Willamette River Foam Investigation – December 11, 2012

Overview

Foam on surface water can come from several of sources including decomposing leaf litter, aquatic organisms such as phytoplankton and diatoms, and detergents which can collect in storm water or pass through wastewater treatment plants and wash into waterways.

Identifying and precisely apportioning which sources are responsible for surface foam is difficult because there is may be a combination of factors responsible for foaming. Sufficient data to demonstrate the relative contributions of sources requires multiple sampling events over time and is costly to obtain. However, water quality data is essential for understanding and identifying serious problems that may be detrimental to aquatic life and other beneficial water uses.

What was done?

On December 11, 2012 staff from the Oregon DEQ laboratory in Hillsboro collected water quality samples to investigate foam accumulations on the surface of the Willamette River. The samples were collected off a boat ramp at Jon Storm Park on the Willamette River just upstream from the mouth of the Clackamas River (Figure 1).

Figure 1 Water quality sampling location at Jon Storm boat ramp.

The location was selected because it provided good access to the Willamette River and to foam that was accumulating on the surface (Figure 2). The boat ramp

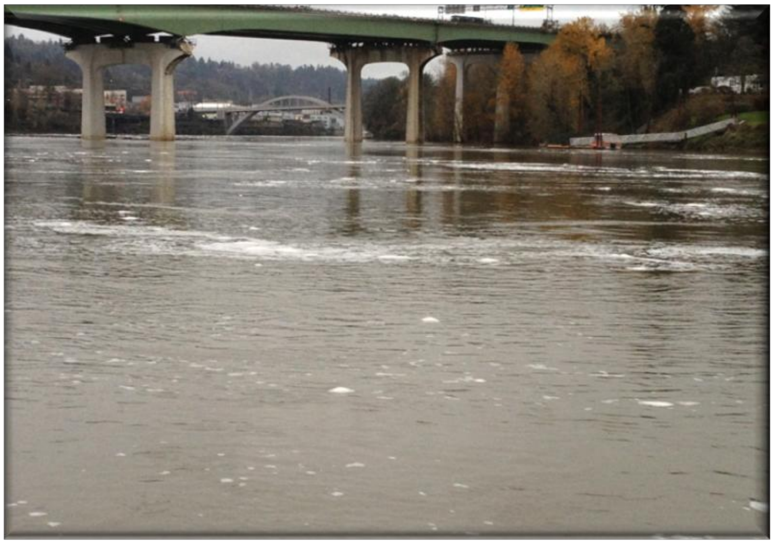

Figure 2 Foam accumulations on the surface of the Willamette River downstream of Willamette Falls. The highway 205 overpass is visible in the background.

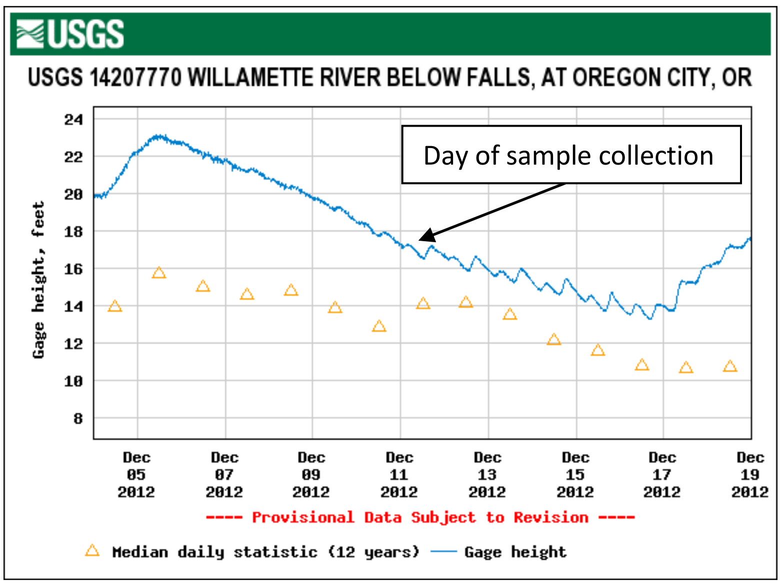

Figure 3 Flow on the Willamette River for the two week period around the sampling event (http://waterdata.usgs.gov/or/nwis/rt).

is located approximately 1.5 miles downstream of Willamette Falls. At the time of sampling the river was running 3 feet above the 12 year median height for the day (Figure 3). It is notable that the river stage was up to 7 feet above the 12 year average in the week prior to sampling.

A sample of the water and the foam was collected for ***conventional water quality parameters*** including water temperature, dissolved oxygen, pH, turbidity, conductivity and nutrients (nitrogen and phosphorus). These are fundamental measurements that are useful for understanding the general condition of the water.

In addition, we measured ***additional water quality parameters*** that can be indicators of foam generation. Those were: Total Organic Carbon, Dissolved Organic Carbon, Tannins and Lignins, Surfactants, and Diatoms. Each of these parameters is potentially useful for understanding what the source of foam accumulation could be.

Results

Conventional water quality parameters

Parameter	*Units*	*Result*
Water Temperature	*°C*	*8.7*
Dissolved Oxygen	*% saturation*	*113*
pH	*pH units*	*7.2*
Turbidity	*NTU*	*19*
Conductivity	*µmhos/cm*	*61*
Nutrients (Ammonia)	*mg/L*	*0.021*
Orthophosphate	*mg/L*	*0.03*

Additional water quality parameters

Parameter	*Units*	*Result*
Total Organic Carbon	*mg/L*	*2.1*
Dissolved Organic Carbon	*mg/L*	*2.3*
Tannins and Lignins	*mg/L*	*Non-detect*
Surfactants	*mg/L*	*Non-detect*
Phytoplankton	*#/mL*	*331*


Figure 4 Foam piling up on boat ramp.

Discussion

The location and conditions at the time of sampling were optimal. Foam accumulating on the boat ramp provided easy access for sampling to characterize the water quality (Figure 4 & 5). The foam collected in mats along current eddies as it drifted downstream (Figure 6). The foam on the side of the ramp appeared cream colored with brownish streaks running through it (Figure 7). Water quality results did not suggest anything unusual about the water quality. The dissolved oxygen levels were high, which is normal, below falls where gas is forced into the water column. The water temperature and pH were also within the normal range. The turbidity, or clarity of the water, was slightly elevated but not atypical given the heavy rain preceding the sampling event. Ammonia is lower than two other sampling events that occurred in the same area at different times of year and generally unremarkable. Orthophosphate is low. Total Organic Carbon should be less than Dissolved Organic Carbon (DOC) but the values are both low and within the precision of the measurement. DOC is slightly higher than one other measurement taken at the same location at a different time. Lignins, tannins and surfactants were not found in the samples. Phytoplankton densities were low.

Figure 5 Foam collected in a sample jar for phytoplankton analysis.

Figure 6 Foam mats collecting in eddies looking downstream.

The two most abundant species in the samples were *Cocconeis placentula* and *Achnanthes minutissima* (Figure 8). *Cocconeis placentula* is a commonly occurring species in rivers and streams and is usually attached to the stream bottom. It may have been present in our samples because it was scoured off of rocks at Willamette Falls or swept off the bottom below Willamette Falls. Similarly, *Achnanthes minutissima* is typically attached to the bottom. Taken together, the water quality information and the phytoplankton look essentially normal for the time of year the samples were collected. While the data does not resolve the cause of the foam,

Figure 7 White foam with brown streaks running through it.

it does help to rule out some potentially detrimental pollutants.

Conclusions

The information collected from this investigation indicates that the most likely cause remains the turbulent aeration of organic materials like leaves, algae, aquatic plants and storm water runoff at the base of Willamette Falls during the first heavy rains in fall season, not from soap or detergent pollution. Flows were well above average in the time period preceding this event and the collection site is approximately 1.5 miles downstream of Willamette Falls. Foam is often observed in natural waters that results from turbulence and unidentified organic matter (Hutchinson 1957). Similar foaming phenomenons are documented in other areas under similar conditions, at the same time of year (Fuller, D. 2003). Based on the findings of this investigation ODEQ Laboratory staff feel that no further investigation is warranted at this time.

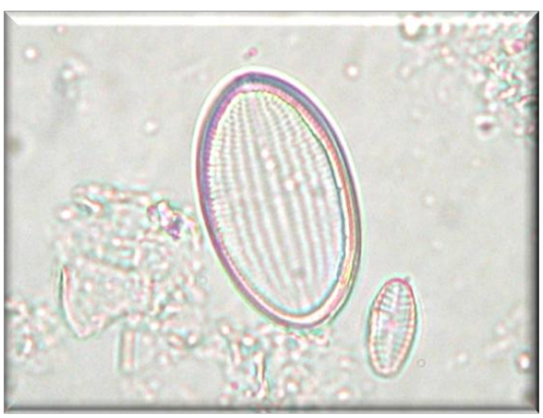

Figure 8 Cocconeis placentula and Achnanthes minutissima the most abundant diatoms found in the samples (http://commons.wikimedia.org/wiki/File:Cocconeis_placentula.jpeg.)

References:

Hutchinson, G. Evelyn. 1957. A Treatis on Limnology, Volume I. John Wiley and Sons, Inc. New York. Pages 899-900.

Fuller, D. 2003. The occurrence of foam on lakes and streams. Great Lakes Environmental Directory, 394 Lake Ave. S. Suite #222, Duluth, MN 55802. (http://www.arrialaska.org/foam-in-streams.html)

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