Surface water

January 2021

Pharmaceuticals and chemicals of concern in Minnesota lakes

A statewide 2017 study of surface water shows that several medicines and other chemical contaminants found in Minnesota's lakes may be harmful to aquatic fish and wildlife.

MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT

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Contributors/acknowledgements

This report contains the results of a study that characterizes the presence and effects of unregulated contaminants in Minnesota's Lakes. The study was made possible through funding by the Minnesota Clean Water Fund.

The authors thank the following for assistance and advice in designing and carrying out this study:

Lee Engel, Dereck Richter, Jordan Donatell, Joe Hadash, Isaac Martin, Lindsay Egge, and Josh Stock for fieldwork and sampling;

Shawn Nelson for ArcGIS and figure development;

SGS AXYS Analytical Services for help in developing the list of analytes for this study and the logistics to make it a success.

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This report is available in alternative formats upon request, and online at www.pca.state.mn.us.

Document number: tdr-g1-21

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Executive summary

In 2017, 50 Minnesota lakes, selected at random, were sampled for a broad suite of chemical contaminants, including pharmaceuticals, alkylphenols, hormones, illicit drugs, anti-corrosive chemicals, and disinfectants. This report contains the results of that study.

This and several previous investigations of varying size over the past 10 years clearly demonstrate that these "contaminants of emerging concern," such as antibiotics and antidepressants, the pesticide DEET, alkylphenols, and the disinfectant triclosan are widespread in our lakes, rivers, and streams. Many of these chemicals are endocrine active, mimicking naturally occurring hormones. Concern is growing over the effect these chemicals may have on fish and wildlife and human health at very low concentration.

This study is the third in a series of large-scale, probabilistic investigations that were designed to understand the extent to which these chemical contaminants are present in surface water on a statewide level. Of the 163 chemicals tested, 55 were found in lakes at least once. All 50 lakes contained at least one contaminant. Twenty-one of these chemicals may pose a risk to aquatic ecosystems, with five of these – the frequently detected insect repellant DEET, the hormone estrone, bisphenol A, 4-nonylphenol, and 4-n-octylphenol – of the greatest level of concern due to their toxicity, potential for bioaccumulation, frequency of detection, persistence, and the concentrations at which they were found.

Introduction

Dramatic improvements in laboratory analysis provide ways to detect chemicals at concentrations that were unachievable 30 years ago, allowing us to understand with increasing clarity the contaminants present in water at part per trillion concentrations. With these low levels of detection now available to researchers, several investigations (Bradley et al., 2017; Kasprzyk-Hordern et al., 2008; Lee et al., 2004) have revealed that a wide variety of chemicals ranging from medicines and hormones to plasticizers and anti-corrosives are commonly found in surface water, even at relatively remote locations (Ferrey et al., 2012; Lyons et al., 2014).

In addition to the improved abilities of detection, our understanding of the effects these contaminants have on a molecular, cellular, organism, and population scales is rapidly expanding. The near-extinction of the Gyps vulture in Asia, for example, is due to the introduction of the painkiller diclofenac in India for the veterinary treatment of cattle (Oaks et al., 2004). Similarly, the presence of a few parts per trillion of a hormone contraceptive results in the collapse of fish populations (Kidd et al., 2007). More recent studies show that exposure to extremely low concentrations of cocaine that are often found in wastewater-impacted river water destroys the muscle tissue of the silver eel, a commercially important species in Europe, possibly impairing its migration in the Atlantic (Capaldo et al., 2018). Other research has revealed effects more subtle but as worrisome: in fish, for example, the expression of hundreds of genes is altered by short-term exposure to mixtures of these chemicals in water at parts per trillion concentrations (Martinović-Weigelt et al., 2014). The effects of most pharmaceuticals and other chemicals found in water, however, are not known.

The source of these contaminants to our environment is found in the frequent use of pharmaceuticals, detergents, personal care products, and other commercial or industrial products in our society. Either through disposal or excretion, these chemicals can eventually make their way through wastewater treatment plants(Lee et al., 2011), septic fields(Baker et al., 2014; Schaider et al., 2017), and storm water systems(Fairbairn et al., 2018) that act as conduits of this contamination to surface water. Many of these chemicals have also been found in precipitation (Ferrey et al., 2018), perhaps accounting for the results of previous studies (Ferrey et al., 2017; 2015) of randomly selected locations that found detectable concentrations of these contaminants in Minnesota's lakes and rivers not affected by wastewater.

This study of emerging contaminants is the second of Minnesota lakes done in conjunction with the National Lake Assessment (Engel et al., 2018). The first, completed in 2012, showed that 38 of the 125 chemicals tested were found in at least one lake, with 47 of the 50 lakes sampled containing at least one chemical. In that investigation, several pharmaceuticals were found, including sulfonamide antibiotics and antidepressants, as well as steroid hormones, alkylphenols, bisphenol A, and the insecticide DEET, which was the most commonly detected contaminant. All were detected in part per trillion concentrations.

A wider list of analytes, totaling 163 chemicals, were tested in this study of 50 lakes that were, like those of the 2012 study, randomly selected across Minnesota. This expanded list of analytes included more pharmaceuticals, illicit drugs, and corrosion inhibitors that were not tested in the 2012 investigation. A risk analysis of the chemicals that were detected in these lakes suggests that several may be persistent in surface water and may be toxic to aquatic organisms at the concentrations at which they were found in this study.

Methods

National Lakes Assessment selection process. The US Environmental Protection Agency (EPA) conducts national randomized surveys of lakes, rivers, wetlands, and estuaries to measure the health of U.S. waters. The 2017 National Lakes Assessment was the 12th in a series of those surveys that included 50 lakes in Minnesota that were sampled by the Minnesota Pollution Control Agency (MPCA) for this study of contaminants. Lakes with a minimum of 1 ha in size and a depth of at least 1 m were eligible for inclusion. Lakes were selected by the EPA using a generalized random tessellation stratified design. This design allows for surveys that can be stratified by multiple lake size classes while maintaining a spatial balance throughout the state. Five lake size classes (1–4 ha, 4–10 ha, 10–20 ha, 20–50 ha, and >50 ha) were designated in the 2017 survey. The relative abundance of lakes in each of these size classes allowed for weighting the results when applied to the overall population of lakes in that size class (e.g., population of Minnesota lakes 1–4 ha in size). Figure 1 shows the locations from which samples were collected for this study, and Appendix A includes more detailed location information on each lake included for the study.

Water sampling. Simple grab samples were collected in one-liter amber glass or HDPE bottles, depending on the analysis for which the sample was intended. Field staff avoided fragrances, insect repellant (DEET), or sunscreen prior to sampling and wore disposable nitrile gloves while sampling. Sample bottles were transported to the site in re-sealable plastic bags.

Samples were collected from the bow of the boat moving slowly upwind. Sample bottles were removed from the plastic re-sealable bags and uncapped only with gloved hands. Bottles were rinsed with surface water three times and immersed below the surface so as not to allow exposed skin above the gloved hand to come into contact with the surface water. The final sample was collected without headspace in the bottle. Once filled, bottles were re-capped, re-sealed in the plastic bags, and chilled in coolers on ice.

After returning from the field, samples were refrigerated at 4 C in re-sealable plastic bags and shipped overnight to SGS AXYS Analytical Services (Sydney, BC, CA) or to the Minnesota Public Health Laboratory for analysis. The maximum holding time for samples was seven days. Appendix B contains additional sampling details.

Mapping and land use analysis. All 50 lakes were mapped in ESRI ArcGIS 10.2. Watershed boundaries were delineated for all lakes using geographic information system–based tools, including the Minnesota Department of Natural Resources automated catchment tool (https://gisdata.mn.gov/dataset/hydrographytools). Digital elevations and stream flow lines helped establish the accuracy of the boundaries.

Land use composition was determined for all lakes based on the EPA 2011 National Land Cover Database (Table 1). Aggregated categories included: developed (all residential and urban classes), cropland (all cultivated cropland), rangeland (pasture and grassland), forest (deciduous, coniferous, mixed, and shrub/scrub), wetland, and open water. Land use was tabulated for each lake and expressed as a percentage of the total watershed draining to the lake. For some analyses, developed and cropland uses were combined to yield a "disturbed" land use category, and forest and wetland uses were combined to yield an "undisturbed" designation. In addition, the number, location, and type of animal feedlots were mapped.

Analytes. A total of 163 chemicals were analyzed (Table 2, Appendix C). Pharmaceuticals, personal care products, alkylphenols, bisphenol A, triclosan, and triclocarban were analyzed by SGS AXYS. The hormones 17β-estradiol, estrone, estriol, the anti-corrosive chemicals benzotriazole, benzothiazole and their derivatives, and illicit drugs were analyzed by the Minnesota Department of Health laboratory.

Detailed analytical methods can be found in Appendix D. A companion study, conducted by the Minnesota Department of Agriculture, analyzed 148 pesticide compounds also in conjunction with the National Lakes Assessment for 2017. The results of that analysis was reported separately(Ribikawskis et al., 2019).

Statistical analysis

Condition estimates. The percentage of lakes within the state likely to contain detectable concentrations of each analyte was estimated on a 95% confidence interval based on the analytical results for each lake. Data for each analyte were categorized as detect or non-detect. The categorical data were analyzed using a conditional estimation statistic in "R" statistical software and "spsurvey" (Kincaid, 2005).

Non-detect analysis. Because of the large percentage of non-detections (NDs) of analytes in this study, a Kaplan-Meier analysis was used to derive general statistics for chemicals with censored datasets with at least 20% detections using ProUCL Software, Version 5.1 (https://www.epa.gov/land-research/proucl-software) (Appendix F, Table 1). Concentration percentiles are also reported for chemicals analyzed in this study (Appendix F, Table 2). Mann-Kendall analysis was used in the trend analysis of detections versus land use.

Aquatic Toxicology Profiles. Chemicals detected in this investigation were prioritized for their potential to harm aquatic ecosystems using the MPCA Aquatic Toxicity Profile guidance (Streets and Dobbins, 2017). This assessment takes into consideration the bioaccumulation, toxicity, biodegradability of the chemical in question, their tendency to persist in the environment, the detection frequency and concentration at which they are found in the study, and whether they interact with or affect the endocrine system based on published data. Chemicals were categorized as high, intermediate, or low risk priority to the aquatic environment.

Results

Detections. Fifty-five of the 163 chemicals in Table 2 were detected in at least one lake in this study. Every lake sampled contained at least one of the contaminants in Table 2, with an average of 6.1 chemicals detected per lake. The highest number of detections was in South Lake (MN-10003), which at the time of sampling received WWTP effluent from the city of Winsted, with 24 total detections. The fewest number of detections were in two lakes: Carman Lake (MN-10045), NE of Detroit Lakes, and MN-10034, an unnamed lake south of Perham, had one detection each (Table 3). Figure 2 shows the number of chemicals detected by sampling location.

Chemicals detected include eleven antibiotics or anti-fungal medications, five antidepressants, two lipid-lowering drugs, and two hormones. Four alkylphenols and seven anti-corrosive chemicals were also found. One illicit drug (cocaine) was detected. This is a similar profile of chemicals that have been reported in prior studies of Minnesota lakes and rivers.

The hormone estrone was detected the most frequently, at 70% of the locations, followed by N,N – diethyl-meta-toluamide (DEET) at 50% (Figure 3). The alkylphenols 4-nonylphenol and 4-n-octylphenol (the breakdown products of alkylphenol ethoxylate detergents) were present in 46% and 24% of the lakes, respectively. The antidepressants sertraline and fluoxetine were found in 30% and 26% of the lakes, respectively; and the anticorrosive chemicals benzothiazole, benzotriazole, and the derivatives of benzotriazole were frequently detected. Erythromycin and carbadox were the most frequently detected antibiotics. Oxycodone was present in 24% of the lakes, while metformin, the drug used to treat type II diabetes, and bisphenol A, an endocrine active chemical used in the manufacture of polycarbonate plastic, were both detected in 12% of the lakes. Triclosan was found at 8% of the sites. Twenty chemicals

in Table 1 were detected in 10% or more of the lakes sampled. Appendix E contains the complete data for the study and a summary of the field and laboratory quality assurance.

Cotinine (the metabolite of nicotine), amphetamine, oxycodone, metformin, the diuretic triamterene, the antidepressants citalopram and venlafaxine, the anti-inflammatory drug colchicine, and the x-ray contrast agent iopamidol were all detected in the current study. These were not included for testing in the 2012 lake study.

Concentrations. Table 4 shows the maximum concentrations found for each of the chemicals that were detected. Of the 55 chemicals detected, 32 were found at maximum concentrations below 10 ng/L. Five were found above 100 ng/L: DEET was found at the highest concentration of 1580 ng/L in MN-10192, an unnamed lake, while the x-ray contrast agent iopamidol and the anticonvulsant medicines lamotrigine and topiramate were found in South Lake (MN-10003) at 685, 245, and 145 ng/L, respectively. Bisphenol A was detected at 117 ng/L in MN-10049, an unnamed lake.

Summary statistics and percentiles derived for each of the chemicals detected in this study are found in Appendix F. Box plots showing the range of concentrations for chemicals with at least 20% detections are found in Appendix G. Summary statistics for the laboratory reporting limits of each analyte are reported in Appendix H.

Detections and Land Use. Chemicals were found in lakes associated with every land use, including, as in past studies, several remote lakes that lacked an apparent source of contamination. Generally, there were fewer detections in lakes surrounded by higher percentages of forested land use ($p = 1.2x10^{-6}$, Figure 4a), consistent with the observation that there were relatively few detections in the northern areas of the state characterized by a high degree of forested land (Fig. 3). A significant, though weaker, trend of increasing detections in lakes as the amount of surrounding land that is either developed or cropped ($p = 7.0x10^{-6}$, Figure 4b). There were no discernable trends in the total number of chemicals in lakes sorted by other land use designations, such the number of feedlot permits or the percent of wetlands.

The number of detections, combined with the random selection and size of the lakes sampled, allowed an estimate of the extent to which each chemical was present in Minnesota lakes (Figure 5). This condition estimate indicated that 75% of lakes were likely to contain the hormone estrone, and 43% were likely to have detectable concentrations of 4-nonylphenol. Thirty-six percent of lakes contained oxycodone and cotinine, with roughly 29% likely to contain DEET and 26% with bisphenol A. The antidepressants sertraline and fluoxetine and the x-ray contrast agent iopamidol were each predicted to be present in 23% of the state's lakes. Other chemicals that were detected in this study were predicted to be present in a smaller proportion of the state's lakes.

The sources of these chemical contaminants to lakes are numerous. Wastewater treatment plant effluent is an established and major source of contaminants to surface water (Lee et al., 2011), such as South Lake at the time of this investigation. Contaminants are also introduced to lakes through residential septic system drain fields situated near surface water. A recent study demonstrated that untreated storm water (Fairbairn et al., 2018) is a significant source of a wide variety of pharmaceuticals, pesticides, alkylphenols, and benzotriazole to rivers and lakes. Many of the frequently detected contaminants in this investigation are present in precipitation and air at concentrations similar to what are found in lakes (Cheng et al., 2006; Ferrey et al., 2018), including DEET, bisphenol A, cocaine, benzothiazole, and antibiotics, representing a pathway for these chemicals to reach even very remote lakes.

The findings of this study are largely consistent with those of the 2012 lake study (Ferrey et al., 2015) in which at least one of the 125 chemicals tested were found in 47 of the 50 lakes sampled, with an

average of 3.7 detections per lake. In that investigation, the pesticide DEET was detected in 75% of the lakes, with bisphenol A, cocaine, androstenedione, the antibiotic carbadox, and the antidepressant amitriptyline among the most frequently detected contaminants. An additional 38 pharmaceuticals and other chemicals were included for testing in the 2017 lake study, expanding considerably the scope of our understanding of the variety of chemicals present in Minnesota lakes. Together, the 2012, 2017, and other Minnesota lake studies (Writer et al., 2010) demonstrate a widespread presence of pharmaceuticals, alkylphenols, personal care products, and other commercial/industrial chemicals in surface water at low concentrations across the state.

Effects

The Minnesota Department of Health (MDH) has derived screening values and provides human-health based guidance for over half of the compounds detected in this study (Suchomel et al., 2018). The maximum concentrations found in this study were compared to the available MDH human-health risk-based values (Table 5). None of the MDH screening guidance values were exceeded by chemical concentrations detected in this study, and none of the 50 lakes sampled for this study are used as a source of potable water.

Chemicals detected in this study were also evaluated for their potential to cause adverse aquatic ecological effects by considering bioaccumulation, acute and chronic toxicity, detection frequency, concentration, half-life in the environment, potential for biodegradation, and endocrine activity (Streets and Dobbins, 2017). This evaluation allows aquatic contaminants to be prioritized according to their potential to cause harm in aquatic ecosystems. Assigning a priority level to a contaminant does not imply consequent regulatory action, only that a certain level of priority has been ascribed to a chemical based on published physicochemical information available for it.

Data sufficient for full evaluation was available for 39 of the 55 total chemicals were that were detected in this study. Five of the 39 chemicals that were evaluated – the insecticide DEET, the hormone estrone, bisphenol A, 4-nonylphenol, and 4-n-octylphenol – are considered high priority contaminants with a total score of five (Table 6). All of these are endocrine active chemicals. The maximum concentration at which bisphenol A was detected – 177 ng/L – exceeded the acute toxicity value of 60 ng/L. Nineteen of the 55 chemicals are considered intermediate priority at the concentrations detected. Five of these – gemfibrozil, thiabendazole, 17β-estradiol, triclosan, and colchicine – are considered endocrine active. Several pharmaceuticals are expected to have half-lives greater than six months in water: the antidepressant citalopram, the anti-fungal miconazole, oxycodone, and the antibiotics azithromycin, roxithromycin, erythromycin, and ofloxacin. Citalopram, azithromycin, oxycodone, roxithromycin, and erythromycin are expected to have half-lives of at least 54 months in sediment. Only two of the 55 chemicals detected – the mono- and diethoxylates of 4-nonylphenol – are predicted to readily biodegrade in the aquatic environment. However, the likely product of that biodegradation, 4-nonylphenol, is more toxic and more persistent in the aquatic environment than the parent chemicals.

A recent study indicates that neither the number of contaminants detected nor the sum of their concentrations at a given location are correlated with adverse biological effects in surface water (Collette et al., 2019). However, other research shows that organisms are affected when exposed to particular chemicals at part per trillion levels. Many of the contaminants are endocrine active, allowing them to influence the physiology, behavior, and reproduction of animals at extremely low concentration. For example, the endocrine active chemical 4-nonylphenol affects the reproductive competence and behavior of fathead minnows at the nanogram per liter concentrations typically found in surface water (Schoenfuss et al., 2008).

Antidepressants are among the most commonly detected pharmaceuticals in surface water. Because these chemicals modulate neurotransmitters, they affect the physiology and reproductive status of organisms at the low concentrations at which they are detected in aquatic ecosystems. Fathead minnow embryos exposed to the antidepressants fluoxetine and venlafaxine at concentrations as low as 25 parts per trillion exhibited slower predator avoidance reactions after hatching. Similarly, fish had increased predator avoidance response time when they were exposed to mixtures of the antidepressants fluoxetine, bupropion, venlafaxine, and sertraline at low concentrations after hatching. The authors suggested that effects of exposure to these antidepressants may have a direct impact on the survival and, ultimately, the reproductive fitness of the individuals (Painter et al., 2009). Similarly, fluvoxamine is known to affect spawning and larval release in bivalves at concentrations as low as 30 parts per trillion (Fong, 1998), and antidepressants disrupt locomotion and reduce fecundity in snails (Fong and Ford, 2014).

Illicit drugs, with potent pharmacological properties, may also pose a risk to aquatic organisms. Research shows that extremely low concentrations of cocaine, widely detected in surface water, causes serious and long-lasting damage to the morphology and physiology of the skeletal muscle of the silver eel, a commercially important fish in Europe (Capaldo et al., 2018). In addition, Parolini et al. (2013) discovered that the breakdown product of cocaine, benzoylecgonine, is highly cytotoxic, causing an increase in oxidative stress that affects biological membrane stability, enzyme activities, and cellular DNA.

Antibiotics, which are commonly detected in surface water, can act as an ecological factor that could potentially affect microbial communities (for a review, see Ding and He (2010)), including the expansion of antibiotic resistance and possible disturbance of microbial ecosystems with effects on microbial nitrogen transformation, methanogenesis, and sulfate reduction. Considerable antibiotic resistance has been detected in bacteria from wastewater treatment plants that receive an influx of antibiotics from municipal and hospital sewage (Reinthaler, 2002). A significant contribution to the development of antibiotic-resistance is made through the exposure of bacteria to sub-lethal concentrations of the drug; studies show that bacterial resistance mutations are rapidly enriched at very low antibiotic concentrations (Hughes and Andersson, 2012; Kohanski et al., 2010).

Population level effects

While numerous studies point to adverse effects of pharmaceuticals and other contaminants on a molecular or cellular level (Ferrey et al., 2017; Parolini and Binelli, 2012) or on the level of the individual organism, it is more difficult to demonstrate harmful effects of these chemicals at the population level. However, the far-reaching consequences of exposure to even small amounts of these chemicals are illustrated in two studies.

In one, the hormone 17α-ethinylestradiol (a synthetic estrogen of contraceptives) was added to an experimental lake at 5 parts per trillion. Two years after addition of the hormone, the researchers observed a collapse in the fathead minnow population and a subsequent disappearance of the trout in the lake (Kidd et al., 2007).

Another example is of the common pain medication diclofenac, introduced to India in the 1990s as an anti-inflammatory medicine for oxen and other large animals. Diclofenac is highly toxic to the Asian vulture, causing necrosis of the kidneys and death after the bird consumes the meat of a carcass that contains even a very small amount of the drug. As a result, greater than 97% of the vultures on the Indian subcontinent have been eradicated by exposure to this chemical alone (Oaks et al., 2004). As a result, the population of wild dogs has increased, assuming the role of scavenger no longer filled by the

vulture, with a subsequent increase in the occurrence of rabies – a serious and unforeseen consequence to human health caused by the environmental release of this pharmaceutical to the ecosystem.

Conclusions

The results of this investigation demonstrate, as have previous studies, that lakes are widely contaminated by small amounts of pharmaceuticals, hormones, and other chemicals including anticorrosive chemicals and surfactants. Fifty-five of the 163 chemicals tested were detected at least once. Every lake sampled contained at least one contaminant. The most commonly detected contaminants were the hormone estrone, the insecticide DEET, the alkylphenols 4-nonylphenol and 4-n-octylphenol, the antidepressants fluoxetine and sertraline, and anticorrosive chemicals. Several additional chemicals were detected in this study that were not tested previously. The frequency of contaminant detections is positively correlated with disturbed land use. The diverse sources of these contaminants, reflected in their widespread public use, include effluent from municipal wastewater treatment plants as well as individual sewage treatment systems and storm water, with some contribution from precipitation. DEET, estrone, bisphenol A, 4-nonylphenol, and 4-n-octylphenol are considered high priority contaminants to aquatic ecosystems. While the extent and severity of the effects these contaminants pose to lakes is not fully understood, there is evidence that several of these contaminants may be having adverse effects on organisms that possibly extend to the level of fish and wildlife populations.

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Figure 1. Locations of sampling locations for this study.

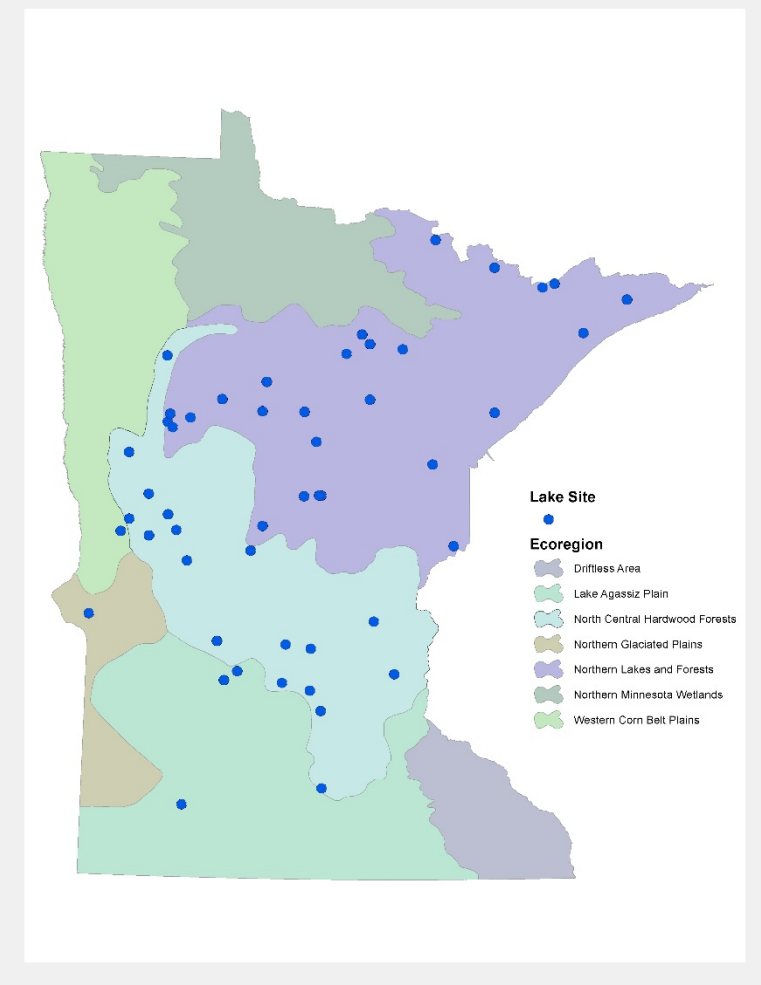


Figure 2. Magnitude of detections at each sampling location.

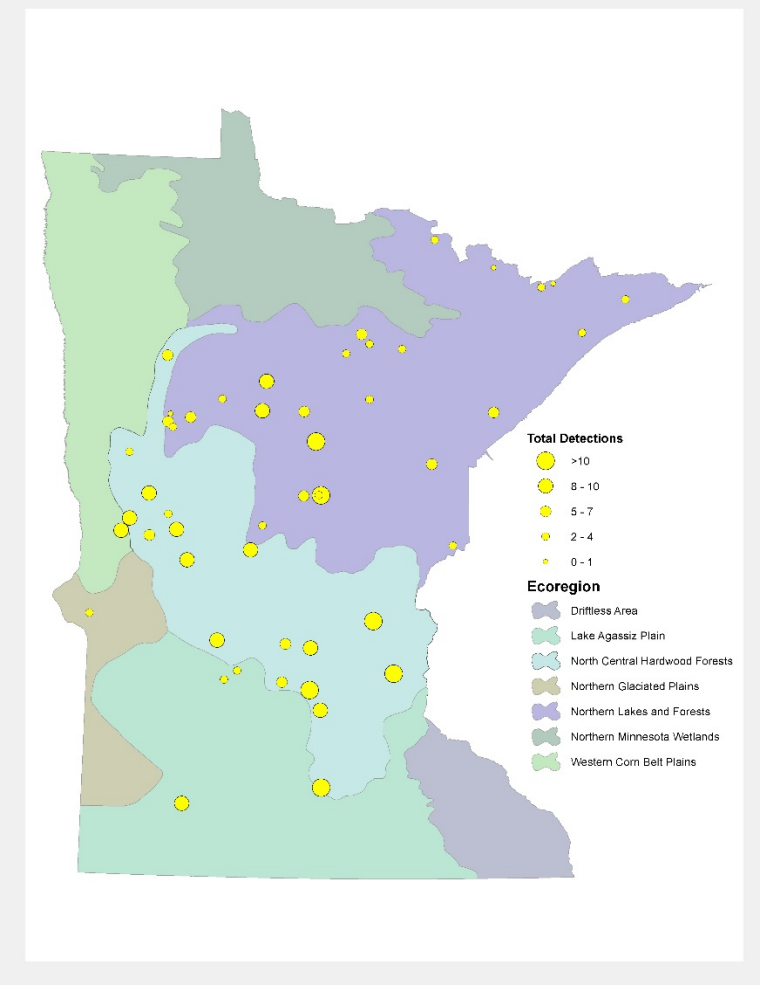


Figure 3. Percent detections of the top 25 chemicals found in lakes sampled for this study.

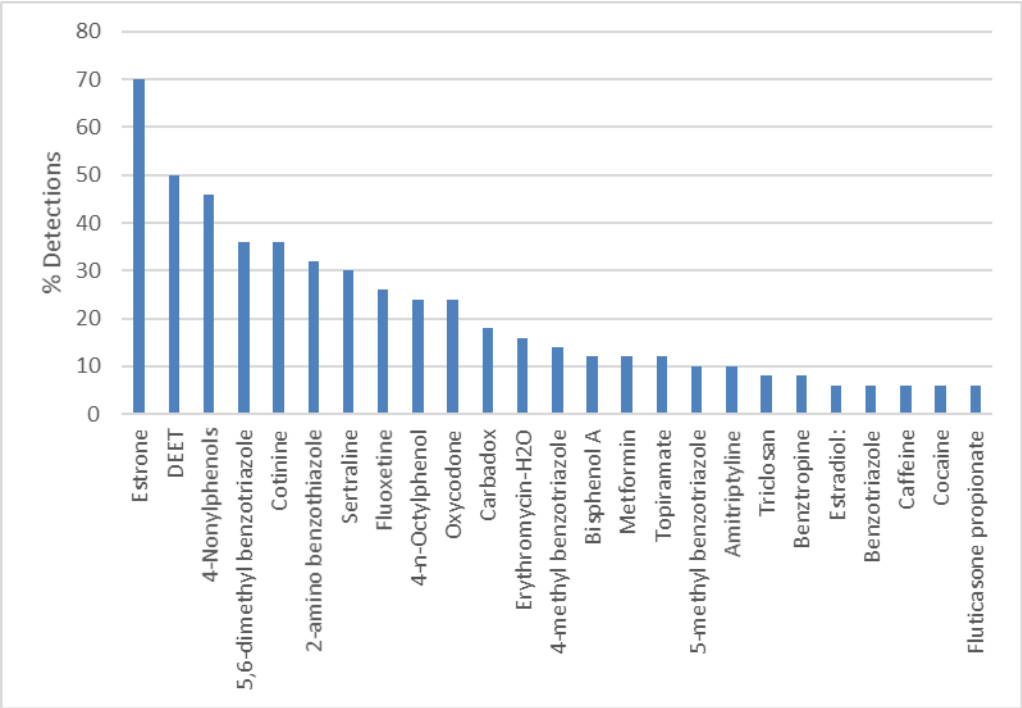


Figure 4a.

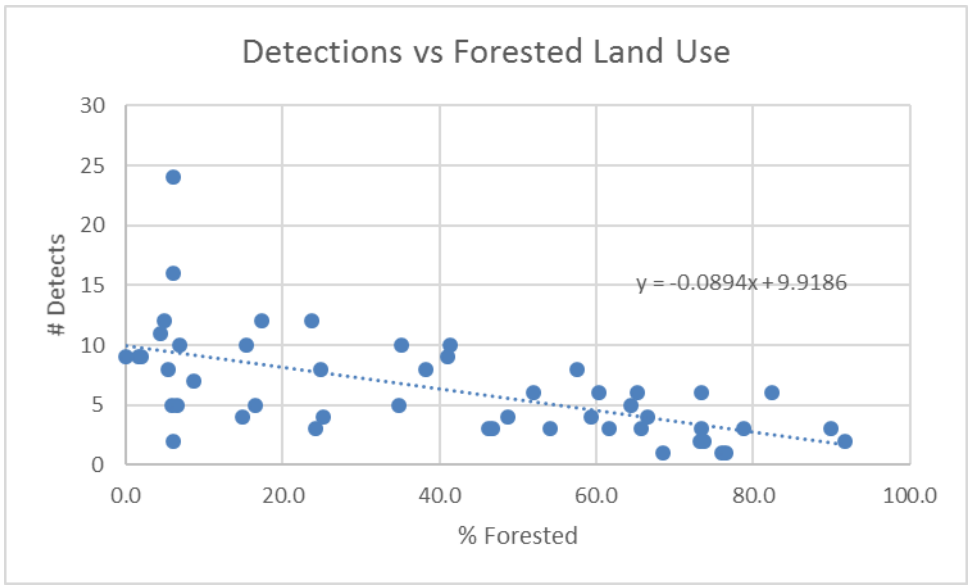


Figure 4b.

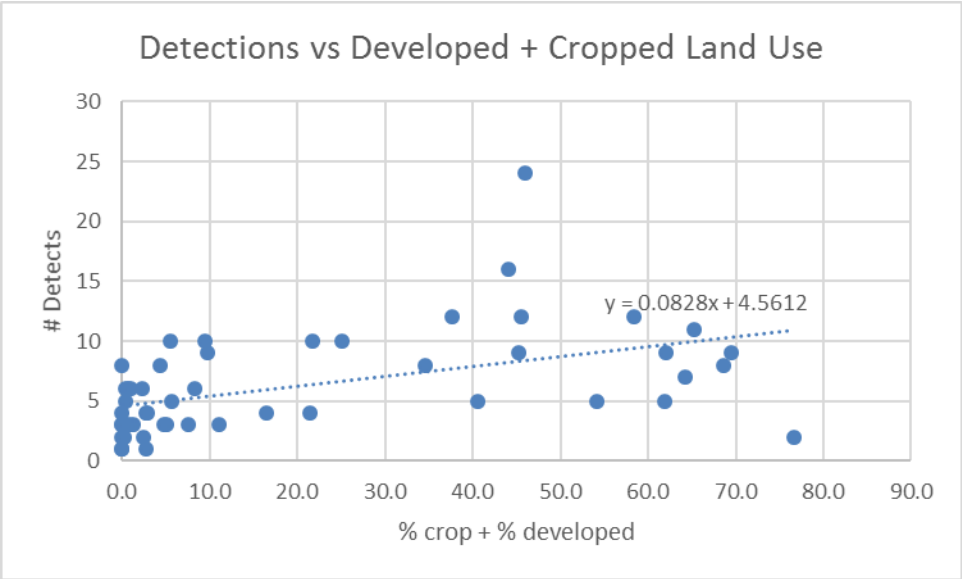

Detections vs Developed + Cropped Land Use
Detects
% crop + % developed
y = 0.0828x + 4.5612
0
5
10
15
20
25
30
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0

Figure 5. Estimate of the number of lakes that contained chemicals analyzed in this study in 2017.

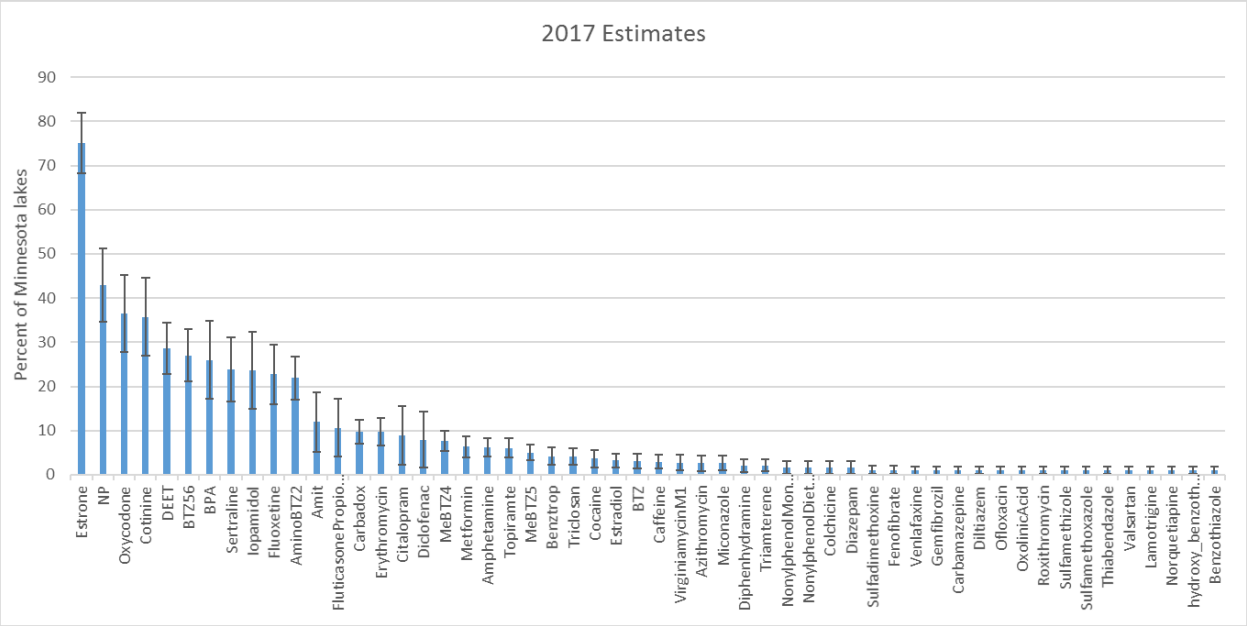


Table 1. Land use data for the lakes sampled in this study

Lake ID	Sample ID	% Open Water	% Developed	% Barren	% Forest	% Range	% Crop	% Wetland	Total %	Major Land Use
31026600	NLA17_MN-10001	22.0	2.9	0.075	66.6	1.3	0	7.0	100.0	Forest
7006000	NLA17_MN-10002	17.7	3.7	0	4.8	5.5	54.7	13.7	100.0	Crop
43001400	NLA17_MN-10003	27.3	3.7	0	6.0	16.0	42.3	4.8	100.0	Crop
21008000	NLA17_MN-10004	63.7	18.5	0	6.8	6.4	3.2	1.3	100.0	Open Water
69012900	NLA17_MN-10005	16.8	0.38	0	82.4	0	0	0.34	100.0	Forest
18012300	NLA17_MN-10006	17.4	1.2	0	46.7	11.9	0	22.7	100.0	Forest
11048000	NLA17_MN-10007	30.7	4.3	0	57.6	5.8	0	1.6	100.0	Forest
16064300	NLA17_MN-10008	23.3	0.81	0	73.4	0.25	0	2.2	100.0	Forest
47001500	NLA17_MN-10009	41.0	3.2	0	5.9	10.3	37.4	2.1	100.0	Open Water
62007300	NLA17_MN-10010	35.5	45.6	0	17.2	0	0	1.7	100.0	Developed
56047600	NLA17_MN-10011	22.9	5.7	0	24.9	11.3	28.9	6.3	100.0	Crop
3024200	NLA17_MN-10012	55.2	0.39	0	34.8	2.3	0	7.3	100.0	Open Water
69075700	NLA17_MN-10014	30.9	0.0	0	61.6	0	0	7.5	100.0	Forest
3075100	NLA17_MN-10016	17.8	0.0	0	46.2	13.4	11.1	11.5	100.0	Forest
56081000	NLA17_MN-10017	20.9	1.6	0	2.0	0	43.6	31.9	100.0	Crop
38062300	NLA17_MN-10018	7.4	0.0	0	91.7	0	0	0.98	100.0	Forest
49007900	NLA17_MN-10019	37.3	2.0	0	48.7	6.1	0.68	5.2	100.0	Forest
69092000	NLA17_MN-10020	15.2	1.7	0	73.7	5.4	0.79	3.2	100.0	Forest
30007200	NLA17_MN-10021	19.3	5.3	0	23.6	9.5	32.3	9.9	100.0	Crop
58001300	NLA17_MN-10022	30.9	7.5	0	54.1	5.1	0	2.4	100.0	Forest
26007100	NLA17_MN-10023	25.6	6.3	0	8.6	1.1	58.0	0.31	100.0	Crop
11013600	NLA17_MN-10025	13.3	0.71	0	65.3	4.1	0	16.6	100.0	Forest
86023000	NLA17_MN-10026	48.4	3.2	0	15.4	9.7	21.9	1.4	100.0	Open Water
77003500	NLA17_MN-10027	29.5	3.9	0	41.3	20.3	1.6	3.3	100.0	Forest
38049200	NLA17_MN-10028	24.0	0.0	0	76.0	0	0	0	100.0	Forest
17005600	NLA17_MN-10030	32.1	4.6	0	1.6	2.1	57.4	2.2	100.0	Crop
31020000	NLA17_MN-10032	9.9	4.9	0	25.1	32.9	11.5	15.7	100.0	Range
29029600	NLA17_MN-10033	8.7	0.0	0	90.0	0.26	0	1.0	100.0	Forest
56017100	NLA17_MN-10034	6.5	4.6	0	6.1	10.6	72.0	0.25	100.0	Crop
56084600	NLA17_MN-10037	19.2	10.8	0	5.3	4.5	57.8	2.3	100.0	Crop
9005000	NLA17_MN-10038	22.2	5.7	0	64.4	0.24	0	7.4	100.0	Forest
73042500	NLA17_MN-10042	0.72	18.8	0	16.5	27.5	35.3	1.0	100.0	Crop
69020800	NLA17_MN-10044	23.1	0.0	0	68.6	0	0	8.3	100.0	Forest
3020900	NLA17_MN-10045	11.7	2.8	0	76.5	1.3	0	7.7	100.0	Forest
34020600	NLA17_MN-10046	46.0	4.2	0	35.2	8.4	5.3	0.95	100.0	Open Water
18014600	NLA17_MN-10047	17.3	0.0	0	60.3	20.0	2.4	0	100.0	Forest
31051300	NLA17_MN-10048	18.6	0.95	0	73.4	2.7	0	4.4	100.0	Forest
44015500	NLA17_MN-10049	14.3	5.6	0	52.0	11.1	2.7	14.2	100.0	Forest
16018200	NLA17_MN-10159	23.8	0.34	0	73.3	0	0	2.6	100.0	Forest
34003300	NLA17_MN-10161	12.5	3.1	0.056	6.5	14.9	58.8	4.2	100.0	Crop
3007700	NLA17_MN-10179	11.3	0.0	0	41.1	0.61	9.8	37.3	100.0	Forest
56013400	NLA17_MN-10180	18.1	5.3	0	14.9	43.5	16.2	2.0	100.0	Range
06-0120-00	NLA17_MN-10183	29.2	4.7	0	0	0	64.8	1.2	100.0	Crop
11048700	NLA17_MN-10187	47.5	0.0	0	38.3	0	0	14.3	100.0	Open Water
10010700	NLA17_MN-10188	16.4	34.8	0	4.4	7.7	30.4	6.2	100.0	Developed
11004700	NLA17_MN-10189	27.8	5.1	0	65.7	0	0	1.3	100.0	Forest
3019900	NLA17_MN-10191	30.3	0.0	0	59.4	0.30	0	10.0	100.0	Forest
34044000	NLA17_MN-10192	24.4	1.1	0	6.1	1.4	43.1	24.0	100.0	Crop
18043000	NLA17_MN-10193	7.4	0.36	0	24.2	50.6	0	17.4	100.0	Range
31062300	NLA17_MN-10194	11.4	3.9	0	78.8	3.7	0.92	1.3	100.0	Forest

Table 2. List of analytes.

Pharmaceuticals					
1,7-Dimethylxanthine	Diazepam	Naproxen	Theophylline		
10-hydroxy-amitriptylin	Diclofenac	Norfloxacin	Thiabendazole		
2-Hydroxy-ibuprofen	Digoxigenin	Norfluoxetine	Tilmicosin		
Acetaminophen	Digoxin	Norgestimate	Topiramate		
Albuterol	Diltiazem	Norquetiapine	Trazodone		
Alprazolam	Diphenhydramine	Norverapamil	Triamterene		
Amitriptyline	Doxorubicin	Ofloxacin	Trimethoprim		
Amlodipine	Drospirenone	Ormetoprim	Tylosin		
Amphetamine	Enalapril	Oxacillin	Valsartan		
Amsacrine	Enrofloxacin	Oxazepam	Venlafaxine		
Atenolol	Eprosartan	Oxolinic Acid	Verapamil		
Atorvastatin	Erythromycin-H2O	Oxycodone	Virginiamycin M1		
Azathioprine	Etoposide	Paroxetine	Warfarin		
Azithromycin	Fenofibrate	Penicillin G	Zidovudine		
Benztropine	Flumequine	Penicillin V			
Busulfan	Fluoxetine	Promethazine	**Hormones**		
Caffeine	Furosemide	Propoxyphene	17α-Ethinyl Estradiol		
Carbadox	Gemfibrozil	Propranolol	17β-Estradiol		
Carbamazepine	Glipizide	Pseudoephedrine/Ephedrine	Betamethasone		
Cefotaxime	Glyburide	Quetiapine	Equilin		
Cimetidine	Hydrochlorothiazide	Ramipril	Estriol		
Ciprofloxacin	Hydrocodone	Ranitidine	Estrone		
Citalopram	Ibuprofen	Rosuvastatin	Fluocinonide		
Clarithromycin	Iopamidol	Roxithromycin	Fluticasone propionate		
Clinafloxacin	Irbesartan	Sarafloxacin	Hydrocortisone		
Clonidine	Lamotrigine	Sertraline	Medroxyprogesterone Acetate		
Clopidogrel	Lincomycin	Simvastatin	Melengestrol Acetate		
Clotrimazole	Lomefloxacin	Sulfachloropyridazine	Methylprednisolone		
Cloxacillin	m-Chlorophenylpiperazine	Sulfadiazine	Prednisolone		
Codeine	Melphalan	Sulfadimethoxine	Prednisone		
Colchicine	Meprobamate	Sulfamerazine	Trenbolone		
Cotinine	Metformin	Sulfamethazine	Trenbolone acetate		
Cyclophosphamide	Metoprolol	Sulfamethizole			
Daunorubicin	Metronidazole	Sulfamethoxazole			
Decoquinate	Miconazole	Sulfanilamide			
Dehydronifedipine	Morphine	Sulfathiazole			
Desmethyldiltiazem	Moxifloxacin	Tamoxifen			
Diatrizoic acid	Mycophenolate Mofetil	Teniposide			
Alkylphenols					
4-n-Octylphenol					
4-Nonylphenol diethoxylates					
4-Nonylphenol monoethoxylates					
4-Nonylphenol					
Benzotriazoles/Benzothiazoles					
Benzothiazole					
Benzotriazole					
5,6-dimethyl benzotriazole					
5-methyl benzotriazole					
2-amino benzothiazole					
2-hydroxy benzothiazole					
4-methyl benzotriazole					
Illicit drugs					
3,4-methylenedioxy-N-methylamphetamine (MDMA)					
Cocaine					
Benzoylecgonine					
Methamphetamine					
Antiseptics					
Triclosan					
Triclocarban					
Bisphenol A					
DEET					

Table 3. Number of chemicals detected by lake.

	Alkyl-phenols	Bisphenol A	Triclosan	List 1*	List 3	List 4	List 5	List 6	Supple-mental List	Benzo-triazoles and hormones	Total detects
NLA17_MN-10001	0	0	0	1	0	0	2	0	0	0	3
NLA17_MN-10002	1	0	0	2	0	3	3	0	0	3	12
NLA17_MN-10003	1	0	0	6	1	2	3	3	3	5	24
NLA17_MN-10004	0	0	0	1	0	1	2	0	1	4	9
NLA17_MN-10005	2	0	0	0	0	0	2	0	1	2	7
NLA17_MN-10006	1	0	0	1	0	0	1	0	0	0	3
NLA17_MN-10007	1	0	0	1	0	0	2	0	0	2	6
NLA17_MN-10008	1	0	0	0	0	1	1	0	0	1	4
NLA17_MN-10009	0	0	0	1	0	1	1	0	1	1	5
NLA17_MN-10010	1	0	1	1	0	1	1	0	0	6	11
NLA17_MN-10011	1	0	0	1	0	1	1	0	0	2	6
NLA17_MN-10012	0	0	1	0	0	1	1	0	0	2	5
NLA17_MN-10014	1	0	0	1	0	0	1	0	0	1	4
NLA17_MN-10016	0	0	0	0	0	1	0	0	0	2	3
NLA17_MN-10017	3	1	0	1	0	1	1	0	0	2	9
NLA17_MN-10018	1	0	0	0	0	0	2	0	0	0	3
NLA17_MN-10019	1	0	0	1	0	1	0	0	0	1	4
NLA17_MN-10020	1	0	0	0	0	0	0	1	0	1	3
NLA17_MN-10021	1	0	0	2	0	2	1	0	1	4	11
NLA17_MN-10022	0	0	0	0	0	0	2	0	0	0	2
NLA17_MN-10023	0	0	0	2	0	2	1	0	0	2	7
NLA17_MN-10025	1	0	0	0	0	0	2	0	0	1	4
NLA17_MN-10026	1	0	0	1	0	1	2	0	1	4	10
NLA17_MN-10027	1	0	0	4	0	1	2	0	0	1	9
NLA17_MN-10028	1	0	0	0	0	0	1	0	0	0	2
NLA17_MN-10030	1	0	0	1	0	1	1	0	0	3	7
NLA17_MN-10032	1	1	0	0	0	0	0	0	1	1	4
NLA17_MN-10033	0	1	0	0	0	1	0	0	0	1	3
NLA17_MN-10034	0	0	0	0	0	0	0	0	0	1	1
NLA17_MN-10037	0	0	0	2	0	2	0	0	0	3	7
NLA17_MN-10038	1	0	1	0	0	0	1	0	0	1	4
NLA17_MN-10042	1	0	0	0	0	1	1	0	0	1	4
NLA17_MN-10044	1	0	0	0	0	0	0	0	0	1	2
NLA17_MN-10045	1	0	0	0	0	0	0	0	0	0	1
NLA17_MN-10046	1	0	1	1	0	1	3	0	0	3	10
NLA17_MN-10047	1	0	0	0	0	0	2	1	0	1	5
NLA17_MN-10048	1	0	0	2	0	1	2	0	0	1	7
NLA17_MN-10049	0	1	0	1	0	1	1	0	0	1	5
NLA17_MN-10159	1	0	0	0	0	0	1	0	0	0	2
NLA17_MN-10161	1	0	0	1	0	1	0	0	0	2	5
NLA17_MN-10179	1	1	0	2	0	1	0	0	0	2	7
NLA17_MN-10180	1	0	0	1	0	0	1	0	0	1	4
NLA17_MN-10183	0	0	0	2	0	2	1	0	0	3	8
NLA17_MN-10187	1	0	0	1	0	1	2	0	0	2	7
NLA17_MN-10188	0	0	0	2	0	1	2	0	0	3	8
NLA17_MN-10189	1	0	0	0	0	0	2	0	0	1	4
NLA17_MN-10191	0	0	0	1	0	0	1	0	0	2	4
NLA17_MN-10192	0	0	0	4	0	5	1	0	1	6	17
NLA17_MN-10193	0	1	0	1	0	0	0	0	0	1	3
NLA17_MN-10194	1	0	0	1	0	0	0	0	0	1	3
NLA17_MN-10003 FB	1	0	0	0	0	0	1	0	0		2
NLA17_MN-10012FB	1	0	0	4	0	0	1	0	0		6
		*See Appendix E for analytical Lists and data									

Table 4. Maximum concentration of detected chemicals.

Chemical	Maximum concentration (ng/L)
DEET	1580
Iopamidol	685
Lamotrigine	226
Topiramate	145
Bisphenol A	117
Carbamazepine	54.5
4-methyl benzotriazole	53
Benzotriazole	48
4-Nonylphenols	42.1
Benzothiazole	42
Metformin	38.6
2-hydroxy benzothiazole	35
Cotinine	24.5
Sulfamethoxazole	22.3
5-methyl benzotriazole	22
Caffeine	21.3
Triamterene	21.1
4-Nonylphenol monoethoxylates	19.8
5,6-dimethyl benzotriazole	18
Norquetiapine	17.9
Carbadox	13.6
Fluoxetine	13.5
4-Nonylphenol diethoxylates	10
Amitriptyline	9.77
Valsartan	9.06
Triclosan	6.76
Sulfamethizole	6.59
Azithromycin	5.68
Sulfadimethoxine	5.68
Venlafaxine	5.03
Diclofenac	4.88
Ofloxacin	4.76
Amphetamine	4.66
Virginiamycin M1	4.63
Fluticasone propionate	4.57
Colchicine	3.96
Thiabendazole	3.78
4-n-Octylphenol	3.7
Gemfibrozil	3.2
Oxolinic Acid	3.14
Erythromycin-H2O	2.66
Sertraline	2.66
2-amino benzothiazole	2.3
Estrone	2.2
Miconazole	1.84
Citalopram	1.72
Diphenhydramine	1.68
Oxycodone	1.12
Fenofibrate	0.593
Benztropine	0.589
Cocaine	0.511
Roxithromycin	0.433
17β Estradiol	0.42
Diltiazem	0.419
Diazepam	0.388

Table 5. Minnesota Department of Health Screening Values

Chemical	Maximum Concentration found in this study (ng/L)	MDH Guidance		Guidance concentration to Max concentration Ratio
		ng/L	Type*	
17 beta Estradiol	0.42	*2 to 20*	*HBV 17 αEthinylestradiol*	5 to 50
Amphetamine	4.66	40	SWV	9
Fluoxetine	13.5	200	SWV	15
Benztropine	0.589	10	SWV	17
Oxycodone	1.12	20	SWV	18
Amitriptyline	9.77	200	SWV	20
Metformin	38.6	4000	SWV	104
Sertraline	2.66	300	SWV	113
DEET	1580	200000	HRL	127
Lamotrigine	226	30000	SWV	133
Sulfamethizole	6.59	1000	SWV	152
Bisphenol A	117	20000	HRL	171
Triamterene	21.1	4000	SWV	190
Benzotriazole	48	20000	HBV	417
4-methyl benzotriazole	53	20000	RAA for Tolytriazole	*377*
4-Nonylphenols	42.1	20000	HBV	475
Azithromycin	5.68	3000	SWV	528
Carbamazepine	54.5	40000	HRL	734
5-methyl benzotriazole	22	20000	RAA	909
Valsartan	9.06	9000	SWV	993
Fenofibrate	0.593	600	SWV	1012
Diazepam	0.388	400	SWV	1031
Ofloxacin	4.76	5000	SWV	1050
Venlafaxine	5.03	10000	HBV	1988
Diclofenac	4.88	10000	SWV	2049
Gemfibrozil	3.2	10000	SWV	3125
Sulfamethoxazole	22.3	100000	RAA	4484
Triclosan	6.76	50000	HRL	7396
Diltiazem	0.419	4000	SWV	9547
Erythromycin-H2O	2.66	40000	SWV	15038
4-n-Octylphenol	3.7	100000	HBV	27027
No Current 'guidance'				
Iopamidol	685			
Topiramate	145			
Benzothiazole	42			
2-amino benzothiazole	2.3			
2-hydroxy benzothiazole	35			
Cotinine	24.5			
Caffeine	21.3			
4-Nonylphenol monoethoxylates	19.8			
5,6-dimethyl benzotriazole	18			
Norquetiapine	17.9			
Carbadox	13.6			
4-Nonylphenol diethoxylates	10			
Sulfadimethoxine	5.68			
Virginiamycin M1	4.63			
Fluticasone propionate	4.57			
Colchicine	3.96			
Thiabendazole	3.78			
Oxolinic Acid	3.14			
Estrone	2.2			
Miconazole	1.84			
Citalopram	1.72			
Diphenhydramine	1.68			
Cocaine	0.511			
Roxithromycin	0.433			
*Type of Guidance:				
HRL, Health Risk Limit				
HBV, Health Based Value				
RAA, Risk Assessment Advice				
SWV, Screening Water Value				

Table 6. Risk evaluation of detected chemicals by Aquatic Toxicity Profile criteria

Chemical	CAS RN	log K_{ow}	Score	log K_{oc}	Score	Bioaccum-ulates?	$t_{1/2}$ water (m)	$t_{1/2}$ air (h)	$t_{1/2}$ sediment (m)	$t_{1/2}$ soil (m)	Predicted to readily biodegrade?	Score	Suspected endocrine disruptor?	Score	% Detect	Detected in > 20% of samples?	Score	Acute toxicity value (ug/L)	Chronic toxicity value (ug/L)	Toxic?	Score	Max Conc (ug/L)	Max Conc > Toxicity ?	Score	Total Score
DEET	134-62-3	2.3	0	2.1	1	1	1	10	2.5	11	No	1	Yes	1	50	Yes	1	1243	75	Yes	1	1.58	No	0	5
Estrone	53-16-7	3.4	0	4.4	1	1	1.25	2	11.25	2.5	No	1	Yes	1	70	Yes	1	2184	415	Yes	1	0.0022	No	0	5
Bisphenol A	80-05-7	3.32	0	4.58	1	1	1	3	11	2.5	No	1	Yes	1	12	No	0	0.06		Yes	1	0.177	Yes	1	5
4-nonylphenol	104-40-5	5.8	1	4.6	1	1	0.5	5	4.5	1	No	1	Yes	1	46	Yes	1	8	6	Yes	1	0.042	No	0	5
4-n-octylphenol	1806-26-4	5.5	1	4.3	1	1	0.5	5	4.5	1	No	1	Yes	1	24	Yes	1	79	13	Yes	1	0.0037	No	0	5
Carbamazepine	298-46-4	2.3	0	3.1	1	1	1.25	1	11.25	2.5	No	1	Yes	1	2	No	0	256	130	Yes	1	0.0545	No	0	4
Sertraline	79617-96-2	5.3	1	5.2	1	1	2	3	18	4	No	1		0	30	Yes	1	28	7	Yes	1	0.00266	No	0	4
Gemfibrozil	25812-30-0	4.8	1	2.8	0	1	1.25	3	11.25	2.5	No	1	Yes	1	2	No	0	4933	889	Yes	1	0.0032	No	0	4
Fluoxetine	54910-89-3	4.1	1	5	1	1	2	7	18	4	No	1		0	26	Yes	1	79	19	Yes	1	0.0135	No	0	4
Thiabendazole	148-79-8	2.5	0	3.6	1	1	0.5	4	4.5	1	No	1	Yes	1	2	No	0	275	66	Yes	1	0.00378	No	0	4
17 beta-Estradiol	50-28-2	4	1	4.2	1	1	1.25	2	11.25	2.5	No	1	Yes	1	6	No	0	1129	212	Yes	1	0.00042	No	0	4
Triclosan	3380-34-5	4.8	1	4.4	1	1	2	16	18	4	No	1	Yes	1	8	No	0	469	71	Yes	1	0.00676	No	0	4
Colchicine	64-86-8	1.9	0	3.3	1	1	2	1	18	4	No	1	Yes	1	2	No	0	4616	238	Yes	1	0.00396	No	0	4
Valsartan	137862-53-4	3.7	0	4.3	1	1	0.5	6	4.5	1	No	1		0	2	No	0	3865	393	Yes	1	0.00906	No	0	3
Citalopram	59729-33-8	3.7	0	4.4	1	1	6	3	54	12	No	1		0	4	No	0	360	65	Yes	1	0.00172	No	0	3
Diltiazem	42399-41-7	2.8	0	3.5	1	1	1	1	18	4	No	1		0	2	No	0	2151	281	Yes	1	0.00042	No	0	3
Diphenhydramine	58-73-1	3.3	0	3.9	1	1	1.25	2	11.25	2.5	No	1		0	4	No	0	798	116	Yes	1	0.00168	No	0	3
Azithromycin	83905-01-5	4	1	3.5	1	1	6	1	54	12	No	1		0	4	No	0	1874	286	Yes	1	0.00568	No	0	3
Caffeine	58-08-2	-0.07	0	1	0	0	0.5	13	4.5	1	No	1	Yes	1	6	No	0	15	4	Yes	1	0.0213	No	0	3
Diazepam	439-14-5	2.8	0	3.9	1	1	1.25	26	11.25	2.5	No	1		0	2	No	0	983	70	Yes	1	0.00039	No	0	3
Benztropine	86-13-5	4.3	1	5	1	1	1.25	3	11.25	2.5	No	1		0	8	No	0	142	31	Yes	1	0.00059	No	0	3
Miconazole	22916-47-8	6.3	1	5.7	1	1	6	4	54	12	No	1		0	4	No	0	44	1.8	Yes	1	0.00184	No	0	3
Carbadox	6804-07-5	-1.4	0	3.8	1	1	1.25	26	11.25	2.5	No	1		0	18	No	0	7840	1553	Yes	1	0.0136	No	0	3
Roxithromycin	80214-83-1	2.8	0	4	1	1	6	1	54	1	No	1		0	2	No	0	4663	601	Yes	1	0.00043	No	0	3
4-nonylphenol monoethoxylate	104-35-8	5.6	1	3.6	1	1	0.5	5	4.5	1	Yes	0	Yes	1	2	No	0	105	19	Yes	1	0.02	No	0	3
4-nonylphenol diethoxylate	20427-84-3	5.3	1	3.4	1	1	0.5	4	4.5	1	Yes	0	Yes	1	2	No	0	211	38	Yes	1	0.01	No	0	3
Amitriptyline	549-18-8	2.2	0	5.5	1	1	1.25	0.2	11.25	2.5	No	1		0	10	No	0	81714	10459	No	0	0.0097	No	0	2
Oxycodone	76-42-6	0.66	0	1.9	0	0	6	1	54	12	No	1		0	24	Yes	1	46786	3304	No	0	0.00112	No	0	2
Amphetamine	300-62-9	1.8	0	2.9	0	0	0.5	5	4.5	1	No	1		0	12	No	0	3803	348	Yes	1	0.00189	No	0	2
Cocaine	50-36-2	2.3	0	2.9	0	0	1.25	5	11.25	2.5	No	1		0	6	No	0	4350	459	Yes	1	0.00051	No	0	2
Erythromycin	114-07-8	3.1	0	2.7	0	0	6	1	54	12	No	1		0	16	No	0	6369	747	Yes	1	0.00266	No	0	2
Triamterene	396-01-0	1	0	2.3	0	0	1.25	1	11.25	2.5	No	1		0	4	No	0	1859	69	Yes	1	0.0211	No	0	2
Venlafaxine	93413-69-5	3.3	0	2.9	0	0	2	2	18	4	No	1		0	2	No	0	653	101	Yes	1	0.00503	No	0	2
Sulfamethoxazole	723-46-6	0.89	0	2.4	0	0	1.25	1	11.25	2.5	No	1		0	2	No	0	1872	86	Yes	1	0.0223	No	0	2
Sulfadimethoxine	122-11-2	1.2	0	1.5	0	0	1.25	1	11.25	2.5	No	1		0	2	No	0	2259	66	Yes	1	0.00568	No	0	2
Sulfamethizole	144-82-1	0.5	0	1.8	0	0	1.25	11	11.25	2.5	No	1		0	2	No	0	2001	96	Yes	1	0.00659	No	0	2
Metformin	657-24-9	-2.6	0	1.4	0	0	0.5	2	4.5	1	No	1		0	12	No	0	1927735	93719	No	0	0.0386	No	0	1
Ofloxacin	82419-36-1	-0.2	0	1.1	0	0	6	1	54	12	No	1		0	2	No	0	1786232	114427	No	0	0.00476	No	0	1
Iopamidol	60166-93-0	-1.4	0	1	0	0	2	5	18	4	No	1		0	10	No	0	914314	13876	No	0	0.685	No	0	1

High priority
Intermediate priority
Low priority

Appendix A

Sampling locations

dowlknum	NLA ID Number	Common Name	MPCA_WID	LATDDNAD83	LONDDNAD83
31026601	NLA17_MN-10001	Long Lake	31-0266-01	47.59769	-93.404179
7006001	NLA17_MN-10002	Eagle Lake	07-0060-01	44.196174	-93.895147
43001400	NLA17_MN-10003	South Lake	43-0014-00	44.941857	-94.03179
21008000	NLA17_MN-10004	Lake Darling	21-0080-00	45.918516	-95.396114
69012900	NLA17_MN-10005	Spring Lake	69-0129-00	47.06933	-92.002495
18012300	NLA17_MN-10006	Lookout Lake	18-0123-00	46.437489	-93.956862
11048000	NLA17_MN-10007	Long Lake	11-0480-00	47.073725	-94.602085
16064300	NLA17_MN-10008	Richey Lake	16-0643-00	47.666127	-90.989786
47001500	NLA17_MN-10009	Lake Jennie	47-0015-00	44.999533	-94.333149
62007300	NLA17_MN-10010	Snail Lake	62-0073-00	45.071876	-93.123448
56047600	NLA17_MN-10011	Round (Maine) Lake	56-0476-00	46.419539	-95.840158
3024200	NLA17_MN-10012	Flat Lake	03-0242-00	46.974667	-95.654811
69075700	NLA17_MN-10014	Net Lake	69-0757-00	48.395589	-92.65807
3075100	NLA17_MN-10016		03-0751-00	46.732481	-96.075943
56081000	NLA17_MN-10017		56-0810-00	46.127338	-96.132169
38062300	NLA17_MN-10018	Spree Lake	38-0623-00	48.022137	-91.439901
49013900	NLA17_MN-10019		49-0139-00	46.197096	-94.574839
69092000	NLA17_MN-10020	Waymier Lake	69-0920-00	47.559673	-93.032859
30007200	NLA17_MN-10021	Long Lake	30-0072-00	45.474305	-93.34527
58001300	NLA17_MN-10022	Greigs Lake	58-0013-00	46.052741	-92.472116
26007100	NLA17_MN-10023		26-0071-00	46.101536	-95.819669
11013600	NLA17_MN-10025	Lake Lomish	11-0136-00	47.075603	-94.131055
86023000	NLA17_MN-10026	Mink Lake	86-0230-00	45.264124	-94.026654
77003500	NLA17_MN-10027	Beauty Lake	77-0035-00	46.006903	-94.700663
38049200	NLA17_MN-10028	Neglige Lake	38-0492-00	48.049413	-91.304875
17005601	NLA17_MN-10030		17-0056-01	44.053487	-95.375979
31020000	NLA17_MN-10032	Mississippi Lake	31-0200-00	47.172121	-93.400244
29029600	NLA17_MN-10033		29-0296-00	47.159962	-95.05454
56017102	NLA17_MN-10034		56-0171-02	46.266936	-95.618801
56084600	NLA17_MN-10037	Iverson Lake	56-0846-00	46.223239	-96.043872
9005000	NLA17_MN-10038	Jaskari Lake	09-0050-00	46.677941	-92.700608
73042500	NLA17_MN-10042	NA	73-0425-00	45.293028	-94.300677
69020800	NLA17_MN-10044	Nibin Lake	69-0208-00	48.178299	-91.984373
3020900	NLA17_MN-10045	Carman Lake	03-0209-00	47.036109	-95.630361
34020600	NLA17_MN-10046	Andrew Lake	34-0206-00	45.309795	-95.043781
18014600	NLA17_MN-10047		18-0146-00	46.42891	-94.123514
31051300	NLA17_MN-10048	Gale Lake	31-0513-00	47.670335	-93.492759
44015500	NLA17_MN-10049		44-0155-00	47.480799	-95.684953
16018200	NLA17_MN-10159	Ball Club Lake	16-0182-00	47.91123	-90.486604
34003300	NLA17_MN-10161	Ella Lake	34-0033-00	45.081482	-94.817053
3007700	NLA17_MN-10179		03-0077-00	47.012936	-95.404108
56013400	NLA17_MN-10180		56-0134-00	46.148935	-95.522221
6012000	NLA17_MN-10183	Cup Lake	06-0120-00	45.488031	-96.442548
11048700	NLA17_MN-10187	Little Twin Lake	11-0487-00	47.300345	-94.559887
10010700	NLA17_MN-10188	Braunworth Lake	10-0107-00	44.788143	-93.912771
11004700	NLA17_MN-10189	Mule Lake	11-0047-00	46.845788	-93.995424
3019900	NLA17_MN-10191	Johnson Lake	03-0199-00	46.934603	-95.597946
34044000	NLA17_MN-10192		34-0440-00	45.010821	-94.957309
18043000	NLA17_MN-10193		18-0430-00	46.435335	-93.933384
31062300	NLA17_MN-10194	Boy Lake	31-0623-00	47.522356	-93.665472

Appendix B

Water sample collection

Samples were collected in one-liter amber glass or HDPE bottles, depending on the specific analysis for which the sample was intended. Sample bottles for pharmaceutical, triclosan, bisphenol A, and alkylphenol analyses were provided by SGS AXYS Analytical Services in Sidney, BC, Canada. 250 ml amber glass bottles for illicit drugs, benzotriazole, and benzothiazole analyses were provided by the Minnesota Department of Health, Public Health Laboratory.

Field staff did not apply fragrances, insect repellant (DEET), or sunscreen prior to sampling and wore disposable powder-free, nitrile gloves while sampling. Sample bottles were transported to the site in re-sealable plastic bags and coolers.

Samples were collected at arm's length from the bow of the watercraft moving slowly upwind. Sample bottles were removed from the plastic re-sealable bags and uncapped for sample collection only with gloved hands. Samples were not collected during rainfall. Sample collection was not flow-weighted.

For all sample collection events, sample bottles were rinsed with the surface water three times by filling and emptying the bottle completely. Bottles were immersed below the surface so as not to allow exposed skin above the gloved hand to come into contact with the surface water. The final sample was collected without headspace in the bottle. Once filled, bottles were re-capped, re-sealed in the plastic bags, and chilled in the accompanying coolers on ice.

Field blanks were collected by transporting duplicate sample bottles to a location where samples were collected. Field blank water, also supplied by the laboratory in identical glass or HDPE bottles, was transported to the site. Field blank water bottles were transported in identical re-sealable plastic bags and in coolers to replicate the procedure used for actual samples. Using gloved hands and facing upwind, the field blank water was poured from the lab-supplied bottles into empty sample bottles without rinsing. The field blank samples were then re-capped, re-sealed in plastic bags, and treated identically to the surface water samples.

After returning from the field, samples were refrigerated at 4 degrees C. All samples were kept in the original re-sealable plastic bags and were shipped overnight to SGS AXYS Analytical Services or to the Minnesota Public Health Laboratory for analysis. The maximum holding time for samples, from the date of collection to their extraction in the laboratory, was seven days.

Appendix C

Chemicals analyzed in this study and their uses

Alkylphenols	
4-Nonylphenol diethoxylate	Nonionic detergent
4-Nonylphenol monoethoxylate	Nonionic detergent
4-Nonylphenol	An alkylphenol; a breakdown product of nonylphenol ethoxylate detergents
4-n-Octylphenol	An alkylphenol; a breakdown product of octylphenol ethoxylate detergents
Personal Care Products	
DEET	Pesticide; insect repellant
Triclosan	Antibacterial disinfectant
Triclocarban	Antibacterial disinfectant
Illicit/Recreational Drugs	
Cocaine	Central nervous system stimulant
Benzoylecgonine	Metabolite of cocaine
MDMA	Psychoactive drug
Methamphetamine	Central nervous system stimulant; recreational drug
Hormones	
17α-Ethinylestradiol	A synthetic estrogen used in birth control medications
17β-Estradiol	An estrogen and major female sex hormone
Betamethasone	A corticosteroid anti-inflammatory medication
Equilin	An estrogen and a female sex hormone
Estriol	An estrogen and a female sex hormone
Estrone	An estrogen and a female sex hormone
Medroxyprogesterone acetate	Synthetic progesterone used in hormone treatment and as a contraceptive
Melengestrol acetate	A contraceptive hormone used in veterinary medicine
Trenbolone	Steroid hormone used to increase muscle mass in livestock
Trenbolone acetate	Steroid hormone used to increase muscle mass in livestock
Pharmaceuticals/Medications	
1,7-Dimethylxanthine	Metabolite of caffeine
10-Hydroxy-amitriptyline	Metabolite of amitriptyline
2-Hydroxy-ibuprofen	Metabolite of ibuprofen
Acetaminophen	A common analgesic
Albuterol	Asthma medication; smooth muscle relaxant
Alprazolam	A sedative and muscle relaxant
Amitriptyline	An antidepressant
Amlodipine	Blood pressure medication
Amphetamine	Central nervous system stimulant
Amsacrine	Antineoplastic; anti-cancer drug
Atenolol	Beta blocker used to treat cardiovascular disease and hypertension
Atorvastatin	Lipid regulator
Azothioprine	Immunosuppressive used in organ transplantation and autoimmune disease
Azithromycin	Antibiotic
Benztropine	Anticholinergic used to treat Parkinson's disease
Busulfan	Antineoplastic used in cancer treatment
Caffeine	Central nervous system stimulant; psychoactive drug
Carbadox	Antibiotic used in rearing swine

Carbamazepine	Anticonvulsant used to treat epilepsy and attention deficit hyperactivity disorder (ADHD)
Cefotaxime	An antibiotic
Cimetidine	Inhibitor of stomach acid production
Ciprofloxacin	An antibiotic
Citalopram	Antidepressant (Selective serotonin reuptake inhibitor)
Clarithromycin	An antibiotic
Clinafloxacin	An antibiotic
Clonidine	Adrenergic agonist used to treat high blood pressure, attention deficit hyperactivity disorder (ADHD), and anxiety.
Clopidogrel	Antiplatelet medicine used to reduce the risk of stroke and heart disease.
Clotrimazole	Antifungal medication
Cloxacillin	An antibiotic
Codeine	Narcotic analgesic
Colchicine	Medication used to treat gout
Cotinine	Metabolite of nicotine
Cyclophosphamide	Antineoplastic used in cancer treatment
Daunorubicin	Chemotherapy drug
Decoquinate	Antiprotozoan drug used in veterinary medicine
Dehydronifedipine	Metabolite of nifedipine, a blood pressure medication
Desmethyldiltiazem	A metabolite of diltiazem
Diatrizoic acid	x-ray contrast agent
Diazepam	Anti-anxiety medication; sedative
Diclofenac	A nonsteroidal anti-inflammatory drug used to treat pain.
Digoxigenin	A plant-derived steroid used as a probe in molecular biology
Digoxin	Heart medication
Diltiazem	Heart medication
Diphenhydramine	Antihistamine
Doxorubicin	Cancer chemotherapeutic drug
Drospirenone	Steroidal progestin used in hormone replacement therapy and contraceptives
Enalapril	ACE inhibitor used to treat hypertension and chronic heart failure
Enrofloxacin	A veterinary antibiotic
Eprosartan	Blood pressure medication
Erythromycin-H2O	An antibiotic
Etoposide	Chemotherapeutic drug
Fenofibrate	Lipid regulator
Flumequine	An antibiotic
Fluocinonide	Anti-inflammatory steroid
Fluoxetine	Antidepressant (Selective serotonin reuptake inhibitor)
Fluticasone propionate	Steroid medication for asthma
Furosemide	Diuretic used to treat high blood pressure and edema
Gemfibrozil	Lipid regulator
Glipizide	Anti-diabetic drug
Glyburide	Anti-diabetic drug
Hydrochlorothiazide	Diuretic used to treat high blood pressure and edema
Hydrocodone	Narcotic analgesic
Hydrocortisone	Cortisol; a steroid hormone
Ibuprofen	Nonsteroidal anti-inflammatory analgesic
Iopamidol	X-ray contrast agent
Irbesartan	Medicine used to treat high blood pressure
Lamotrigine	An anticonvulsant used to treat epilepsy

Lincomycin	An antibiotic
Lomefloxacin	An antibiotic
Meprobamate	Anti-anxiety medication; sedative
Methylprednisolone	Synthetic anti-inflammatory corticosteroid
Melphalan	Cancer chemotherapeutic drug
m-chlorophenylpiperazine	Psychoactive drug
Metformin	Type 2 diabetes medication
Metoprolol	Blood pressure medication
Metronidazole	An antibiotic and antiprotozoal
Miconazole	Topical antifungal medication
Morphine	Opiate-derived pain medication
Moxifloxacin	An antibiotic
Mycophenolate mofetil	Immunosuppressant drug
Naproxen	An analgesic
Norfloxacin	A seldom used antibiotic
Norfluoxetine	An antidepressant
Norgestimate	A hormone used in oral contraceptives
Norquetiapine	Metabolite of quetiapine, an anti-psychotic drug
Norverapamil	Blood pressure medication
Ofloxacin	An antibiotic
Ormetoprim	An antibiotic used with sulfonamides
Oxacillin	An antibiotic
Oxazepam	Anti-anxiety medication
Oxolinic Acid	An antibiotic
Oxycodone	Narcotic analgesic
Paroxetine	An antidepressant
Penicillin G	An antibiotic
Penicillin V	An antibiotic
Prednisolone	An anti-inflammatory corticosteroid and active metabolite of prednisone
Prednisone	An anti-inflammatory corticosteroid
Promethazine	An antihistamine
Propoxyphene	An analgesic
Propranolol	Sedative and blood pressure medication
Pseudoephedrine	Stimulant; nasal and sinus decongestant
Quetiapine	Antipsychotic drug used to treat schizophrenia and bipolar disorder
Ramipril	Drug used to treat high blood pressure
Ranitidine	Inhibitor of stomach acid production
Rosuvastatin	Lipid regulator
Roxithromycin	An antibiotic
Sarafloxacin	An antibiotic
Sertraline	An antidepressant
Simvastatin	Lipid regulator
Sulfachloropyridazine	One of several sulfonamide antibiotics
Sulfadiazine	One of several sulfonamide antibiotics
Sulfadimethoxine	One of several sulfonamide antibiotics
Sulfamerazine	One of several sulfonamide antibiotics
Sulfamethazine	One of several sulfonamide antibiotics
Sulfamethizole	One of several sulfonamide antibiotics
Sulfamethoxazole	One of several sulfonamide antibiotics

Sulfanilamide	One of several sulfonamide antibiotics
Sulfathiazole	One of several sulfonamide antibiotics
Tamoxifen	Drug used in the treatment of breast cancer
Teniposide	Chemotherapeutic
Theophylline	Asthma medication
Thiabendazole	A fungicide used to control fungal disease in fruits and vegetables
Tilmicosin	A veterinary antibiotic
Topiramate	An anticonvulsant medicine used to treat epilepsy
Trazodone	An antidepressant
Triamterene	Diuretic used to treat hypertension and edema
Trimethoprim	An antibiotic used together with sulfonamides
Tylosin	An antibiotic
Valsartan	Blood pressure medication
Venlafaxine	Antidepressant (Selective serotonin reuptake inhibitor)
Verapamil	Medication for high blood pressure and migraines
Virginiamycin	An antibiotic
Warfarin	Blood thinner
Zidovudine	Anti-retroviral medication

Other	
Bisphenol A	Material to make polycarbonate plastic and other uses
2-aminobenzothiazole	Degradation product of benzothiazole
2-hydroxybenzothiazole	Degradation product of benzothiazole
4-methylbenzotriazole	Degradation product of benzotriazole
5-methylbenzotriazole	Degradation product of benzotriazole
5,6-dimethylbenzotriazole	Degradation product of benzotriazole
Benzothiazole	Feedstock used in the manufacture of dyes and other chemicals
Benzotriazole	Corrosion inhibitor

Appendix D

Analytical methods.

Pharmaceuticals and personal care products. The pharmaceuticals and personal care products selected for analysis were based on USEPA Method 1694 [17] with additional compounds incorporated into list 3 and two additional runs for list 5 and list 6 compounds (see Supplemental Data for SGS AXYS Analytical Services lists 1, 3, 4, 5 and 6). This expanded USEPA 1694 analyte list represents those pharmaceutical and personal care compounds identified by the USEPA, the Minnesota Pollution Control Agency, and other SGS AXYS clients as priorities for assessment based on previous detection, annual consumption, expected toxicity, and persistence. For analysis of compounds from lists 1, 3, 5 and 6, a 1.0-L sample was filtered (1.6mm), adjusted to pH 2 by addition of hydrochloric acid (HCl), spiked with a suite of isotopically labeled internal standards, and extracted by solid-phase extraction using an Oasis HLB cartridge (Waters). The extract was analyzed by liquid chromatography–tandem mass spectrometry (LC-MS/MS) operated in the electron spray ionization (ESI)–positive mode for list 1, 5 and 6 compounds and analyzed in the ESI-negative mode for list 3 compounds. Separate analysis runs and conditions were used for each of the lists of target analytes.

Alkylphenols. An unfiltered 1.0-L sample was spiked with isotopically labeled internal standards, adjusted to pH 11–12 by the addition of potassium carbonate solution, and acetylated with acetic anhydride. The extract was then acidified to pH 6 with HCl and extracted with hexane. Extracts were cleaned up by silica column chromatography and analyzed by gas chromatography–mass spectrometry operated in the multiple ion detection mode.

Bisphenol A. A 0.5-L sample was filtered (1.6 mm), adjusted to pH 2 by addition of HCl, spiked with deuterated bisphenol A internal standard, and extracted by solid-phase extraction using an Oasis HLB cartridge. The extract was analyzed by LC-MS/MS operated in the ESI-negative mode.

Triclosan. A 0.5-L sample was filtered (1.6mm), adjusted to pH 2 by addition of HCl, spiked with [13C]-labeled triclosan, and extracted by solid-phase extraction using an Oasis HLB cartridge. The extract was analyzed by LC-MS/MS operated in the ESI-negative mode.

Appendix E

Report Analytical Tables

https://www.pca.state.mn.us/sites/default/files/tdr-g1-21a.pdf

Field quality control and assurance.

See Appendix B for detailed description of the field sampling protocol, sample treatment, and precautions taken during sampling.

Sample holding times were seven days or less before sample extraction at the laboratory.

Samples were held at 4 C from the time of sampling to the time of extraction.

Two field blanks were collected. No sample duplicates were collected due to budget limitations.

Six of the 163 chemicals analyzed in this study - ciprofloxacin, clinafloxacin, DEET, 4-nonylphenol, norfloxacin, and ofloxacin – were detected in field blanks. Field blank detections were not used to censor or correct sample data results. All field blank data reported together with sample data.

Laboratory quality control and assurance.

Methods were validated by US EPA Tier 1 procedures. All analytes were quantified either by isotope dilution internal standard quantification or, when an isotopically labeled analog of the analyte was unavailable, by internal standard methods using a related labeled compound. This produces accurate results that are recovery-corrected for losses during the analysis procedure and compensated for LC/MS/MS suppression or enhancement due to sample matrix.

Each analysis batch included a "known" or quality control sample to demonstrate the accuracy of the method for each analyte. Recoveries of all added labeled standards were monitored to ensure that analyses were in control and meeting regular method specifications. The reporting limit was determined for each compound on a sample specific basis as the concentration (corrected for surrogate recovery) corresponding to the lowest concentration calibration standard.

For each batch of samples analyzed, a lab blank was included to demonstrate that detected analytes were not due to laboratory background or other external contamination. Results for laboratory blanks were compliant with SGS-AXYS' statistically determined blank control limits (mean plus 3 standard deviations of approximately 30 blanks). Sample results were censored if reported concentrations were within 10 times the concentration reported in the laboratory blank. For benzotriazoles, benzothiazoles, and their derivatives, lab blanks were required to be less than one half of each analyte's reporting limit. No blank corrections were applied to the benzotriazoles or benzothiazole data as there were no significant detects in the blanks.

Initial instrument calibration was performed using a series of calibration solutions that encompass the working concentration range. Initial calibration for any native compound requires at least 5 consecutive calibration levels. Initial calibration solutions contained the suite of labelled surrogate, recovery standards, and authentic targets. The concentration of the native analytes in the solutions varied to encompass the working range of the instrument, while the concentrations of the surrogates and recovery standards remain constant. Instrument quality control included running a multi-concentration series, regular instrument blanks, and continuing calibration checks. A mid-level calibration solution was analyzed every 12 hours or every 20 samples, whichever occurred first.

Sample specific detection limits (SDLs) were calculated using 3 times the signal of the noise in the target channel converted to an equivalent sample concentration. The reporting limit for each target compound was defined as the concentration equivalent to the lowest calibration standard analyzed or the SDL, whichever was greater.

Table E-1. SGS-AXYS laboratory data flags for the current data set.

SGS-AXYS Lab Flag	Definition	Impact on data
H	Concentration reported is estimated.	Sample data flagged with H has been censored at the reporting limit.
U	Not detected at the reporting limit	Sample concentration is reported as less than the reporting limit
D	Dilution data	Sample data concentrations are reported as received by the laboratory.

SGS-AXYS Lab Flag	Definition	Impact on data
B	Analyte found in the sample is less than 10X the concentration in the associated blank	Sample data is censored at concentrations less than 10 times the concentration reported in the laboratory blank.
R	Peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration	Sample data flagged with R has been censored at the reporting limit.
NQ	Data not quantifiable	Samples are not included in the data set.

Appendix F

Summary statistics on all detection

Table F-1.

General Statistics											
2017 NLA data, in order of detection frequency											
General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method for chemicals with at least 20% detections.											
Chemical	**NumObs**	**# Missing**	**Num Ds**	**NumNDs**	**% NDs**	**Min ND**	**Max ND**	**KM Mean**	**KM Var**	**KM SD**	**KM CV**
Estrone	50	0	35	15	30.00%	0.093	0.17	0.536	0.267	0.516	0.963
DEET	50	0	25	25	50.00%	0.734	0.817	46.89	48372	219.9	4.69
4-Nonylphenols	50	0	23	27	54.00%	0.41	2.62	6.743	99.42	9.971	1.479
5,6-dimethyl benzotriazole	50	0	18	32	64.00%	0.39	0.69	1.58	10.55	3.249	2.056
Cotinine	50	0	18	32	64.00%	1.37	1.56	2.591	12.06	3.473	1.34
2-amino benzothiazole	50	0	16	34	68.00%	0.22	0.42	0.42	0.193	0.439	1.047
Sertraline	50	0	15	35	70.00%	0.382	2.46	0.578	0.173	0.415	0.719
Fluoxetine	50	0	13	37	74.00%	1.38	1.57	2.27	6.311	2.512	1.107
Oxycodone	50	0	12	38	76.00%	0.562	1.61	0.631	0.0195	0.14	0.221

Table F-2.

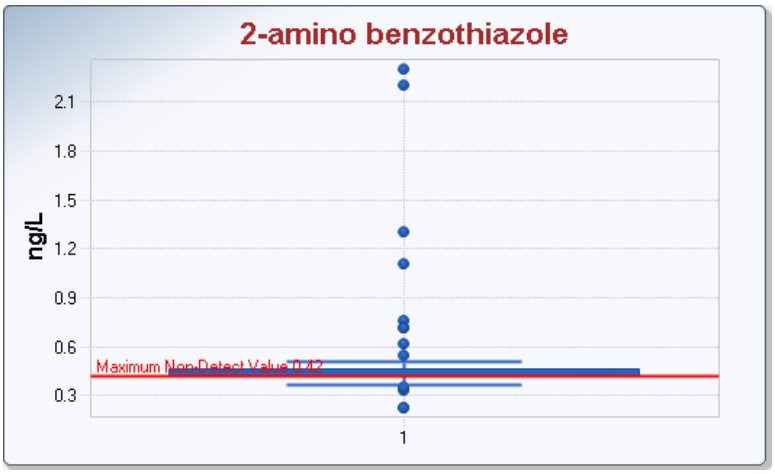
Percentiles using all Detects (Ds) and Non-Detects (NDs)											
Variable	**NumObs**	**# Missing**	**10%ile**	**20%ile**	**25%ile(Q1)**	**50%ile(Q2)**	**75%ile(Q3)**	**80%ile**	**90%ile**	**95%ile**	**99%ile**
1,7-Dimethylxant ine	50	0	<56.4	<57.3	<57.65	<59.55	<60.38	<60.42	<60.91	<61.36	<62.26
10-hydroxy-amitriptyline	50	0	<0.16	<0.19	<0.20	<0.24	<0.29	<0.30	<0.33	<0.35	<0.42
2-amino benzothiazole	50	0	<0.37	<0.42	<0.42	<0.42	0.46	0.492	0.715	1.21	2.251
2-hydroxy benzothiazole	50	0	<23.00	<23.00	<23.00	<23.00	<23.00	<23.00	<23.00	<23.00	<29.12
2-Hydroxy-ibuprofen	50	0	<75.20	<76.38	<76.88	<79.15	<80.48	<80.62	<81.43	<81.86	<83.06
4-methyl benzotriazole	50	0	<0.74	<0.74	<0.74	<0.74	<0.74	<0.74	1.58	7.725	33.89
4-n-Octylphenol	50	0	<0.23	<0.29	<0.30	<0.39	<0.51	<0.53	<0.60	<0.67	<0.89
4-Nonylphenol diethoxylate	50	0	<0.86	<1.06	<1.10	<1.36	<1.56	<1.62	<1.80	<1.97	<6.09
4-Nonylphenol monoethoxylates	50	0	<1.04	<1.29	<1.34	<1.72	<2.06	<2.18	<2.84	<3.11	<11.72
4-Nonylphenols	50	0	<0.73	<0.92	<0.99	<1.77	<9.85	<14.40	20.04	25.47	39.65
5,6-dimethyl benzotriazole	50	0	<0.66	<0.69	<0.69	<0.69	1.065	1.5	2.55	7.85	15.06
5-methyl benzotriazole	50	0	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.83	5.26	16.12
Acetaminophen	50	0	<14.1	<14.3	<14.43	<14.9	<15.1	<15.1	<15.21	<15.36	<15.6
Albuterol	50	0	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05	<1.05
Alprazolam	50	0	<0.28	<0.29	<0.29	<0.30	<0.30	<0.30	<0.31	<0.31	<0.40
Amitriptyline	50	0	<0.42	<0.50	<0.52	0.804	1.233	1.304	1.639	2.78	6.869
Amlodipine	50	0	<1.41	<1.44	<1.45	<1.50	<1.51	<1.52	<1.55	<1.60	<1.80
Amphetamine	50	0	<1.45	<1.47	<1.48	<1.50	<1.53	<1.53	<1.56	<1.56	1.941
Amsacrine	50	0	<0.08	<0.08	<0.08	<0.21	<0.27	<0.29	<0.36	<0.42	<0.67
Atenolol	50	0	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62	<0.62
Atorvastatin	50	0	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56
Azathioprine	50	0	<1.95	<1.98	<2.00	<2.02	<2.41	<2.62	<2.90	<3.24	<5.04
Azithromycin	50	0	<1.51	<1.56	<1.68	<2.07	2.498	2.616	4.992	5.026	5.391
Benzothiazole	50	0	<39.00	<39.00	<39.00	<39.00	<39.00	<39.00	<39.00	<39.00	<40.53
Benzotriazole	50	0	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	<3.90	6.65	29.87
Benzoylecgonine	50	0	<0.29	<0.29	<0.29	<0.30	<0.31	<0.33	<0.49	<0.60	<0.73
Benztropine	50	0	<0.47	<0.48	<0.48	<0.50	<0.50	<0.50	<0.51	<0.54	0.567
Betamethasone	50	0	<1.43	<1.47	<1.48	<1.50	<1.53	<1.54	<2.25	<3.82	<4.67
Bisphenol A	50	0	<1.96	<2.00	<2.01	<2.04	<2.08	<2.12	2.69	18.41	72.95
Busulfan	50	0	<2.18	<2.22	<2.24	<8.08	<14.98	<17.58	<22.91	<24.66	<28.05
Caffeine	50	0	<14.10	<14.30	<14.43	<15.00	<15.10	15.2	15.31	15.5	18.56
Carbadox	50	0	<1.49	<1.51	<1.53	3.18	4.715	6.214	8.303	12.07	13.16
Carbamazepine	50	0	<1.41	<1.43	<1.44	<1.50	<1.51	<1.51	<1.53	<1.55	<28.56
Cefotaxime	43	7	<5.91	<6.04	<6.06	<18.1	<28.4	<34.2	<81.02	<98.73	<159.8
Cimetidine	50	0	<1.63	<1.63	<1.63	<1.63	<1.63	<1.63	<1.63	<1.63	<1.63
Ciprofloxacin	45	5	<10.5	<11.58	<12.	<17.6	<22.7	<24.22	<25.58	<31.72	<39.81
Citalopram	50	0	<0.40	0.531	0.61	1.05	1.393	1.654	1.92	2.161	2.645
Clarithromycin	50	0	<1.41	<1.43	<1.44	<1.49	<1.51	<1.51	<1.52	<1.54	<1.56
Clinafloxacin	45	5	<18.2	<22.2	<24.1	<30.3	<36.1	<37.	<40.68	<43.78	<75.44
Clonidine	50	0	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56
Clopidogrel	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.49	<0.51
Clotrimazole	50	0	<0.38	<0.38	<0.39	<0.40	<0.40	<0.40	<0.41	<0.41	<0.42
Cloxacillin	50	0	<2.82	<2.86	<2.89	<2.98	<3.02	<3.02	<3.05	<3.07	<3.12
Cocaine	50	0	<0.14	<0.15	<0.15	0.205	0.299	0.313	0.382	0.395	0.517
Codeine	50	0	<3.12	<3.12	<3.12	<3.12	<3.12	<3.12	<3.12	<3.12	<3.12
Colchicine	50	0	<0.80	<1.48	<2.16	<3.11	4.195	4.64	6.278	6.811	8.043
Cotinine	50	0	<1.46	<1.48	<1.49	<1.53	2.688	2.9	3.97	5.459	17.18
Cyclophosphamide	50	0	<0.76	<0.78	<0.79	<0.81	<0.93	<1.01	<1.13	<1.65	<2.29
Daunorubicin	50	0	<7.60	<7.73	<7.84	<8.03	<8.24	<8.35	<9.94	<11.61	<32.58
Decoquinate	45	5	<0.05	<0.06	<0.07	<0.09	<0.11	<0.12	<0.13	<0.24	<0.30
DEET	50	0	<0.76	<0.77	<0.79	<2.25	24.3	29.82	51.16	64.71	843.3
Dehydronifedipine	50	0	<.56	<.57	<.58	<.6	<.61	<.62	<.68	<.73	<.77
Desmethyldiltiazem	50	0	<0.14	<0.15	<0.15	<0.15	<0.15	<0.17	<0.21	<0.31	<0.60
Diatrizoic acid	47	3	<22.72	<23.50	<23.70	<24.20	<36.85	<48.90	<70.78	<100.40	<369.50
Diazepam	50	0	<0.28	<0.29	<0.29	<0.30	<0.30	<0.31	<0.36	<0.38	0.584
Diclofenac	50	0	<3.01	<3.06	<3.10	<3.17	<3.22	<3.22	<3.26	<3.29	<4.22
Digoxigenin	50	0	<111.3	<130.4	<137.3	<174.	<210.	<226.6	<264.9	<311.1	<392.6
Digoxin	50	0	<5.64	<5.73	<5.77	<5.96	<6.04	<6.04	<6.09	<6.14	<6.23
Diltiazem	50	0	<0.29	<0.29	<0.29	<0.30	<0.31	<0.32	<0.34	<0.39	0.422
Diphenhydramine	50	0	<0.56	<0.57	<0.58	<0.60	<0.60	<0.61	<0.61	<0.62	1.175
Doxorubicin	50	0	<22.60	<22.90	<23.05	<23.85	<24.10	<24.20	<24.41	<24.66	<39.02
Drospirenone	50	0	<7.60	<7.81	<7.86	<8.03	<8.16	<8.27	<9.05	<10.61	<15.65
Enalapril	50	0	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31	<0.31
Enrofloxacin	45	5	<2.97	<3.02	<3.02	<3.4	<4.28	<4.41	<4.8	<4.97	<5.96
Eprosartan	50	0	<0.95	<1.00	<1.03	<1.15	<1.25	<1.29	<1.43	<1.50	<1.65
Erythromycin-H2O	50	0	2.16	2.208	2.23	2.29	2.318	2.33	2.377	2.501	2.636
Estradiol	50	0	<0.24	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.415
Estrone	50	0	<0.17	<0.17	<0.17	0.315	0.793	0.912	1.4	1.5	1.857
Etoposide	50	0	<1.94	<1.97	<1.98	<2.01	<2.06	<2.65	<3.80	<3.82	<3.91
Fenofibrate	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.49	<0.56
Flumequine	50	0	<1.43	<1.45	<1.46	<1.5	<1.52	<1.52	<1.59	<2.22	<2.64
Fluocinonide	50	0	<5.64	<5.73	<5.77	<5.98	<6.04	<6.05	<6.13	<6.19	<9.19
Fluoxetine	50	0	<1.42	<1.44	<1.45	<1.50	1.565	1.712	4.451	6.131	13.26
Fluticasone propionate	50	0	<1.96	<1.98	<2.00	<2.04	2.555	2.662	3.44	4.476	9.627
Furosemide	50	0	<37.60	<38.20	<38.48	<39.60	<40.28	<40.32	<40.91	<41.53	<45.72
Gemfibrozil	50	0	<1.41	<1.43	<1.44	<1.49	<1.51	<1.51	<1.53	<1.55	<2.40
Glipizide	50	0	<5.64	<5.73	<5.77	<5.94	<6.03	<6.05	<6.10	<6.14	<6.23
Glyburide	50	0	<2.82	<2.86	<2.89	<2.97	<3.02	<3.02	<3.05	<3.07	<3.12
Hydrochlorothiazide	50	0	<18.80	<19.10	<19.25	<19.85	<20.18	<20.22	<20.51	<66.37	<68.62
Hydrocodone	50	0	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56	<1.56
Hydrocortisone	50	0	<56.40	<57.30	<57.75	<60.00	<60.85	<61.48	<77.38	<90.10	<105.40

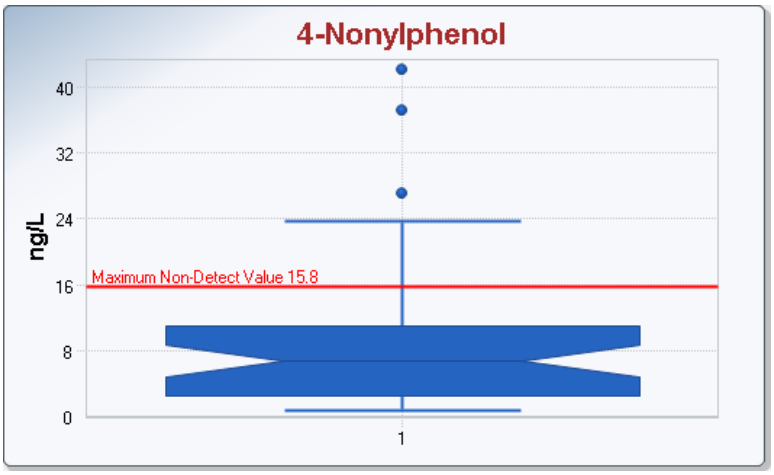
Percentiles using all Detects (Ds) and Non-Detects (NDs)											
Variable	NumObs	# Missing	10%ile	20%ile	25%ile(Q1)	50%ile(Q2)	75%ile(Q3)	80%ile	90%ile	95%ile	99%ile
Ibuprofen	50	0	<14.10	<14.30	<14.43	<14.80	<15.10	<15.10	<15.30	<15.36	<15.60
Iopamidol	50	0	<78.37	<79.86	<80.10	<84.50	<137.30	<153.40	<196.50	<259.40	<487.00
Lamotrigine	50	0	<3.01	<3.06	<3.08	<3.17	<3.22	<3.23	<3.28	<3.50	<117.10
Lincomycin	50	0	<2.82	<2.86	<2.89	<2.98	<3.02	<3.02	<3.05	<3.07	<3.12
Lomefloxacin	45	5	<5.97	<7.56	<8.6	<11.1	<14.3	<14.72	<17.38	<20.28	<27.12
m-Chlorophenylpiperazine	50	0	<2.20	<2.53	<2.67	<3.15	<3.68	<3.79	<4.57	<4.82	<7.41
Medroxyprogesterone Acetate	50	0	<3.92	<3.96	<3.98	<4.03	<4.25	<4.36	<5.11	<5.56	<7.63
Melengestrol Acetate	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.52	<0.63
Melphalan	47	3	<23.40	<24.10	<37.75	<103.00	<152.50	<185.40	<219.80	<301.60	<395.80
Meprobamate	50	0	<3.76	<3.82	<3.85	<3.97	<4.02	<4.03	<4.06	<4.09	<4.15
Metformin	50	0	<2.90	<2.97	<2.97	<3.04	3.953	4.088	8.657	14.82	35.51
Methylprednisolone	50	0	<3.94	<3.99	<4.00	<4.15	<13.80	<14.62	<21.40	<28.49	<39.16
Metoprolol	50	0	<1.52	<14.34	<16.18	<19.75	<25.70	<29.98	<34.11	<42.01	<50.69
Metronidazole	50	0	<3.80	<3.84	<3.87	<3.99	<4.02	<4.03	<4.07	<4.11	<4.43
Miconazole	50	0	<1.42	<1.45	<1.45	<1.50	<1.51	<1.52	<1.55	1.623	1.781
Moxifloxacin	48	2	<3.93	<4.03	<4.88	<10.05	<16.18	<17.12	<20.19	<21.13	<52.26
Mycophenolate Mofetil	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.49	<0.51
Naproxen	50	0	<2.93	<2.96	<2.96	<3.02	<3.54	<4.08	<6.10	<11.92	<16.17
Norfloxacin	45	5	<25.52	<28.82	<31.7	<40.	<56.2	<58.56	<71.18	<79.2	<120.2
Norfluoxetine	50	0	<1.41	<1.43	<1.44	<1.49	<1.51	<1.51	<1.52	<1.54	<1.56
Norgestimate	50	0	<2.82	<2.87	<2.9	<3.	<3.17	<3.46	<4.32	<4.53	<5.7
Norquetiapine	50	0	<0.90	<0.92	<0.92	<0.95	<0.97	<0.97	<0.98	<0.99	<9.65
Norverapamil	50	0	<0.14	<0.15	<0.15	<0.15	<0.15	<0.16	<0.17	<0.21	<0.26
Ofloxacin	45	5	<1.48	<1.95	<2.21	<3.27	<3.88	<4.34	4.844	5.042	5.388
Ormetoprim	50	0	<.57	<.58	<.58	<.6	<.6	<.61	<.61	<.62	<.93
Oxacillin	50	0	<2.82	<2.86	<2.89	<2.98	<3.02	<3.02	<3.05	<3.07	<3.12
Oxazepam	50	0	<3.76	<3.83	<3.90	<4.00	<4.04	<4.06	<4.13	<4.24	<5.42
Oxolinic Acid	50	0	<0.61	<0.73	<0.79	<0.95	<1.50	<1.86	<2.44	3.685	15.72
Oxycodone	50	0	0.589	0.597	0.599	0.627	0.754	0.777	0.883	1.092	1.37
Paroxetine	50	0	<3.76	<3.82	<3.85	<3.97	<4.02	<4.03	<4.07	<4.12	<4.76
Penicillin G	50	0	<2.82	<2.86	<2.89	<2.98	<3.02	<3.02	<3.05	<3.07	<3.12
Penicillin V	50	0	<2.82	<2.86	<2.89	<2.98	<3.02	<3.02	<3.05	<3.07	<3.12
Prednisolone	50	0	<5.84	<5.93	<6.01	<14.90	<30.55	<32.10	<42.12	<46.36	<91.60
Prednisone	50	0	<19.09	<19.68	<19.80	<20.45	<80.60	<89.44	<104.60	<145.30	<180.00
Promethazine	50	0	<0.38	<0.38	<0.39	<0.40	<0.41	<0.41	<0.97	<1.16	<2.28
Propoxyphene	50	0	<0.28	<0.29	<0.29	<0.30	<0.30	<0.30	<0.31	<0.31	<0.31
Propranolol	50	0	<1.88	<1.91	<1.93	<1.99	<2.01	<2.01	<2.03	<2.05	<2.08
Quetiapine	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.49	<0.51
Ramipril	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.49	<0.51
Ranitidine	50	0	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82	<0.82
Rosuvastatin	50	0	<3.76	<3.86	<3.89	<4.00	<4.03	<4.05	<4.18	<4.52	<5.65
Roxithromycin	50	0	<0.29	<0.29	<0.30	<0.30	<0.32	<0.35	0.438	0.527	0.638
Sarafloxacin	45	5	<14.8	<15.06	<15.1	<20.6	<24.3	<24.88	<27.22	<36.14	<46.71
Sertraline	50	0	<0.40	<0.40	<0.41	0.509	0.778	0.887	1.072	1.978	2.562
Simvastatin	50	0	<18.80	<19.10	<19.25	<19.85	<20.20	<20.32	<66.60	<66.86	<67.46
Sulfachloropyridazine	50	0	<1.41	<1.43	<1.44	<1.5	<1.51	<1.51	<1.53	<1.56	<3.04
Sulfadiazine	50	0	<1.41	<1.43	<1.44	<1.49	<1.51	<1.51	<1.52	<1.54	<1.56
Sulfadimethoxine	50	0	<0.30	<0.31	<0.32	<0.44	<0.67	<0.78	<1.00	<1.35	<3.65
Sulfamerazine	50	0	<.57	<.61	<.63	<.83	<1.21	<1.27	<1.62	<2.26	<2.6
Sulfamethazine	50	0	<.61	<1.27	<1.52	<2.36	<3.95	<4.01	<5.35	<7.17	<9.59
Sulfamethizole	50	0	<0.59	<0.60	<0.60	<0.88	<1.37	<1.46	<1.64	<2.06	<4.92
Sulfamethoxazole	50	0	<0.58	<0.59	<0.60	<0.61	<0.90	<1.17	<2.32	<2.97	<13.01
Sulfanilamide	50	0	<14.1	<14.3	<14.43	<14.9	<15.1	<15.12	<15.41	<15.98	<32.94
Sulfathiazole	50	0	<1.43	<1.46	<1.47	<1.51	<1.57	<1.65	<1.88	<2.09	<2.88
Tamoxifen	50	0	<0.38	<0.38	<0.39	<0.40	<0.40	<0.40	<0.41	<0.41	<0.42
Teniposide	50	0	<3.81	<3.88	<3.90	<4.00	<4.03	<4.05	<4.13	<4.80	<5.33
Theophylline	50	0	<57.93	<59.08	<59.30	<60.30	<61.70	<63.88	<82.94	<86.41	<100.00
Thiabendazole	50	0	<1.41	<1.44	<1.45	<1.50	<1.51	<1.51	<1.53	<1.55	<2.70
Tilmicosin	50	0	<1.80	<1.83	<1.85	<1.90	<1.93	<1.93	<1.95	<1.97	<2.06
Topiramate	50	0	<0.90	<0.92	<0.94	<0.96	<0.98	1.01	1.359	1.796	75.27
Trazodone	50	0	<0.45	<0.46	<0.46	<0.48	<0.48	<0.48	<0.49	<0.49	<0.51
Trenbolone	50	0	<3.76	<3.82	<3.85	<3.97	<4.02	<4.03	<4.06	<4.09	<4.15
Trenbolone acetate	50	0	<0.29	<0.30	<0.30	<0.36	<0.44	<0.48	<0.60	<0.75	<0.87
Triamterene	50	0	<0.29	<0.30	<0.30	<0.30	<0.31	<0.31	<0.31	<0.31	11.14
Triclocarban	50	0	<2.82	<2.86	<2.89	<2.97	<3.02	<3.02	<3.05	<3.07	<3.12
Triclosan	50	0	<4.97	<5.02	<5.03	<5.08	<5.17	<5.25	<5.52	6.352	6.75
Triclosan	50	0	<56.40	<57.30	<57.65	<59.35	<60.30	<60.50	<61.03	<61.36	<62.26
Trimethoprim	50	0	<1.48	<1.5	<1.55	<2.08	<3.08	<3.18	<3.53	<3.73	<7.55
Tylosin	50	0	<5.64	<5.73	<5.77	<5.96	<6.04	<6.04	<6.09	<6.14	<6.23
Valsartan	50	0	<3.80	<3.84	<3.90	<4.01	<4.12	<4.27	13.3	13.4	13.5
Venlafaxine	50	0	<0.38	<0.68	<0.95	<1.61	<3.21	<3.21	<3.24	<3.29	<4.20
Verapamil	50	0	<0.14	<0.15	<0.15	<0.15	<0.15	<0.15	<0.16	<0.18	<0.26
Virginiamycin M1	50	0	<2.82	<2.86	<2.89	<2.99	<3.02	<3.03	<3.14	4.054	4.701
Warfarin	50	0	<1.41	<1.43	<1.44	<1.48	<1.51	<1.51	<1.53	<1.54	<1.56
Zidovudine	50	0	<23.70	<24.28	<24.53	<55.35	<112.00	<123.60	<188.80	<227.90	<286.90

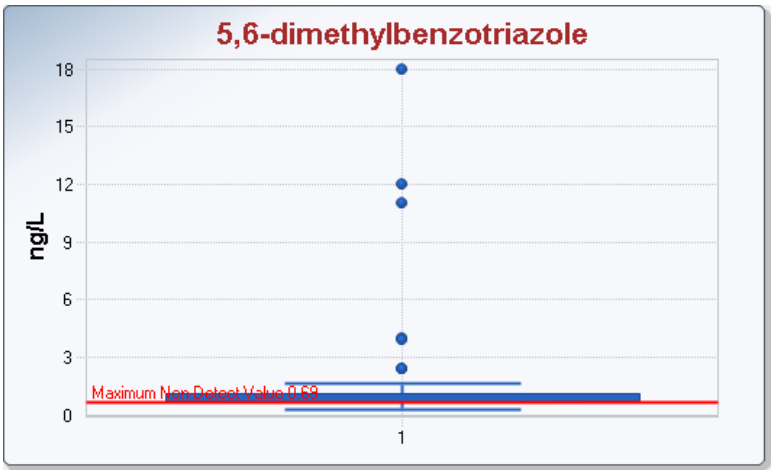
1. Highlighted values include detections above the analytical reporting limit.
2. Samples reported by the laboratory as non-quantifiable (NQ) are listed as missing observations.
3. Percentiles are reported for non-detected chemicals with more than one analytical detection limit.

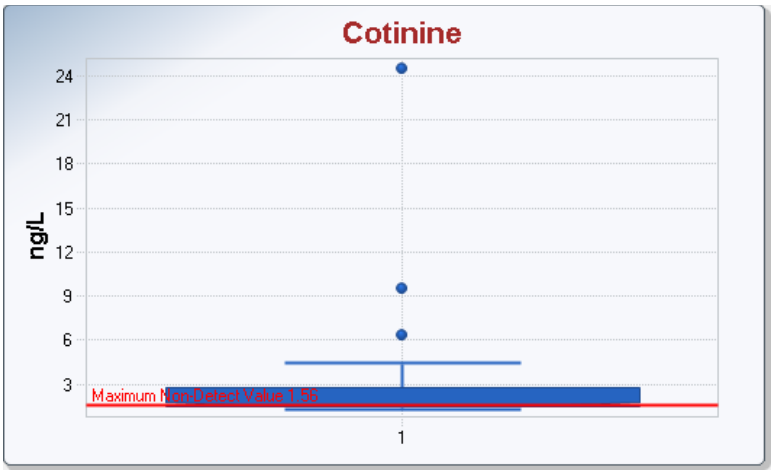
Appendix G

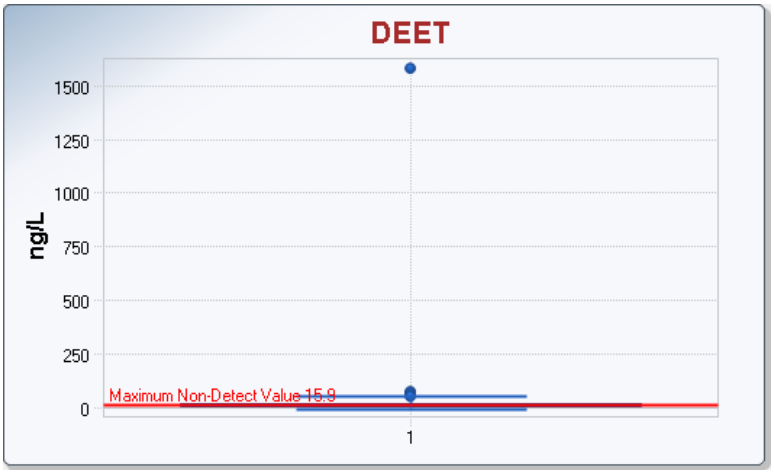
Box plots of analytes with at least 20% detections.

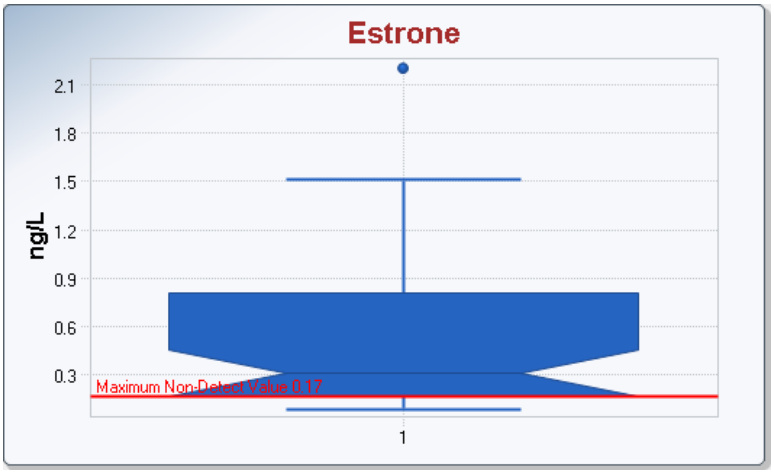

2-amino benzothiazole
ng/L
2.1
1.8
1.5
1.2
0.9
0.6
0.3
Maximum Non-Detect Value 0.42
1

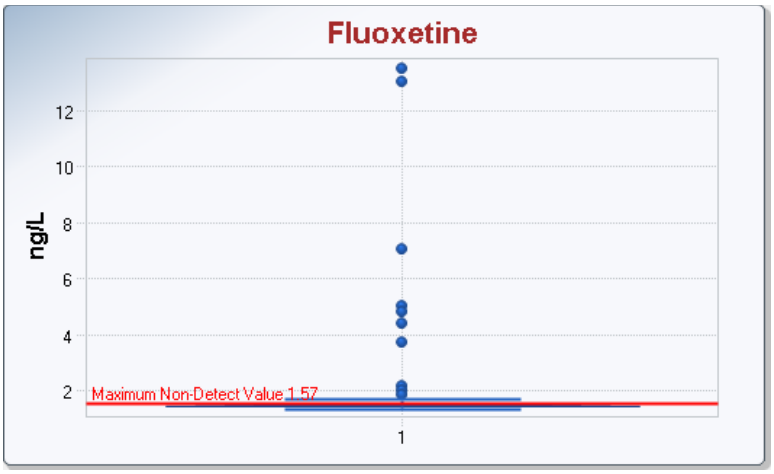

4-Nonylphenol
ng/L
40
32
24
16
8
0
Maximum Non-Detect Value 15.8
1

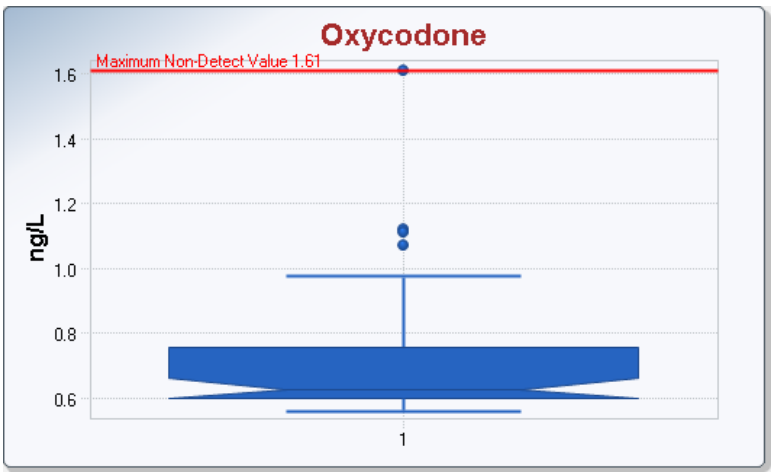

5,6-dimethylbenzotriazole
ng/L
18
15
12
9
6
3
0
Maximum Non-Detect Value 0.69
1

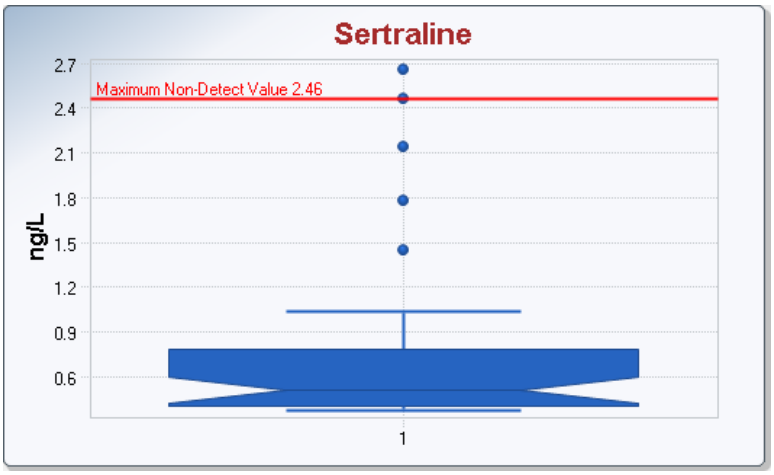

Cotinine
ng/L
24
21
18
15
12
9
6
3
Maximum Non-Detect Value 1.55
1


DEET
ng/L
1500
1250
1000
750
500
250
0
Maximum Non-Detect Value 15.9
1


Estrone
ng/L
2.1
1.8
1.5
1.2
0.9
0.6
0.3
Maximum Non-Detect Value 0.17
1


Fluoxetine
ng/L
12
10
8
6
4
2
Maximum Non-Detect Value 1.57
1


Oxycodone
Maximum Non-Detect Value 1.61
ng/L
1.6
1.4
1.2
1.0
0.8
0.6
1


Sertraline
Maximum Non-Detect Value 2.46
ng/L
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
1

Appendix H

Descriptive statistics for analytical reporting limits

Table H-1. Summary statistics on the analytical reporting limits for chemicals analyzed in this study.

	Count	Min	Max	Median	Mean	Lab
1,7-Dimethylxanthine	50	55	62.7	59.55	59.10	SGS-AXYS
10-hydroxy-amitriptyline	50	0.14	0.48	0.24	0.25	SGS-AXYS
17alpha-Ethinyl Estradiol	50	0.19	0.19	0.19	0.19	MDH
2-amino benzothiazole	28	0.42	0.42	0.42	0.42	SGS-AXYS
2-hydroxy benzothiazole	49	23.00	23.00	23.00	23.00	SGS-AXYS
2-Hydroxy-ibuprofen	50	73.40	83.60	79.15	78.80	SGS-AXYS
3,4-methylenedioxy-N-methyla	50	0.50	0.50	0.50	0.50	MDH
4-methyl benzotriazole	42	0.74	0.74	0.74	0.74	SGS-AXYS
4-n-Octylphenol	35	0.18	1.02	0.37	0.42	SGS-AXYS
4-Nonylphenol diethoxylates	49	0.71	2.02	1.32	1.32	SGS-AXYS
4-Nonylphenol monoethoxylate	49	0.66	3.32	1.72	1.77	SGS-AXYS
4-Nonylphenols	49	0.66	3.32	1.72	1.77	SGS-AXYS
5,6-dimethyl benzotriazole	26	0.69	0.69	0.69	0.69	SGS-AXYS
5-methyl benzotriazole	42	0.80	0.80	0.80	0.80	SGS-AXYS
Acetaminophen	50	13.80	15.70	14.90	14.78	SGS-AXYS
Albuterol	49	0.27	1.09	0.30	0.35	SGS-AXYS
Alprazolam	50	0.28	0.48	0.30	0.30	SGS-AXYS
Amitriptyline	45	0.30	1.90	0.72	0.85	SGS-AXYS
Amlodipine	50	1.38	1.94	1.50	1.49	SGS-AXYS
Amphetamine	43	1.37	1.56	1.50	1.49	SGS-AXYS
Amphetamine	50	1.10	1.10	1.10	1.10	MDH
Amsacrine	50	0.07	0.74	0.21	0.21	SGS-AXYS
Atenolol	49	0.55	0.62	0.60	0.60	SGS-AXYS
Atorvastatin	49	1.37	1.56	1.50	1.50	SGS-AXYS
Azathioprine	50	1.87	6.23	2.02	2.32	SGS-AXYS
Azithromycin	48	1.40	5.09	2.03	2.31	SGS-AXYS
Benzothiazole	49	39.00	39.00	39.00	39.00	SGS-AXYS
Benzotriazole	45	3.90	3.90	3.90	3.90	SGS-AXYS
Benzoylecgonine	50	0.28	0.75	0.30	0.34	SGS-AXYS
Benzoylecgonine	50	0.50	0.50	0.50	0.50	MDH
Benztropine	46	0.46	0.52	0.49	0.49	SGS-AXYS
Betamethasone	50	1.39	4.70	1.50	1.75	SGS-AXYS
Bisphenol A	44	1.00	2.30	2.03	1.95	SGS-AXYS
Busulfan	50	2.07	30.50	8.08	9.91	SGS-AXYS
Caffeine	47	13.8	15.7	14.9	14.78	SGS-AXYS
Carbadox	35	1.44	8.07	2.74	3.05	SGS-AXYS
Carbamazepine	49	1.38	1.57	1.49	1.48	SGS-AXYS
Cefotaxime	43	5.74	201	18.1	29.54	SGS-AXYS
Cimetidine	49	0.55	2.23	0.61	0.67	SGS-AXYS
Ciprofloxacin	45	5.81	43.20	17.60	18.36	SGS-AXYS
Citalopram	48	0.38	2.88	1.05	1.11	SGS-AXYS
Clarithromycin	50	1.38	1.57	1.49	1.48	SGS-AXYS
Clinafloxacin	45	12.70	95.50	30.30	31.21	SGS-AXYS
Clonidine	49	1.37	1.56	1.50	1.50	SGS-AXYS
Clopidogrel	50	0.44	0.53	0.47	0.47	SGS-AXYS

	Count	Min	Max	Median	Mean	Lab
Clotrimazole	50	0.37	0.42	0.40	0.39	SGS-AXYS
Cloxacillin	NA	NA	NA	NA	NA	SGS-AXYS
Cocaine	47	0.14	0.52	0.20	0.23	SGS-AXYS
Cocaine	50	0.47	0.47	0.47	0.47	MDH
Codeine	49	2.73	3.12	3.00	2.99	SGS-AXYS
Codeine	50	7.90	7.90	7.90	7.90	MDH
Colchicine	49	0.75	9.17	3.10	3.33	SGS-AXYS
Cotinine	31	1.37	1.56	1.50	1.49	SGS-AXYS
Cyclophosphamide	44	0.73	2.70	0.80	0.91	SGS-AXYS
Daunorubicin	50	7.34	49.00	8.03	9.21	SGS-AXYS
Decoquinate	39	0.04	0.31	0.09	0.11	SGS-AXYS
DEET	52	0.73	12.30	0.80	1.01	SGS-AXYS
Dehydronifedipine	50	0.55	0.782	0.599	0.61	SGS-AXYS
Desmethyldiltiazem	50	0.14	0.70	0.15	0.18	SGS-AXYS
Diatrizoic acid	36	22.00	53.70	24.05	27.60	SGS-AXYS
Diazepam	49	0.28	0.74	0.30	0.31	SGS-AXYS
Diclofenac	49	2.93	3.54	3.16	3.15	SGS-AXYS
Digoxigenin	44	61.4	396	165.5	178.59	SGS-AXYS
Digoxin	50	5.5	6.27	5.955	5.91	SGS-AXYS
Diltiazem	49	0.275	0.425	0.301	0.31	SGS-AXYS
Diphenhydramine	48	0.55	0.627	0.5955	0.59	SGS-AXYS
Doxorubicin	50	22.00	52.40	23.85	24.20	SGS-AXYS
Drospirenone	50	7.34	15.80	8.03	8.45	SGS-AXYS
Enalapril	49	0.27	0.31	0.30	0.30	SGS-AXYS
Enrofloxacin	45	2.86	6.25	3.40	3.69	SGS-AXYS
Eprosartan	50	0.92	1.72	1.15	1.17	SGS-AXYS
Equilin	50	0.49	0.49	0.49	0.49	SGS-AXYS
Erythromycin-H2O	37	2.13	2.37	2.27	2.26	SGS-AXYS
Estradiol	40	0.34	0.34	0.34	0.34	MDH
Estriol	49	0.12	0.12	0.12	0.12	MDH
Estrone	50	0.17	0.17	0.17	0.17	MDH
Etoposide	50	1.87	3.92	2.01	2.36	SGS-AXYS
Fenofibrate	49	0.44	0.53	0.47	0.47	SGS-AXYS
Flumequine	50	1.39	2.66	1.5	1.56	SGS-AXYS
Fluocinonide	50	5.50	12.00	5.98	6.04	SGS-AXYS
Fluoxetine	37	1.38	1.57	1.48	1.47	SGS-AXYS
Fluticasone propionate	47	1.91	11.20	2.02	2.57	SGS-AXYS
Furosemide	50	36.70	48.90	39.60	39.61	SGS-AXYS
Gemfibrozil	49	1.38	1.57	1.48	1.48	SGS-AXYS
Glipizide	50	5.50	6.27	5.94	5.91	SGS-AXYS
Glyburide	50	2.75	3.14	2.97	2.95	SGS-AXYS
Hydrochlorothiazide	50	18.30	69.70	19.85	23.48	SGS-AXYS
Hydrocodone	49	1.37	1.56	1.50	1.50	SGS-AXYS
Hydrocortisone	50	55.00	119.00	60.00	63.49	SGS-AXYS
Ibuprofen	50	13.80	15.70	14.80	14.78	SGS-AXYS

	Count	Min	Max	Median	Mean	Lab
Iopamidol	45	74.80	267.00	81.90	109.18	SGS-AXYS
Irbesartan	50	0.44	0.53	0.47	0.47	SGS-AXYS
Lamotrigine	49	2.93	3.78	3.16	3.17	SGS-AXYS
Lincomycin	50	2.75	3.14	2.98	2.95	SGS-AXYS
Lomefloxacin	45	4.43	27.30	11.10	11.73	SGS-AXYS
m-Chlorophenylpiperazine	50	1.87	9.78	3.15	3.30	SGS-AXYS
Medroxyprogesterone Acetate	50	3.74	8.24	4.03	4.31	SGS-AXYS
Melengestrol Acetate	50	0.44	0.65	0.48	0.48	SGS-AXYS
Melphalan	47	22.20	405.00	103.00	117.17	SGS-AXYS
Meprobamate	50	3.67	4.18	3.97	3.94	SGS-AXYS
Metformin	40	2.73	15.90	3.03	3.80	SGS-AXYS
Methamphetamine	50	0.75	0.75	0.75	0.75	MDH
Methylprednisolone	50	3.67	47.20	4.15	10.18	SGS-AXYS
Metoprolol	50	1.41	55.10	19.75	20.75	SGS-AXYS
Metronidazole	50	3.70	4.66	3.99	3.96	SGS-AXYS
Miconazole	48	1.38	1.72	1.49	1.49	SGS-AXYS
Morphine	50	9.10	9.10	9.10	9.10	MDH
Moxifloxacin	48	3.76	77.50	10.05	12.21	SGS-AXYS
Mycophenolate Mofetil	50	0.44	0.53	0.47	0.47	SGS-AXYS
Naproxen	50	2.78	17.00	3.02	4.19	SGS-AXYS
Norfloxacin	45	17.70	133.00	40.00	46.30	SGS-AXYS
Norfluoxetine	50	1.38	1.57	1.49	1.48	SGS-AXYS
Norgestimate	50	2.75	6.28	3	3.27	SGS-AXYS
Norquetiapine	49	0.88	1.06	0.95	0.95	SGS-AXYS
Norverapamil	50	0.14	0.26	0.15	0.16	SGS-AXYS
Ofloxacin	44	1.44	5.45	3.24	3.14	SGS-AXYS
Ormetoprim	50	0.556	1.03	0.599	0.61	SGS-AXYS
Oxacillin	NA	NA	NA	NA	NA	SGS-AXYS
Oxazepam	50	3.67	6.02	4.00	4.02	SGS-AXYS
Oxolinic Acid	49	0.57	25.40	0.94	1.78	SGS-AXYS
Oxycodone	37	0.56	1.61	0.61	0.67	SGS-AXYS
Paroxetine	50	3.67	5.32	3.97	3.97	SGS-AXYS
Penicillin G	NA	NA	NA	NA	NA	SGS-AXYS
Penicillin V	50	2.75	3.14	2.98	2.95	SGS-AXYS
Prednisolone	50	5.55	104.00	14.90	20.68	SGS-AXYS
Prednisone	50	18.30	181.00	20.45	52.10	SGS-AXYS
Promethazine	50	0.37	2.34	0.40	0.54	SGS-AXYS
Propoxyphene	50	0.28	0.31	0.30	0.30	SGS-AXYS
Propranolol	50	1.83	2.09	1.99	1.97	SGS-AXYS
Pseudoephedrine/Ephedrine	50	0.78	0.78	0.78	0.78	MDH
Quetiapine	50	0.44	0.53	0.47	0.47	SGS-AXYS
Ramipril	50	0.44	0.53	0.47	0.47	SGS-AXYS
Ranitidine	39	0.56	0.91	0.61	0.62	SGS-AXYS
Rosuvastatin	50	3.67	6.03	4.00	4.04	SGS-AXYS
Roxithromycin	49	0.28	0.71	0.30	0.33	SGS-AXYS

	Count	Min	Max	Median	Mean	Lab
Sarafloxacin	45	14.40	53.40	20.60	21.61	SGS-AXYS
Sertraline	35	0.38	2.46	0.43	0.60	SGS-AXYS
Simvastatin	50	18.30	67.80	19.85	25.32	SGS-AXYS
Sulfachloropyridazine	50	1.38	3.14	1.50	1.54	SGS-AXYS
Sulfadiazine	50	1.38	1.57	1.49	1.48	SGS-AXYS
Sulfadimethoxine	49	0.28	1.53	0.42	0.55	SGS-AXYS
Sulfamerazine	50	0.55	2.75	0.83	1.02	SGS-AXYS
Sulfamethazine	50	0.59	11.70	2.36	2.92	SGS-AXYS
Sulfamethizole	49	0.56	3.19	0.88	1.03	SGS-AXYS
Sulfamethoxazole	49	0.57	3.34	0.61	0.94	SGS-AXYS
Sulfanilamide	45	13.80	42.00	15.00	15.59	SGS-AXYS
Sulfathiazole	50	1.39	3.39	1.51	1.60	SGS-AXYS
Tamoxifen	50	0.37	0.42	0.40	0.39	SGS-AXYS
Teniposide	50	3.70	5.48	4.00	4.04	SGS-AXYS
Theophylline	50	55.50	106.00	60.30	63.94	SGS-AXYS
Thiabendazole	49	1.38	1.57	1.5	1.479592	SGS-AXYS
Tilmicosin	50	1.76	2.13	1.90	1.89	SGS-AXYS
Topiramate	44	0.88	1.33	0.95	0.97	SGS-AXYS
Trazodone	50	0.44	0.53	0.47	0.47	SGS-AXYS
Trenbolone	50	3.67	4.18	3.97	3.94	SGS-AXYS
Trenbolone acetate	50	0.28	0.93	0.36	0.41	SGS-AXYS
Triamterene	47	0.27	0.31	0.30	0.30	SGS-AXYS
Triclocarban	50	2.75	3.14	2.97	2.95	SGS-AXYS
Triclosan	44	4.91	6.74	5.07	5.12	SGS-AXYS
Triclosan (List 3)	50	55.00	62.70	59.35	59.09	SGS-AXYS
Trimethoprim	50	1.39	10.70	2.08	2.44	SGS-AXYS
Tylosin	50	5.50	6.27	5.96	5.91	SGS-AXYS
Valsartan	49	3.70	13.60	4.00	5.15	SGS-AXYS
Venlafaxine	49	0.37	3.34	1.61	1.92	SGS-AXYS
Verapamil	50	0.14	0.26	0.15	0.15	SGS-AXYS
Virginiamycin M1	48	2.75	4.77	2.98	3.03	SGS-AXYS
Warfarin	50	1.38	1.57	1.48	1.48	SGS-AXYS
Zidovudine	50	22.40	308.00	55.35	82.56	SGS-AXYS

NA, Not available.

All concentrations in ng/L