

morro bay
volunteer monitoring

Morro Bay Volunteer Monitoring Program

Stormwater Monitoring

Fall 2008



Where is *this* water coming from?

Streets, sidewalks, driveways and rooftops all contribute to the water pouring out of this pipe. Known as 'impervious surfaces,' our rooftops and streets are designed to shed water, not absorb it. When it rains, all of the water falling onto these surfaces has to go somewhere. A network of gutters, drains and pipes quickly whisks this water away and prevents flooding. In the process, stormwater runoff is generated.

Stormwater runoff is the term used to describe water that has fallen as precipitation and traveled over impervious surfaces to reach an outfall. Outfall locations where runoff is finally deposited may be retention basins, lakes, rivers or the ocean. For the city of Morro Bay and the community of Los Osos, all stormwater eventually reaches Morro Bay.

Stormwater runoff is a 'nonpoint source' problem. This means that no single person, business, or agency is directly responsible for creating the problem. In fact, everyone who lives in the community plays a role in stormwater pollution.

The First Flush Theory...

The climate of the Central Coast plays a major role in the volume and quality of stormwater runoff. The majority of the precipitation falls between October and May, which is followed by a four month period of dryness. As soon as the last storm of the season has passed, pollutants begin building up on streets, driveways and in our storm drainage system. These surfaces accumulate oils, metals, chemicals and trash until they are washed away by the first storm in the fall.

The term 'First Flush' refers to the highly concentrated pollution load commonly found in the runoff from the first storm of the season. As the rainfall courses over streets and sidewalks to the drainage system, it picks up all of these pollutants. At the end of the line (or outfall) all of these pollutants are deposited into Morro Bay.

Many people believe that the water that flows into storm drains goes to a treatment plant or through a filtration system to remove pollution. In Morro Bay and Los Osos, this is not the case. Stormwater (as shown in the photo above) drains directly into Morro Bay without any prior treatment.



Oil, grease and litter are all carried into Morro Bay by stormwater runoff.



Stormwater Pollution Ingredients

Oil and Grease: Comes from a variety of sources including plants, soaps, foods or cars.

Nitrates: Commonly found as one of the concentrated, active ingredients in fertilizers.

Dissolved Metals: Primarily generated by tire and brake wear in cars. Zinc and copper are two of the most concentrated metals.

***E. coli* bacteria:** *E. coli* is an indicator of fecal contamination by people or animals.

Turbidity: Turbidity is a measurement of water clarity. Pure rainwater has a very low turbidity.

The Stormwater Monitoring Challenge

No two rainstorms are the same. This fact makes monitoring stormwater and analyzing the data particularly challenging. Some storms last a short time but drop a lot of water, while others have a long duration with light rainfall. Typically, the 'First Flush' on the Central Coast occurs during October and yields between 0.10" and 0.25" of rainfall. While this may not be considered a large storm, it still generates a significant volume of runoff. However, 2008 was not a typical year.

A brief summer thunderstorm on the morning of August 15th generated just enough runoff for sample collection. The storm was very short, and only 0.07" of rain was recorded. Although the amount of runoff generated was much less than during an average winter storm, there was clearly runoff reaching Morro Bay. Testing showed that the runoff had very high levels of pollutants, as much as three times what had been detected in other First Flush events. The data resulted in more questions than answers.

The biggest lingering question was whether or not the pollution levels in the runoff change as it continues to rain during a storm. Are pollutants diluted by the addition of more clean rainwater? Or does more rainfall pick up more pollution?

A modified approach...

To better understand how stormwater runoff changes throughout a storm event, the monitoring program targeted two large storm drain outfalls in Morro Bay for time series monitoring. Rather than collect a single sample from many drains during one storm, volunteers collected a series of samples from only two outfalls, every 15 minutes for an hour.

After a long, sleepless night, the rainfall started around 4:30 a.m. on October 4th. The search for answers was on.



Antecedent Dry Period: ADP

An important factor in First Flush monitoring is the number of days since the last significant rainstorm. This is known as the Antecedent Dry Period (ADP) and is measured as the number of dry days between storm events.

In 2008, the ADP before the first flush lasted from April 2, 2008 to August 15, 2008. This means that pollutants built up for **135 days** prior to the storm event on August 15th.

The ADP between the August storm and the second storm on October 4th was considerably shorter, only **50 days**.

The results are in...

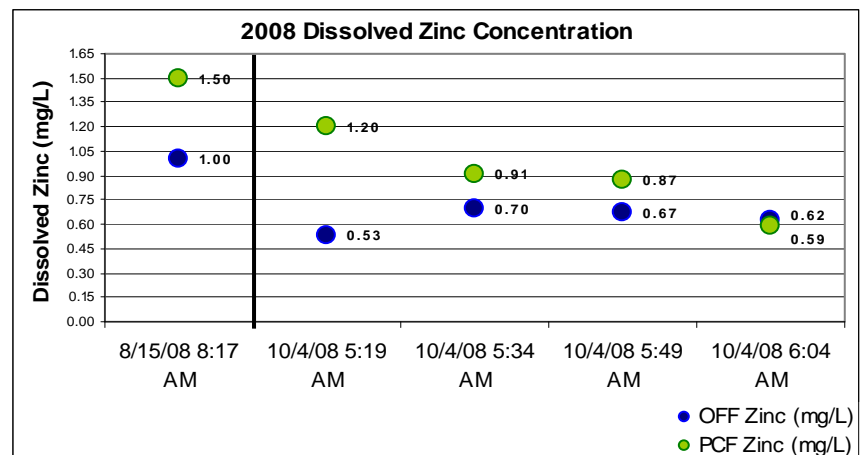
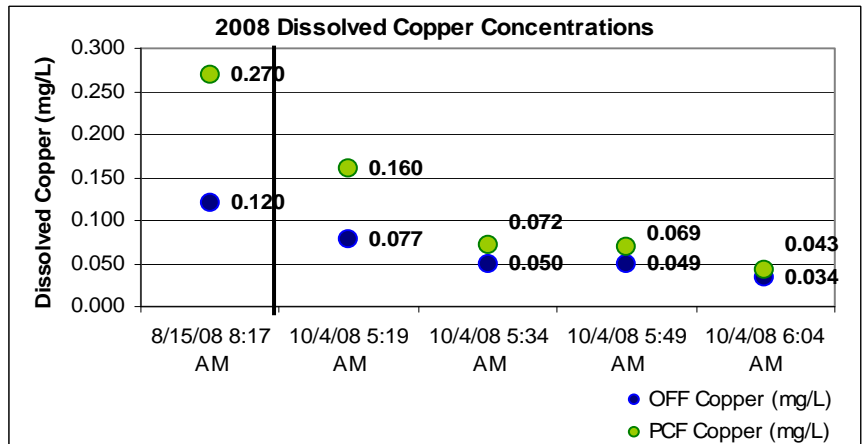
Dissolved Metals

The graphs on the right show how dissolved metals changed during two storm events monitored in Fall 2008. Samples from the brief storm in August showed higher concentrations than any of the time series samples collected in October.

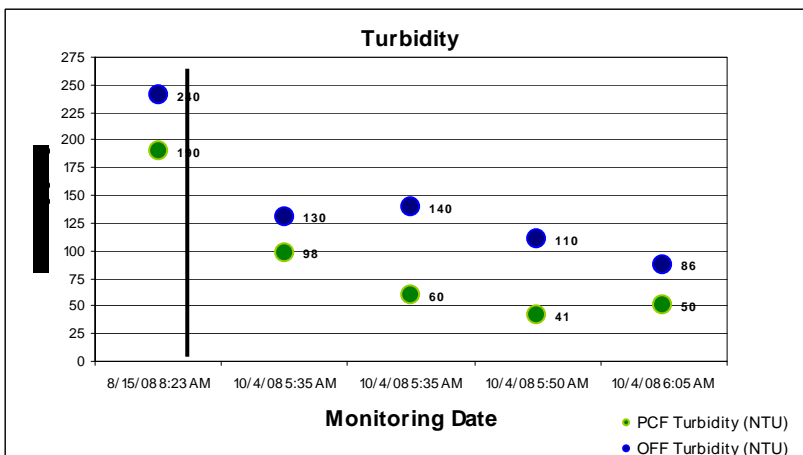
The four samples collected during the October storm show a reduction in dissolved metals as the storm progressed.

Dissolved copper and zinc in stormwater is most commonly derived from brake pad and tire wear on vehicles. Copper is an important component in brake pads, and small particles are rubbed off as brake dust. Zinc oxide is a common component in tires and is released into the environment as tires wear down on roads.

Both copper and zinc are also found in architectural materials. Copper rain gutters or roofing can release particles into the water as they wear. Zinc is commonly used in galvanizing, and poorly galvanized materials may contribute zinc as they wear down.



Turbidity



Turbidity measurements are a method of quantifying the overall clarity of the water. Turbidity doesn't measure a single pollutant, but characterizes the impact of the all of the dissolved and suspended particles in the water. By comparison, the turbidity of drinking water is less than 4 NTU. Creek water is typically less than 20 NTU under dry weather conditions.

Site Key

PCF: Concrete culvert at the end of Pacific Street along the Embarcadero near the Flying Dutchman Restaurant

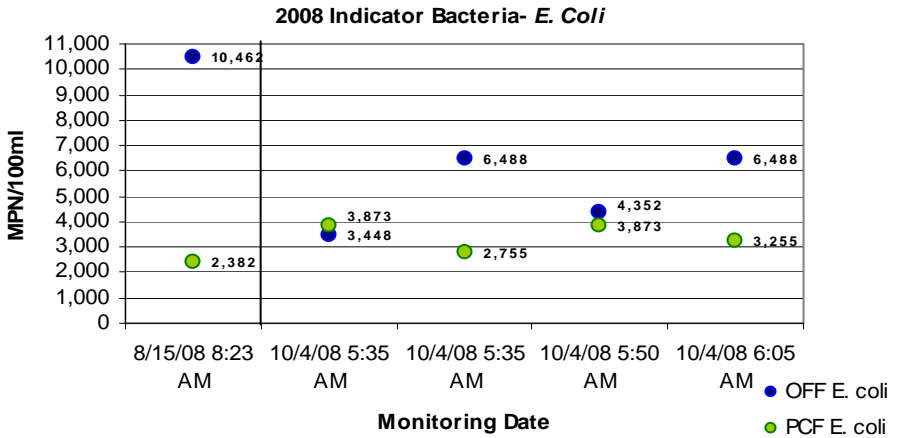
OFF: Concrete culvert at the end of Marina Street along the Embarcadero near the Marina Square Building

NTD: PVC culvert at the southern edge of Tidelands Park along the Embarcadero

ROS: Concrete culvert at the end of Front Street between Rose's Landing and Embarcadero Grill, on the south side of the dock

Bacteria

Bacteria tests are used to estimate the concentration of pathogenic bacteria in stormwater runoff. *E. coli* is an indicator of fecal contamination, which can come from human or animal sources. While there are no specific regulatory limits or targets for bacteria in stormwater, the limit for swimming safely in lakes, rivers or the ocean is 235 MPN/100 mL. The lowest bacteria level of the season was still ten times the level safe for swimming.

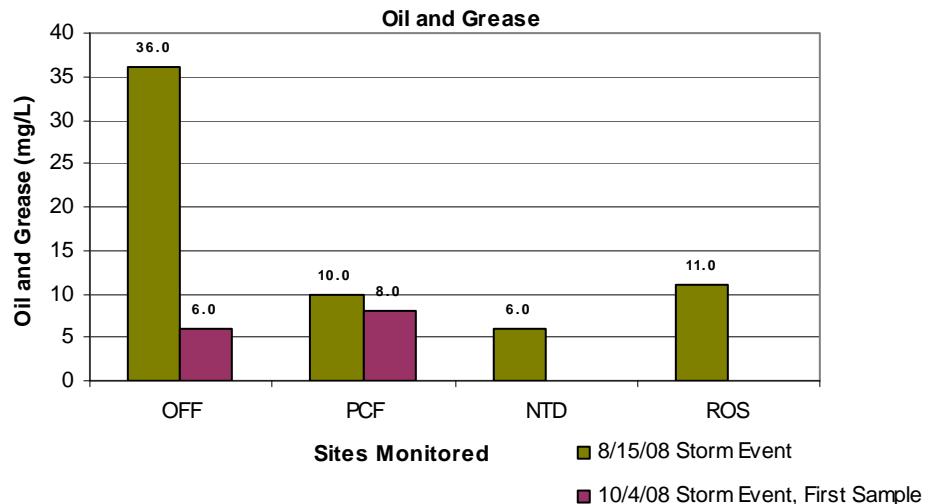


Oil and Grease

Oil and grease can come from a broad range of natural and man-made sources. Oily eucalyptus leaves, leaky automobile engines, and dishwashing or car washing soaps all contain oil and grease.

During the October storm, additional tests were run to determine if a portion of the 'oil' was from gasoline. The results did not indicate gasoline as a major source of the oils detected in the stormwater.

Interestingly, oil and grease was detected only in the first of the four samples. This indicates that oil and grease are likely mobilized and flushed through the system early in the storm.



How do we clean this water up?

1. Don't wash your car in your driveway.

Oil and grease from carwash soaps, copper from brake dust, zinc from tires, and phosphates from soaps will all go straight to the stormdrains. If you take your car to a coin wash or commercial car wash, the wash water is treated onsite to remove pollutants.

2. Avoid applying fertilizer to lawns and gardens right before a rain storm.

There's no way to know if it will rain a half an inch or three inches. Apply fertilizer when you can control the amount of watering and runoff through an irrigation system.

3. Support street sweeping efforts by your city or community services district.

Street sweeping literally vacuums up stormwater pollutants. Sweeping removes not only large pieces of litter (like cigarette butts or food wrappers) but can also retain smaller particles from automotive wear and tear.