Regional Water Quality NEWSLETTER

DATE: Report for February 2009
Sampling conducted January 2-3 2009
A 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. T&O levels are low now in the winter. However because of rains last week turbidity levels were elevated (average 30 NTU).
2. SRP is releasing Salt River water because the reservoirs are full, which means that there is higher DOC (~ 4.5 mg/L) in the SRP canals – than if Verde River water was being released which has a slightly lower DOC of 3.5 to 4 mg/L. Higher DOC leads to higher THM formation.
3. Because more Salt River water is being used, we sampled the Salt River reservoirs and analyzed the DOC by size exclusion chromatography (SEC-DOC) to evaluate if the "nature" of the DOC is similar. For the most part the DOC throughout the Salt River is fairly uniform, although samples from Canyon Lake had slightly higher molecular weight DOC – which tends to form more THMs.
4. Sampling for EDC/PPCPs at a recharge system (GRUSP), wastewater treatment plants and an effluent dominated stream were made – and data are summarized below. Data next month will include EDC/PPCP data from local water treatment plants.

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			10 ppm Calgon WPH		10 ppm Calgon WPH	None			10 ppm Norit Hydrodarco O
Copper Sulfate			None		None	None			None
PreOxidation			none		None	none			None
Alum Dose Alkalinity pH			50 133/117 7.0		50 98 7.0	25 138 6.8			22 140 7.6
Finished water DOC DOC removal[2]		2.3 mg/L 11%	3.1 mg/L 34%		2.8 38%		3.6 18%		3.8 18%
Average turbidity over last 7 days			15-35 NTU		30 NTU	7.7			9.0
Recommendations	Off line			Down from Jan 6 thru April 2		Values are for before plant shut down		Down until April 15th	

[1] Ferric chloride instead of alum; plus 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

Table 1
SRP/CAP OPERATIONS - Values in cfs, for March 2, 2009

System	SRP Diversions	CAP
Arizona Canal	553	0
South Canal	427	0
Pumping	44	0
Total	1024	0

- **SRP is releasing water from both Verde and Salt River Systems**. Salt River release from Saguaro Lake: 1800 cfs; it is unusual to be releasing Salt River water this time of year. Verde River release from Bartlett Lake: 100 cfs. ***Water in the SRP is primarily from the Salt River*** *– historically we have Verde River water until mid-April.*
- **Flow over Granite Reef Dam**: 875 cfs (this is water being released into the Salt River and not the SRP canal system. This is being done because the Salt River reservoirs are >99% of full capacity.
- **The Verde River system** is at 73% of full capacity

The **Snowpack in Arizona is above average** this year (see table below from: http://www.wcc.nrcs.usda.gov/reports/UpdateReport.html?textReport=Arizona&textRptKey=2&textFormat=SNOTEL+Snowpack+Update+Report&StateList=2&RegionList=Select+a+Region+or+Basin&SpecialList=Select+a+Special+Report&MonthList=January++++++++&DayList=6&YearList=2009&FormatList=N&OutputFormatList=HTML&textMonth=January++++++++&textDay=6&CompYearList=select+a+year)

Table 2 - Water Treatment Plants – March 2, 2009

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
24th Street WTP Inlet	**<2.0**	**2.1**	**<2.0**
24th Street WTP Treated	**<2.0**	**<2.0**	**<2.0**
Deer Valley Inlet	**<2.0**	**2.3**	**<2.0**
Deer Valley WTP Treated	**<2.0**	**<2.0**	**<2.0**
Val Vista Inlet	**<2.0**	**2.8**	**<2.0**
Val Vista WTP Treated –East			
Val Vista WTP Treated -West			
Union Hills Inlet	**<2.0**	**2.5**	**<2.0**
Union Hills Treated	**<2.0**	**2.1**	**<2.0**
Tempe North Inlet			
Tempe North Plant Treated			
Tempe South WTP	**<2.0**	**2.3**	**<2.0**
Tempe South Plant Treated	**<2.0**	**<2.0**	**<2.0**
Greenway WTP Inlet	**<2.0**	**2.1**	**<2.0**
Greenway WTP Treated	**<2.0**	**2.5**	**<2.0**
Glendale WTP Inlet	**<2.0**	**2.7**	**<2.0**
Glendale WTP Treated	**<2.0**		
Glendale WTP Treated (Lab)			

Conclusion: Taste and odor levels are low, because MIB and geosmin are not noticeable in tap water until their concentrations exceed 10 ng/L.

Table 3 - Canal Sampling – March 2, 2009

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal			
	Union Hills Inlet	<2.0	2.5	<2.0
	CAP Canal at Cross-connect			
AZ Canal	Salt River @ Blue Pt Bridge	<2.0	2.0	<2.0
	Verde River @ Beeline	2.7	2.7	<2.0
	AZ Canal above CAP Cross-connect	<2.0	2.7	<2.0
	AZ Canal below CAP Cross-connect	<2.0	2.3	<2.0
	AZ Canal at Highway 87	<2.0	2.3	<2.0
	AZ Canal at Pima Rd.	<2.0	2.3	<2.0
	AZ Canal at 56th St.	<2.0	2.5	<2.0
	AZ Canal - Inlet to 24th Street WTP	<2.0	2.1	<2.0
	AZ Canal - Central Avenue	<2.0	2.3	<2.0
	AZ Canal - Inlet to Deer Valley WTP	<2.0	<2.0	<2.0
	AZ Canal - Inlet to Glendale WTP	<2.0	2.7	2.7
South and Tempe Canals	South Canal below CAP Cross-connect	<2.0	2.6	<2.0
	South Canal at Val Vista WTP	<2.0	2.8	<2.0
	Head of the Tempe Canal	<2.0	2.4	<2.0
	Tempe Canal - Inlet to Tempe's South Plant	<2.0	2.3	<2.0

Table 4 - Reservoir Samples – March 3, 2009

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant	Eplimnion			
Lake Pleasant	Hypolimnio			
Verde River @ Beeline		2.7	2.7	<2.0
Bartlett Reservoir	Epilimnion	<2.0	<2.0	3.2
Bartlett Reservoir	Epi-near dock	<2.0	<2.0	<2.0
Bartlett Reservoir	Hypolimnio	<2.0	<2.0	<2.0
Salt River @ BluePt Bridge		<2.0	2.0	<2.0
Saguaro Lake	Epilimnion	<2.0	2.7	<2.0
Saguaro Lake	Epi - Duplicate	<2.0	2.2	<2.0
Saguaro Lake	Epi-near doc	<2.0	2.3	<2.0
Saguaro Lake	Hypolimnio	<2.0	<2.0	<2.0

Organic Matter Status In the Treatment Plants

Water Treatment Plants – March 02, 2009

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN	DOC removal (%)
24th Street WTP Inlet	4.67	0.118	2.52	0.56	
24th Street WTP Treated	3.08	0.053	1.72	0.50	34
Deer Valley Inlet	4.57	0.120	2.62	0.56	
Deer Valley WTP Treated	2.84	0.046	1.61	0.53	38
Val Vista Inlet	4.68	0.119	2.54	0.56	
Val Vista WTP Treated –East					
Val Vista WTP Treated -West					
Union Hills Inlet	2.53	0.041	1.61	0.71	
Union Hills Treated	2.25	0.023	1.03	0.79	11
Tempe North Inlet					
Tempe North Plant Treated					
Tempe South WTP	4.61	0.117	2.55	0.52	
Tempe South Plant Treated	3.79	0.079	2.09	0.45	18
Greenway WTP Inlet	4.42	0.119	2.70	0.57	
Greenway WTP Treated	3.63	0.048	1.33	0.46	18
Glendale WTP Inlet	4.81	0.122	2.52	0.58	
Glendale WTP Treated					

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)

Organic Matter Status In the Canals

Canal Sites

Sample Description	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Waddell Canal				
Union Hills Inlet	2.53	0.041	1.61	0.71
CAP Canal at Cross-connect				
Salt River @ Blue Pt Bridge	4.74	0.121	2.55	0.55
Verde River @ Beeline	2.27	0.063	2.78	0.54
AZ Canal above CAP Cross-connect	4.66	0.117	2.50	0.48
AZ Canal below CAP Cross-connect	4.67	0.117	2.51	0.48
AZ Canal at Highway 87	4.68	0.117	2.50	0.47
AZ Canal at Pima Rd.	4.62	0.118	2.54	0.56
AZ Canal at 56th St.	4.66	0.117	2.52	0.55
AZ Canal - Inlet to 24th Street WTP	4.67	0.118	2.52	0.56
AZ Canal - Central Avenue	4.53	0.120	2.64	0.58
AZ Canal - Inlet to Deer Valley WTP	4.57	0.120	2.62	0.56
AZ Canal - Inlet to Glendale WTP	4.81	0.122	2.52	0.58
AZ Canal - Inlet to Greenway WTP	4.42	0.119	2.70	0.57
South Canal below CAP Cross-connect	4.67	0.118	2.52	0.50
South Canal at Val Vista WTP	4.68	0.119	2.54	0.56
Head of the Tempe Canal	4.66	0.120	2.57	0.52
Tempe Canal - Inlet to Tempe's South Plant	4.61	0.117	2.55	0.52
Chandler WTP – Inlet				

Organic Matter Status In the Watershed

Reservoir Samples – March 02, 2009

Reservoir sampling will be conducted only monthly. CAP is sampling Lake Pleasant on slightly different days than the other reservoirs.

Sample Description	Location	DOC (mg/L)	UV254 (1/cm)	SUVA (L/mg-m)	TDN
Lake Pleasant	Eplimnion				
Lake Pleasant	Hypolimnio				
Verde River @ Beeline		2.27	0.063	2.78	0.54
Bartlett Reservoir	Epilimnion	3.62	0.102	2.82	0.34
Bartlett Reservoir	Epi-near dock				
Bartlett Reservoir	Hypolimnio	4.94	0.123	2.49	0.65
Salt River @ BluePt Bridge		4.74	0.121	2.55	0.55
Saguaro Lake	Epilimnion	5.41	0.124	2.29	0.65
Saguaro Lake	Epi - Duplicate	5.21	0.122	2.34	0.53
Saguaro Lake	Epi-near doc				
Saguaro Lake	Hypolimnio	3.41	0.096	2.82	0.49
Verde River at Tangle	Feb-09	5.15	0.298	5.78	0.30
Havasu	Feb-09	2.45	0.041	1.67	0.69

Special Sampling

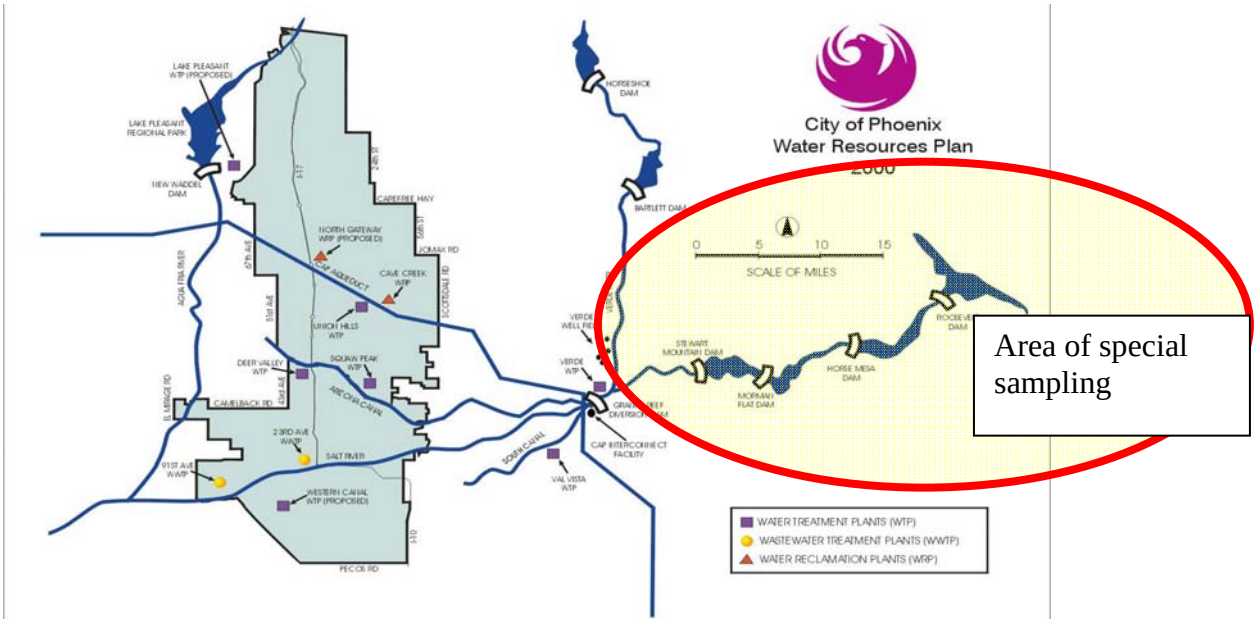
Reported last month:

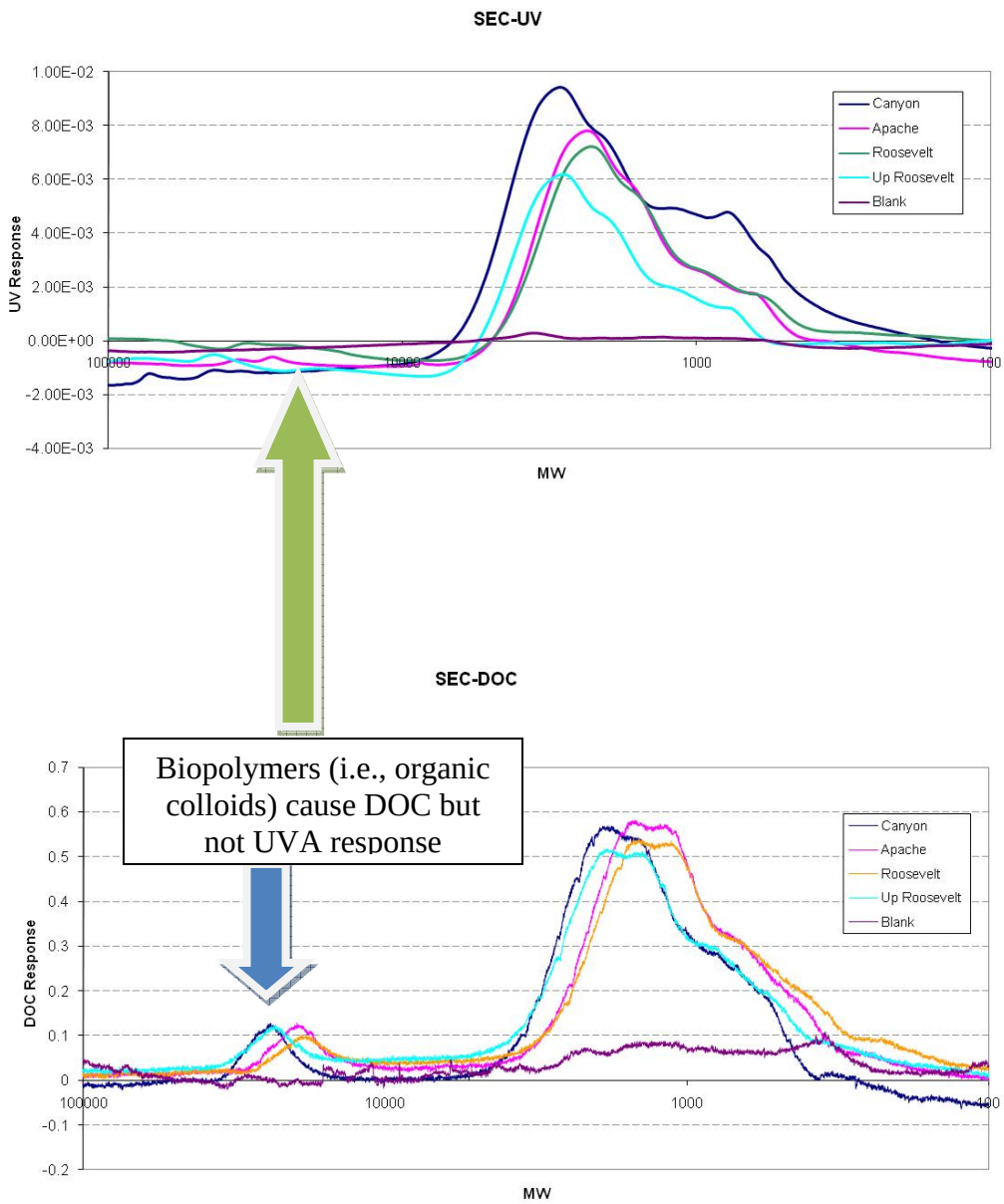
In response to some concerns about releasing water from the Salt River because of upstream runoff we measured organic levels in all the Salt River reservoirs last week. The results are shown below. The results suggest there will NOT be a pulse of TOC or turbidity moving through the Salt River during high release. Releases on the Verde River may be different because there is less storage.

New Information:

Size exclusion chromatography (SEC) with on-line DOC or UV absorbance at 254 nm detection is shown on the next page (SEC-DOC & SEC-UVA). Organic colloids are present and represent 5% to 10% of the DOC response in the 10K to 50K Dalton size range. There is more intermediate molecular weight DOC (1K to 10K) than lower molecular weight material (300 to 1K). Organics in Canyon Lake appear to differ from the other lakes, and this is consistent with having a higher DOC and UV254 of the bulk water. This information could suggest that the organics in Canyon represent the last of a "pulse" of organics from the major runoff events from several years ago.

	DOC (mg/l)	TDN (mg/l)	UV254 (cm^{-1})	SUVA (m^{-1}/(mg/L)
Canyon Lake	4.87	0.61	0.134	2.8
Apache Lake	4.46	0.57	0.119	2.7
Roosevelt Lake A	4.20	0.32	0.109	2.6
Roosevelt Lake B	4.20	0.26	0.111	2.6





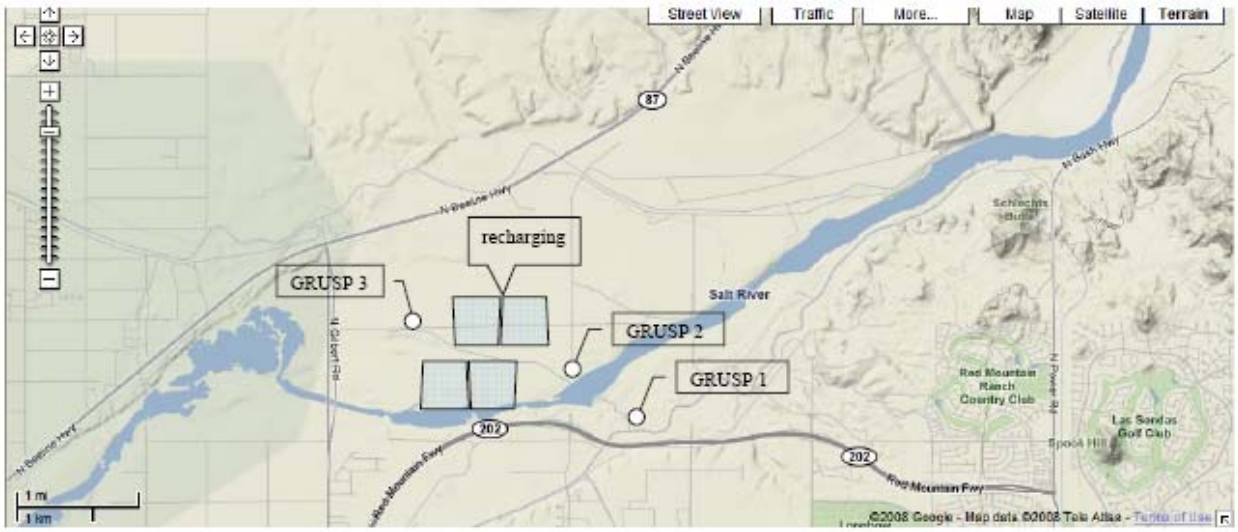
Summary of SEC-TOC (normalized area under the curves)

Size range (Da)	Upper Roosevelt	Lower Roosevelt	Canyon	Apache
10K to 50K	10%	7%	6%	8%
1K to 10K	59%	50%	66%	54%
300 to 1K	26%	35%	26%	34%
100 to 300	5%	8%	2%	4%

EDC/PPCPs at Granite Reef Underground Storage Project (GRUSP)

GRUSP is located adjacent to the Salt River near the head of the Arizona and South Canals at Gilbert Road. Samples were selected from several monitoring wells labeled below. Pharmaceuticals & Personal Care Products (PPCPs) and Steriods (i.e, EDCs) were analyzed on samples these samples and the results are summarized in the table below. The monitoring well at GRUSP site 3 was impacted by sulfamethoxazole (antibiotic) and sucralose (artificial sweetner). These compounds were not present in other samples or field blanks (next table).

Under consideration is the possibility of recharging treated wastewater into GRUSP instead of SRP surface water which now enters. A table below shows the WWTP data for EDC/PPCPs. First, it should be noted that most compounds are removed >99.99% (4 logs). Only a few compounds are further removed during UV treatment, at levels applied for disinfection purposes. However, sucralose concentrations are very high in wastewater effluent – and therefore may serve as a good tracer of wastewater.



PPCP/EDC Concentrations in parts per trillion (ng/L)

Sample Name	Grusp #1	Grusp #2	Grusp #3	Grusp #3-Duplicate
Acetaminophen	0.0	0.0	0.0	0.0
Caffeine	6.0	3.8	4.9	6.5
Carbamazepine	0.9	0.8	0.7	0.7
Cotinine	0.0	< 0	0.0	0.0
DEET	0.3	0.3	0.4	0.5
Diazepam	0.0	< 0	< 0	0.0
Fluoxetine	0.0	0.9	0.8	0.8
Hydrocodone	0.0	0.0	0.0	0.0
Meprobamate	0.6	0.4	0.3	0.4
Primidone	0.0	0.0	1.1	0.8
Oxybenzone	7.6	4.7	6.0	4.5

Sulfamethoxazole	2.9	6.7	124.0	114.0
Erythromycin	0.5	0.5	0.5	0.5
Trimethoprim	1.2	0.7	0.0	0.0
Ibuprofen	0.0	0.0	0.0	0.0
Naproxen	2.7	0.8	0.3	0.3
Dilantin	3.4	4.0	3.9	4.9
Triclosan	0.9	1.4	0.0	0.5
Diclofenac	0.0	0.0	0.0	0.0
Sucralose	0.0	0.0	135.0	152.0
Estradiol	< 0	< 0	< 0	0.0
Ethynyl Estradiol	< 0	0.2	< 0	< 0
Testosterone	0.7	0.0	0.0	0.0
Progesterone	0.1	0.2	0.0	0.2

Sample blanks and samples from a local wastewater treatment plant (WWTP)

Sample Name	field blank	lab blank	WWTP Influent	WWTP Effluent	WWTP post UV
Acetaminophen	0.0	0.0	444000.0	0.0	0.0
Caffeine	0.8	0.5	51100.0	26.8	38.7
Carbamazepine	0.5	0.5	1100.0	1110.0	1270.0
Cotinine	0.0	< 0	5550.0	5.9	22.6
DEET	< 0	< 0	285.0	211.0	189.0
Diazepam	0.0	0.0	2.7	3.2	2.6
Fluoxetine	0.9	0.0	0.0	262.0	181.0
Hydrocodone	0.0	0.0	113.0	38.3	15.1
Meprobamate	0.2	0.2	1330.0	477.0	450.0
Primidone	0.0	0.4	604.0	342.0	216.0
Oxybenzone	3.8	4.0	5740.0	35.6	30.4
Sulfamethoxazole	1.4	1.0	1780.0	3430.0	1960.0
Erythromycin	0.5	0.5	332.0	85.7	117.0
Trimethoprim	0.0	1.5	788.0	222.0	233.0
Ibuprofen	0.0	0.0	7000.0	0.0	0.0
Naproxen	0.0	0.0	23200.0	18.7	10.1
Dilantin	1.2	1.0	109.0	228.0	189.0
Triclosan	0.8	0.0	3180.0	50.1	48.1
Diclofenac	0.0	0.0	458.0	274.0	125.0
Sucralose	0.0	0.0	39100.0	34200.0	42900.0
Estradiol	0.6	1.1	0.0	< 0	0.0
Ethynyl Estradiol	< 0	< 0	13.5	0.2	0.1
Testosterone	0.0	0.0	128.0	0.0	0.0
Progesterone	0.2	0.1	19.8	0.2	0.0

EDC/PPCPs in the Santa Cruz River downstream of the Nogales WWTP

To begin to understand the potential fate and transport of EDC/PPCPs should they occur in water supplies, we looked to an effluent dominated stream (Santa Cruz River near Nogales – see map with sampling points). Data for the December 2008 sampling is shown in the table below. There was not a large decrease in any of the EDC/PPCPs along several miles of the Santa Cruz river – suggesting that most of the EDC/PPCPs that enter the aquatic environment are fairly "stable".

Sample Name	Nogales WWTP inf	Nogales WWTP eff	Santa Cruz A	Santa Cruz A-Dup	Santa Cruz B	Santa Cruz C	Santa Cruz D
Acetaminophen	150000	286	127	146	126	88	73
Caffeine	37900	95	216	189	408	474	260
Carbamazepine	553	125	119	126	116	107	81
Cotinine	1320	1840	1620	1760	1170	870	479
DEET	720	239	193	224	193	159	111
Diazepam	2	3	3	3	3	2	2
Fluoxetine	0	12	9	8	3	1	1
Hydrocodone	2	2	2	2	2	3	3
Meprobamate	83	59	65	68	65	69	56
Pentoxifylline	58	46	54	50	86	109	79
Primidone	36	27	34	34	50	57	46
Oxybenzone	10200	38	36	44	47	35	19
Sulfamethoxazole	3360	2180	2460	2170	2990	3370	2770
Erythromycin	901	208	199	431	384	442	311
Trimethoprim	1240	272	297	340	551	542	497
Ibuprofen	1300	512	433	541	587	467	436
Naproxen	7540	528	427	452	382	353	407
Dilantin	70	74	71	82	76	69	70
Triclosan	1010	299	239	278	216	176	217
Diclofenac	1610	1050	827	964	540	480	582
TBBA	0	0	0	0	0	0	0
Suclralose	9710	7230	7710	7600	6270	4730	5320
Estradiol	14	88	87	54	35	67	54
Ethynyl Estradiol	0	1	0	0	1	1	< 0
Testosterone	13	1	1	1	1	1	1
Progesterone	7	2	7	8	5	4	3