPN/100ml)
♦ water temperature (5°C – 19°C)	♦ total zinc (96 – 678 µg/l)
♦ pH (6.5 – 8.0)	♦ total copper (ND – 270 µg/l)
♦ nitrate as N (0.24 – 2.97 mg-N/l)	♦ total lead (ND – 58 µg/l)
♦ orthophosphate as P (0.06 – 11.4 mg-P/l)	♦ total suspended solids (TSS) (15 – 645 mg/l)
♦ total coliform (120,331 - >241,920 MPN/100 ml)	♦ total dissolved solids (TDS) (45 – 1420 mg/l)

This was the fifth year of the First Flush monitoring event, which continues to attract dedicated volunteers who return each year to brave late hours and inclimate weather to gather important data. The MBNMS and its partners thank these volunteers for their dedication.

[1] **All of the sites (see Attachment 1 for more information) were monitored for the parameters listed. Beside each parameter in parenthesis is the range of concentrations that were detected during each of the events. Units are represented as milligrams per liter (mg/l) , micrograms per liter (µg/l), Most Probable Number per 100 milliliters (MPN/100 ml), and micro Siemens (µS)**

Introduction

Volunteer monitoring was spawned from a concept that recognizes that agencies often lack the resources necessary to adequately characterize water quality. Within the MBNMS, numerous outfalls discharge storm water and dry weather runoff that carries pollutants from the urban landscape. In 1997, the Coastal Watershed Council initiated the Urban Watch volunteer monitoring program that for the past eight years has been characterizing the quality of water from these sources. In 2000, the Network started the First Flush monitoring program to characterize the water flowing into the sanctuary during the first storm of the season.

Together, these programs are filling a gap in information by monitoring the quality of water flowing from storm drains, a source of water pollution that is overlooked by traditional programs. The Urban Watch program measures pollutant concentrations in dry season storm drain outflow, and the First Flush program compliments Urban Watch by measuring pollutant concentrations from the same locations as Urban Watch, but during the first storm of the year that generates significant runoff after months of dry weather accumulation.

This monitoring is developing a core dataset that is establishing trends; identifying hot spots for follow up action, and establishing a baseline to which future data can be compared against. The results from these programs enable local officials and resource managers to better understand how to effectively address water quality concerns. Ultimately, these programs will provide a feedback mechanism on current urban runoff control efforts.

Methods

The same storm drain outfalls that are regularly monitored by the Urban Watch volunteers during the dry weather season were also monitored for this event. One or two sets of water samples were taken at each of the sites (see Attachment 1 for more information about the sites).

Every site in all six cities had a designated team and set of equipment. Each team had a team leader responsible for the monitoring equipment and sample bottles. The criteria used for mobilization included sheeting water on the roadways, heavy flow through the storm drain system and conductivity levels around 500 microSiemens (μS). Conductivity measures the amount of ions in the water. Background levels can be greater than 1500 μS at some locations. In most cases, measurements below 1000 μS indicate that it is the storm water flowing from the outfall and not the typical urban runoff that flows year round.

At the majority of sites, two suites of samples were gathered at 30 minute intervals, observations were made continuously, and changes were recorded. An automated water sampler was deployed at two locations, Hilby in Seaside and Lover's Point in Pacific Grove. The water sampler was an ISCO 2900 (Lincoln, NE) provided by the Monterey Regional Water Pollution Control Agency. Teams were also at these locations to record physical parameters and document observations.

When the volunteers arrived at their designated site, conductivity measurements were used to indicate if it was indeed storm water runoff flowing from the outfalls. The field data sheet was used by all monitoring teams to follow a standard protocol (See Attachment 2-Field Data Sheet). At the site, the volunteers measured conductivity using either an Oakton TDSTester 3 or 4. Water temperature was measured using a spirit bulb thermometer. The pH was measured using Macherey-Nagel non-bleeding pH test strips with a range of 4.5-10. Physical observations such as trash, odor, bubbles, scum, and oil sheen were also

recorded on the field data sheet. As the on-site measurements were collected, sample bottles were filled for analysis at a certified laboratory. The lab analysis included nitrate as nitrogen, orthophosphate as phosphorus, total coliform, *E. coli*, total zinc, total copper, total lead, hardness, total suspended solids (TSS), and total dissolved solids (TDS) (see Attachment 3 for analytical methods).

Quality Assurance/Quality Control

- All volunteers were trained in the use of monitoring equipment and protocols for collecting water samples.
- The conductivity meters were calibrated before being assigned to each team.
- Standardized field data sheets were provided with written instructions on how to complete them so that each team followed the same protocols.
- Each sample had a unique sample identification number.
- Field replicates and container blanks were collected.
- All lab data was reviewed for QA/QC and validated by the Network Coordinator
- All data is tabulated in a CCAMP Excel file

Volunteers at San Carlos outfall in Monterey training for the First Flush event and collecting samples for the Dry Weather monitoring event.

Results and Discussion

In order to evaluate the data collected during both of these events, the results have been compared to receiving water benchmarks established by the Central Coast Regional Water Quality Control Board. Receiving water standards are target concentrations for a given waterbody, such as a stream, lake or in this case the ocean, which assumes substantial mixing and dilution. The data in this report is the actual pollutant concentration of the water coming from the pipe. *It does not take into account any dilution factor which will occur when the effluent enters the ocean.* Metal results were compared to the Central Coast Basin Plan Water Quality Objectives (WQO) for the protection of marine aquatic life. Because there are no numerical water quality objectives in the Basin Plan for total coliform, *E. coli*, nitrate, orthophosphate, total suspended solids (TSS), and total dissolved solids (TDS, those results were compared with the Central Coast Ambient Monitoring Program's (CCAMP) action levels. CCAMP's action levels are benchmarks that are set at levels, for receiving water concentrations, at which pollutants may impact cold-water fish or human health, and are typically levels representing existing regulatory standards, levels derived from the literature or other agency references, or levels that are elevated relative to the data distribution for that parameter on the Central Coast. It is important to note that both Basin Plan water quality objectives and CCAMP action levels are established for receiving waters and NOT for discharge waters. A significant amount of dilution and mixing usually occurs in the receiving waters within a short distance of each outfall.

Nutrients

Nitrogen is an element that is needed for plant growth. Plant growth is generally limited by phosphate, and **nitrate** concentrations by varying amounts. Possible sources of nitrate include runoff from fertilized lawns, agricultural and pasture lands; runoff from construction sites due to disturbed soil and mixing of plant materials into the soil; and septic leachate. The action level established by CCAMP for nitrate (NO_3-N) is 2.25 mg-N/l. The nitrate results for the dry weather event were higher than during the First Flush. Merced had the highest nitrate concentration for dry weather at 4.33 mg-N/L. Eighth St. in Pacific Grove had the second highest concentration of 3.01 mg-N/L during the dry weather flow. Woodrow had the third highest nitrate concentration for both events at 2.78 mg-N/L measured during the Dry Weather event. During the First Flush, all of the sites were well below the action level except for five sites, Steinbeck Plaza (Monterey), Lover's Pt, Pico, Central and 8th St (PG) which were all below 3.0 mg-N/L. Nitrate concentrations typically are lower in large rain events because of dilution. Over the past five years, the average nitrate concentrations were below the action level at the majority of sites (see Figure 1).

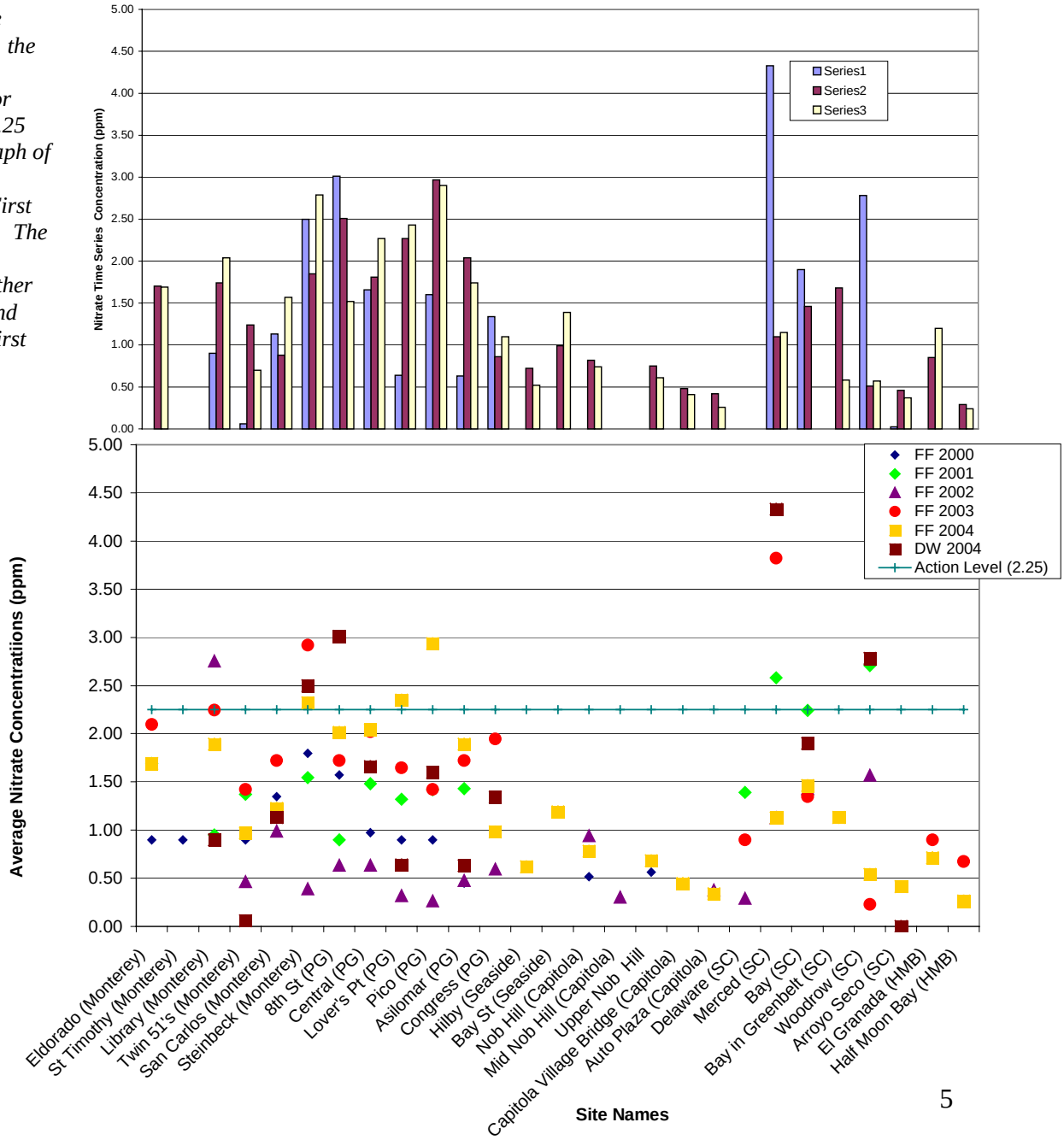


Figure 1. The sites are grouped by city across the bottom. The CCAMP informal action level for nitrate as nitrogen is 2.25 mg-N/l(ppm). (1a) Graph of nitrate as nitrogen concentrations in the First Flush 2004 time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and each subsequent column represents the time series samples, usually taken 30 minutes apart. (1b) Graph of 5-year trend. Average nitrate concentrations are represented.

Phosphorus is an essential element for plant growth and can affect plant growth in low concentrations. **Orthophosphate** is a form of phosphorus commonly found bound to soil particles, in sewage, fertilizers, and in detergents that contain phosphates. Orthophosphate is also found in several automotive products including emissions, tires, fluids, and fuels. In aquatic systems, orthophosphate is rapidly taken up by algae and aquatic plants. With excessive amounts present, large algal blooms can occur. The CCAMP action level for orthophosphate (PO_4^{3-} -P) is 0.12 parts per million (ppm) or (mg-P/l). During the Dry Weather event, 10 of 14 sites exceeded the action level, the highest being Steinbeck Plaza at 1.74 mg-P/L. During the First Flush, Lover's Point had the highest orthophosphate concentration (11.4 mg-P/L). Steinbeck Plaza had the second highest orthophosphate concentration (4.1 mg-P/L). Orthophosphate levels were very similar to last year's results and exceeded the CCAMP action level at every site. All of the Monterey and Pacific Grove sites have exceeded the orthophosphate action level for all five years (see Figure 2).

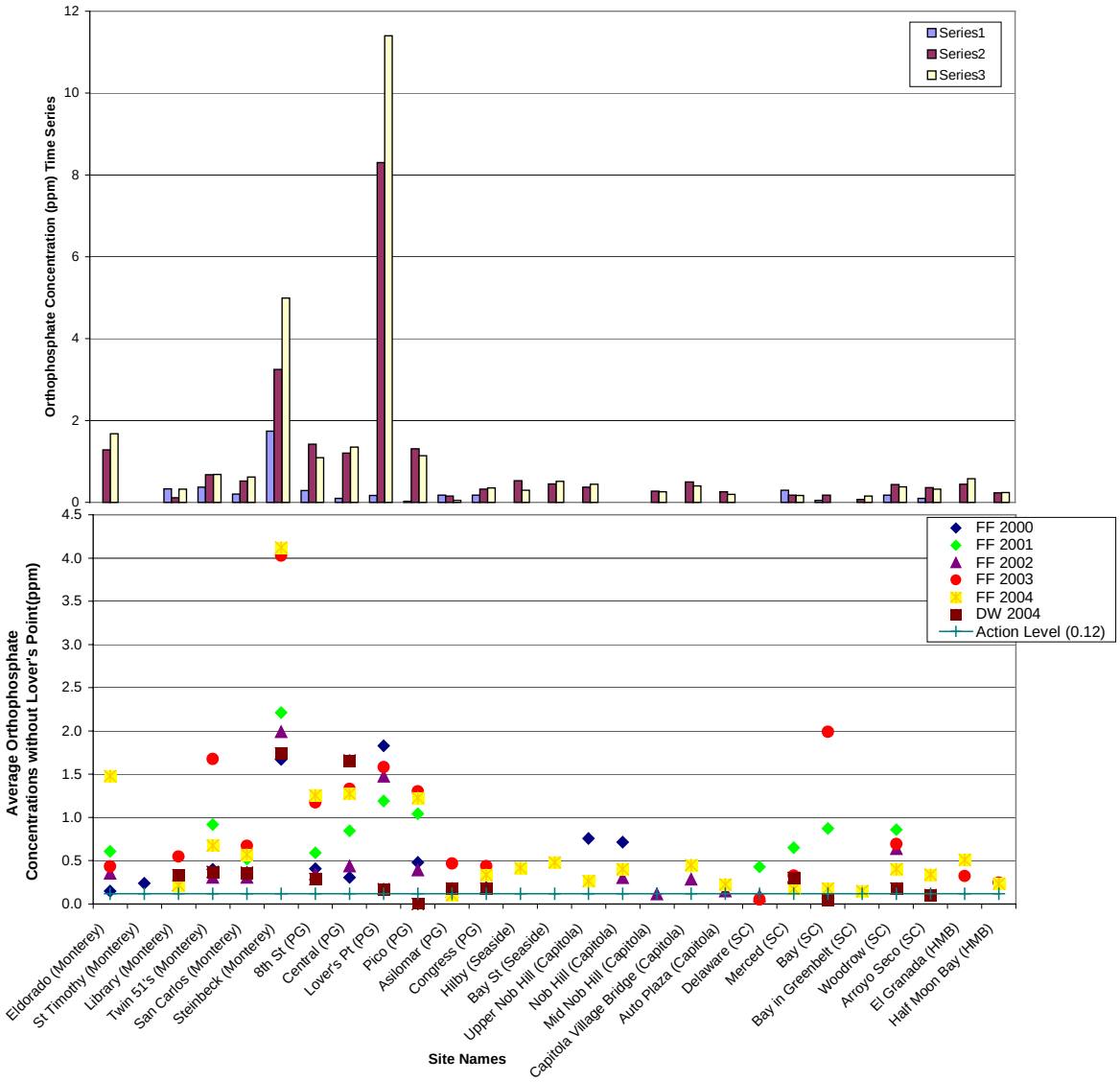


Figure 2. The sites are grouped by city. The CCAMP action level for orthophosphate as phosphorus is 0.12 mg-P/l. (2a) Graph of orthophosphate as phosphorus concentrations in the First Flush 2004 time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. (2b) Graph of 5-year trend. Average concentrations are represented. This graph excludes the Lover's Point(11.4 mg-P/L) result to enable a more readable scale for the other sites.

Bacteria

Total coliform and ***Escherichia coli*** (*E. coli)* are types of bacteria. They are pollutants of concern due to their human health effects. *E. coli* is a member of the fecal coliform group which is a part of the total coliform group. The presence of these types of bacteria indicate there could be pathogens present. Pathogens are the organisms that are harmful to both humans and marine organisms but pathogens themselves, are difficult to measure. Because of its aquatic effects, the CCAMP action level for total coliform is 10,000 Most Probable Number (MPN)/100 ml. The CCAMP action level for *E. coli* is 400 MPN/100 ml.

Nine of fourteen sites exceeded the *E. coli* water quality objective of 400 MPN/100 ml during the Dry Weather monitoring. These included all of the Monterey and Pacific Grove sites and Arroyo Seco in Santa Cruz. All of the sites, except Eldorado in Monterey, exceeded the *E. coli* water quality objective of 400 MPN/100 ml during the First Flush. Pico and Woodrow samples contained more than 200,000 MPN/100 ml. They were, by far, the highest concentration at all of the sites. The sites in Seaside, Capitola and Santa Cruz (except Woodrow) were substantially lower than Monterey and Pacific Grove sites(see Figure 3).

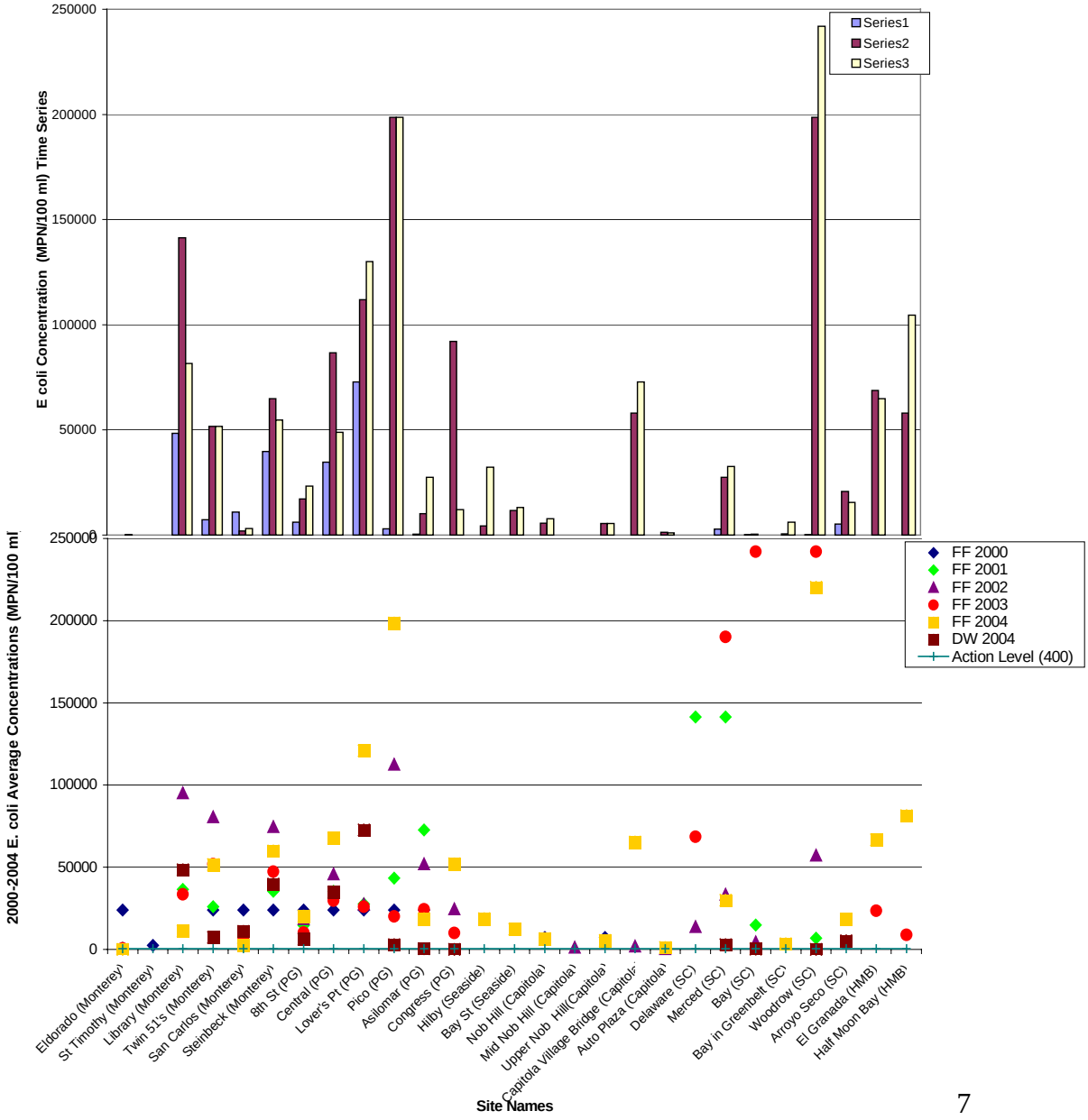


Figure 3. The sites are grouped by city for E.coli. The EPA Water Quality Objective is 400 MPN/100 ml. (3a) The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. (3b) Average E. coli concentrations for the past 5 First Flush events.

Metals

Storm water runoff in coastal urban areas has been known to produce significant toxicity to early life stages of aquatic organisms due to the presence of trace metals. The effects include reduced reproduction, developmental deformities, and mortality. In this monitoring event, samples were analyzed for total zinc (Zn), total copper (Cu), and total lead (Pb). The California Basin Plan has established water quality criteria for these metals.

The background concentration for **total zinc** (Zn) in seawater on the Central Coast is 8 parts per billion (ppb) or micrograms per liter (µg/l). The Basin Plan water quality objective for Zn is 200 µg/l. San Carlos outfall was the only site to exceed the total zinc WQO at 306 µg/l for the Dry Weather event. Zinc concentrations in the First Flush ranged from 96 – 678 µg/l. All of the sites in Monterey, Pacific Grove, Seaside, Half Moon Bay and El Granada, exceeded the Basin Plan WQO for total zinc (< 200 µg/l) during the First Flush. One of four sites in Santa Cruz and three of four in Capitola exceeded the WQO for zinc. Steinbeck Plaza had the highest zinc (678 µg/l) concentrations of all the sites this year and the majority of sites in previous years (see Figure 4). Sources of zinc may include galvanized roofing and siding materials for buildings, metal parts or scrap, guardrails, chain link fencing, or vehicle tires.

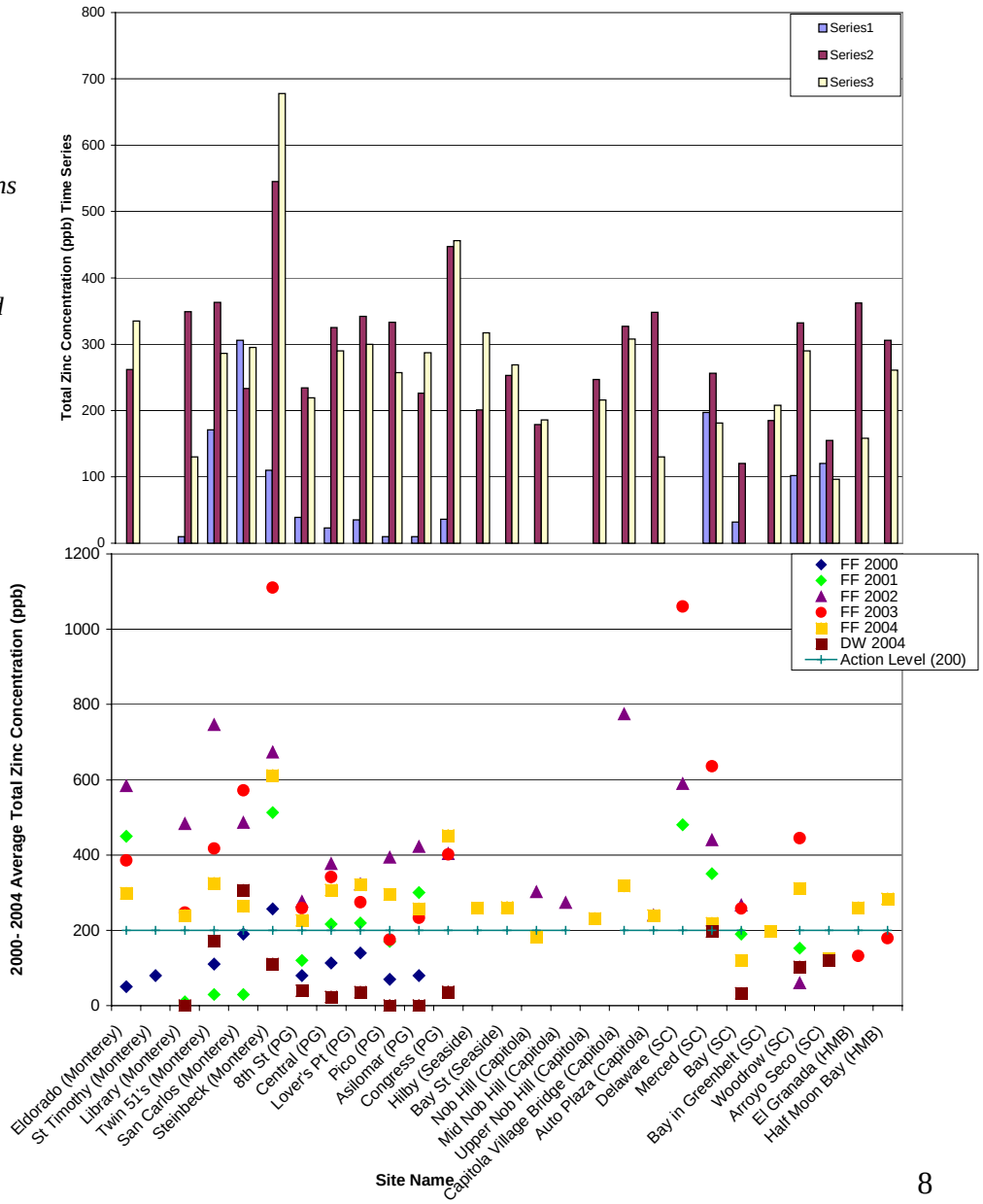


Figure 4. The sites are grouped by city. The Basin Plan Water Quality Objective for total zinc is 200 µg/l. (4a) Graph of total zinc concentrations in a time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. Non-detects are represented as ½ the PQL(10 ppb) (4b) Graph of 5-year trend. Average concentrations are represented.

The background concentration for **total copper** in sea water is 2 µg/l . Total total copper concentrations in storm water samples ranged from non-detect to 270 µg/l. The Basin Plan standard established for Cu is 30 µg/l (ppb). Steinbeck Plaza and San Carlos outfalls in Monterey were the only sites to have detectable copper concentrations(> 30 ppb), 52 and 70 µg/l respectively during the dry weather event. All of the sites in Monterey, Pacific Grove, Seaside, Half Moon Bay and El Granada, exceeded the Basin Plan WQO for total copper during the First Flush. All of the Santa Cruz sites were non-detect for copper, as were 3 of 4 Capitola sites. Each year, Asilomar in PG has one of the highest copper concentrations. This year, it had the highest concentration at 270 µg/l and was double last year's average result. Steinbeck Plaza had the second highest copper concentration at 191 µg/l of all the sites this year and the majority of sites in previous years (see Figure 5). Sources of copper may include architectural elements such as roofs and rain gutters, or vehicle brake pads.

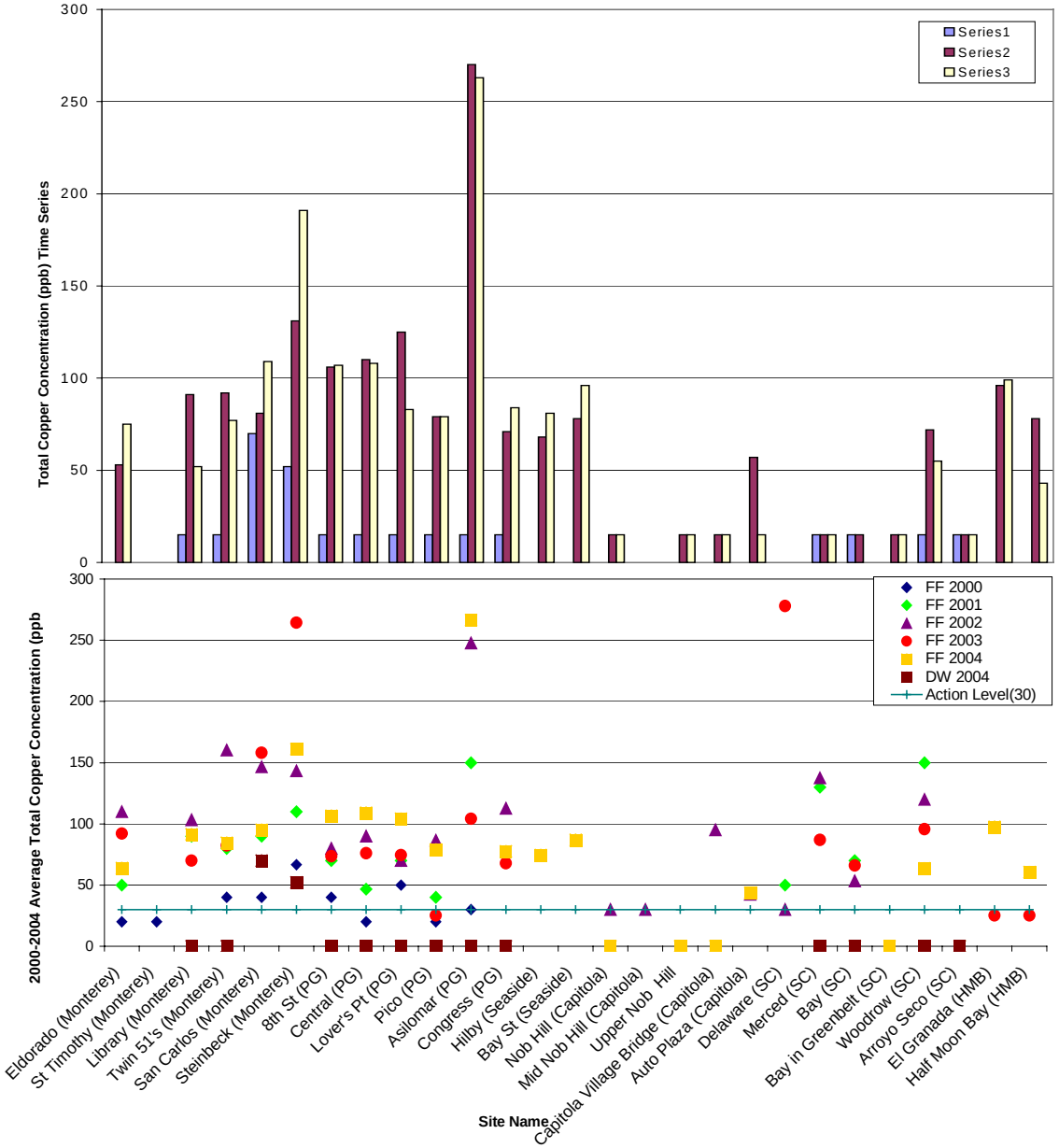


Figure 5. The sites are grouped by city. The Basin Plan Water Quality Objective for total copper is 30 ppb. (5a) Graph of total copper concentrations in a time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. Non-detects are represented as ½ the PQL(15 ppb). (4b) Graph of 5-year trend. Average total copper concentrations are represented.

Total Lead (Pb) concentrations ranged from non-detect to 92 µg/l. The Basin Plan water quality objective for total lead is 30 µg/l. No site exceeded the Basin Plan WQO for lead during the dry weather event. One site in each city, except for the Half Moon Bay area, exceeded the WQO for lead during the First Flush. The Library in Monterey and Woodrow in Santa Cruz had the highest concentrations measuring 58 and 56 µg/l respectively (see Figure 6). Sources of lead in stormwater may include automobile emissions, tire wear, lubricating oil and grease, lead battery residues, or leaded paint residues.

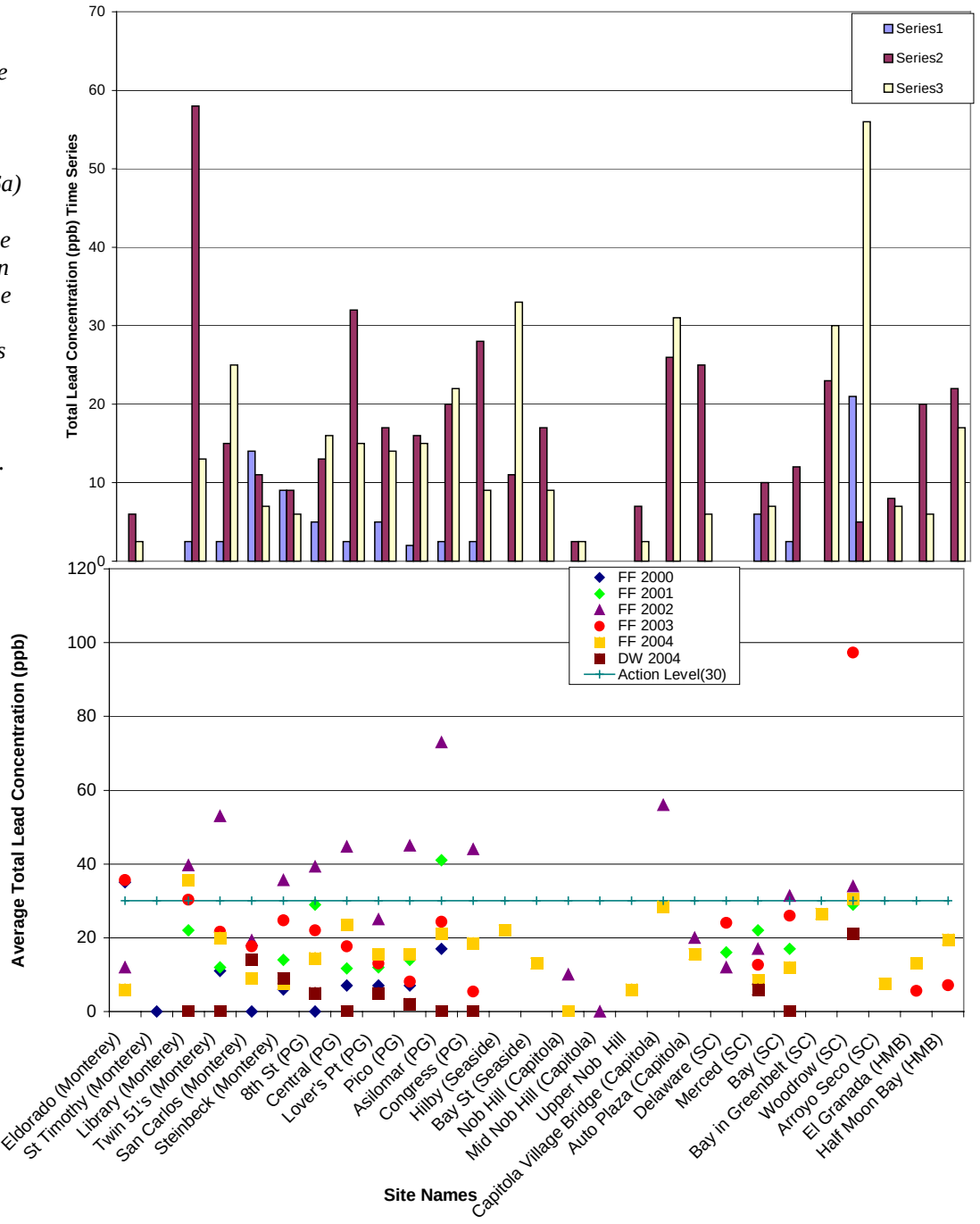


Figure 6. The sites are grouped by city. The Basin Plan Water Quality Objective for total lead is 30 ppb. (6a) Graph of total lead concentrations in a time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. Non-detects are represented as ½ the PQL(5.0 ppb) (4b) Graph of 5-year trend. Average Total lead concentrations are represented.

Total Suspended Solids(TSS)

Total suspended solids (TSS) are important to measure because the suspended solids carry pollutants. The suspended solids provide a media or polar charge to attract contaminants. High amounts of sediment are harmful to fish populations because they destroy habitat, can suffocate eggs in fresh water systems, and/or limit the food supply. It also may clog gills or impair an organism's vision when feeding. High TSS can mitigate metal toxicity.

No site exceeded the action level of 500 mg/l during the Dry Weather event. The Library (790 mg/L), Woodrow (645 mg/L), and El Granada (689 mg/L), were the only sites to exceed the action level during the First Flush. The majority of sites were below 200 mg/L TSS (see Figure 8).

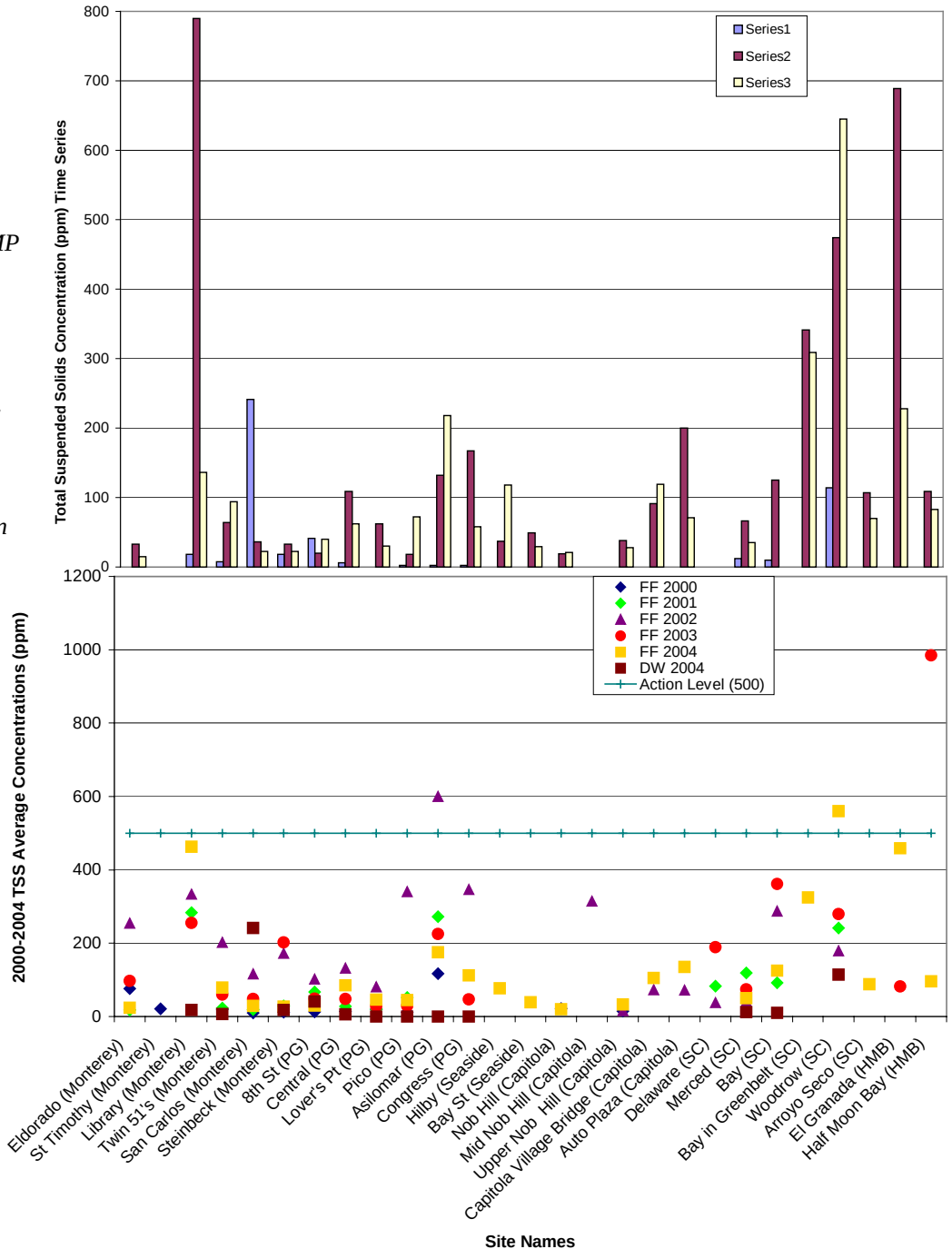


Figure 8. The sites are grouped by city. The CCAMP action level for TSS is 500 ppm.. (8a) Graph of total suspended solid concentrations in a time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. (4b) Graph of 5-year trend. Average TSS concentrations are represented

Total Dissolved Solids (TDS)

Total dissolved solids are a measurement of the amount of dissolved solids in a sample of water. These solids are usually ions of salts such as sodium, chloride, calcium, carbonate, potassium, or magnesium. These dissolved ions are conductors of electricity and therefore the results can be compared to conductivity measurements taken with the pocket meter.

All of the total dissolved solids (TDS) samples except for Library and Twin's in Monterey were at or below 1500 mg/l and decreasing during the First Flush. The majority of sites were below 500 mg/l. The Twin 51's had the highest concentrations with the first sample measuring 1570 mg/l, then quickly dropping to 341 mg/l. The Library site had the second highest concentrations with the first sample measuring 1420 mg/l and the second sample 976 mg/l. In general, Seaside, Capitola, Santa Cruz and Half Moon Bay sites reported much lower TDS values than Monterey and Pacific Grove sites (see Figure 9).

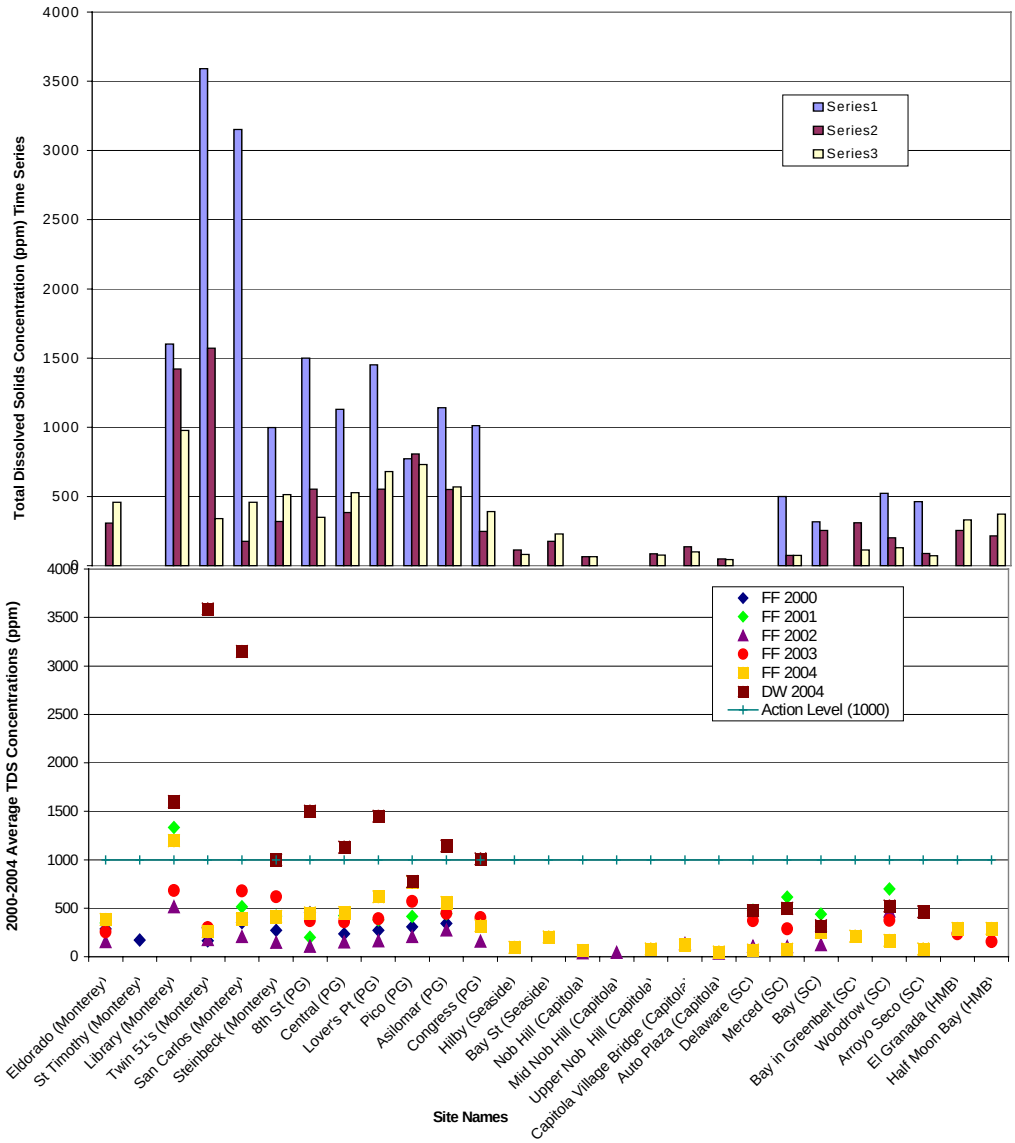


Figure 9. The sites are grouped by city. The CCAMP action level for TDS is 1000 mg/l. (9a) Graph of total dissolved solid concentrations in a time series. The first column (Series 1) represents the dry weather sample taken, the second series represents the First Flush sample and time series samples, usually taken 30 minutes apart. (4b) Graph of 5-year trend. Average concentrations are represented

Visual Observations

At each site, for both the Dry Weather event and First Flush, visual observations were recorded on the back of the data sheet including trash, oil sheen, sewage (odor), and bubbles or scum. For the Dry Weather event; trash was observed at 7 sites, no sewage at any site, oil sheen at one site and bubbles/scum at three sites. During the First Flush event; trash was observed at 17 sites, no sewage at any site, no oil sheen at any sites and bubbles/scum was observed at eighteen sites.

Conclusions

This year we held the first annual dry weather monitoring event and the fifth annual First Flush monitoring event within the Monterey Bay National Marine Sanctuary. Each year, First Flush educates citizens about the quality of water that flows into the MBNMS during the first major storm of the season. This year, the dry weather component provided volunteers with added training for collecting water samples according to the First Flush protocols and provided an indication of what is flowing into the Sanctuary during the dry weather season. Overall, the dry weather results looked very good. The two parameters that were detected most often were *E. coli* and orthophosphate.

Because of the large geographic range of sites, different drainage characteristics and the logistics of mobilizing volunteers, a variation of sampling times occurred during the storms. Collecting two samples at every location over a one-hour time span, gives more reliability and comparability to the data. The Monterey, Pacific Grove and Seaside teams were out monitoring within the first hour of heavy rainfall in those respective cities. The Santa Cruz and Capitola teams mobilized as soon as there was sheeting water on the roadways (caused by the storm from the north), however, they had several hours of on and off rainfall prior to them mobilizing.

The First Flush event continues to grow. This year, a dry weather event and several new sites were added to the program. Capitola participated again for the third time since this program began in 2000. The program was also implemented in Seaside at just two locations this year and it is anticipated there will be more next year. The Coastal Watershed Council Coordinators made some adjustments to the sites in Santa Cruz this year. Based on lessons learned and more appropriate sampling locations, the Bay St site was moved up the hill into a greenbelt for better coverage of the drainage. Also, the Delaware site was moved to “Arroyo Seco” in a residential neighborhood above HWY 1. The previous site at Delaware was in an industrial area being monitored by the City of Santa Cruz. Just one sample was collected at the old sites for historical consistency and two samples at the new sites.

There are sites that stand out from the rest with high pollutant concentrations. Most cities had at least one site that warrants additional monitoring and source investigation.

- In Monterey, **Steinbeck Plaza** had the highest zinc (678 μg/l) and second highest copper (191 μg/l) concentrations of all the sites this year and the majority of sites in previous years. It also had the second highest orthophosphate (4.99 mg-P/l) concentration and one of the highest nitrate (2.79 mg-N/l) concentrations of all the sites. The **Library** had the highest lead concentration of all of the sites (58 μg/l) and has had high lead concentrations historically.

- In Pacific Grove, **Asilomar** has one of the highest copper concentrations every year monitored. This year, it had the highest concentration at 270 μg/l, double last year’s average result. **Lover’s Point** had the highest orthophosphate concentration of 11.4 mg-P/l. This is more than 5 times higher than the orthophosphate concentration at the majority of sites and it also had one of the three highest nitrate concentrations at 2.43 mg-N/L. **Pico** had one of the highest *E. coli* concentrations of all the sites at

198,628 MPN/100 ml this year, and previous years. Pico also had one of the highest nitrate concentrations of all the sites at 2.97 mg/L.

- Seaside did not participate in the Dry Weather event, but will be conducting some dry weather baseline monitoring in 2005. For the First Flush, both **Hilby** and **Bay St**. were generally in the middle range for all of the parameters measured compared to the other cities. While they exceeded most of the water quality objectives, they did not have the highest concentration for any parameter. More sites will be monitored during the First Flush in 2005.

- In Capitola, there was no flow at any of the sites during the Dry Weather event. The Capitola sites in general, had very low concentrations of *E. coli*, metals, nutrients and TSS during the First Flush. However, the **Capitola Village Bridge** site, in the two years that lead was monitored, had higher lead concentrations than the majority of sites and averaged above the Basin Plan WQO.

- In Santa Cruz, overall, the results were much better this year. **Bay Street's** orthophosphate concentration dropped from 1.99 mg-P/l in 2003 to 0.16 mg-P/l in 2004. It also went from having one of the highest *E. coli* concentrations > 241,920 MPN/100 ml in 2003 to just 410 MPN/100 ml in 2004. **Woodrow** had the highest lead concentration of 221 μg/l in 2003, yet in 2004, it was just 56 μg/l. Woodrow did have the highest *E. coli* concentrations of > 220,274 MPN/100 ml for the second year in a row. This is very high compared to previous years and the other sites. Woodrow also had the highest TSS concentration of 645 mg/L of all of the sites. **Arroyo Seco** was a new site added this year to replace the Delaware site in Santa Cruz. While the First Flush results were satisfactory; the lead concentration during the dry weather monitoring was very high. The dry weather sample was collected in a stagnant pool, which may be the reason for the high lead concentration, therefore the results were not included in this report. **Merced** had the highest nitrate concentration (4.944 mg-N/l) in 2003 and has commonly had the highest nitrate over the years. However, in 2004, during the First Flush, the nitrate concentration was just 1.15 mg/L. Merced did have the highest nitrate of all the sites for the dry weather monitoring at 4.33 mg-N/L.

- In the Half Moon Bay area in 2003, **Half Moon Bay** and **El Granada** had very low concentrations of every parameter measured except for TSS, in which Half Moon Bay had the highest concentration of all of the sites. In 2004, both sites had elevated *E. coli* concentrations of 81,282 and 66,775 MPN/100 ml respectively. These levels are still much lower than some of the more urban areas. Copper, lead and zinc concentrations more than doubled last year's results at both sites.

This report is written to provide a summary of the results collected during the Dry Weather and First Flush monitoring events and not necessarily to make conclusions or explanations as to why particular sites have higher results than others. The coordinators of the event will work with each city to review the results and take further actions where warranted. Each sub-drainage is very unique in its topography and land use and each of us may have our own ideas of why certain parameters exceed water quality objectives at particular sites. As we collect more information on the water quality at these sites, we gain a better understanding of the areas that necessitate further investigation. This is being done at the Steinbeck Plaza outfall in the spring of 2005. A grant from the Sanctuary Integrated Monitoring Network with matching funds from the City of Monterey, Marine Pollution Studies Lab and the Copper Development Association, will enable the Network to do upstream source tracking of zinc and copper, as well as toxicity plume studies around the outfall in Monterey Bay. We hope to use the information learned from this study to explain high metal concentrations in other drainages. More studies, such as this one may be justified in the future.

It is difficult to determine when and if particular follow up actions affect results the following year. For example, one site was identified as having high zinc concentrations in past years. The City was informed of the situation and they conducted some follow up with neighboring businesses. This year the zinc concentrations were significantly lower. We hope that actions such as these do contribute to improved water quality and demonstrate the value of these events.

Overall, pollutant concentrations fell between previous year's concentrations. Santa Cruz and Capitola sites fared much better than the other cities that participated. Orthophosphate, *E. coli*, total copper and total zinc continue to be the biggest concern in most of the cities. The number of sites monitored continues to grow which provides more data for comparison and a better understanding of the quality of the water flowing into the Monterey Bay National Marine Sanctuary. We must remember that the values reported in this report are a cumulative result of each person living near the ocean. Our homes, cars, yards, and pets all contribute to the pollutant load flowing into the Monterey Bay National Marine Sanctuary every day, not just when it rains.

In conclusion, this event is an exceptional mix of committed citizens that care about their environment and collecting important data. Sixty-four volunteers mobilizing late at night and on a weekend, made this event possible. Their services are greatly appreciated.

Attachment 1

Station Name	Station ID	Drainage Area (acres)	Primary Land Use	Description	Location	Receiving Water
Eldorado (aka Major Sherman) (Monterey)	MSD1		80% residential 20% commercial	Drainage ditch	Intersection of Major Sherman Lane Eldorado Street	Lake
Twin's (Monterey)	MSD3	365	90% residential 10% commercial	Two 51” diameter concrete pipes	Below walking path at Heritage Harbor-adjacent to Wharf I, west ~500ft.	Ocean
San Carlos (Monterey)	MSD4	70	40% commercial 35% residential 25% public land	36” diameter concrete pipe	On the beach adjacent to the west side of Coast Guard pier.	Ocean
Steinbeck (Monterey)	MSD5	37	90% commercial 10% residential	36” diameter concrete pipe	At Steinbeck Plaza on Cannery Row at the end of Prescott Street	Ocean
Library (Monterey)	MSD6	467	100% residential	Drainage ditch	665 Pacific Street adjacent to the Monterey Public Library on the Northeast side of Pacific Street.	Ocean
8th Street (Pacific Grove)	PGSD1	35	100% residential	Concrete pipe	West of Ocean View Blvd. between 7th and 8th.	Ocean
Central & 13th (aka Greenwood Park) (Pacific Grove)	PGSD2	250	90% residential 10% commercial	Concrete pipe	Greenwood Park at the corner of 13th and Central Ave.	Ocean
Lover's Pt (Pacific Grove)	PGSD3	222	90% residential 10% commercial	Concrete pipe	At the top of the cliff on the SE side of main beach at Lover's Pt	Ocean
Pico (Pacific Grove)	PGSD4	131	100% residential	Concrete pipe	On the W side of Sunset Drive approx. 60 ft. N of Pico St.	Ocean
Asilomar (Pacific Grove)	PGSD5	94	90% residential 10% commercial	Drainage ditch	On the W side of Sunset Drive due W of the Asilomar Convention Ctr.	Ocean

Bay Ave. (Seaside)	SSD2	1,300	Residential and commercial	90” reinforced concrete pipe	At the end of Bay Ave. and Sand Dunes Rd.	Ocean
Hilby (Seaside)	SSD1	240	Residential and commercial	60” reinforced concrete pipe	At the south side of intersection of Hilby Ave and Canyon Del Rey Blvd.	Lake
Delaware (Santa Cruz)	SCSD1	352	90% residential 5% commercial 5% open space	Concrete pipe	On S side of W. Cliff Dr. at Monterey St.	Creek
Arroyo Seco	SCSD6					
Merced Ave (Santa Cruz)	SCSD2	1289	40% residential 10% commercial 50% open space	Concrete pipe	On S. side of W. Cliff Dr. at Merced Ave.	Ocean
Bay Street (Santa Cruz)	SCSD3	285	95% commercial 5% residential	Surface drainage	On S side of W. Cliff Dr. at Bay St.	Creek
Bay Street Greenbelt	SCSD5					
Woodrow (Santa Cruz)	SCSD4	736	80% residential 10% commercial 10% open space	Surface drainage	On S side of W. Cliff Dr. at Woodrow Ave.	Ocean
El Granada	EG 1				Major outfall at Surfers Beach along Highway 1 in El Granada	Ocean
Half Moon Bay	HMB1				Storm drain in Half Moon Bay at Main Street and Pilarcitos Creek	Creek

Attachment 2a – 1st page of Field Data Sheet

Monterey Bay National Marine Sanctuary

First Flush 2004

Field Data Sheet **Date:**

City		**Arrival Time**	
Station ID		**Departure Time**	
Time Rain Began		**Station Name**	

Team Members with phone #'s

1		4	
2		5	
3		6	

Detailed description of weather conditions (drizzle, rain, wind, visibility, cloud cover, darkness, etc.):

Field Measurements: **Time Bucket Filled** ___:___ am / pm

Instrument ID:	Person taking Measurement	Parameter	Measurement	Replicate
		H20 Temp	F or C	F or C
		pH		
		Conductivity	µS	µS
		Transparency	cm	cm

Notes (include any observations from back side, ie. types of trash, biological observations, etc.

Attachment 2b – 2nd page of Field Data Sheet

Changes Over Time			Station ID							
			(answer yes or no to the observations below)					FLOW (cm)		
Time	Conductivity (µS)	Murkiness	Rain	Trash	Sewage	Oil Sheen	Bubbles/ Scum	Velocity (gpm)	Depth (cm)	Width (cm)

Sample collection for one time series:

Sample ID	Time	Collected by:	Container Type
			clear 100 ml - bacteria
			sq. white plastic 250 ml - metals
			sq. white plastic 1 L - nutrients/TDS,TSS

Duplicates or Blanks collected: Yes or No

Sample Custody:

Relinquished By:	Date /Time	Received By:	Date/Time

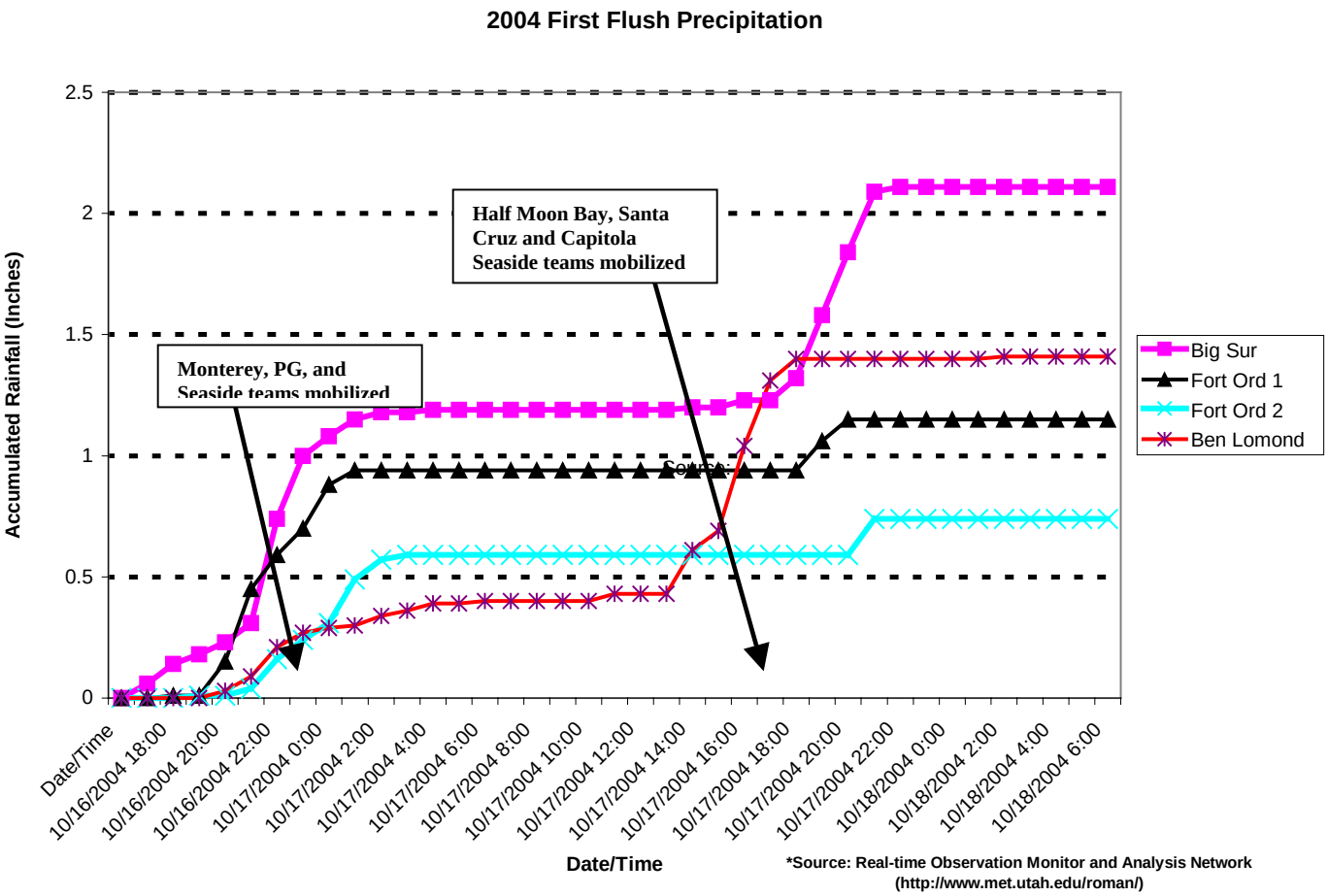
Attachment 3

METHODS USED IN THE FIRST FLUSH 2004 SAMPLING EVENT

	Constituent	Detection Limits	Units	Laboratory	Method #	Method Principles
Field Measurements						
	Conductivity	10	µS	Field		Electrodes
	Water Temp.	- 5	°C	Field		Spirit bulb
	pH	4.5		Field		Non-bleeding test strips
	Transparency	2	Cm	Field		Transparency tube
Nutrients						
	Nitrate as N	0.05	mg/l	Monterey Bay Analytical	EPA 300.0	
	Orthophosphate as P	0.05	mg/l	Monterey Bay Analytical	EPA 300.0	
Bacteria						
	Total coliform	1	MPN/100 ml	Monterey Bay Analytical	Colilert	Chromogenic Substrate
	E. coli	1	MPN/100 ml	Monterey Bay Analytical	Colilert	Chromogenic Substrate
	Total coliform	1	MPN/100 ml	Monterey Bay Analytical	Colilert	Chromogenic Substrate
	E. coli	1	MPN/100 ml	Monterey Bay Analytical	Colilert	Chromogenic Substrate
Total Metals						
	Total zinc	20	µg/l	Monterey Bay Analytical	SM3111B[2]	acid digestion, AA flame
	Total copper	30	µg/l	Monterey Bay Analytical	SM3111B[1]	acid digestion, AA flame
	Total lead	5	µg/l	Monterey Bay Analytical	SM3113B[1]	acid digestion, graphite furnace
WQ parameters						
	total suspended solids (TSS)	5	mg/l	Monterey Bay Analytical	SM2540D[1]	Gravimetric: filtration thru 1.1µm, glass fiber drying and weighing of particulates
	total dissolved solids (TDS)	10	mg/l	Monterey Bay Analytical	SM2540C[1]	Gravimetric: drying and weighing of 1.1µm filtrate

[2] Standard Methods for the Examination of Water and Wastewater 20th Edition

Attachment 4



*Source: Real-time Observation Monitor and Analysis Network (http://www.met.utah.edu/roman/)