

Flagstaff City Manager's CEC Advisory Panel

Final Report

January 9, 2018



Five Years ago, Flagstaff's City Manager recognized the importance of water to the future of our community and organized an Advisory Panel of 12 local, state and nationally recognized researchers, scientists and industry professionals to help understand what Compound of Emerging Concern (CECs) mean to our local community. Flagstaff has been known around the State as a leader in its willingness to tackle tough issues relating to water head-on and the creation of this Advisory Panel is just one more example.

The Advisory Panel first met in January 2013 and was asked to help the City determine what to study and identify steps that are necessary to better understand the effects, if any CECs have in our raw, treated and reclaimed water. The focus of discussions has initially been around the "human health impacts" as opposed to animal, aquatic or environmental impacts. The City recognizes that all of these are important to our community; however, we needed to start somewhere.

The purpose of this Final Report is to provide a summary conclusion to the five (5) year collaborative work conducted by the Flagstaff City Manager's CEC Advisory Panel. The last meeting of the full panel was on November 3, 2017. Additionally, this report contains the analytical results of sampling conducted by the City in 2014 and 2015. Over the past five years, the City has sought advice from the Panel on the meaning of these CEC analytical results and whether they warrant concern or modification of Flagstaff's use and management of reclaimed water. This effort has looked at both chemical and antibiotic resistance aspects of CECs. The results and conclusions of the antibiotic resistant bacteria (ARB) / antibiotic resistance gene (ARG) sampling will be provided in a separate report.

The last time City staff provided an update to the Advisory Panel was September 14, 2015, via a Preliminary Data Report. This report summarized sampling updates for CECs in source water (untreated lake water and groundwater), potable water (after filtration or disinfection of source water), and reclaimed water. **Flagstaff's water system currently meets all U.S. EPA and state regulatory requirements. All analyses of recent samples collected from our source water and the distribution system are below the primary (regulated) and secondary (nonregulated) maximum contaminant level (MCL) standards.**

CEC & ADVISORY PANEL BACKGROUND

Compounds of Emerging Concern (CECs) are substances that have been released to, found in, or have the potential to enter our water supplies. Collectively, CECs include chemicals — pharmaceuticals, personal care products (PPCPs), endocrine disruptors, antibiotic resistant bacteria (ARB), and antibiotic resistance genes (ARGs) — found in trace or very low concentrations that are unregulated by the U.S. EPA. These compounds are termed "emerging"

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not because they only appeared recently but because the technologies for detection have improved in recent years, facilitating our ability to identify them at lower levels than ever before. The same CECs detected in the Flagstaff potable and reclaimed water systems are so widespread in the environment that they are found in foods and beverages including bottled water (WRF, 2015).

Flagstaff's previous City Manager, Kevin Burke, organized an Advisory Panel of 12 local, state, and nationally recognized scientific professionals to help us understand what CECs mean locally. The Panel was asked to recommend actions to better understand the effects, if any, of these constituents in our source water, drinking water, reclaimed water, and respective distribution systems, and to provide the City with an assessment of the risk CECs pose to human health, both in general and for Flagstaff. The Panel first met in January 2013 and issued its Interim Report in July 2013. The 2013 interim report is available online at www.flagstaff.az.gov/cec

2013 INTERIM REPORT RESULTS & RECOMMENDATIONS

The Advisory Panel's Interim Report found no evidence that the continued use of reclaimed water poses undue risk to human health. However, the Panel advised implementing a proactive measure in case regulations are established: sampling for trace substances in Flagstaff's water supplies and systems to provide background information. It also recommended testing for ARGs and ARB in reclaimed water. The recommended constituents included chemicals specified in the U.S. EPA's Unregulated Contaminant Monitoring Rule (UCMR 3). This rule requires public water systems to sample for contaminants during the development of regulatory decisions. The UCMR 3 list contains 30 constituents. The Panel also suggested that the City sample for some constituents that are not currently listed on the UCMR list.

Further, the Advisory Panel recommended convening a subcommittee of its members to discuss future study and possible funding opportunities. The Research Subcommittee quickly determined that a comprehensive epidemiological and microbial study of antibiotic resistant bacteria to determine any potential link between human health effects and reclaimed water within Flagstaff is of such scale, cost, and specificity that it is unlikely to find a specific grant to match the full scope of the study. Therefore, the Research Subcommittee developed an approach to study Flagstaff's water that included several different research components. A full status update on the Research Subcommittee's research projects and discussion on sampling was provided to the full Advisory Panel in May 2014 and is available online www.flagstaff.az.gov/cec.

SUMMARY OF 2014–2015 SAMPLING ACTIVITIES

September 14, 2015, Advisory Panel Preliminary Data Report issued the following sampling updates on drinking water and reclaimed water:

- 1) Sampling update of the reclaimed and drinking water systems to study ARB and ARG; and

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- 2) Sampling update of source water (untreated lake water and groundwater), potable water (after filtration or disinfection of source water) and reclaimed water for CECs only (not endocrine disruptors or ARG).

Summary of the July 26, 2016 discussions of the Research Subcommittee:

These data were presented to the Panel's Research Subcommittee on July 26, 2016. Members in attendance included Channah Rock, Ph.D., and Jeanie McClain, Ph.D. (by phone) — University of Arizona; Amy Pruden, Ph.D. — Virginia Tech; and David Engelthaler, Ph.D. — TGEN North. Additionally, Jeff Mosher, formerly the Executive Director, National Water Research Institute and now with the Water Environment & Reuse Foundation was invited as a guest who has extensive experience in reclaimed water issues in California and Arizona.

1—ARB and ARG Project Status (National Science Foundation Grant)

Over the past 2 years, City staff, under the guidance of the Research Subcommittee, collected samples throughout the reclaimed and drinking water distribution systems that were analyzed for ARB and ARGs by the University of Arizona, Virginia Tech, and TGen North with NSF funding. At the meeting, Panel members presented updates on the status of their analytical results and preliminary conclusions. The final results from the ARB/ARG analysis will be compiled in a separate report from the Research Subcommittee.

12/23/2016 Update: The Research Subcommittee has collected thousands of data points across Flagstaff and other municipal water systems, in Arizona and elsewhere, over the past two years. These data allow for spatial and temporal studies of water samples collected from multiple points along the treatment and distribution system. Water samples have been analyzed using traditional bacteriological tools as well as a number of advanced genomic analysis techniques. While the final results continue to be analyzed, initial results have not identified any increased risks associated with the Flagstaff reclaimed water as compared to other analyzed water re-use systems. The specific genomic analysis of reclaimed water from Flagstaff distribution points has not identified any obvious concerns identified with the continued public use of reclaimed water. Further, the genomic epidemiologic analysis of bacterial isolates from the water system and the local healthcare system has not identified any ongoing linkage between the systems. A parallel laboratory experiment is also underway which, together with the field data collected from Flagstaff and other partners using reclaimed water, is of great value to water professionals in understanding how reclaimed water management practices can best address concerns about ARB and ARG. While these studies are ongoing, the Research Subcommittee has identified a relatively cost efficient methodology for long term serial monitoring of the bacterial dynamics of water system. The final results from the Subcommittee will include a recommendation for the adoption of such a methodology.

2—CEC System Sampling Project Status

Samples were collected at locations in the reclaimed and drinking water distribution systems:

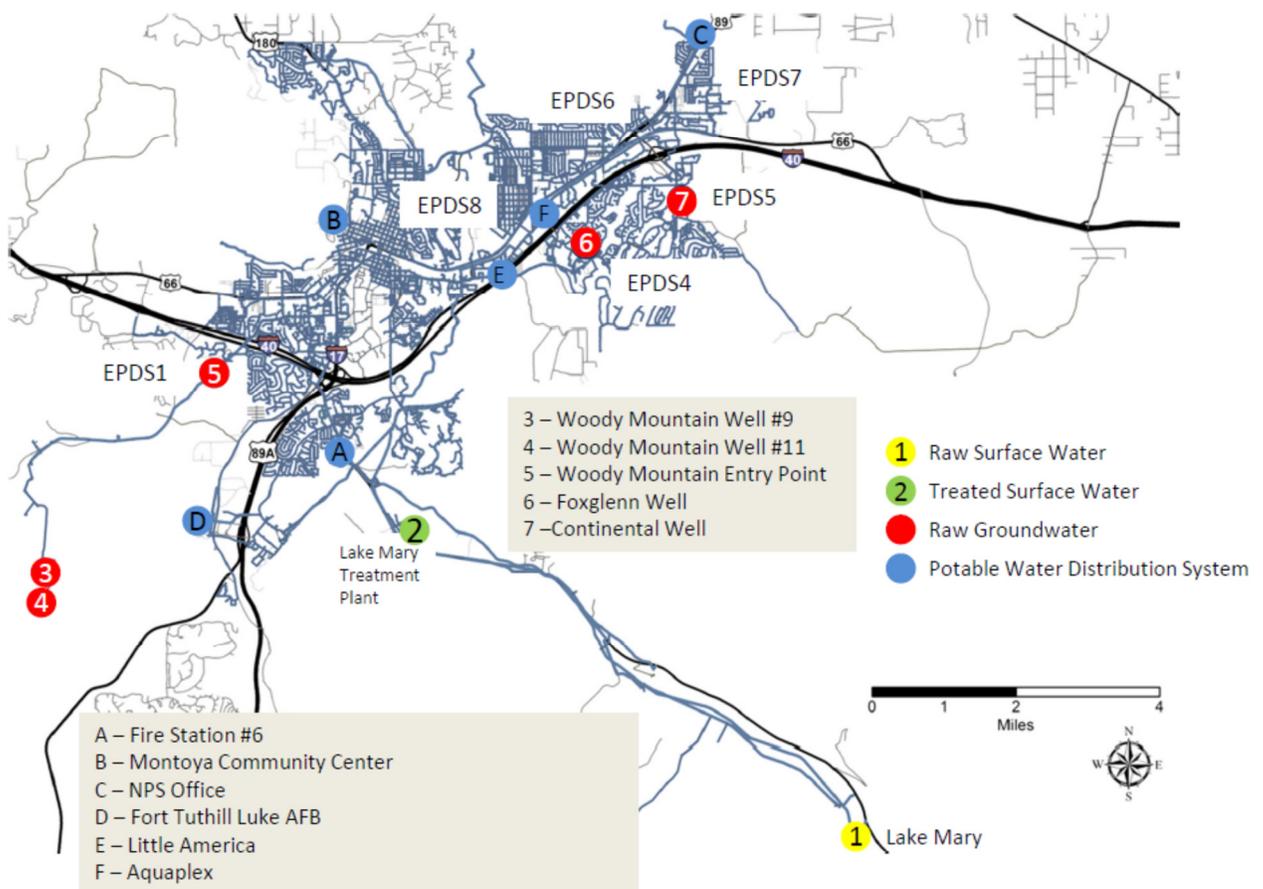
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- Two reclaimed sources
- Five locations in the reclaimed water distribution system
- Raw water from Upper Lake Mary
- Treated surface water from the Lake Mary Water Treatment Plant
- Raw groundwater from five wells
- Six locations in the drinking water distribution system

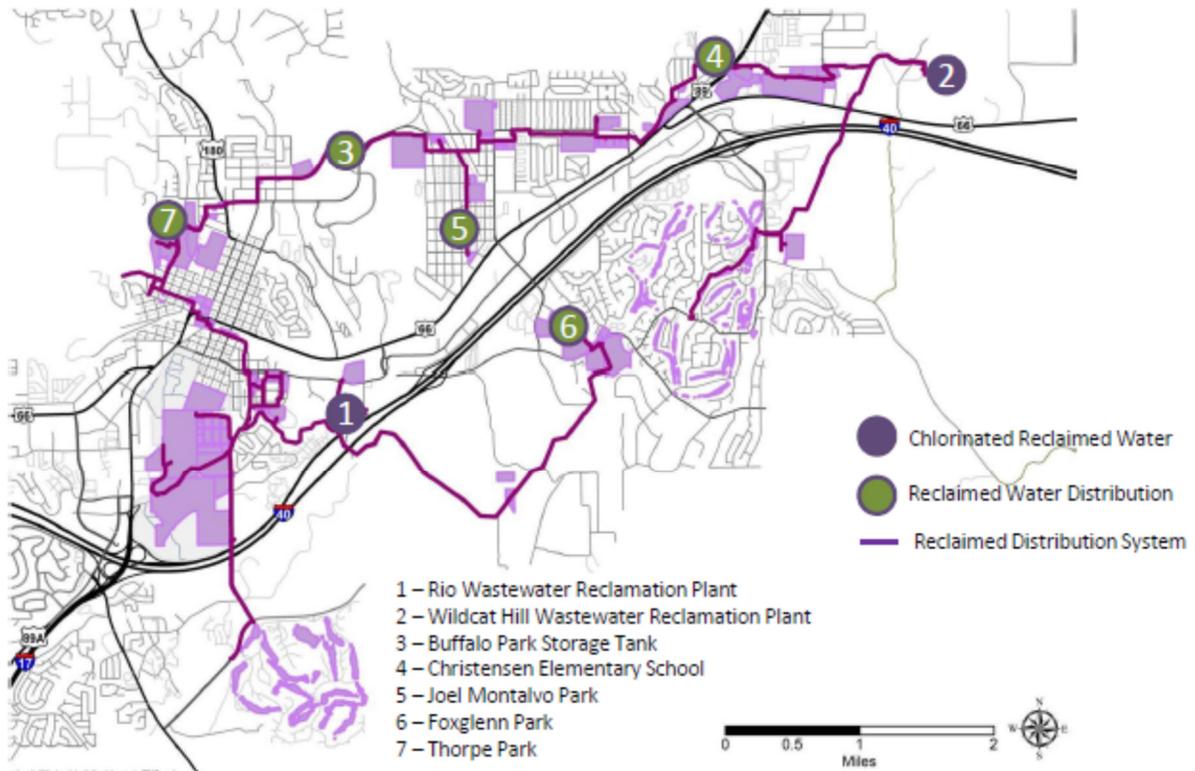
The samples were analyzed for up to 96 CECs (see **Appendix A**), including caffeine, 17-beta estradiol, triclosan, and N-Nitroso-dimethylamine (NDMA), which were specifically recommended by the Panel. All analyses were conducted by a national laboratory, Eurofins Eaton Analytical, in Phoenix, Arizona. Additionally, the City conducted sampling at the nine Entry Points to the Distribution System (EPDS) and at nine points in the distribution system in accordance with the UCMR 3.

Sample locations are identified on the maps below.

CEC Potable Water System Sampling



CEC Reclaimed Water System Sampling



RESULTS

The sampling results are provided in the tables in **Appendix A**. CECs were detected at trace concentrations, similar to previous sampling efforts since 2002. Note that these compounds have also been detected in trace concentrations in other communities nationwide. They are so widespread in the environment that they are found in foods and beverages, including bottled water (WRF, 2015).

The samples collected during 2014 and 2015 add more CEC baseline data to the City's water quality database. We continue to take water quality seriously. The City of Flagstaff is taking a proactive approach by voluntarily establishing baseline water quality information beyond the requirements under current State or Federal regulations.

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In July 2013, the Advisory Panel concluded that there were no data to suggest that the continued use of reclaimed water provides undue risk to human health. After four years of study, the Panel agreed with their initial conclusions and made no additional recommendations to how Flagstaff manages and uses reclaimed water. The Panel did provide suggestions for follow-on research and monitoring of the presence of ARBs and ARGs in reclaimed water, comparing to relevant local and national data.

ADDITIONAL INFORMATION

In 2010, Governor Brewer convened a Blue Ribbon Panel on Water Sustainability, of which Flagstaff was a panel member. That panel made recommendations for improving statewide water sustainability through recycling and conservation practices. In response to those recommendation, the Arizona Department of Environmental Quality convened a 35-member Advisory Panel on Emerging Contaminants (APEC) in 2012 at approximately the same time Flagstaff's City Manager was convening his own CEC Advisory Panel. Flagstaff was invited to be a member of the statewide APEC Panel. In September 2016, the APEC published a Status Report on Emerging Contaminants in Arizona Water. This report contains, among other things, CECs and their concentrations found within waters throughout Arizona (e.g., groundwater, surface water, drinking water and reclaimed water), potential ecological and health impacts, and recommendations for monitoring and guidance for Utilities around the State on the best approach to collect and interpret occurrence data that provides CEC signatures for source water and distribution system.

On January 1, 2016, the Arizona Department of Environmental Quality (ADEQ) published a Notice of Rulemaking Docket announcing they were making changes to the reclaimed rules, including changes to allowable reclaimed water uses and standards. The Notice included statewide listening sessions to be conducted over the winter and spring of 2016. ADEQ collected input from the listening sessions, including one held in Flagstaff, and published a formal Notice of Proposed Rulemaking on June 23, 2017. Additionally, ADEQ set up a Panel of statewide experts seeking their technical recommendations and the City of Flagstaff and Coconino County were invited to participate. The panel consisted of two workgroups. The Recycled Water Quality Standards workgroup's purpose was to evaluate whether ADEQ's reclaimed water quality standards and testing are adequate for their designated uses. The Recycled Water Infrastructure and Technology workgroup's purpose was to provide technical recommendations that ensure recycled water infrastructure and water treatment are appropriately regulated to protect human health and the environment given current technology. This workgroup was also tasked to provide policy and rule recommendations to ensure safe direct potable reuse. The panel's recommendations were due to ADEQ by October 31, 2017.

ADEQ asked the Panel (i.e., both workgroups) if the existing five reclaimed water classes (A+, A, B+, B, and C) are satisfactory to ensure the safe use of reclaimed water for existing uses, to

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protect public health and if the State needs more or fewer classes. The Panel provided draft recommendations to ADEQ in August 2017 to re-evaluate testing of turbidity, nitrogen and E.coli. However, they did not include any recommendations for additional testing for constituents such as unregulated CECs or ARB/ARGs.

REFERENCES

Arizona Department of Environmental Quality, Emerging Contaminants in Arizona Water – A Status Report, September 2016

Arizona Department of Environmental Quality Reclaimed Water Panel Draft Recommendation, August 21, 2017

City of Flagstaff, September 14, 2015, CEC Advisory Panel Preliminary Data Report, 13 p, last accessed September 3, 2016, <http://www.flagstaff.az.gov/documentcenter/view/47743>

City of Flagstaff, May 2014, CEC Advisory Panel Update, 4 p., last accessed August 27, 2015 www.flagstaff.az.gov/DocumentCenter/Home/View/44360

City of Flagstaff, July 16, 2013, CEC Panel Interim Report, 5 p., last accessed August 27, 2015 www.flagstaff.az.gov/DocumentCenter/View/42688

Water Research Foundation (WRF), 2015, Pharmaceuticals and Endocrine Disrupting Compounds in Water: A Primer for Public Outreach, 4387a, 85p.

CONTACTS

Josh Copley, City Manager
City of Flagstaff
211 W. Aspen Avenue
Flagstaff, Arizona 86001
JCopley@flagstaffaz.gov
928-213-2081

Brad Hill, R.G., *Water Services* Director
City of Flagstaff
211 W. Aspen Avenue
Flagstaff, Arizona 86001
bhill@flagstaffaz.gov
928-213-2400

APPENDIX A: ANALYTICAL DATA TABLES

NOTE: CECs were detected in nanograms per liter (ng/l) or parts per trillion (ppt). UCMR3 constituents were detected in micrograms per liter (ug/l) or parts per billion (ppb). For perspective, one part per billion is the equivalent of one-half teaspoon in an Olympic-sized pool, or one penny in \$10 million. One part per trillion is equivalent to one-half teaspoon in 1,000 Olympic-sized pools, or one penny in \$10 billion (WRF, 2015).

Table 1: Raw Groundwater (2014–2015)

CEC Constituent ¹	# of Samples Collected	# of Samples with detections	Lowest Concentration Detected	Range of Detected Concentrations (2011–2015) ²	Units ³
Acesulfame-K	8	1	ND	20	ng/l
Fluoxetine	8	1	ND	24	ng/l

1—Each tested for a maximum of 95 CECs; 2—The range of detected concentrations where more than one sample had a detectable concentration; 3—ng/l = nanograms per liter or ppt

Table 2: Raw Surface Water (2011–2015)

CEC Constituent ¹	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Range of Detected Concentrations (2011–2015) ²	Units ³
4-nonylphenol	3	1	ND	380	ng/l
Acetaminophen	3	1	ND	72	ng/l
Albuterol	3	1	ND	20	ng/l
Atenolol	3	1	ND	5.5	ng/l
BPA	3	1	ND	22	ng/l
Caffeine	3	1	ND	6.6	ng/l
Flumequine	3	1	ND	630	ng/l
Naproxen	3	1	ND	10	ng/l
Oxolinic Acid	3	1	ND	420	ng/l
Pentoxifylline	3	1	ND	25	ng/l
Quinoline	3	1	ND	7.4	ng/l
Sulfadiazine 7	3	1	ND	6	ng/l
Theobromine	3	2	ND	23-46	ng/l

1—Each tested for a maximum of 95 CECs; 2—The range of detected concentrations where more than one sample had a detectable concentration; 3—ng/l = nanograms per liter or ppt

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Table 3: Treated Surface Water (2011–2015)

CEC Constituent ¹	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Range of Detected Concentrations (2011–2015) ²	Units ³
4-nonylphenol	4	2	ND	110 - 200	ng/l
Acetaminophen	4	1	ND	64	ng/l
Albuterol	4	2	ND	12 - 21	ng/l
Atenolol	4	1	ND	6.1	ng/l
Caffeine	4	1	ND	6.4	ng/l
DACT	4	2	ND	7.6 - 21	ng/l
DEA	4	1	ND	6.2	ng/l
Flumequine	4	2	ND	330 - 480	ng/l
Naproxen	4	1	ND	12	ng/l
Oxolinic Acid	4	2	ND	231 - 310	ng/l
Pentoxifylline	4	2	ND	16 - 23	ng/l
Quinoline	4	2	ND	5.7 - 7.5	ng/l
TCEP	4	2	ND	22 - 32	ng/l
Theobromine	4	3	ND	43	ng/l

1—Each tested for a maximum of 95 CECs; 2—The range of detected concentrations where more than one sample had a detectable concentration; 3—ng/l = nanograms per liter or ppt

Table 4: Potable Water Distribution System (2010–2015)

CEC Constituent ¹	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Range of Detected Concentrations ²	Units ³
4-nonylphenol	11	1	ND	260	ng/l
Acesulfame-K	11	1	ND	34	ng/l
Acetaminophen	11	1	ND	25	ng/l
Albuterol	11	4	ND	11 - 13	ng/l
Azithromycin	11	1	ND	37	ng/l
Caffeine	11	4	ND	5.4 - 82	ng/l
Chloridazon	11	1	ND	14	ng/l
DEET	11	2	ND	2.1 - 2.4	ng/l
Flumequine	11	5	ND	34 - 290	ng/l
Iohexal	11	1	ND	42	ng/l
Iopromide	11	2	ND	5.2 - 5.5	ng/l
Oxolinic Acid	11	2	ND	231 - 310	ng/l
Pentoxifylline	11	2	ND	16 - 23	ng/l
Propazine	11	1	ND	6.5	ng/l
Quinoline	11	2	ND	5.7 - 7.5	ng/l
Sulfachloropyridazine	11	1	ND	5	ng/l
Sulfadimethoxine	11	1	ND	6.3	ng/l
Sulfamethazine	11	1	ND	8.6	ng/l
TCEP	11	1	ND	8.6	ng/l
Theobromine	11	7	ND	12 - 66	ng/l
Triclocarban	11	1	ND	7	ng/l
Triclosan	11	2	ND	19 - 37	ng/l

1—Each tested for a maximum of 95 CECs; 2—The range of detected concentrations where more than one sample had a detectable concentration; 3—ng/l = nanograms per liter or ppt

Note: Constituents may have been detected in the potable water system that were not detected in the raw groundwater, raw surface water, and treated surface water because of the very low detection limits (parts per trillion) and sampling locations with public access, such as sinks and drinking fountains. These locations may be more susceptible to contamination, especially at part per trillion concentrations, and could result in false positive results.

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Table 5: UCMR 3 (2013–2014)

UCMR3 Constituent	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Highest Concentration Detected	Units ¹
Chromium at Entry Point					
4th Quarter 2013	9	9	0.35	2.7	ug/l
1st Quarter 2014	2	2	0.37	0.53	ug/l
2nd Quarter 2014	9	9	0.55	2.2	ug/l
3rd Quarter 2014	2	1	ND	0.4	ug/l
Chromium in Distribution					
4th Quarter 2013	9	9	1	2.2	ug/l
1st Quarter 2014	2	2	1.2	1.6	ug/l
2nd Quarter 2014	9	9	0.63	1.6	ug/l
3rd Quarter 2014	2	2	0.33	0.5	ug/l
Hexavalent Chromium at Entry Point					
4th Quarter 2013	9	9	0.41	2.2	ug/l
1st Quarter 2014	2	2	0.39	0.58	ug/l
2nd Quarter 2014	9	9	0.51	2.1	ug/l
3rd Quarter 2014	2	2	0.02	0.39	ug/l
Hexavalent Chromium in Distribution					
4th Quarter 2013	9	9	1.2	2.2	ug/l
1st Quarter 2014	2	2	1.3	1.7	ug/l
2nd Quarter 2014	9	9	0.64	1.8	ug/l
3rd Quarter 2014	2	2	0.47	1.9	ug/l
Strontium at Entry Point					
4th Quarter 2013	9	9	34	140	ug/l
1st Quarter 2014	2	2	43	47	ug/l
2nd Quarter 2014	9	9	35	110	ug/l
3rd Quarter 2014	2	2	29	53	ug/l
Strontium in Distribution					
4th Quarter 2013	9	9	66	97	ug/l
1st Quarter 2014	2	2	74	93	ug/l
2nd Quarter 2014	9	9	35	100	ug/l
3rd Quarter 2014	2	2	41	57	ug/l
Vanadium at Entry Point					
4th Quarter 2013	9	9	0.61	5.7	ug/l
1st Quarter 2014	2	2	1.5	1.8	ug/l
2nd Quarter 2014	9	9	0.97	3.6	ug/l
3rd Quarter 2014	2	2	0.81	1.9	ug/l
Vanadium in Distribution					

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UCMR3 Constituent	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Highest Concentration Detected	Units ¹
4th Quarter 2013	9	9	0.72	3.7	ug/l
1st Quarter 2014	2	2	2.4	3.5	ug/l
2nd Quarter 2014	9	9	1.4	3.3	ug/l
3rd Quarter 2014	2	2	1.3	2.4	ug/l
Chlorate in Entry Point					
4th Quarter 2013	9	1	ND	38	ug/l
1st Quarter 2014	2	0	ND	ND	ug/l
2nd Quarter 2014	9	0	ND	ND	ug/l
3rd Quarter 2014	2	0	ND	ND	ug/l
Chlorate in Distribution					
4th Quarter 2013	9	1	ND	54	ug/l
1st Quarter 2014	2	0	ND	ND	ug/l
2nd Quarter 2014	9	0	ND	ND	ug/l
3rd Quarter 2014	2	0	ND	ND	ug/l
1,4 Dioxane in Entry Point					
4th Quarter 2013	9	0	ND	ND	ug/l
1st Quarter 2014	2	0	ND	ND	ug/l
2nd Quarter 2014	9	1	ND	0.53	ug/l
3rd Quarter 2014	9	0	ND	ND	ug/l

The following UCMR3 constituents were not detected in the Flagstaff water system:

Cobalt

Molybdenum

1,1-Dichloroethane

1,2,3-Trichloropropane

1,3-butadiene

Bromochloromethane

Bromomethane (Methyl Bromide)

Chlorodifluoromethane

Chloromethane(Methyl Chloride)

Perfluoro octanesulfonic acid - PFOS

Perfluoro-1-butanesulfonic acid -PFBS

Perfluoro-1-hexanesulfonic acid - PFHxS

Perfluoroheptanoic acid - PFHpA

Perfluoro-n-nonanoic acid -PFNA

Perfluorooctanoic acid - PFOA

¹ ug/l = micrograms per liter

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Table 6: Chlorinated Reclaimed Source Water (2010–2015)

CEC Constituent¹	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Range of Detected Concentrations²	Units³
N-Nitroso-dimethylamine (NDMA)	4	2	ND	3.7 - 4.7	ng/l
1,7-Dimethylxanthine	4	3	ND	90 - 140	ng/l
2,4-D	4	3	ND	15 - 57	ng/l
Acesulfame-K	4	3	ND	580 - 1300	ng/l
Acetaminophen	4	3	ND	57 - 1600	ng/l
Albuterol	4	3	ND	5.4 - 110	ng/l
Amoxicillin (semi-quantitative)	4	2	ND	10,000 - 14,000	ng/l
Androstenedione	4	1	ND	5	ng/l
Atenolol	4	4	130	360	ng/l
Atrazine	4	1	ND	5.1	ng/l
Azithromycin	4	1	ND	1500	ng/l
Butalbital	4	3	ND	9.4 - 11	ng/l
Caffeine	4	4	7.3	82	ng/l
Carbamazepine	4	4	100	130	ng/l
Carisoprodol	4	4	19	39	ng/l
Cimetidine	4	2	ND	94 - 120	ng/l
Cotinine	4	4	94	120	ng/l
DACT	4	1	ND	12	ng/l
DEET	4	4	92	330	ng/l
Dehydronifedipine	4	2	ND	6.9 - 8	ng/l
Diclofenac	4	1	ND	13	ng/l
Dilantin	4	4	53	110	ng/l
Diltiazem	4	2	ND	18 - 27	ng/l
Diuron	4	4	48	62	ng/l
Erythromycin	4	2	ND	39 - 62	ng/l
Estradiol	4	1	ND	23	ng/l
Estrone	4	2	ND	8.3 - 210	ng/l
Flumequine	4	2	ND	530 - 600	ng/l
Fluoxetine	4	3	ND	25 - 57	ng/l
Gemfibrozil	4	2	ND	6.3 - 380	ng/l
Ibuprofen	4	2	ND	20 - 410	ng/l
Iohexal	4	2	81	81 - 910	ng/l
Iopromide	4	1	ND	22	ng/l
Isoproturon	4	2	ND	190 - 470	ng/l
Ketoprofen	4	3	ND	15 - 24	ng/l
Ketorolac	4	2	ND	11 - 21	ng/l

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CEC Constituent¹	# of Samples Collected	# of Samples with Detections	Lowest Concentration Detected	Range of Detected Concentrations²	Units³
Lidocaine	4	2	ND	179 - 180	ng/l
Lincomycin	4	3	ND	18 - 25	ng/l
Linuron	4	2	ND	5.6 - 8.1	ng/l
Lopressor	4	4	92	340	ng/l
Meprobamate	4	4	81	140	ng/l
Naproxen	4	1	ND	1000	ng/l
Oxolinic Acid	4	2	ND	140 - 380	ng/l
Primidone	4	4	96	140	ng/l
Progesterone	4	1	ND	6.2	ng/l
Propylparaben	4	2	ND	6 - 11	ng/l
Quinoline	4	3	ND	8.4 - 56	ng/l
Sucralose	4	4	8400	54000	ng/l
Sulfamerazine	4	1	ND	320	ng/l
Sulfamethoxazole	4	1	ND	470	ng/l
Sulfathiazole	4	1	ND	18	ng/l
TCEP	4	4	200	380	ng/l
TCP	4	1	ND	12	ng/l
TDCPP	4	4	940	1400	ng/l
Testosterone	4	1	ND	12	ng/l
Theobromine	4	4	43	140	ng/l
Theophylline	4	3	ND	56 - 200	ng/l
Triclosan	4	2	ND	66 - 110	ng/l
Trimethoprim	4	2	ND	300 - 380	ng/l
Warfarin	4	1	ND	5.4	ng/l

1—Each tested for a maximum of 95 CECs; 2—The range of detected concentrations where more than one sample had a detectable concentration; 3—ng/l = nanograms per liter or ppt

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Table 7: Reclaimed Water within the Distribution System (2014–2015)

CEC Constituent	# of Samples Collected	# of samples with detections	Lowest Concentration Detected	Highest Concentration Detected	Units
N-Nitroso-dimethylamine (NDMA)	11	8	ND	2.3 - 17	ng/l
1,7-Dimethylxanthine	11	10	ND	11 - 90	ng/l
2,4-D	11	7	ND	32 - 240	ng/l
4-nonylphenol - semi quantitative	11	6	ND	240 - 1000	ng/l
4-tert-octylphenol	11	2	ND	160 - 340	ng/l
Acesulfame-K	11	11	520	17000	ng/l
Acetaminophen	11	5	ND	220 - 690	ng/l
Albuterol	11	5	ND	59 - 110	ng/l
Amoxicillin (semi-quantitative)	11	1	ND	220	ng/l
Androstenedione	11	1	ND	5	ng/l
Atenolol	11	11	25	330	ng/l
Atrazine	11	1	ND	5.2	ng/l
Bezafibrate	11	1	ND	5.8	ng/l
BPA	11	2	ND	34 - 770	ng/l
Butalbital	11	5	ND	5.2 - 9.8	ng/l
Caffeine	11	10	ND	7.7 - 66	ng/l
Carbamazepine	11	11	37	150	ng/l
Carisoprodol	11	11	20	55	ng/l
Cotinine	11	11	15	78	ng/l
DACT	11	4	ND	5.5 - 45	ng/l
DEA	11	1	ND	10	ng/l
DEET	11	10	ND	18 - 340	ng/l
Dehydronifedipine	11	9	ND	5.1 - 66	ng/l
Diclofenac	11	1	ND	20	ng/l
Dilantin	11	11	29	170	ng/l
Diuron	11	11	6.4	98	ng/l
Erythromycin	11	2	ND	13 - 27	ng/l
Estradiol	11	3	ND	15	ng/l
Estrone	11	6	ND	6.7 - 13	ng/l
Flumequine	11	5	ND	370 - 910	ng/l
Fluoxetine	11	7	ND	10 - 24	ng/l
Furosimide	11	1	ND	24	ng/l

Flagstaff City Manager's Compounds of Emerging Concern Advisory Panel

CEC Constituent	# of Samples Collected	# of samples with detections	Lowest Concentration Detected	Highest Concentration Detected	Units
Gemfibrozil	11	7	ND	5.5 - 73	ng/l
Ibuprofen	11	1	ND	22	ng/l
Iohexal	11	11	130	12000	ng/l
Iopromide	11	11	20	700	ng/l
Isoproturon	11	4	ND	160 - 280	ng/l
Ketoprofen	11	7	ND	6.6 - 32	ng/l
Ketorolac	11	1	ND	6.7	ng/l
Lidocaine	11	3	ND	6.7 - 88	ng/l
Lincomycin	11	4	ND	17 - 25	ng/l
Linuron	11	4	ND	5.7 - 7.7	ng/l
Lopressor	11	11	20	150	ng/l
Meprobamate	11	11	37	190	ng/l
Naproxen	11	2	ND	78	ng/l
OUST (Sulfameturon, methyl)	11	1	ND	7.3	ng/l
Oxolinic Acid	11	4	ND	290 - 660	ng/l
Pentoxifylline	11	1	ND	8.9	ng/l
Primidone	11	11	26	140	ng/l
Propazine	11	2	ND	8.2 - 9.7	ng/l
Propylparaben	11	4	ND	9.6 - 120	ng/l
Quinoline	11	5	ND	7.1 - 58	ng/l
Simazine	11	5	ND	5.2 - 11	ng/l
Sucralose	11	11	20000	58000	ng/l
Sulfamethoxazole	11	2	ND	14 - 120	ng/l
TCEP	11	11	46	290	ng/l
TCPP	11	10	ND	450 - 1100	ng/l
TDCPP	11	10	ND	940 - 1300	ng/l
Testosterone	11	3	ND	11 - 15	ng/l
Theobromine	11	11	12	110	ng/l
Theophylline	11	10	ND	22 - 58	ng/l
Triclocarban	11	2	ND	7.2 - 8.2	ng/l
Triclosan	11	4	ND	13 - 20	ng/l
Trimethoprim	11	2	ND	20 - 32	ng/l

1—Each tested for a maximum of 95 CECs; 2—The range of detected concentrations where more than one sample had a detectable concentration; 3—ng/l = nanograms per liter or ppt