



Morro Bay Volunteer Monitoring Program

First Flush Monitoring

Fall 2005

Background

'First Flush' is a monitoring effort to measure pollutant levels in urban runoff from the first heavy rainstorm of the season, which is typically the most contaminated runoff of the year. After months of dry weather, storm water picks up particles and contaminants that have accumulated on driveways, streets, yards and in storm drains. This pollution is deposited, untreated, into our local waterways including creeks and Morro Bay.

In the mid-1990s, the Central Coast Regional Water Quality Control Board (CCRWQCB) partnered with MBNEP volunteers to conduct three seasons of First Flush (FF) monitoring. The current effort, organized by the VMP, monitors many of the same sites to help track long-term trends in runoff and highlight areas requiring further monitoring.

Monitoring Effort

Six volunteers and one VMP staff member mobilized at 7:30 p.m. on Monday, October 17 to capture what is typically some of the most polluted stormwater of the year. Sampling began as soon as the rain was heavy enough to cause flow in the gutters and all samples were collected within an hour of the start of monitoring.

In the field, runoff was monitored for dissolved oxygen and temperature.

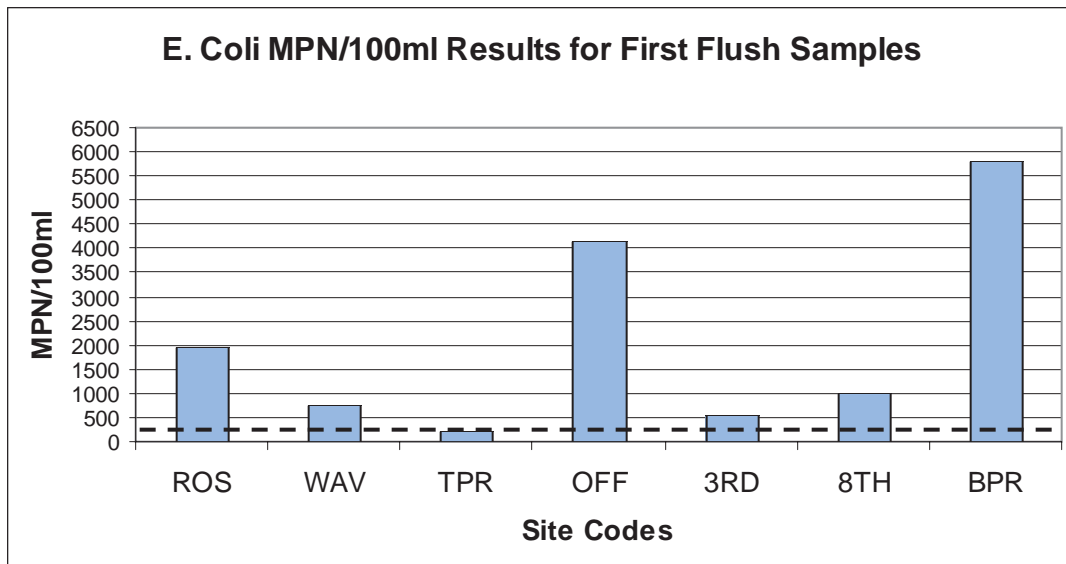
Samples were analyzed by VMP staff for total coliform, *E. coli*, turbidity, conductivity, and pH. Samples were delivered to a laboratory for detailed analysis for nitrates, orthophosphates, total dissolved solids, total suspended solids, dissolved metals (copper, nickel, zinc and lead) and oil & grease.

First Flush Monitoring Sites

Monitoring sites were distributed throughout Los Osos and Morro Bay and were selected because they were monitored during the effort in the mid-1990s. The Morro Bay sites were the T-Pier on the Embarcadero (TPR), the culvert between Rose's and the Fish Bowl Restaurants (ROS), the culvert at Marina St. and the Embarcadero (OFF) and the culvert behind Wavelengths Surf (WAV). In Los Osos, the sites monitored were the culvert at Baywood Pier (BPR), the intersection of Fourth and Pismo Streets (4TH), and the standpipe at Eighth and El Morro Streets (8TH). The wetland above Cuesta Inlet and the gully below the golf course in Morro Bay were also set as monitoring sites but could not be monitored due to inadequate flow.



Bacteria Levels in FF Stormwater Runoff



For *E. coli*, results varied from 216 MPN/100 mL to 5,794 MPN/100 mL. EPA's recommended criteria for *E. coli* for safe recreational contact is 235 MPN/100 mL, indicated by the dashed line on the graph. Although results exceeded this

criteria at all sites except for one, the overall trend was a reduction in bacteria levels versus historical data. Surfrider advises people to stay out of the water for up to 72 hours after a storm event.

Historical Bacteria Levels

For both the historical and the 2005 data, bacteria averages were higher in Los Osos than Morro Bay.

Although the historical effort analyzed for fecal coliform, the 2005 effort analyzed for *E. coli*. However, the fecal coliform and *E. coli* results could still be compared to look at overall trends. The two monitoring seasons with the most data were selected. Geomeans were calculated for each year for Los Osos and for Morro Bay. A geomean is a special kind of average that minimizes the effect of outlier data.

Location	Year	Fecal Coliform (1996) and <i>E. coli</i> (2005) [MPN/100 mL]
Los Osos	1996	77138
	2005	1435
Morro Bay	1996	300
	2005	676

What are the levels of concern?

In general, there are no regulatory standards for the urban runoff itself. The water that receives this runoff (a creek or Morro Bay) must meet certain regulatory standards. The data was compared to various criteria.

The runoff data was compared to the receiving water standards defined in the Basin Plan by the CCRWQCB for all parameters listed in the Basin Plan. It does not contain standards for all analytes.

Orthophosphate, total dissolved solids (TDS) and total suspended solids (TSS) results were compared to the Central Coast Ambient Monitoring Program (CCAMP) attention levels. These are not regulatory standards, but rather levels derived from other regulations and literature.

E. coli results were compared to EPA's Ambient Water Quality Criteria for Bacteria.

Nutrients Detected in the FF Runoff

Site	Orthophosphates 1995-6 (mg/L)	Orthophosphates 1996-7 (mg/L)	Orthophosphates 1997-8 (mg/L)	Orthophosphates for 2005 (mg/L)	Nitrates 2005 (mg/L)
WAV	0.06	0.12	0.18	0.87	1.4
TPR	-	-	-	1.3	1.8
ROS	-	-	-	0.53	1.5
OFF	-	-	-	0.63	1
BTH	-	0.98	-	0.66	1
4TH	0.97	1.5	0.89	0.52	1.4
BPR	0.29	0.58	-	1.4	1.1

For nutrients, elevated levels were detected in the stormwater runoff, although not as high as might be expected. In 2005, nutrients were analyzed in the form of orthophosphate as P and nitrates as N. The CCAMP action level for nitrates as N is 2.25 mg/L and for orthophosphate as P the level is 0.12 mg/L. All of the orthophosphate levels exceeded the

action level. None of the detected nitrate levels exceeded the action level. In the 2005 effort, average orthophosphate levels were higher in Los Osos than the average in Morro Bay. Nitrates had the opposite trend with the Morro Bay average slightly higher than the Los Osos average.

Dissolved Copper, Nickel, Lead and Zinc Detected at Nearly All Sites

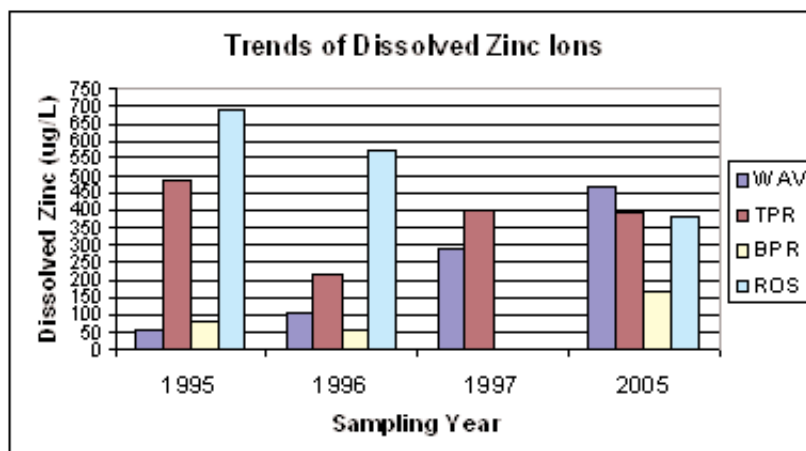
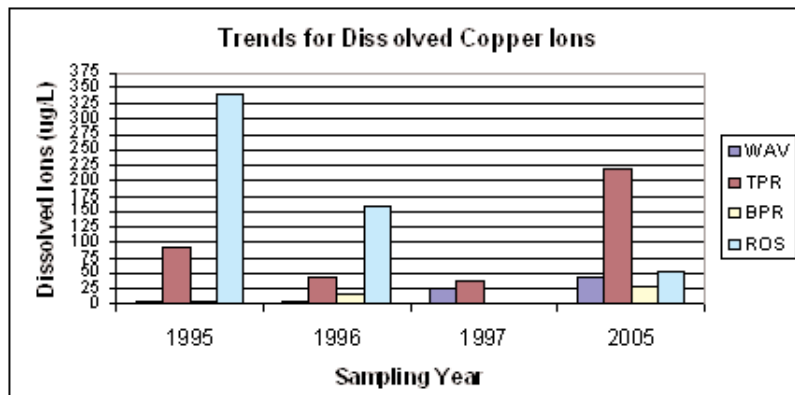
The stormwater was analyzed for copper, lead, nickel and zinc in its dissolved form at all seven sites. All metals were detected at all sites except for two.

In general, dissolved metals levels from Morro Bay during the 2005 monitoring effort were higher on average than the values from Los Osos.

While lead was detected at all sites except for one, none of the sites had levels that exceeded the Basin Plan standards.

For copper, nickel and zinc, results for all three metals at all sites except for one exceeded the Basin Plan standards for protection of marine life.

Dissolved metal levels in receiving waters should remain below 10 ug/L for copper and 20 ug/L for zinc to protect marine life.



Conclusions from MBNEP First Flush Monitoring Effort for 2005

BAD NEWS - The following observations are of note and may require further investigation:

- **Bacteria** levels were above EPA's recommended safe recreational contact level at all sites monitored in 2005 except for one. Levels were especially high at Baywood Pier (5,794 MPN/100 mL) and the culvert at the end of Marina Street (4,130 MPN/100 mL).
- **Turbidity** levels were detected at greater than 10 NTU, the CCAMP attention level, at all sites. Readings varied from 38 NTU to the highest value of 547 NTU (4th and Pismo Streets).
- **Orthophosphates** were detected at levels above the CCAMP recommended attention level at all sites, with especially high values detected at Baywood Pier (1.4 mg/L) and the T Pier on the Embarcadero (1.3 mg/L).
- **Nickel** was detected at levels above the Basin Plan standard of 2 ug/L for protection of marine life at all sites. The highest levels were detected at the T Pier (25 ug/L), behind the Wavelengths Surf Shop (21 ug/L) and from the culvert between Rose's and the Fish Bowl restaurants on the Embarcadero (21 ug/L).
- **Copper** was detected at levels above the Basin Plan standard of 10 ug/L at all sites. The highest level was 220 ug/L at the T Pier. All other readings were considerably lower (from 27 to 52 ug/L).
- **Zinc** was detected at levels above the Basin Plan standard of 20 ug/L at all sites except for one (4th and Pismo Streets in Los Osos). The highest levels were at the T Pier (390 ug/L) and behind Wavelengths Surf (470 ug/L).
- **TDS** exceeded the CCAMP recommended attention level at the T Pier (1,300 mg/L) and at Baywood Pier (1,500 mg/L).

GOOD NEWS - Parameters that did not violate the regulatory or attention levels were as follows:

- **Dissolved oxygen** did not drop below 7 mg/L (Basin Plan standard) at any of the sites.
- **pH** was in the range of 7 to 8.5 at all of the sites (Basin Plan standard).
- **Nitrate as nitrogen** was detected between 1.0 and 1.8 mg/L at all sites, below the 2.25 mg/L CCAMP attention level.
- **Lead** levels ranged from non-detect to 4 ug/L, below the 10 ug/L level protective of marine life defined in the Basin Plan.
- **Conductivity** levels were below the Basin Plan standard (3,000 uS/cm) at all sites.
- **Oil & grease** levels were non-detect at all sites. The detection level was 5 mg/L.

AREAS TO WATCH - A few sites stood out as having elevated levels of multiple analytes:

- **T Pier in Morro Bay:** This site had the highest detected levels of nickel (25 ug/L) and copper (220 ug/L), and the second highest detected level of zinc (390 ug/L). It also had the second highest detected level of orthophosphates (1.3 mg/L).
- **Baywood Pier in Los Osos:** This site had the highest detected level of E. coli (5,794 MPN/100 mL), elevated levels of nickel (19 ug/L), copper (28 ug/L) and zinc (170 ug/L), and the highest detected TDS levels (1,500 mg/L). It also had the highest level of orthophosphates (1.4 mg/L).

Thank You, Volunteers!

We'd like to recognize the dedicated volunteers who braved the rain and cold to monitor.

Bob Croyle
Rich Dennis
Tim Dodson
Sarah Eminhizer
Katie Lockhart
Justin Popov