

REGIONAL WATER QUALITY NEWSLETTER

DATE: Report for April 2012

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: March and April 2012

SUMMARY: EVALUATION AND RECOMMENDATIONS

1. SRP is currently releasing Salt River water and MIB levels are low. Data for March and April were < 5 ng/L. CAP is delivering water from the Colorado River and MIB levels are low.
2. We are starting to measure sucralose in the water supply network as an indicator of human activity in the watershed, presumably from discharge of treated effluent (sustainable water supplies) although discharges from houseboats and other disposal can not be overlooked. Initial data indicates a low contribution of these sources (< 5%) in the watersheds.
3. DOC levels in Bartlett and Saguaro Lakes have been slowly decreasing over the past 6 months. We have started sampling, quarterly, all the Salt River reservoirs to monitor for potential impacts of the Wallow fire (data is included)
4. Characterization of molecular weight size fractions of DOC in raw and treated water from several WTPs is presented to show how efficient different facilities are. In the coming months we will be relating this to the potential to tailor treatments to improve THM precursor control.

Water Volume Tid-Bits:

- SRP does NOT plan to move any CAP water in SRP canals this calendar year. For the summer the SRP canals will have Salt River Water, and some groundwater.
- In Lake Powell: During WY 2012, water storage has fallen by 2,102,371 AF and total outflows have exceeded total inflows by 1,996,611 AF. Reservoirs above Lake Powell are 78% full, and Lake Powell is 63% full.

Quick Update of Water Supplies for April 2012 (during day of sampling – April 3)

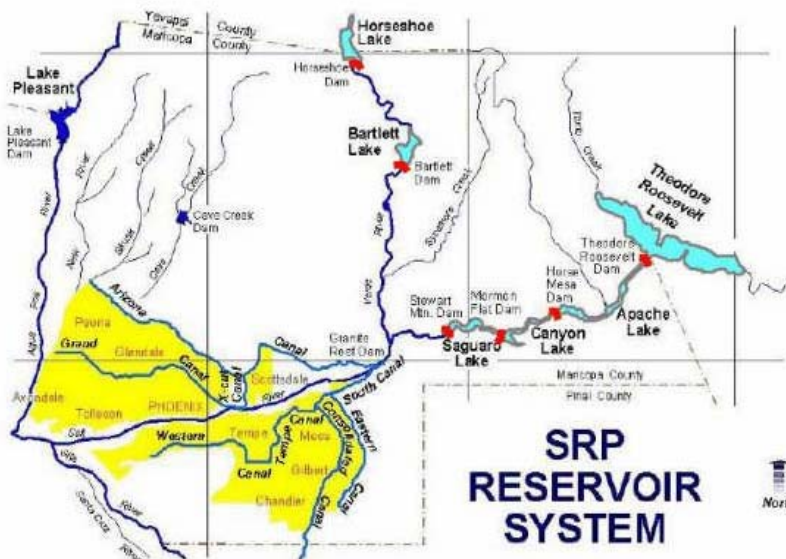
Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 72% full	874 cfs	495 cfs into Arizona Canal 504 cfs into South Canal (87% Salt River Water)	4.5 mg/L
Verde River	Reservoirs At 28% full	125 cfs		2.5 mg/L
Colorado River	Lake Pleasant is 93% full (Lake Powell is 64% full)	from Colorado River (Lake Pleasant NOT releasing water)	0 cfs of CAP water into Arizona Canal	3.0 mg/L
Groundwater	Generally increasing due to recharge	122 cfs pumping by SRP	164 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>



We are starting to measure Sucralose

Sucralose is a potential tracer of treated wastewater effluent in surface waters. Sucralose is an artificial sweetener that is poorly removed by municipal wastewater treatment plants and occurs in treated effluents at 1 to 10 µg/L (1000 to 10,000 ng/L). Sucralose is generally considered non-reactive in lakes, rivers too and therefore may be a surrogate for the amount of sustainable water entering potable water treatment plants. Our first set of data are shown below and concentrations of 0.160 to 0.318 µg/L are observed. This suggests that <5% of the water in these sources are of wastewater origin.

Location	Water Source	Sucralose (ppt)
Havasu	CAP	228
R2A – Lake Pleasant Hypolimnion	CAP	318
R3 – Wadell Canal	CAP	121
R25 – Verde at Tangle	Verde River	160
Highway 87	Salt River	231

Dissolved Organic Carbon In Reservoirs and Treatment Plants

DOC = Dissolved organic carbon

UV254 = ultraviolet absorbance at 254 nm (an indicator of aromatic carbon content)

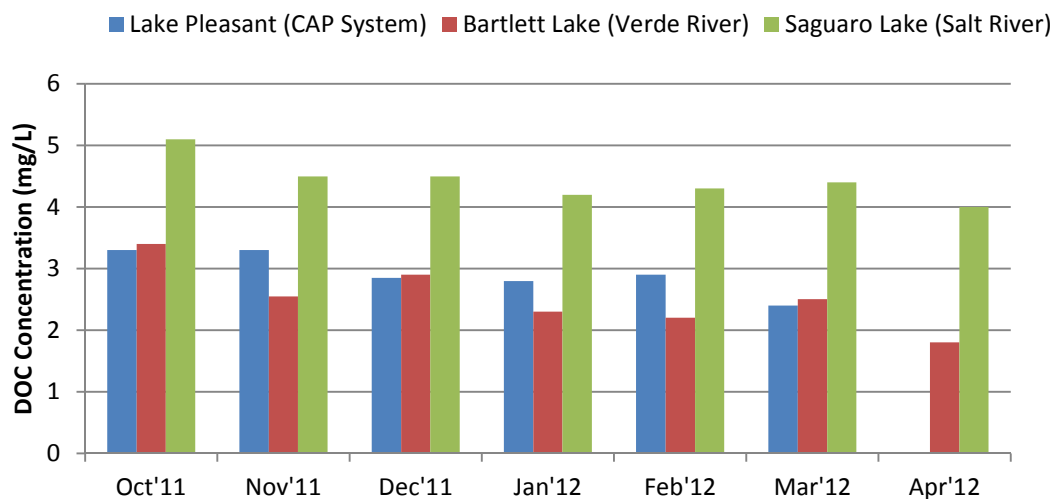
SUVA = UV254/DOC

TDN = Total dissolved nitrogen (mgN/L)

Reservoir Samples – April 2012

Reservoir sampling will be conducted only monthly.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant (March)	Epilimnion	2.4	0.05	1.9	0.4
Lake Pleasant (March)	Hypolimnion	2.4	0.05	1.9	0.4
Verde River @ Beeline		1.5	0.03	2.2	0.6
Bartlett Reservoir	Epilimnion	1.5	0.04	2.7	0.2
Bartlett Reservoir	Epi-near dock	1.9	0.04	2.4	0.3
Bartlett Reservoir	Hypolimnion	1.7	0.05	2.7	0.3
Salt River @ BluePt Bridge		3.5	0.07	2.1	0.2
Saguaro Lake	Epilimnion	3.9	0.08	1.9	0.3
Saguaro Lake	Epi - Duplicate	4.1	0.08	1.9	0.4
Saguaro Lake	Epi-near dock	3.9	0.07	1.9	0.4
Saguaro Lake	Hypolimnion	4.1	0.08	1.9	0.4
Verde River at Tangle		4.6	0.25	5.4	0.3
Havas		2.4	0.05	1.9	0.6



Organic Matter in Canal

April 2012

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	Not Available			
Anthem WTP Inlet	3.8	0.05	1.3	1.3
Union Hills Inlet	2.2	0.04	2.0	0.5
CAP Canal at Cross-connect	-	-	-	-
Salt River @ Blue Pt Bridge	3.5	0.07	2.1	0.2
Verde River @ Beeline	1.5	0.03	2.2	0.6
AZ Canal above CAP Cross-connect	3.0	0.07	2.2	0.2
AZ Canal below CAP Cross-connect	3.2	0.07	2.1	0.2
AZ Canal at Highway 87	3.1	0.06	2.0	0.2
AZ Canal at Pima Rd.	3.7	0.07	1.9	0.4
AZ Canal at 56th St.	3.1	0.07	2.2	0.3
AZ Canal - Central Avenue	3.3	0.07	1.9	0.3
AZ Canal - Inlet to Glendale WTP	3.3	0.07	2.1	0.8
AZ Canal - Inlet to GreenwayWTP	3.2	0.05	1.7	1.0
South Canal below CAP Cross-connect	3.1	0.07	2.2	0.2
Head of the Tempe Canal	2.7	0.06	2.1	0.4
Tempe Canal - Inlet to Tempe's South Plant	2.2	0.05	2.1	0.6
Head of the Consolidated Canal	2.6	0.06	2.1	0.6
Middle of the Consolidated Canal	2.5	0.06	2.2	0.3
Chandler WTP – Inlet	3.2	0.07	2.0	1.1

Organics at the Water Treatment Plants

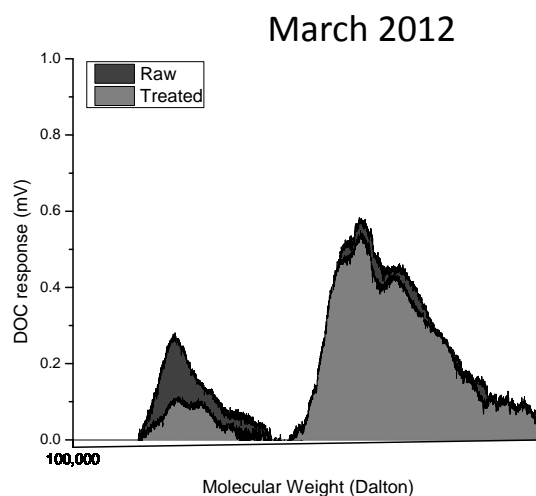
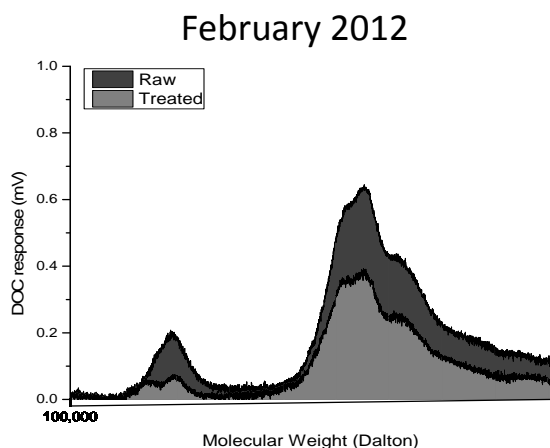
April 2012

Table 2 - Water Treatment Plants – April 02, 2012					
Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
Union Hills Inlet	2.2	0.04	2.0	0.5	
Union Hills Treated	1.3	0.02	0.4	0.0	40
Tempe North Inlet	offline				
Tempe North Plant Treated					
Tempe South Inlet	2.2	0.05	2.1	0.6	
Tempe South Plant Treated	1.2	0.02	1.8	0.6	47
Greenway WTP Inlet	3.2	0.05	1.7	1.0	
Greenway WTP Treated	2.7	0.03	1.0	0.4	16
Glendale WTP Inlet	3.3	0.1	2.1	0.8	
Glendale WTP Treated	offline				
Anthem WTP Inlet	3.8	0.05	1.3	0.9	
Anthem WTP Treated	2.1	0.04	2.0	0.5	45
Chandler WTP Inlet	3.2	0.07	2.0	1.1	
Chandler WTP Treated	2.2	0.04	1.8	0.8	31

Organic Carbon Molecular Weight Removal at Valley WTPs

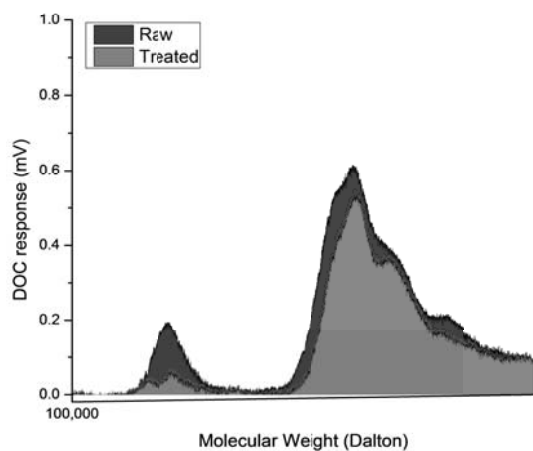
Size exclusion chromatography (SEC) with in-line DOC detection allows us to fingerprint the relative size of DOC in raw and treated water. The x-axis in the figures below show the molecular size (from large to small) of DOC. The y-axis is related to the amount of DOC of each size. The plots are shaded to show the fraction removed, essentially, is the difference between RAW and TREATED. Overall, most plants do a good job at removing the first peak (larger molecular weight colloidal material). The second peak (the largest peak usually) represents humic and polar acids that are partially removed by coagulation. Samples from Tempe had an instrument error and will be presented in the future. Over the coming months we will attempt to relate these SEC-DOC data to THM control.

Anthem

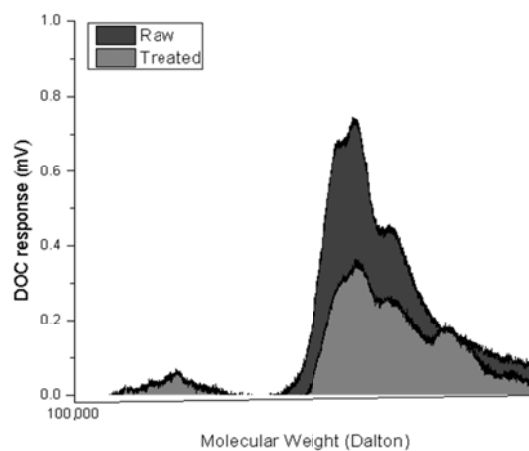


Union Hills

February 2012

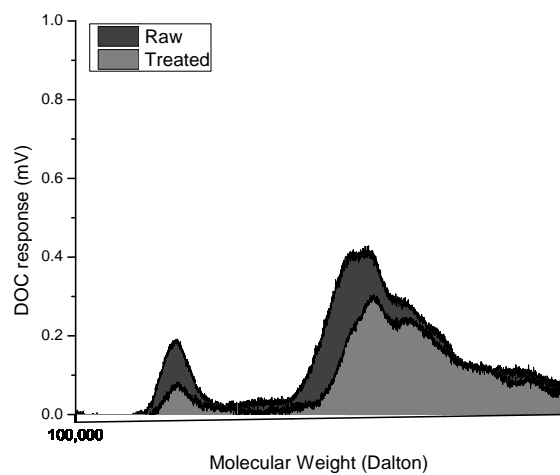


March 2012

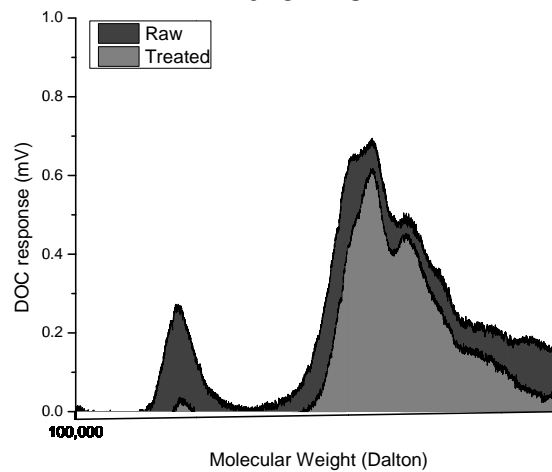


Chandler

February 2012



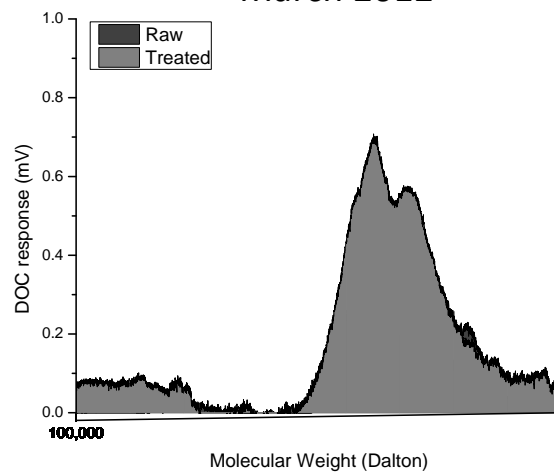
March 2012



Greenway

February 2012
(offline)

March 2012

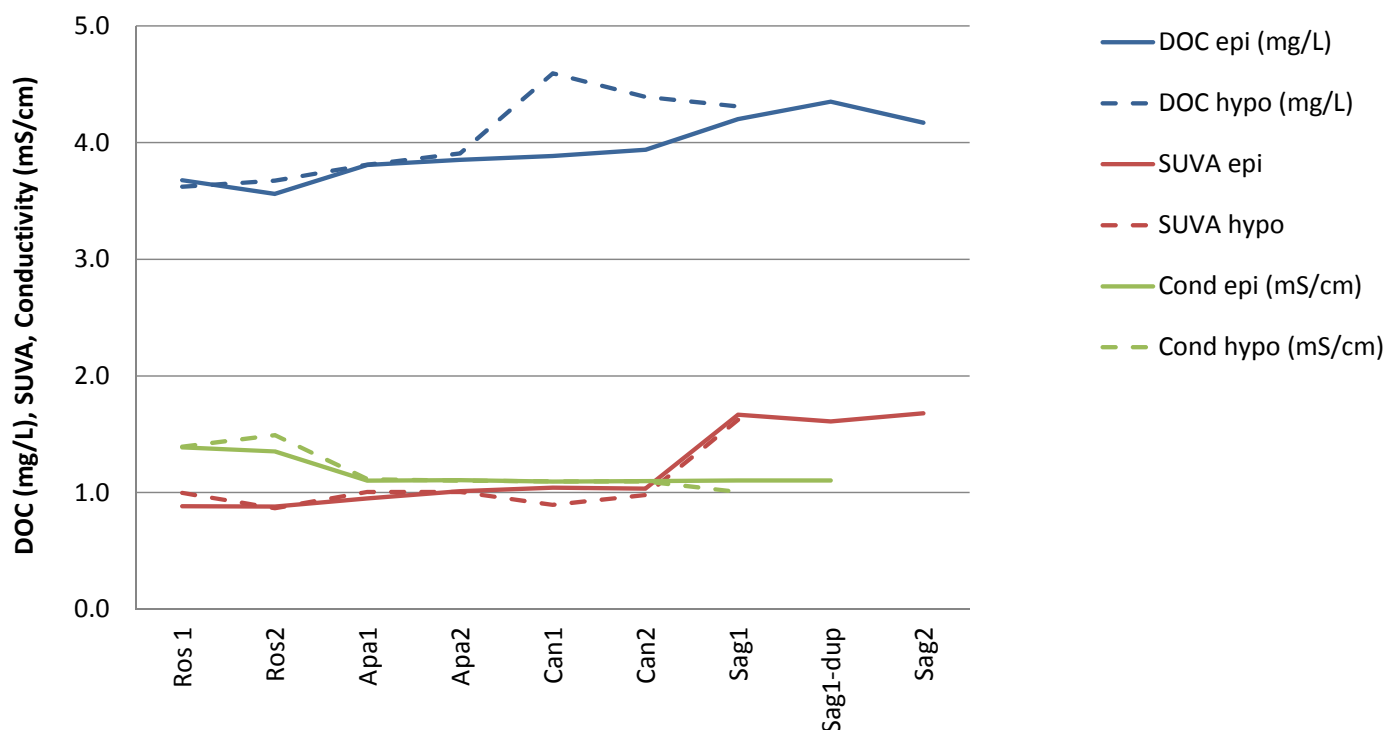


1st Quarter Results from Sampling of Salt River Reservoirs

We are sampling Roosevelt (Ros), Apache (Apa), Canyon (Can) and Saguaro (Sag) lakes quarterly for organic matter parameters to understand the potential impacts of the Wallow fire. Data for Feb 2012 are shown below. At least 2 sampling locations in each reservoir are being collected, and multiple depth samples from each analyzed. Here we show two depth locations for each site: epi – near the surface; hypo – deeper in the lake. The DOC levels in Roosevelt are roughly 1 mg/L lower than Saguaro Lake currently, but it appears a higher layer of DOC water is present at depth in Canyon Lake. Specific UV absorbance (UVA₂₅₄ / DOC) is an indicator of relative “humification” of the organics, where higher SUVA values make organic matter easier to coagulate, but also more prone to producing THMs upon chlorination. We are also tracking conductivity (Cond) as a measure of the salt content to develop linkages between sources of organic matter – more on that in coming months. As part of collaborations with ADEQ we are also measuring nitrogen and phosphorous, and that data will be shown in coming months as well.

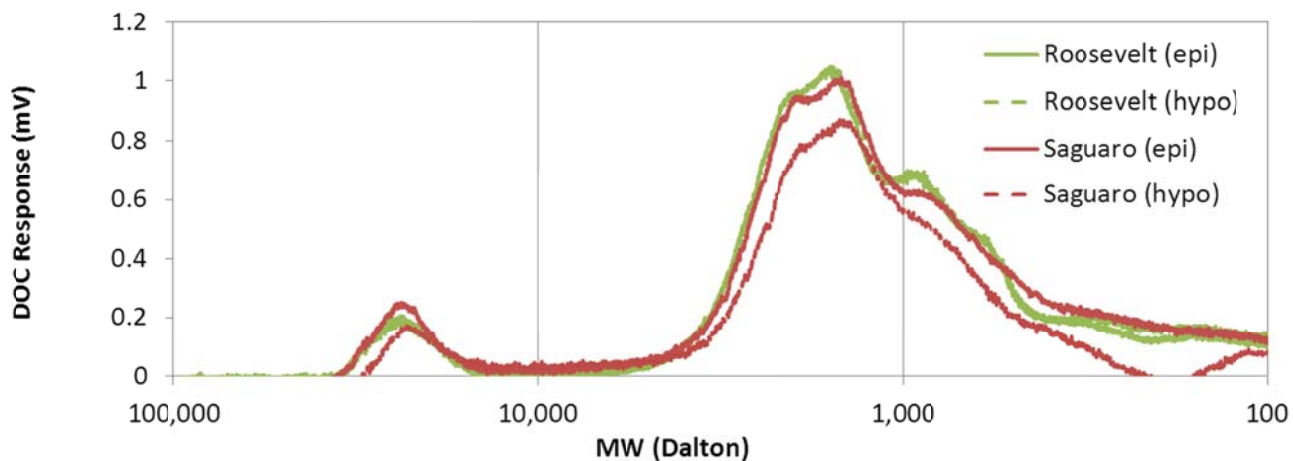
Organic matter in the Salt River, collected above Roosevelt Lake, for late March 2012 was 2.1 mg/L (TDN = 0.5 mgN/L) and SUVA = 4 cm⁻¹(mg/L)⁻¹.

Quarterly Reservoir Sampling Results (Feb 2012)



On the same lake samples we are also measuring SEC-DOC (see below). So far there is no significant differences in the molecular size distribution of samples from different lakes in the system. We may expect more significant changes as runoff stops and during the summer as algae production begins.

SEC-DOC



Reservoir	Roosevelt				Apache				Canyon				Saguaro			
Location	1A (epi)	1B (hypo)	2A (epi)	2B (hypo)	1A (epi)	1B (hypo)	2A (epi)	2B (hypo)	1A (epi)	1B (hypo)	2A (epi)	2B (hypo)	1A (epi)	1A- dup (hypo)	2A (epi)	3A (Near dock)
10,000 to 100,000	8%	6%	7%	7%	8%	10%	7%	6%	9%	8%	8%	9%	13%	17%	15%	22%
1,000 to 10,000	56%	56%	51%	57%	56%	55%	57%	60%	54%	53%	54%	53%	49%	43%	57%	37%
100 to 1,000	36%	38%	42%	36%	36%	36%	36%	34%	37%	39%	38%	38%	37%	40%	28%	41%

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 noticeable 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. Here we summarize the occurrence during the cooler months:

Levels in March & April 2012 were low.

- MIB levels were below 2 ng/L everywhere, except Saguaro Lake which had 3 to 4 ng/L.
- Geosmin levels were low in the reservoirs (< 2 ng/L), but were present in the canals at 2 to 5 ng/L.

Algae is starting to grow. Here is a photo from the Salt River below Saguaro Lake (near Blue Point Bridge) showing algae growth mid-channel. Algae is growing on the bottom of the stream and sloughing off into the water column. This is probably occurring as nutrient rich water from deep in Saguaro Lake is being released into the shallow channel where it is growing in our abundant sunlight



Data on T&O compounds for April 2, 2012

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet	2.8	2.1	<2.0
Union Hills Treated	2.2	<2.0	<2.0
Tempe North Inlet			
Tempe North Plant Treated			
Tempe South WTP	2.5	2.1	<2.0
Tempe South Plant Treated	2.2	<2.0	<2.0
Anthem Inlet	5.6	<2.0	<2.0
Anthem Treated	2.2	<2.0	<2.0
Chandler Inlet	2.6	2.5	<2.0
Chandler Treated	2.6	2.4	<2.0
Greenway WTP Inlet	2.7	2.6	<2.0
Greenway WTP Treated	2.4	2.0	<2.0
Glendale WTP Inlet	3.0	2.9	0.4
Glendale WTP Treated			

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal			
	Union Hills Inlet	2.8	2.1	<2.0
	CAP Canal at Cross-connect	2.8	2.1	<2.0
AZ Canal	Salt River @ Blue Pt Bridge	3.3	2.1	<2.0
	Verde River @ Beeline	3.6	6.1	<2.0
	AZ Canal above CAP Cross-connect	3.1	3.7	<2.0
	AZ Canal below CAP Cross-connect	2.9	3.4	<2.0
	AZ Canal at Highway 87	3.1	3.3	<2.0
	AZ Canal at Pima Rd.	3.1	3.6	<2.0
	AZ Canal at 56th St.	2.7	3.1	<2.0
	AZ Canal - Central Avenue	3.4	2.7	<2.0
	AZ Canal - Inlet to Glendale WTP	3.0	2.9	<2.0
	Head of the Consolidated Canal	2.8	2.7	<2.0
	Middle of the Consolidated Canal	2.5	2.7	<2.0
South	South Canal below CAP Cross-connect	3.4	2.9	<2.0
Tempe	Head of the Tempe Canal	2.7	2.6	<2.0
Canals	Tempe Canal - Inlet to Tempe's South Plant	2.5	<2.0	<2.0

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (March 2012)	Eplimnion	<2.0	<2.0	<2.0
Lake Pleasant (March 2012)	Hypolimnion	2.2	<2.0	<2.0
Verde River @ Beeline		3.6	6.1	<2.0
Bartlett Reservoir	Epilimnion	2.6	3.2	<2.0
Bartlett Reservoir	Epi-near dock	2.2	2.7	<2.0
Bartlett Reservoir	Hypolimnion	2.6	<2.0	<2.0
Salt River @ BluePt Bridge		3.3	2.1	<2.0
Saguaro Lake	Epilimnion	3.8	2.4	<2.0
Saguaro Lake	Epi - Duplicate	4.0	2.3	<2.0
Saguaro Lake	Epi-near dock	3.4	2.2	<2.0
Saguaro Lake	Hypolimnion	3.5	<2.0	<2.0
Lake Havasu (March 2012)		2.3	2.1	<2.0
Verde River at Tangle Creek		<2.0	2.4	<2.0
Roosevelt at Salt River Inlet		<2.0	<2.0	<2.0