REGIONAL WATER QUALITY NEWSLETTER

DATE: Report for December 2012 A Tempe, Glendale, Peoria, Chandler, Phoenix, ADEQ, CAP, SRP, Epcor ASU Regional Water Quality Partnership

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

SUMMARY: EVALUATION AND RECOMMENDATIONS

- 1. MIB and geosmin levels dropped significant from earlier this year where peak concentrations in the reservoirs were 75 to 100 ng/L. Currently levels are < 10 ng/L and decreasing since our last sampling event. The exception is Lake Pleasant which has MIB and geosmin levels on the increase; fortunately, though, Lake Pleasant is being filled with Colorado River water and CAP water is not impacted by Lake Pleasant MIB levels currently.
- 2. Dissolved organic carbon (DOC) levels are at the lowest point in a few years mostly because of low runoff (few monsoons) on the Verde River. Higher levels of DOC over the past few years have been working their way through the series of Salt River reservoirs. Our quarterly sampling of the Salt River reservoirs show no noticable elevated levels of DOC due to the Wallow Fire. UV-VIS spectroscopy and fluorescence analysis of organic matter in these lakes show very little difference, which further suggests there are no hidden "pulses" of organics due to the Wallow Fire anywhere in the series of Salt River reservoirs.
- 3. MIB levels are higher in up-stream Salt River reservoirs (compared with Saguaro Lake). Of all the Salt River reservoirs, this quarter, Saguaro lake has the lowest levels of dissolved nitrogen or total phosphorous. Higher levels in upstream reservoirs could be associated with Wallow Fire and may suggest next year could have higher levels of MIB in Saguaro Lake and algae related DOC, because these nutrients spur on growth of algae.

4. Feedback from Last month:

- The on-line THM analyzer (AMS THM-100) was tried by 2 cities. It seems to track grab samples well. One concern was the consumption and cost of chemical reagents. Looks like City of Phoenix may install one on a distribution reservoir.
- GAC in the Valley looks like we have over 18 million pounds of installed GAC. Scottsdale Chapparal plant is regenerating the most frequently (around once every 60-90 days). Some of Phoenix plants are ~ once per 10 months and they are working towards timing to curb summer/fall peak THM season by stagginger replacement frequency/timing. A small group of us are trying to initiate a Water Research Foundation tailored collaboration around GAC, focused on novel applications of pre-oxidation prior to GAC and regeneration frequency effects on THM control. Let me know if you are interested in collaborating if this moves forward.

Quick Update of Water Supplies for December 2012 (during day of sampling – December 5th)

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 52% full	384 cfs	388 cfs into Arizona	4.1 mg/L
Verde River	Reservoirs At 32% full	115 cfs	Canal 73 cfs into South Canal (77% Salt River Water)	2.3 mg/L
Colorado River	Lake Pleasant is 55% full (Lake Powell is 54% full)	Lake Pleasant filling; direct Colorado River water is in the CAP canal	0 cfs of CAP water into Arizona Canal	2.8 mg/L
Groundwater	Generally increasing due to recharge	123 cfs pumping by SRP	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

*** On paper cities are receiving CAP water in the SRP canals, but as a method of "paying back" from the last drought for excess CAP deliveries – SRP is delivering wet water only from the Salt and Verde Rivers Data from the following websites:

- http://www.srpwater.com/dwr/
- <u>http://www.cap-az.com/Operations/LakePleasantOps.aspx</u>
- http://lakepowell.water-data.com/



Dissolved Organic Carbon In Reservoirs and Treatment Plants

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)

Reservoir Samples

Table 4 - Reservoir Samples – December 06, 2012

Reservoir sampling conducted monthly. CAP is sampling Lake Pleasant and Havasu, and USGS is sampling Verde River at Tangle and Salt River above Roosevelt on slightly different days than the other reservoirs.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg- m)	TDN
Havasu		2.7	0.046	1.7	0.4
Laka Diagont	Epilimnion	2.9	0.046	1.6	0.4
	Hypolimnion	3.1	0.046	1.5	0.4
Verde River (November)	@ Tangle	0.7	0.017	2.6	0.1
Verde River	@ Beeline Hwy	1.5	0.041	2.8	0.4
Doutlott Deservoir	Epilimnion	2.2	0.052	2.3	0.3
	Hypolimnion	2.4	0.051	2.1	0.3
Salt River above Roosevelt	above Roosevelt	col	lect by USGS f	ollowing rain ev	rent
	Epilimnion	3.9	0.065	1.7	0.4
Saguaro Lake	Epi - Duplicate	4.3	0.068	1.6	0.5
	Hypolimnion	3.8	0.066	1.7	0.4
Salt River	@ Blue PointBridge	Not releasing from Saguaro Dam			n

Organic Matter in Canal Table 3 - Rivers and Canals –December 05, 2012

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg- m)	TDN
Waddell Canal		Not avai	lable	
Anthem WTP Inlet	3.8	0.050	1.3	0.5
Union Hills Inlet	2.7	0.044	1.7	0.4
CAP Salt-Gila Pump Station	2.9	0.047	1.6	0.5
CAP Mesa Turnout	2.7	0.047	1.7	0.4
CAP Canal at Cross-connect		No flo	OW	
Salt River @ Blue Pt Bridge	Not	releasing fron	n Saguaro Dam	
Verde River @ Beeline	1.5	0.041	2.8	0.4
AZ Canal above CAP Cross-connect		Not avai	lable	
AZ Canal below CAP Cross-connect	3.0	0.058	1.9	0.4
AZ Canal at Highway 87	3.0	0.062	2.1	0.4
AZ Canal at Pima Rd.	3.1	0.060	1.9	0.3
AZ Canal at 56th St.	2.9	0.058	2.0	0.5
AZ Canal - Central Avenue	2.6	0.056	2.1	0.5
AZ Canal - Inlet to Glendale WTP	2.4	0.054	2.3	2.0
AZ Canal - Inlet to GreenwayWTP	1.8	0.039	2.1	1.4
South Canal below CAP Cross-connect	3.0	0.059	2.0	0.4
Head of the Tempe Canal	1.3	0.042	3.2	0.3
Tempe Canal - Inlet to Tempe's South Plant	0.9	0.018	1.9	1.9
Head of the Consolidated Canal	Offline			
Middle of the Consolidated Canal	0.6	0.015	2.5	2.7
Chandler WTP – Inlet		Offlin	ne	

Organics at the W	ater Treatment	Plants
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Table 2 -	- Water	Treatment	Plants -	Decer	nber (05.	2012

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg- m)	TDN
Union Hills Inlet	2.7	0.044	1.7	0.4
Union Hills Treated	2.3	0.022	0.9	0.4
Tempe North Inlet	2.9	0.058	2.0	0.5
Tempe North Plant Treated	1.8	0.025	1.4	0.5
Tempe South Inlet (1st day back online)	0.9	0.018	1.9	3.4
Tempe South Plant Treated	0.4	0.003	0.8	4.2
Greenway WTP Inlet	1.8	0.039	2.1	1.4
Greenway WTP Treated	1.1	0.013	1.2	2.5
Glendale WTP Inlet	2.4	0.054	2.3	2.0
Glendale WTP Treated	1.9	0.027	1.5	1.4
Anthem WTP Inlet	3.8	0.050	1.3	0.5
Anthem WTP Treated	2.7	0.045	1.7	0.4
Chandler WTP Inlet		Offli	ne	_
Chandler WTP Treated		0111		

N	DOC
	removal (%)
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Taste and Odor

MIB, Geosmin and Cyclocitral are compounds naturally produced by algae in our reservoirs and canals, usually when the water is warmer and algae are growing/decaying more rapidly. They are non toxic, but detectable to consumers of water because of their earthy-musty-moldy odor. The human nose can detect these in drinking water because the compounds are semi-volatile. Since compounds are more volatile from warmer water, these tend to be more noticable in the summer and fall. The human nose can detect roughly 10 ng/L of these compounds. Our team collects samples from the water sources and raw/treated WTP samples. We usually present all the data when concentrations start to exceed 5 ng/L.

- Data for this month on the next page
- As usual for December, the elevated MIB & geosmin season has ended. In the canals and treatment plants the levels are < 10 ng/L. This is down from the high teens in early November 2012.
- Lake Pleasant is filling with Colorado River water and actually has the highest levels of year.
- Saguaro Lake had peak MIB levels of 75 ng/L in July 2012 and ~20 to 30 ng/L through November.
- Bartlett Lake had peak MIB levels of 100 ng/L in July and ~20 to 30 ng/L through November.

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	<2.0	<2.0	<2.0
Union Hills Treated	<2.0	<2.0	<2.0
Tempe North Inlet	4.9	<2.0	<2.0
Tempe North Plant Treated	3.7	<2.0	<2.0
Tempe South WTP	3.2	<2.0	<2.0
Tempe South Plant Treated	<2.0	<2.0	<2.0
Anthem Inlet	<2.0	<2.0	<2.0
Anthem Treated	<2.0	<2.0	<2.0
Chandler Inlet			
Chandler Treated			
Greenway WTP Inlet	<2.0	<2.0	<2.0
Greenway WTP Treated	<2.0	<2.0	<2.0
Glendale WTP Inlet	2.6	<2.0	<2.0
Glendale WTP Treated	<2.0	<2.0	<2.0

 Table 2 - Water Treatment Plants – December 4, 2012

Table 3 - Canal Sampling – December 4, 2012

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal			
	Union Hills Inlet	<2.0	<2.0	<2.0
	CAP Canal at Cross-connect			
	Salt River @ Blue Pt Bridge	<2.0	<2.0	<2.0
	Verde River @ Beeline	4.7	<2.0	<2.0
AZ	AZ Canal above CAP Cross- connect			
Canal	AZ Canal below CAP Cross-	1		
	connect	4.7	<2.0	<2.0
	AZ Canal at Highway 87	4.7	<2.0	<2.0
	AZ Canal at Pima Rd.	5.9	<2.0	<2.0
	AZ Canal at 56th St.	4.6	<2.0	<2.0
	AZ Canal - Central Avenue	3.9	<2.0	<2.0
	AZ Canal - Inlet to Glendale	1		
	WTP	2.6	<2.0	<2.0
	Head of the Consolidated Canal			
	Middle of the Consolidated Canal	2.5	<2.0	<2.0
South	South Canal below CAP Cross-			
	connect	4.7	<2.0	<2.0
Tempe	Head of the Tempe Canal	<2.0	<2.0	<2.0
Canals	Tempe Canal - Inlet to Tempe's	1		
	South Plant	3.2	<2.0	<2.0
	Mesa Turnout (Nov)	3.8	5.3	<2.0
	Mesa Turnout	2.5	<2.0	<2.0
	Salt-Gila Pump Nov)	3.5	5.2	<2.0
	Salt-Gila Pump	2.9	<2.0	<2.0

Sample Description	Location	MIB	Geosmin (ng/L)	Cyclocitral
		(ng/L)		(ng/L)
Lake Pleasant (Nov)	Eplimnion	3.4	2.6	<2.0
Lake Pleasant (Nov)	Hypolimnion	3.4	3.4	<2.0
Lake Pleasant	Eplimnion	6.6	2.8	<2.0
Lake Pleasant	Hypolimnion	3.0	<2.0	<2.0
Verde River @ Beeline		4.7	<2.0	<2.0
Bartlett Reservoir	Epilimnion	<2.0	<2.0	<2.0
Bartlett Reservoir	Epi-near dock	<2.0	2.1	<2.0
Bartlett Reservoir	Hypolimnion	<2.0	<2.0	<2.0
Salt River @ BluePt Bridge		<2.0	<2.0	<2.0
Saguaro Lake	Epilimnion	5.9	<2.0	<2.0
Saguaro Lake	Epi -			
	Duplicate	5.1	<2.0	<2.0
Lake Havasu (Nov)		2.9	2.4	<2.0
Lake Havasu		2.6	2.2	<2.0
Verde River at Tangle Creek		2.5	<2.0	<2.0
Roosevelt at Salt River Inlet		<2.0	<2.0	<2.0

Table 4 - Reservoir Samples – December 4, 2012

Data from Quartterly Sampling

- Dissolved organic carbon (DOC) levels are at the lowest point in a few years mostly because of low runoff (few monsoons) on the Verde River. Higher levels of DOC over the past few years have been working their way through the series of Salt River reservoirs. Our quarterly sampling of the Salt River reservoirs show no noticable elevated levels of DOC due to the Wallow Fire. UV-VIS spectroscopy and fluorescence analysis of organic matter in these lakes show very little difference, which further suggests there are no hidden "pulses" of organics due to the Wallow Fire anywhere in the series of Salt River reservoirs.
- 2. MIB levels are higher in up-stream Salt River reservoirs (compared with Saguaro Lake). Of all the Salt River reservoirs, this quarter, Saguaro lake has the lowest levels of dissolved nitrogen or total phosphorous. Higher levels in upstream reservoirs could be associated with Wallow Fire and may suggest next year could have higher levels of MIB in Saguaro Lake and algae related DOC, because these nutrients spur on growth of algae.

Sample			MIB	Geosmin	Cyclocitral	Total Phoshporus
Description	Location	Location	(ng/L)	(ng/L)	(ng/L)	(ug/L)
Lake Roosevelt	Site 1	Eplimnion	2.7	<2.0	<2.0	7.9
Lake Roosevelt	Site 1	Hypolimnion	2.4	<2.0	<2.0	<5.0
Lake Roosevelt	Site 2	Eplimnion	2.5	<2.0	<2.0	<5.0
Lake Roosevelt	Site 2	Hypolimnion	2.3	<2.0	<2.0	<5.0
Lake Apache	Site 1	Eplimnion	4.6	2.5	<2.0	10.5
Lake Apache	Site 1	Hypolimnion	4.5	2.2	<2.0	9.9
Lake Apache	Site 2	Eplimnion	3.6	<2.0	<2.0	18.2
Lake Apache	Site 2	Hypolimnion	3.8	<2.0	<2.0	6.2
Lake Canyon	Site 1	Eplimnion	8.9	2.0	<2.0	13.7
Lake Canyon	Site 1	Hypolimnion	7.8	<2.0	<2.0	7.6
Lake Canyon	Site 2	Eplimnion	8.7	<2.0	<2.0	9.8
Lake Canyon	Site 2	Hypolimnion	7.5	<2.0	<2.0	12.3

Quarterly Lake Sampling - November 15, 2012

Table 5 - Upper Reservoir Quarterly Samples – November 2012

Samples are listed in upstream to downstream order

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg- m)	TDN
	Epilimnion	3.4	0.059	1.7	0.3
Roosevelt	Hypolimnion	3.4	0.059	1.7	0.3
Kooseven	Epilimnion	3.4	0.058	1.7	0.3
	Hypolimnion	3.4	0.058	1.7	0.3
	Epilimnion	3.7	0.061	1.6	0.4
Anapha	Hypolimnion	3.7	0.061	1.6	0.4
Apache	Epilimnion	3.7	0.061	1.7	0.3
	Hypolimnion	3.8	0.061	1.6	0.4
	Epilimnion	4.5	0.063	1.4	0.4
Canyon	Hypolimnion	3.7	0.065	1.7	0.5
Canyon	Epilimnion	3.6	0.063	1.8	0.3
	Hypolimnion	3.6	0.062	1.7	0.3
	Epilimnion	3.9	0.065	1.7	0.1
Saguaro Lake	Epi - Duplicate	4.3	0.068	1.6	0.1
	Hypolimnion	3.8	0.066	1.7	0.1

Below are UV-Vis spectra for the series of Salt River lakes. Roos = Roosevelt Lake, Apa = Apache Lake; Can = Canyon Lake; R9 = Saguaro Lake. A = upper 10 m of the water column & B = sample from deeper in the water column. The spectra are nearly the same, indicating similar composition (chemical bonding) of the organic matter. Similarity continues for **fluorescence spectra** (next page). Compounds fluorescence (give off light energy) when excited based upon the structure of their bonds. Where energy is fluoresced has been shown to relate to the "origin" of organic matter – either allochthonous (derived from soil or other terrestrial organic matter) or autochthonous (derived from algae or bacteria). These samples have autochthonous signatures. More details about intepretting these spectra are available – let us know if you want more information?





Upper Reservoir Quarterly Excitation-Emission Contour Plots



