Regional Water Quality NEWSLETTER

DATE: Report for February 2014
A Tempe, Glendale, Peoria, Chandler, Phoenix, ADEQ, CAP, SRP, Epcor
NSF Central Arizona-Phoenix Long-Term Ecological Research
ASU Regional Water Quality Partnership

http://faculty.engineering.asu.edu/pwesterhoff/research/regional-water-quality-issues/

SUMMARY

1. Taste and odor levels in March 2014 are NOT insignificant in the Arizona Canal. MIB is 2-6 ng/L and Geosmin is 3-7 ng/L, or cumulatively exceed 10 ng/L and may be noticable to the public.

2. Dissolved organic carbon (DOC) levels remain low in the reservoirs (2.8 to 4.7 mg/L), but a new study shows that TOC is the single most influencial water quality factor contributing to the amount of embedded energy in drinking water.

3. The Arizona snowpack is below normal through February 7, 2014 – and without additional snow, then runoff may be light this spring. Low runoff results not only in reduced availability of water in the reservoirs, but reduced runoff brings in less "organic matter" into the reservoirs.

4. Three topics are discussed briefly: 1) Green buildings bring blue water? 2) Areal drones used to photograph water quality over the canal system? 3) Water quality impacts sustainability?

Topics Du jure

Blue-Water at ASU – Related to Green Buildings

Last month we wrote about "blue water" at several ASU buildings. We continue to investigate this, but have found out that many GREEN buildings actually have BLUE problems. That is, the higher the LEED certification of buildings – the less water use per occupant exists. As a consequence there is a loss of chlorine residual in the pipes that lead to a variety of poor water quality issues, ranging from higher microbial counts to higher copper corrosion. One thought for the source of increased corrosion (i.e., slower formation of passivating layers inside copper pipes) is associated with microbial corrosion of copper. Anyway – keep the thoughts coming… Let us know if you have insights on blue water or water quality problems in green buildings.

Real-Time Sensors

SRP has installed a number of real-time sensors that can be tracked on-line. These can be extremely helpful. Additionally – when we are out sampling we often see "unusual" visual observations. For example, here is a photo of a muddy, foamy section of the canal at 56th Street earlier in the month. It got us thinking – should we have visual "sensors". These might be stationary at fixed sites, or perhaps mounted on areal drones that cruse the canals.

Total Organic Carbon (TOC) Rises Yet Again

Environmental Science & Technology

Article

pubs.acs.org/est

Influence of Water Quality on the Embodied Energy of Drinking Water Treatment

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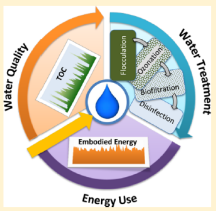
Supporting Information

ABSTRACT: Urban water treatment plants rely on energy intensive processes to provide safe, reliable water to users. Changes in influent water quality may alter the operation of a water treatment plant and its associated energy use or embodied energy. Therefore the objective of this study is to estimate the effect of influent water quality on the operational embodied energy of drinking water, using the city of Tampa, Florida as a case study. Water quality and water treatment data were obtained from the David L Tippin Water Treatment Facility (Tippin WTF). Life cycle energy analysis (LCEA) was conducted to calculate treatment chemical embodied energy values. Statistical methods including Pearson's correlation, linear regression, and relative importance were used to determine the influence of water quality on treatment plant operation and subsequently, embodied energy. Results showed that influent water quality was responsible for about 14.5% of the total operational embodied energy, mainly due to changes in treatment chemical dosages. The method used in this study can be applied to other urban drinking water contexts to determine if drinking water source quality control or modification of treatment processes will significantly minimize drinking water treatment embodied energy.



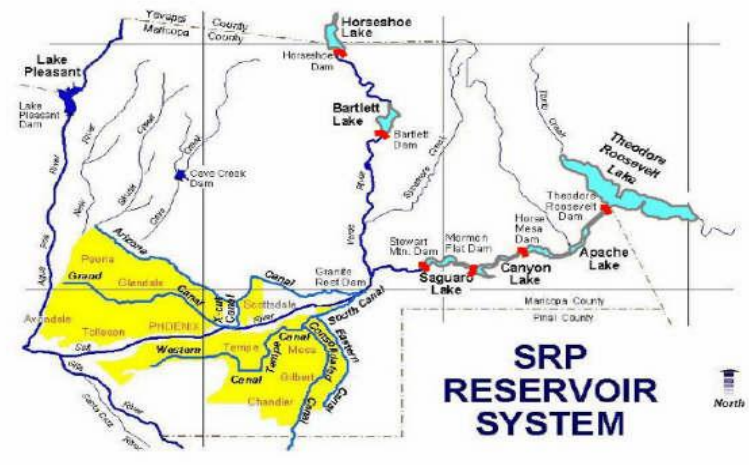
| Environ. Sci. Technol. 2014, 48, 3084−3091

Quick Update of Water Supplies for March 2014
(during day of sampling – March 4, 2014)

Source	Trend in supply	Discharge to water supply system	Flow into SRP Canal System	Dissolved organic carbon Concentration (mg/L) **
Salt River	Reservoirs at 57% full	8 cfs	265 cfs into **Arizona Canal**	4.5 mg/L
Verde River	Reservoirs At 50% full	322 cfs	66 cfs into **South Canal (97% Verde River Water)**	3.5 mg/L
			140 cfs of **CAP water** into Arizona Canal	
Colorado River	Lake Pleasant is 81% full (Lake Powell is 39% full)	Lake Pleasant is being filled from the CAP canal		3.0 mg/L
Groundwater	Generally increasing due to recharge	196 cfs pumping by SRP	196 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
*** 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/
- http://www.cap-az.com/index.php/departments/water-operations/lake-pleasant
- http://lakepowell.water-data.com/



SNOWPACK UPDATE

http://www.thorntonweather.com/snow-basins.php

With exception of the San Francisco Peaks river basin, much of Arizona has significantly less snowpack than average. Snowpack for Lake Powell on the Colorado River is running slightly above average (114% of average for this time of year).

United States Department of Agriculture | Natural Resources Conservation Service | Water and Climate Center Portland, Oregon

S N O W - P R E C I P I T A T I O N U P D A T E

Based on Mountain Data from NRCS SNOTEL Sites
As of TUESDAY: MARCH 11 , 2014

STATE RIVER BASIN	Number of Sites	PERCENT OF Normal Snow Water Equivalent	Accum Precip
ARIZONA			
VERDE RIVER BASIN	5 of 10	2	57
SAN FRANCISCO PEAKS	1 of 1	78	65
CENTRAL MOGOLLON RIM	3 of 4	0	59
LITTLE COLORADO - SOUTHERN HEADWATERS	5 of 6	9	61
UPPER SALT RIVER BASIN / WHITE MOUNTAINS	7 of 8	10	58
SAN FRANCISCO / UPPER GILA RIVER BASIN	7 of 8	12	49
CHUSKA MOUNTAINS	0 of 2	*	*

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

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Havasu (Feb)		2.5	0.053	2.1	0.5
Lake Pleasant (Feb)	Epilimnion	2.8	0.051	1.8	0.6
	Hypolimnion	2.7	0.051	1.9	0.4
Verde River (Feb)	@ Tangle	0.7	0.022	3.3	0.1
Verde River	@ Beeline Hwy	3.4	0.086	2.5	0.1
Bartlett Reservoir	Epilimnion	3.4	0.084	2.5	0.5
	Hypolimnion	3.3	0.088	2.7	0.3
Saguaro Lake	Epilimnion	4.3	0.076	1.8	0.4
	Epi - Duplicate	4.7	0.076	1.6	0.5
	Hypolimnion	4.1	0.075	1.8	0.6

Organic Matter in Canal & Water Treatment Plants

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal	2.7	0.053	1.9	0.4
Anthem WTP Inlet	2.8	0.056	2.0	0.5
Union Hills Inlet	no access			
CAP Salt-Gila Pump Station (Feb)	2.7	0.051	1.9	0.4
CAP Mesa Turnout (Feb)	2.7	0.051	1.9	0.4
CAP Canal at Cross-connect	2.9	0.054	1.9	0.5
Salt River @ Blue Pt Bridge	Offline			
Verde River @ Beeline	3.4	0.086	2.5	0.1
AZ Canal above CAP Cross-connect	3.5	0.108	3.1	0.8
AZ Canal below CAP Cross-connect	3.7	0.120	3.2	0.8
AZ Canal at Highway 87	3.7	0.128	3.5	0.4
AZ Canal at Pima Rd.	7.2	0.384	5.3	1.1
AZ Canal at 56th St.	7.5	0.402	5.3	1.1
AZ Canal - Central Avenue	3.9	0.123	3.2	1.0
AZ Canal - Inlet to Glendale WTP	3.8	0.082	2.1	0.7
AZ Canal - Inlet to GreenwayWTP	2.1	0.060	2.9	1.5
South Canal below CAP Cross-connect	3.7	0.130	3.5	0.4
Head of the Tempe Canal	4.1	0.166	4.0	1.5
Tempe Canal - Inlet to Tempe's South Plant	1.0	0.039	4.0	0.8
Head of the Consolidated Canal	4.3	0.169	3.9	1.5
Middle of the Consolidated Canal	1.7	0.036	2.1	1.9
Chandler WTP – Inlet	0.8	0.026	3.2	4.0

Table 2 - Water Treatment Plants – March 3, 2014

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
Union Hills Inlet	no access				
Union Hills Treated					
Tempe North Inlet	offline				
Tempe North Plant Treated					
Tempe South Inlet	1.0	0.039	4.0	0.8	
Tempe South Plant Treated	0.9	0.022	2.4	2.6	7
Greenway WTP Inlet	2.1	0.060	2.9	1.5	
Greenway WTP Treated	1.5	0.031	2.0	2.4	27
Glendale WTP Inlet	3.8	0.082	2.1	0.7	
Glendale WTP Treated	Offline				
Anthem WTP Inlet	2.8	0.056	2.0	0.5	
Anthem WTP Treated	2.6	0.048	1.9	0.5	8
Chandler WTP Inlet	0.8	0.026	3.2	4.0	
Chandler WTP Treated	0.8	0.018	2.3	4.2	2

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.

Table 4 - Reservoir Samples – March 4, 2014

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (Feb)	Eplimnion	**4.2**	**<2.0**	**<2.0**
Lake Pleasant (Feb)	Hypolimnion	**4.1**	**2.1**	**<2.0**
Verde River @ Beeline		**3.2**	**4.5**	**<2.0**
Bartlett Reservoir	Epilimnion	**<2.0**	**<2.0**	**<2.0**
Bartlett Reservoir	Epi-near dock	**2.4**	**<2.0**	**<2.0**
Bartlett Reservoir	Hypolimnion	**2.3**	**<2.0**	**<2.0**
Salt River @ BluePt Bridge				
Saguaro Lake	Epilimnion	**<2.0**	**<2.0**	**<2.0**
Saguaro Lake	Epi - Duplicate	**<2.0**	**<2.0**	**<2.0**
Saguaro Lake	Epi-near dock	**<2.0**	**<2.0**	**<2.0**
Saguaro Lake	Hypolimnion	**<2.0**	**<2.0**	**<2.0**
Lake Havasu (Feb)		**2.1**	**3.1**	**<2.0**
Verde River at Tangle Creek (Feb)		**<2.0**	**2.1**	**<2.0**
Roosevelt at Salt River Inlet (Feb)		**<2.0**	**<2.0**	**<2.0**

Table 2 - Water Treatment Plants – March 3, 2014

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Union Hills Inlet			
Union Hills Treated			
Tempe North Inlet			
Tempe North Plant			
Tempe South WTP	**<2.0**	**<2.0**	**<2.0**
Tempe South Plant	**<2.0**	**3.7**	**<2.0**
Anthem Inlet	**<2.0**	**<2.0**	**<2.0**
Anthem Treated	**<2.0**	**<2.0**	**<2.0**
Chandler Inlet	**<2.0**	**<2.0**	**<2.0**
Chandler Treated	**<2.0**	**<2.0**	**<2.0**
Greenway WTP Inlet	**<2.0**	**6.8**	**<2.0**
Greenway WTP Treated	**<2.0**	**<2.0**	**<2.0**
Glendale WTP Inlet	**2.2**	**2.6**	**-3.4**
Glendale WTP Treated			
24th St. WTP Inlet			
24th St. WTP Outlet			

Table 3 - Canal Sampling – March 3, 2014

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	**<2.0**	**2.4**	**<2.0**
	Union Hills Inlet			
	CAP Canal at Cross-connect	**<2.0**	**2.4**	**<2.0**
AZ Canal	Salt River @ Blue Pt Bridge			
	Verde River @ Beeline	**3.2**	**4.5**	**<2.0**
	AZ Canal above CAP Cross-connect	**4.2**	**4.4**	**<2.0**
	AZ Canal below CAP Cross-connect	**4.7**	**4.9**	**<2.0**
	AZ Canal at Highway 87	**5.6**	**4.4**	**<2.0**
	AZ Canal at Pima Rd.	**6.9**	**6.6**	**<2.0**
	AZ Canal at 56th St.	**5.5**	**6.3**	**<2.0**
	AZ Canal - Central Avenue	**2.3**	**2.8**	**<2.0**
	AZ Canal - Inlet to Glendale WTP	**2.2**	**2.6**	**<2.0**
	Head of the Consolidated Canal	**3.9**	**3.6**	**<2.0**
	Middle of the Consolidated Canal	**<2.0**	**<2.0**	**<2.0**
	Tempe Canal - Inlet to Tempe's South Plant	**<2.0**	**<2.0**	**<2.0**
	Mesa Turnout (Feb)	**2.1**	**2.5**	**<2.0**
	Salt-Gila Pump (Feb)	**2.0**	**2.6**	**<2.0**