REGIONAL WATER QUALITY NEWSLETTER

DATE: Report for September 2008
Sampling conducted September 2 2008

From the Phoenix, Tempe, Glendale, Peoria, CAP, SRP – ASU Regional Water Quality Partnership

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

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SUMMARY: EVALUATION AND RECOMMENDATIONS

1. Our Regional water quality annual Workshop is scheduled for Thursday October 9, 2008 at Phoenix City Hall from 8:30- 11am. MARK YOUR CALENDARS.
2. MIB Concentrations at the head of the Arizona and South Canals are Very HIGH (~ 30 ng/L) and decrease with distance down the canal. The levels are high in the Salt River (at Blue Point Bridge) and suggests that MIB is exiting from Saguaro Lake. Because of storms and damage to the trailer, lake samples will be collected next week. It is likely this will continue for some time.
3. Most of the water in the canals is Salt River water, which has a slightly higher TOC (~ 5 mg/L) compared to the Verde River (3 mg/L). The flow in the Arizona and South Canals is approximately a 90% Salt River + 10% Verde River blend of water.
4. An executive summary for a Australian report on MIB removal by Ozone and biofiltration is attached (courtesy of a reference from Carollo Eng.)

Table 1 Summary of WTP Operations

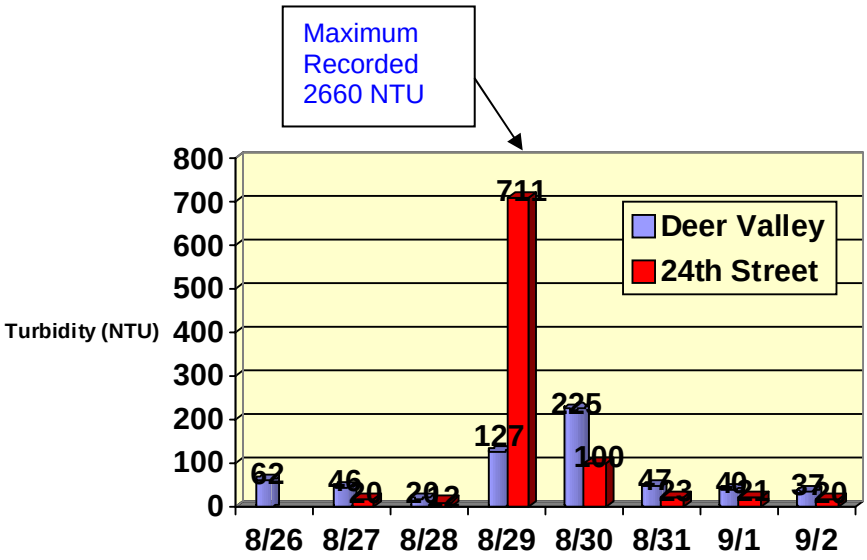
	Verde WTP	Union Hills	24th Street WTP	N.Tempe J.G. Martinez	Deer Valley	Glendale Cholla WTP [3]	Peoria Greenway WTP	Val Vista	South Tempe
	Verde River	CAP Canal	Arizona Canal					South Canal	
PAC Type and Dose		None	Calgon WPH 15.5 ppm		Calgon 12 ppm			Calgon 16 ppm	Norit 30 ppm
Copper Sulfate		0.4 ppm	0.5 ppm		None			None	None
PreOxidation		None	None		None			None	None
Alum Dose Alkalinity pH		12.25 [1] 122 7.2	64 131/104 6.65		60 141/92 8.0 / 6.7			65 132 7.2	30 124 7.3
Finished water DOC DOC removal[2]		2.8 mg/L 20% TTHM reported ~ 40 ppb	2.8 mg/L 41%	3.14 mg/L 34%	3.3 mg/L 31%	2.7 mg/L 44%	3.9 mg/L 18%	2.7/3.3 44%/33 % West/east	3.15 mg/L 34%
Average turbidity over last 7 days		0.6 NTU	See plot		See plot			24 NTU (93 max)	5 NTU
Recommendations							DOC removal has been quite low over the past 2 months. Has a change in operation occurred ?		

[1] Ferric chloride instead of alum; plus 2.25 ppm sulfuric acid

[2] Calculated based upon influent and filtered water DOC (note that DOC – not TOC – is used in this calculation)

[3] Sample from finished water includes a blend of surface and ground water sources

Please send data next month upon requests. I suspect there were some vacations due to memorial day this month.



SRP/CAP OPERATIONS - Values in cfs, for September 2, 2008

System	SRP Diversions	CAP
Arizona Canal	635	79
South Canal	419	0
Pumping	54	0
Total	1108	79

- **SRP is releasing water from both Verde and Salt River Systems**. Salt River release from Saguaro Lake: 927cfs; Verde River release from Bartlett Lake: 100 cfs.

P.O. Box 43020 • Phoenix, AZ 85080-3020
23636 North Seventh Street • Phoenix, AZ 85024
623-869-2333 • www.cap-az.com

DATE: August 29, 2008

TO: Distribution

FROM: Tim Kacerek, CAP Water Control Manager

SUBJECT: Fall 2008 Lake Pleasant/Colorado River Operating Plans

The end of summer releases from Lake Pleasant is approaching. In an effort to optimize the water quality, we intend to stop the Lake Pleasant releases on September 15.

Refilling of Lake Pleasant will begin after January 1, 2009 and we plan on staying in the "fill mode" unless there is an operating emergency which would require releases from Lake Pleasant. No west canal outages are planned between September 15, 2008 and June 1, 2009, so deliveries will be made exclusively from the Colorado River during this period.

For the convenience of our M&I users, we will try to give the treatment plants as much advance notice as possible if the source water changes or if we do anything to change water quality.

The lake is projected to be at elevation 1648.5 by the end of 2008, and finally to elevation 1679 by the end of March 2009.

I hope this fall's operation will bring no surprises. If you have any further questions, you may contact me at (623)869-2563, or Doug Crosby at (623)869-2426.

Table 2 - Water Treatment Plants – September 2, 2008

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
24th Street WTP Inlet	**14.0**	**4.5**	**3.5**
24th Street WTP Treated	**5.9**	**0.0**	**2.4**
Deer Valley Inlet	**10.8**	**4.2**	**4.0**
Deer Valley WTP Treated	**8.6**	**8.2**	**4.6**
Val Vista Inlet	**34.0**	**5.9**	**5.2**
Val Vista WTP Treated –East	**13.8**	**3.3**	**<2.0**
Val Vista WTP Treated -West	**5.9**	**2.0**	**<2.0**
Union Hills Inlet	**2.6**	**<2.0**	**5.7**
Union Hills Treated	**<2.0**	**<2.0**	**<2.0**
Tempe North Inlet	**13.6**	**4.9**	**7.6**
Tempe North Plant Treated	**13.8**	**5.6**	**7.9**
Tempe South WTP	**7.3**	**<2.0**	**<2.0**
Tempe South Plant Treated	**2.4**	**<2.0**	**<2.0**
Tempe South Plant Treated (Lab)			
Greenway WTP Inlet	**8.2**	**4.7**	**9.5**
Greenway WTP Treated	**3.3**	**2.1**	**2.7**
Glendale WTP Inlet	**8.9**	**3.4**	**7.1**
Glendale WTP Treated	**<2.0**	**<2.0**	**2.8**

Table 3 - Canal Sampling – September 2, 2008

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	**<2.0**	**<2.0**	**8.3**
	Union Hills Inlet	**2.6**	**<2.0**	**5.7**
	CAP Canal at Cross-connect	**<2.0**	**<2.0**	**<2.0**
AZ Canal	Salt River @ Blue Pt Bridge	**56.5**	**4.3**	**3.8**
	Verde River @ Beeline	**8.1**	**2.4**	**3.3**
	AZ Canal above CAP Cross-connect	**34.0**	**4.8**	**5.1**
	AZ Canal below CAP Cross-connect	**25.4**	**4.5**	**5.3**
	AZ Canal at Highway 87	**33.0**	**5.1**	**5.0**
	AZ Canal at Pima Rd.	**19.3**	**5.4**	**11.6**
	AZ Canal at 56th St.	**17.0**	**5.7**	**8.7**
	AZ Canal - Inlet to 24th Street WTP	**14.0**	**4.5**	**3.5**
	AZ Canal - Central Avenue	**12.4**	**5.2**	**4.3**
	AZ Canal - Inlet to Deer Valley WTP	**10.8**	**4.2**	**4**
	AZ Canal - Inlet to Glendale WTP	**8.9**	**3.4**	**7.1**
South and Tempe Canals	South Canal below CAP Cross-connect	**31.0**	**5.0**	**4.1**
	South Canal at Val Vista WTP	**34.0**	**5.9**	**5.2**
	Head of the Tempe Canal	**23.3**	**5.4**	**5.1**
	Tempe Canal - Inlet to Tempe's South Plant	**7.3**	**<2.0**	**<2.0**
	Chandler WTP – Inlet			

MIB Concentrations at the head of the Arizona and South Canals are Very HIGH (~ 30 ng/L) and decrease with distance down the canal. The levels are high in the Salt River (at Blue Point Bridge) and suggests that MIB is exiting from Saguaro Lake. Because of storms and damage to the trailer, lake samples will be collected next week. It is likely this will continue for some time.

Table 4 - Water Treatment Plants – September 02, 2008

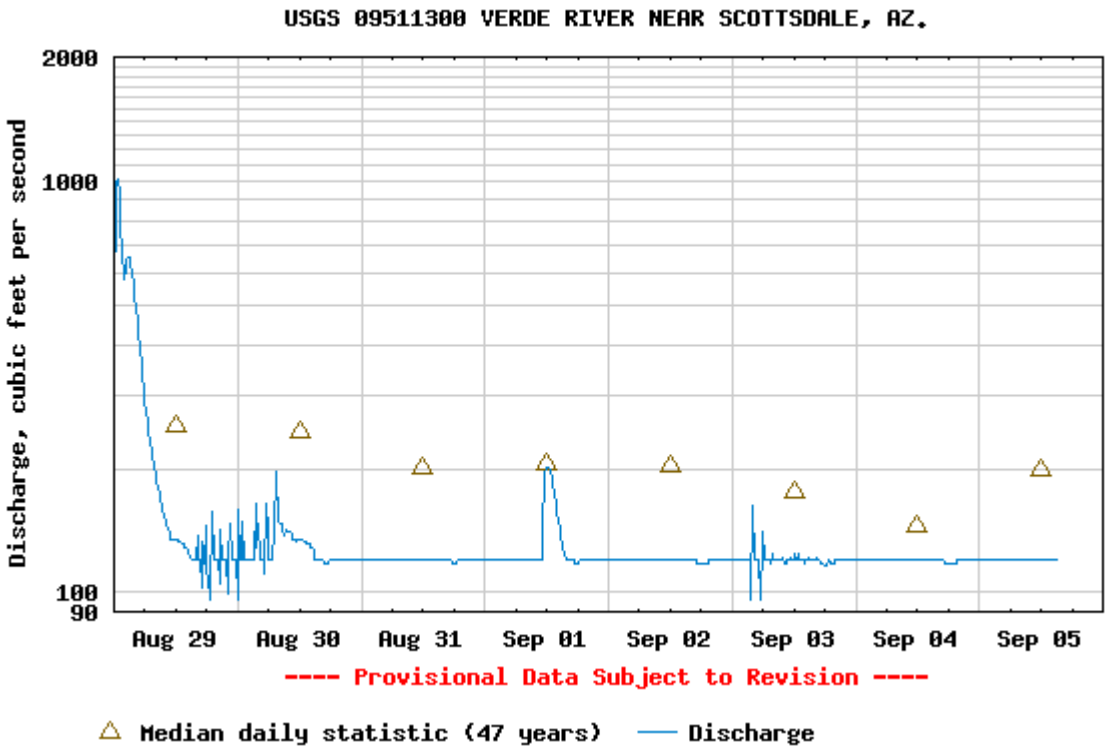
Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
24th Street WTP Inlet	4.75	0.111	2.33	0.67	
24th Street WTP Treated	2.80	0.041	1.46	0.58	41
Deer Valley Inlet	4.71	0.120	2.55	0.71	
Deer Valley WTP Treated	3.27	0.053	1.63	0.66	31
Val Vista Inlet	4.88	0.119	2.44	0.64	
Val Vista WTP Treated –East	3.28	0.053	1.62	0.60	33
Val Vista WTP Treated -West	2.72	0.043	1.59	0.56	44
Union Hills Inlet	3.57	0.053	1.49	0.64	
Union Hills Treated	2.84	0.029	1.03	0.64	20
Tempe North Inlet	4.82	0.126	2.62	0.70	
Tempe North Plant Treated	4.01	0.079	1.98	0.67	17
Tempe South WTP	4.76	0.120	2.51	0.64	
Tempe South Plant Treated	3.15	0.054	1.73	0.60	34
Greenway WTP Inlet	4.69	0.164	3.50	0.78	
Greenway WTP Treated	3.87	0.042	1.08	0.86	18
Glendale WTP Inlet	4.79	0.118	2.47	0.75	
Glendale WTP Treated	2.68	0.044	1.64	1.44	44

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)

Table 5 - Organic Information

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	3.49	0.059		0.746
Union Hills Inlet	3.57	0.053	1.49	0.64
CAP Canal at Cross-connect	3.51	0.058	1.66	0.70
Salt River @ Blue Pt Bridge	5.07	0.122	2.41	0.62
Verde River @ Beeline	3.09	0.134	4.35	0.67
AZ Canal above CAP Cross-connect	4.95	0.121	2.44	0.63
AZ Canal below CAP Cross-connect	4.86	0.110	2.27	0.67
AZ Canal at Highway 87	4.58	0.112	2.45	0.61
AZ Canal at Pima Rd.	4.91	0.135	2.76	0.67
AZ Canal at 56th St.	4.82	0.112	2.33	0.67
AZ Canal - Inlet to 24th Street WTP	4.75	0.111	2.33	0.67
AZ Canal - Central Avenue	4.72	0.114	2.41	0.69
AZ Canal - Inlet to Deer Valley WTP	4.71	0.120	2.55	0.71
AZ Canal - Inlet to Glendale WTP	4.79	0.118	2.47	0.75
AZ Canal - Inlet to Greenway WTP	4.69	0.164	3.50	0.78
South Canal below CAP Cross-connect	5.24	0.120	2.28	0.73
South Canal at Val Vista WTP	4.88	0.119	2.44	0.64
Head of the Tempe Canal	5.16	0.136	2.63	0.73
Tempe Canal - Inlet to Tempe's South Plant	4.76	0.120	2.51	0.64
Chandler WTP – Inlet				

These samples were collected September 2, 2008, and it rained some on September 1 and quite hard on August 30/31 as evident by the hydrograph (flowrate over time) for a gauging station on the Verde River at the Beeline Highway (below). Most of the water in the canals is Salt River water, which has a slightly higher TOC (~ 5 mg/L) compared to the Verde River (3 mg/L). The flow in the Arizona and South Canals is approximately a 90% Salt River + 10% Verde River blend of water.


USGS 09511300 VERDE RIVER NEAR SCOTTSDALE, AZ.
Discharge, cubic feet per second
2000
1000
100
90
Aug 29
Aug 30
Aug 31
Sep 01
Sep 02
Sep 03
Sep 04
Sep 05
---- Provisional Data Subject to Revision ----
Median daily statistic (47 years)
Discharge

Biological filtration processes for the removal of algal metabolites

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http://www.waterquality.crc.org.au/publications/report64_biological_filtration_algal_metabolites%20web.pdf

EXECUTIVE SUMMARY
This project has identified biological filtration as a viable water treatment option for the removal of the algal metabolites 2-methylisoborneol (MIB), geosmin, cylindrosperopsin (CYN) and the microcystin toxins. Effective biological filtration of MIB and geosmin was observed at the Morgan water treatment plant in South Australia, and this was confirmed through laboratory-scale experiments. *Cylindrospermopsis raciborskii* and CYN removals were evident through a biologically-active filtration pilot plant located at North Pine Dam in Queensland, with removal of CYN shown to be through biodegradation. Microcystin toxins were shown to be effectively biodegraded through laboratory-scale columns containing sand sourced from various water treatment plants, under both slow and rapid sand filtration conditions.

Bacteria responsible for the degradation of geosmin, CYN and microcystin within biological filters were isolated and identified, and also shown to have the ability to degrade their respective metabolites in natural waters in planktonic states. A consortium comprising a *Sphingopyxis* sp., *Novosphingobium* sp. and *Pseudomonas* sp. were shown to be responsible for degrading geosmin, with degradation evident only when all three organisms were present. In contrast, individiual bacteria were ishown to be responsible for the degradation of microcystin (*Sphingopyxis* sp. LH21) and CYN (*Sinorhizobium* sp.). Lag periods were shown to exist prior to the onset of degradation of the metabolites. However, upon re-exposure of the organisms to the metabolites, lag periods were reduced, and in some cases eliminated. For example, a lag period of 2 days was evident in planktonic batch studies prior to the degradation of microcystins commencing; however, after continuous exposure of the bacteria to microcystins the lag period was eliminated with complete degradation of microcystins observed within 5 hours.

The complete removal of MIB and geosmin through the sand filters of the Morgan WTP confirms that removal of these metabolites can be achieved under normal WTP operating conditions. However, this was only observed when no disinfectant was introduced into the filters. In addition, it appears that the size of the sand filter particles may play an important role in efficient MIB and geosmin removal, with greater removal with smaller partcile size. The situation at the Morgan WTP should be of particular

interest to SA Water and potentially other water utilities as this plant has demonstrated effective biofiltration of MIB and geosmin. Furthermore, the sand from the filter beds of Morgan WTP was also shown to be highly effective in removing microcystin toxins in laboratory-scale experiments, highlighting the diverse metabolite-degrading microbial community that can exist within the biofilm of WTP sand filters.

In laboratory-scale experiments microcystin appeared to be readily removed through a range of sand filters under both slow and rapid sand filtration conditions, confirming that removal of this metabolite could occur under normal plant operating conditions. Furthermore, the fact that no cytotoxic byproducts of microcystin biodegradation were detected demonstrates the feasibility of biodegradation as a possible removal option for the microcystins.

The development of molecular tools such as PCR has allowed for the detection of the genes involved in the degradation of microcystin. Using this technology we now have the capability to evaluate biological filters in terms of their capacity to remove microcystin, prior to impending microcystinproducing blooms. This is of enormous value to water authorities as it wil enable them to make confident decisions as to whether they can rely on their filters as an effective treatment barrier for these toxins.