Regional Water Quality NEWSLETTER

DATE: Report for November 2011

A Tempe, Glendale, Peoria, Chandler, CAP, SRP, Arizona American Water– ASU Regional Water Quality Partnership

http://enpub.fulton.asu.edu/pwest/tasteandodor.htm

Sampling dates: October 31 & November 1, 2011

SUMMARY: EVALUATION AND RECOMMENDATIONS

1. MIB levels remain elevated in the Salt River water supply now being used – around 15 ng/L. MIB plus geosmin levels are above 10 ng/L – levels noticeable to consumers.

2. Good news – City of Phoenix plans to rejoin our regional water quality effort in 2012 with a desire to focus on effects of the Wallow fires on TOC in the Salt River system. Also, City of Tempe has volunteered to assist with THM analysis to understand which size fractions are responsible for THM formation, and how each unit process can be optimized and selected to synergistically improve removal of each size fraction. Look for this data from us in 2012.

3. We hope to start discussion around a fairly new water quality monitoring tool – based upon UV/VIS spectroscopy (S::can). We want to hear your stories and ideas on how to use this technology.

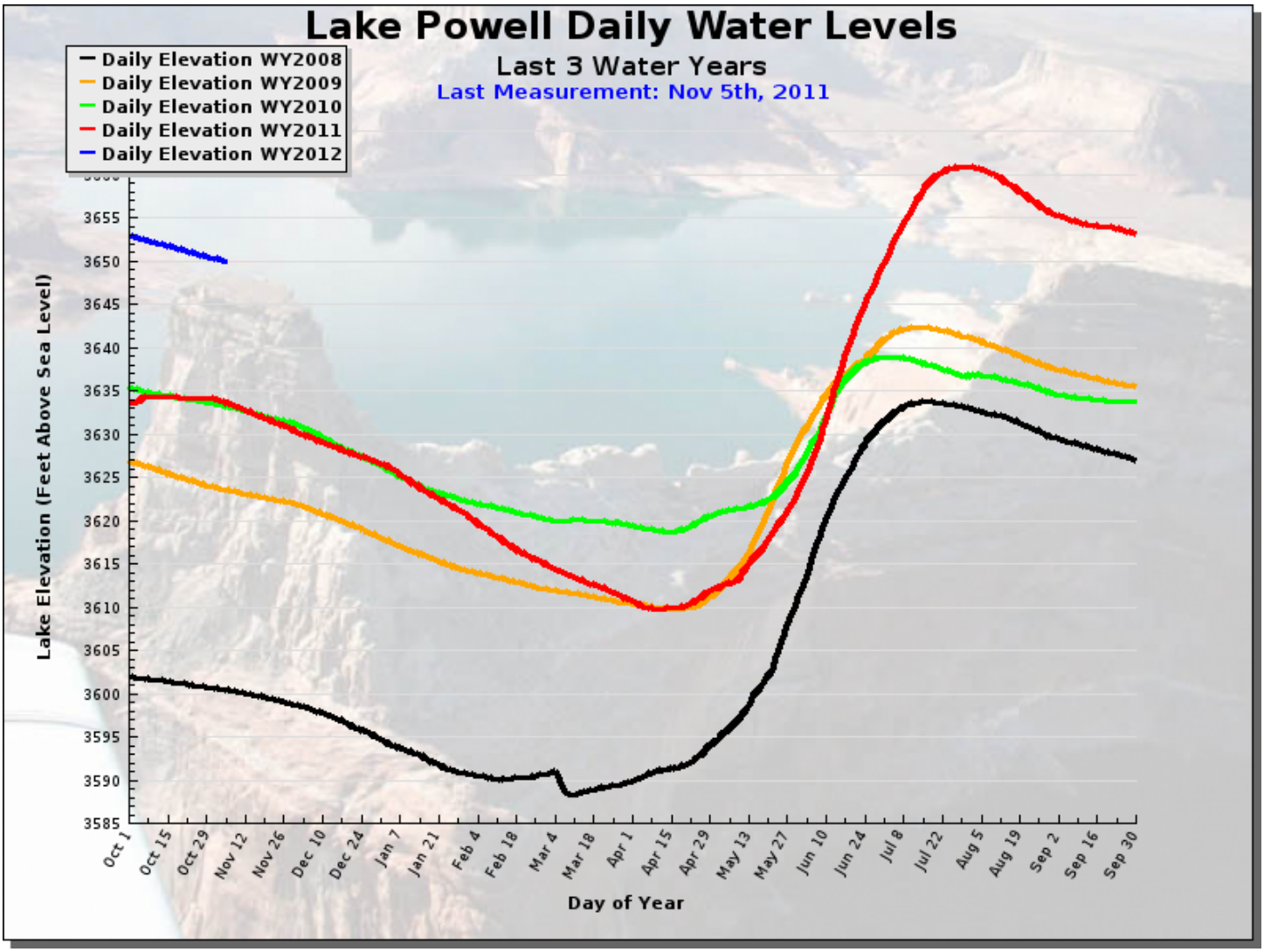
Quick Update of Water Supplies for October 2011
(during day of sampling – October 31, 2011)

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	**MIB** * Concentration (ng/L)	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 71% full	884 cfs	413 cfs into **Arizona Canal**	**20 ng/l [15 ng/L]**	5.0 mg/L
Verde River	Reservoirs At 30% full	125 cfs	569 cfs into **South Canal (88% Salt River Water)**	**23 ng/L [23 ng/L]**	3.7 mg/L
Colorado River	Lake Pleasant is 45% full (Lake Powell is 70% full)	2082 cfs from Colorado River (Lake Pleasant NOT releasing water)	9 cfs of **CAP water** into Arizona Canal	**4 ng/L**	3.4 mg/L
Groundwater	Generally increasing due to recharge	84 cfs pumping by SRP	84 cfs **Groundwater Pumping** into SRP Canals	--	0.5 to 1 mg/L

***Concentration of these taste and odor compounds in the upper [lower] levels of the terminal reservoir (Saguaro Lake on the Salt River; Bartlett Lake on the Verde River; Lake Pleasant on the CAP system
****Concentration of DOC in the terminal reservoir
Data from the following websites:

- http://www.srpwater.com/dwr/
- http://www.cap-az.com/Operations/LakePleasantOps.aspx

Water levels in Lake Powell on the Colorado River



Taste and Odor Data

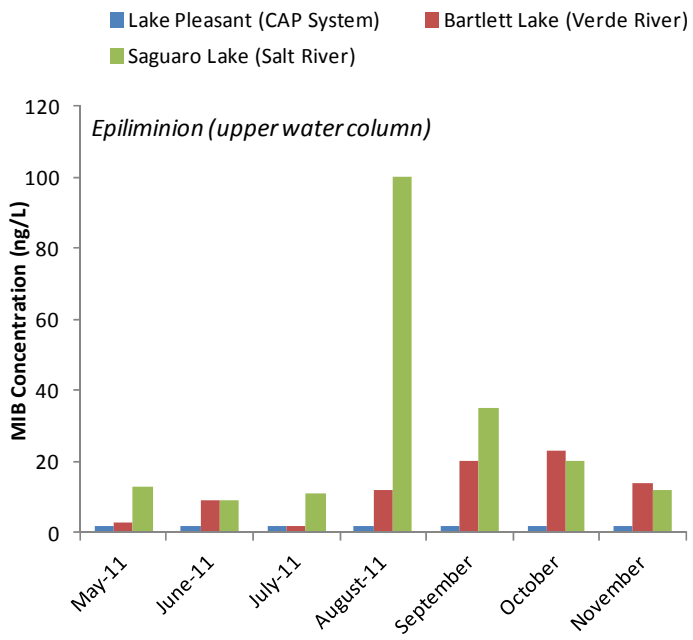
MIB plus geosmin levels above 10 ng/L in finished water lead to noticeable earthy-musty odors by customers. Currently MIB+geosmin levels are above 10 ng/L in the canals.

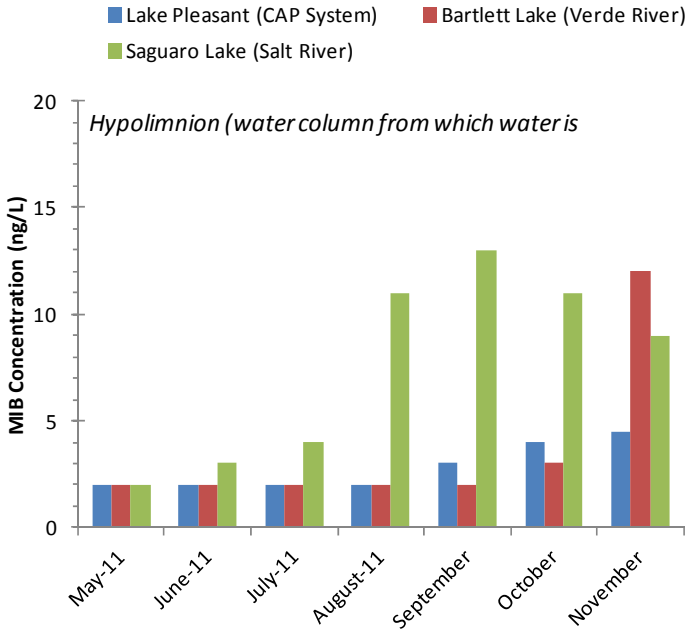
Water Supply Sources

Reservoir Samples – November 2, 2011

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (October 11)	Eplimnion	**<2.0**	**<2.0**	**6.1**
Lake Pleasant (October 11)	Hypolimnion	**4.5**	**<2.0**	**<2.0**
Verde River @ Beeline		**8.2**	**7.9**	**<2.0**
Bartlett Reservoir	Epilimnion	**13.1**	**2.6**	**<2.0**
Bartlett Reservoir	Epi-near dock	**14.1**	**2.3**	**<2.0**
Bartlett Reservoir	Hypolimnion	**12.2**	**2.6**	**<2.0**
Salt River @ BluePt Bridge		**7.8**	**3.0**	**<2.0**
Saguaro Lake	Epilimnion	**12.2**	**2.9**	**<2.0**
Saguaro Lake	Epi - Duplicate	**10.3**	**2.0**	**<2.0**
Saguaro Lake	Epi-near dock	**13.0**	**2.9**	**<2.0**
Saguaro Lake	Hypolimnion	**8.6**	**2.5**	**<2.0**
Lake Havasu (October 11)		**2.0**	**4.4**	**<2.0**
Verde River at Tangle Creek (September 11)		**34.4**	**4.7**	**<2.0**

The lakes are completely thermally destratified – which has lead to mixing with depth of MIB and geosmin, such that MIB and geosmin are exiting the reservoirs through the bottom release gates in Bartlett and Saguaro Lakes. This is leading to high MIB levels in the SRP system, as predicted last month. Fortunately, MIB also biodegrades in the reservoir at a rate of about 1 ng/L/day. This degradation can be observed in Saguaro Lake starting in late August, and Bartlett Lake start in september / october.





MIB levels in canals and removal within WTPs are presented below. Canal water MIB levels are borderline noticable to consumers, and WTPs are using ozone and/or activated carbon effectively to remove these taste and odor compounds.

Table 2 - Water Treatment Plants – October 31, 2011

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	3.1	4.9	14.2
Union Hills Treated	2.2	4.7	<2.0
Tempe North Inlet	13.8	7.7	3.2
Tempe North Plant Treated	3.2	<2.0	<2.0
Tempe South WTP	4.7	2.3	<2.0
Tempe South Plant Treated	2.3	<2.0	<2.0
Anthem Inlet	<2.0	3.5	2.2
Anthem Treated	<2.0	3.0	<2.0
Chandler Inlet	6.6	3.7	2.1
Chandler Treated	5.5	4.0	<2.0
Greenway WTP Inlet	5.0	2.5	<2.0
Greenway WTP Treated	2.7	2.1	<2.0
Glendale WTP Inlet	12.8	2.3	<2.0
Glendale WTP Treated	<2.0	<2.0	<2.0

Table 3 - Canal Sampling –October 31, 2011

System	Sample Description			
CAP	Waddell Canal	<2.0	5.9	<2.0
	Union Hills Inlet	3.1	4.9	14.2
	CAP Canal at Cross-connect	<2.0	4.7	7.1
	Salt River @ Blue Pt Bridge	7.8	3.0	<2.0
	Verde River @ Beeline	8.2	7.9	<2.0
AZ	AZ Canal above CAP Cross-connect			
Canal	AZ Canal below CAP Cross-connect	9.1	4.8	<2.0
	AZ Canal at Highway 87	9.5	5.2	3.2
	AZ Canal at Pima Rd.	8.0	4.3	<2.0
	AZ Canal at 56th St.	11.8	7.4	<2.0
	AZ Canal - Central Avenue	10.5	6.6	<2.0
	AZ Canal - Inlet to Glendale WTP	12.8	5.3	<2.0
	Head of the Consolidated Canal	6.9	4.6	<2.0
	Middle of the Consolidated Canal	6.2	5.4	<2.0
South	South Canal below CAP Cross-connect	7.3	5.6	<2.0
Tempe	Head of the Tempe Canal	8.3	5.8	<2.0
Canals	Tempe Canal - Inlet to Tempe's South Plant	4.7	2.3	<2.0

Organic Matter Update

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant - Oct 2011	Eplimnion	3.2	0.0547	1.7	0.5
Lake Pleasant - Oct 2011	Hypolimnion	3.4	0.0454	1.3	0.5
Verde River @ Beeline		1.7	0.0441	2.6	0.3
Bartlett Reservoir	Epilimnion	2.5	0.0532	2.1	0.3
Bartlett Reservoir	Hypolimnion	2.6	0.0565	2.2	0.3
Salt River @ BluePt Bridge		4.1	0.0810	2.0	0.3
Saguaro Lake	Epilimnion	4.2	0.0772	1.8	0.3
Saguaro Lake	Epi - Duplicate	4.1	0.0778	1.9	0.2
Saguaro Lake	Hypolimnion	4.7	0.0804	1.7	0.5
Verde River at Tangle	Sep-11	1.0	0.0332		0.2
Havasu	Oct-11	2.7	0.0464	1.7	0.5

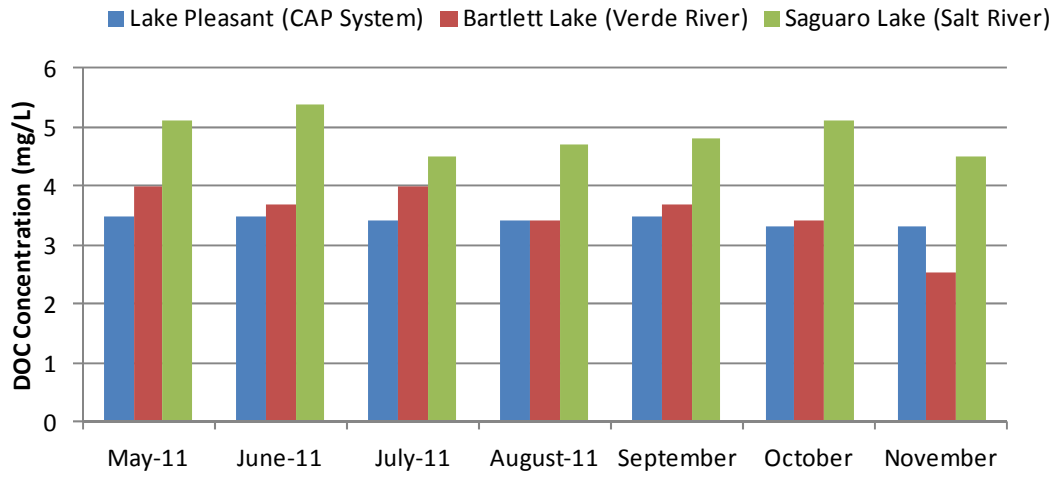
Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	2.8	0.0461	1.6	0.4
Anthem WTP Inlet	2.8	0.0461	1.7	0.4
Union Hills Inlet	2.9	0.0467	1.6	0.4
CAP Canal at Cross-connect	3.3	0.0509	1.5	0.5
Salt River @ Blue Pt Bridge	4.1	0.0810	2.0	0.3
Verde River @ Beeline	1.7	0.0441	2.6	0.3
AZ Canal above CAP Cross-connect				
AZ Canal below CAP Cross-connect	3.6	0.0749	2.1	0.2
AZ Canal at Highway 87	3.7	0.0735	2.0	0.2
AZ Canal at Pima Rd.	3.9	0.0741	1.9	0.3
AZ Canal at 56th St.	3.7	0.0722	1.9	0.4
AZ Canal - Inlet to 24th Street WTP				
AZ Canal - Central Avenue	3.7	0.0727	2.0	0.3
AZ Canal - Inlet to Deer Valley WTP				
AZ Canal - Inlet to Glendale WTP	3.6	0.0695	2.0	0.8
AZ Canal - Inlet to GreenwayWTP	3.7	0.0741	2.0	0.3
South Canal below CAP Cross-connect	3.7	0.0724	2.0	0.2
South Canal at Val Vista WTP				
Head of the Tempe Canal	3.7	0.0736	2.0	0.2
Tempe Canal - Inlet to Tempe's South Plant	3.7	0.0719	2.0	0.2
Head of the Consolidated Canal	3.7	0.0717	2.0	0.2
Middle of the Consolidated Canal	3.4	0.0673	2.0	0.5
Chandler WTP – Inlet	3.4	0.0675	2.0	0.7

Organics at the Water Treatment Plants

Table 2 - Water Treatment Plants –October 31, 2011

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN		DOC removal (%)
Union Hills Inlet	2.9	0.0467	1.6	0.4		
Union Hills Treated	2.4	0.0265	1.1	0.3		18
Tempe North Inlet	3.8	0.0727	1.9	0.4		
Tempe North Plant Treated	2.1	0.0282	1.3	0.3		43
Tempe South WTP	3.7	0.0719	2.0	0.2		
Tempe South Plant Treated	2.2	0.0322	1.4	0.2		39
Greenway WTP Inlet	3.7	0.0741	2.0	0.3		
Greenway WTP Treated	2.6	0.0258	1.0	1.4		31
Glendale WTP Inlet	3.6	0.0695	2.0	0.8		
Glendale WTP Treated	2.3	0.0324	1.4	0.3		35
Anthem WTP Inlet	2.8	0.0461	1.7	0.4		
Anthem WTP Treated	2.5	0.0421	1.7	0.4		10
Chandler WTP Inlet	3.4	0.0675	2.0	0.7		
Chandler WTP Treated	2.8	0.0473	1.7	0.6		18

DOC = Dissolved organic carbon
UV254 = ultraviolet absorbance at 254 nm (an indicator of aromatic carbon content)
SUVA = UV254/DOC
TDN = Total dissolved nitrogen (mgN/L)



Ask the Experts – Follow-up from the Workshop

On-line Sensors

S::can is essentially a UV and/or vis spectrometric probe that is placed in individual water samples or in-line. It collects data similar to a UV/vis spectrophometer (Figure 2), and then analyzes the slope of this data (also called a first order derivative; Figure 3). The slope approach essentially normalizes the data. You can use internal calibrations, but also can calibrate with your own datasets such that this single, reagentless sensor can provide data on nitrate, turbidity, algae, TOC, UV 254 and other parameters of interest. Several local cities have tried out the S::can technology. Our research group has been working with City of Portland, Clancy Consulting and S::can to try to correlate Crypto recovery (from spikes for EPA monitoring requirements) with changes in water quality – and have had good success. Our group was also recently awarded a new EPA project for small drinking water systems where we will purchase a S::can system and validate its ability to be used for remote performance monitoring.

What is your experience with S::can? Do you see it to be a useful monitoring system?

Figure 1 – S::can probe

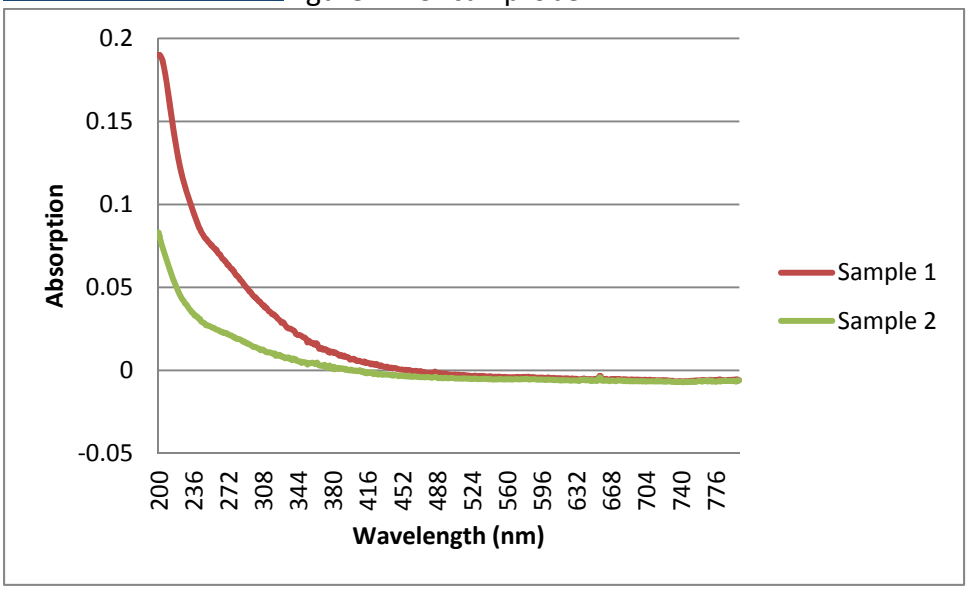


Figure 2 – typical UV/VIS scan from a traditional spectrophotometer

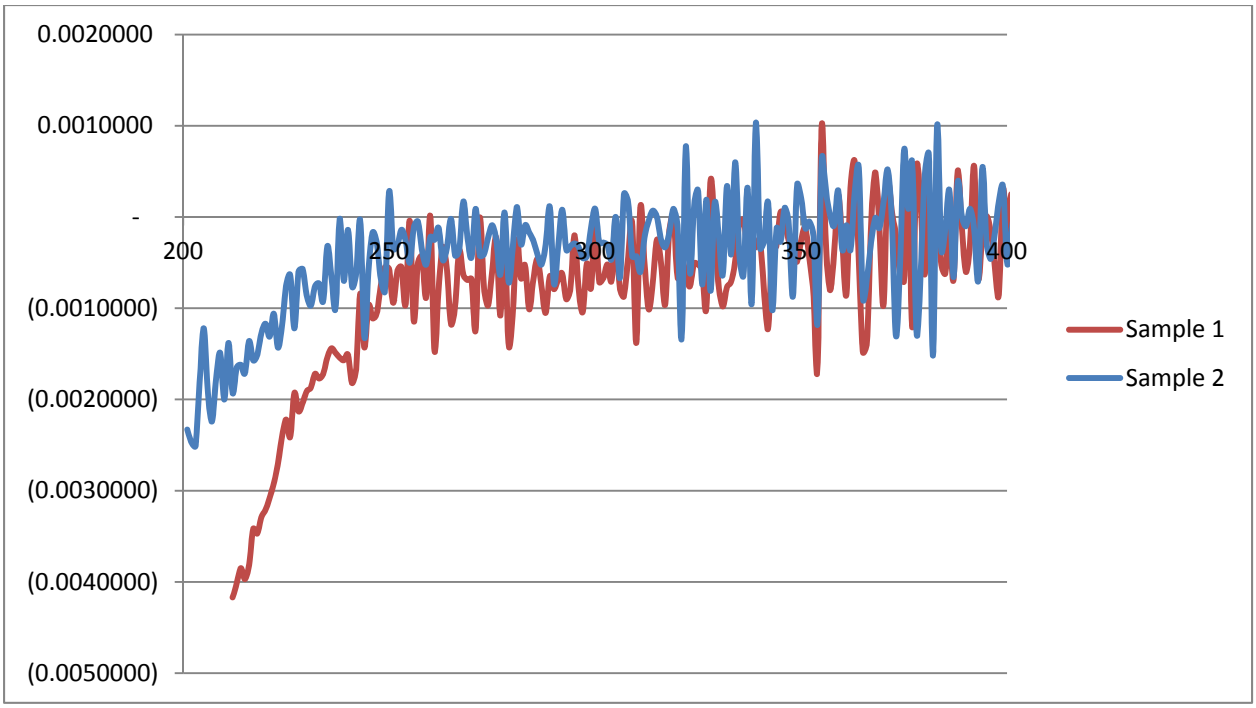


Figure 3 – typical first order derivative using 1 nm internvales. Peaks provide information on changes in water quality.