A Reconnaissance of Contaminants of Emerging Concern in Wastewater and Sludge from Three Publicly Owned Treatment Works in New Jersey

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Project Management: Judy Louis, R. Lee Lippincott, Sandra M. Goodrow and Nicholas Procopio*

Investigators: Jeff Fischer and Tim Wilson**, R. Lee Lippincott*

*NJDEP Division of Science, Research and Environmental Health in Joint Funding Agreement with the **US Geological Survey New Jersey Water Science Center

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Executive Summary

The character of wastewater, landfill leachate, and sludge taken from three New Jersey regions (Areas) has been assessed for multiple contaminants of emerging concern to determine the likelihood of occurrence in various types of developed areas. Regions were determined based on land use and the projected character of wastewater. The distinct areas of land use that were the aim of this study consisted of residential, commercial, industrial (including two areas with pharmaceutical processing), and hospital/retirement areas. Areas contained various sub-sewersheds represented by a sampling station that was characterized by the land use type. For example, Area X contained residential sewersheds, industrial sewersheds, and commercial sewersheds. The three Areas contained a total of twenty-six (26) sampling sites, with seventeen (17) of those sites representing various characteristics of the sewershed and the other samples taken of the influent, effluent, and sludge taken from each of the Area's publicly owned treatment works (POTW). Landfill leachate from one location in each of the three Areas was also analyzed for a suite of compounds.

The contaminants of concern that were investigated came from seven classes of synthetic contaminants. These classifications included pharmaceuticals, pesticides, sterols and hormones, flavors and fragrances, alkylphenol ethoxylates (APEs), polyaromatic hydrocarbons (PAHs) and per- and polyfluorinated alkyl substances (PFASs). The concentration of each compound present in the sample was assessed as to its occurrence and how the result compares to other studies, primarily to the study of 9 POTWs performed by EPA.[i]

Fifty-five (55) pharmaceutical compounds were evaluated in all water samples by the USGS National Water Quality Laboratory. The sludge samples were analyzed for twenty-one (21) pharmaceutical compounds. Pain relievers such as acetaminophen and ibuprofen were commonly detected in multiple samples. Mood stabilizers such as carbamazepine and iminostilbene (dibenzoazepine) were also commonly detected along with the ubiquitous antimicrobial, triclosan. Treated effluents that were discharged from the POTWs typically showed significantly lower concentrations of these compounds than other samples collected from key interceptors upstream of the treatment facility. In some instances, detectable levels of a contaminant were identified in the effluent of the treatment plant but not in the influent to the treatment plant. This was due to the resulting lower detection limits for the effluent samples, since matrix effects resulted in higher detection limits for influent samples.

Water samples were analyzed for twelve (12) pesticides and sludge samples were analyzed for nine (9). Although many of these compounds were below detectable levels, N, N-diethyl- meta-toluamide (DEET) was detected in nearly all samples. Levels of DEET detected in the landfill leachate were up to two orders of magnitude greater than those found in the water, but no detectable levels were determined in the sludge samples.

Various hormones, sterols, flavors, and fragrances were detected in many of the samples. At least four hormones were detected at all sites. Many of the thirteen (13) flavors and fragrances were commonly detected in most samples, with menthol and methyl salicylate providing the largest proportion of the total flavors and fragrances. Of the fourteen (14) nonionic surfactant APEs, all water samples contained detectable levels of between three (3) and ten (10)

compounds. One APE, tris(2-butoxyethyl) phosphate, an organic flame retardant, was found at detectable levels in every sample.

Most of the compounds detected and quantified in this analysis are not currently regulated due to their emerging nature. Where recommended limits or standards exist, only two samples exceeded those limits and both exceedances were in samples from untreated wastewater. The two exceedances were both from Area Z Residential Community that contained 82 ppb of p-cresol (a PAH) and 1.5 ppb pentachlorophenol (a pesticide), which currently have New Jersey groundwater standards of 50 ppb and 0.3 ppb, respectively.

Note: *This report presents the findings from the POTW Study for informational purposes only. The POTW dischargers have requested as part of the joint funding agreement, that their facility name not be disclosed in any reports. The POTWs in this study may not be statistically representative of all POTWs in the New Jersey, nor would these results be expected to be statistically representative for other POTWs in the State. In addition, the analytical methods used in this study were developed for quantifying CECs in environmental waters, not wastewater. Thus, matrix interferences can be considerable and reporting limits can vary considerably from sample to sample. For this reason, comparison of analytes between samples is difficult, and should only be made after comparing reporting limits in all samples.*

1.0 Introduction

Many contaminants of emerging concern (CECs) are present in the environment. The classes of contaminants considered during this study include active pharmaceutical ingredients (APIs) (including sterols and hormones, flavors and fragrances), pesticide/insecticides, alkylphenol ethoxylates (APEs), poly-aromatic hydrocarbons (PAHs), and perfluorinated alkyl substances (PFAS). These compounds are called, "contaminants of emerging concern" because the risk to human health and the environment associated with their presence, frequency of occurrence, or source may not be well known.[ii]

The Department entered into a joint funding agreement with the NJ Water Science Center of the United States Geological Survey (USGS). This research was conducted by the New Jersey Department of Environmental Protection (NJDEP) Division of Science, Research and Environmental Health (DSREH) and USGS at the request of the NJDEP Office of Pretreatment and Residuals to assess the analytical limitations of determining wastewater and sludge levels of contamination that are part of the schedule parameter listing in the USGS analytical methods.

As expected, the principal source of API's to the environment is human waste, either in treated waste released from POTWs, untreated wastes emanating from septic fields, or from the land application of sewage effluent or dried sludge. Previous studies have focused on APIs in sewage-treatment plant discharge and in rivers, which are typically the main environmental receptor for treated wastewater. More recently, concern has arisen in the science community about the presence of waste-derived, antibiotic compounds in the environment, and their associated risks to microbial and aquatic life. Sources of PAHs, pesticides/insecticides and alkyl-phenol compounds also originate in areas of high human activity.

This study was undertaken to determine what CECs occur in raw sewage generated by different source sewersheds, in the influent and the treated waste discharge and in the solid wastes generated by POTWs. Leachate samples taken from multiple landfills were also investigated. This study was initiated to answer the following questions:

1. Do pharmaceutical processing plants, hospitals, and/or other human waste sources represent significant sources of APIs and other CECs to POTWs?
2. What APIs and other CECs are released at the outfalls of large POTWs?
3. What APIs and other CECs are present in biosolids (both wet and dried) produced by POTWs?

Samples were taken from waste streams in carefully selected, isolated sewersheds that included: residential communities, retirement communities, hospitals, commercial areas, and industrial areas that include pharmaceutical processing plants. These processing plants do not synthesize the APIs but create the final marketable product containing the active ingredient. Samples were also obtained from one industrial area not having a pharmaceutical processing plant and from a dormitory residency at a local university. Influent and treated outfall water, and sludge were also sampled at three large sewage treatment plants located in New Jersey. This report summarizes the methods and results from this investigation.

1.1 Compounds Investigated

Seven chemical compound classes were investigated in New Jersey wastewaters and sludge for this study. The seven classes are as follows:

1. **Pharmaceuticals-** A variety of pharmaceuticals used for personal health were investigated as a part of this study. Pharmaceuticals include over-the-counter medication including pain-relief medicines (e.g., acetaminophen and ibuprofen) as well as prescription medications and antibiotics (e.g., codeine, albuterol, doxycycline). Most ingested pharmaceuticals are only partially metabolized, so a portion (metabolized or un-metabolized) is excreted, in urine or feces. Pharmaceuticals can also be released into sewage by improper disposal of unused medicines, and as wastes produced during the manufacturing or reformulation of drug products.

   Other personal care products included in this classification include antimicrobials and antifungals found in consumer products, such as triclosan, chloroxylenol, and fluconazole. These products can enter domestic wastewater from bathing, but also from household and hospital disinfection and sanitation.

2. **Pesticides, Insecticides, Herbicides and Fungicides**- Pesticides and similar compounds are used in many home products used to prevent, destroy, or repel a living, unwanted organism. These products are often referred to according to the type of organism that they control (e.g., insecticides, fungicides). The pesticide group includes compounds from the organochlorine and organophosphorus groups, such as pentachlorophenol, diazinon and chlorpyrifos. Pesticide residuals may enter the waste stream either in wash water, or by improper disposal into waste receptacles.

3. **Sterols and Hormones** - Steroids can be both naturally occurring compounds and synthetic analogues. Natural steroids are found in plants and animals, and include sterols (steroid-based alcohols) and are the most abundant of the steroids. The most common sterol in vertebrates is cholesterol, which is found in cell membranes and serves as a central intermediate in the biosynthesis of many biologically active steroids, including bile acids, corticosteroids, and sex hormones.

   Hormones are synthesized and secreted from cells and act in low concentrations by binding to target-cell receptors to activate a response. Some hormones are classified by chemical structure as steroids. Steroid hormones include the sex hormones, which are, among others, natural estrogens, synthetic estrogens such as EE2 (17 alpha-ethinyl estradiol), progesterone, and testosterone. Several plant steroids are known to mimic animal sex hormones. Sterols and hormones, both natural and synthetic, enter the environment directly from human and animal wastes.

4. **Flavors and Fragrances**

   Flavors and fragrances also both occur naturally, but have also been created synthetically for use in foods, perfumes, fabric softeners, air fresheners and a myriad of other products. The structure of the synthetic compounds is generally proprietary, making them difficult

to detect in general analytical procedures. Some of these compounds can serve as indicators of the human inputs.

For this study, fragrances, such as camphor and menthol are among the compounds quantified for this study. Most of the compounds evaluated for this study can be found in nature, but are likely substantially increased in concentrations due to the introduction of synthetic compounds used in many consumer products.

5. **Alkylphenol Ethoxylates** - The alkylphenol ethoxylate (APE) group includes alkylphenols and alkylphenol ethoxylates. These compounds are synthetic nonionic surfactants used in some detergents and cleaning products and includes their degradation products. The most common APEs are nonylphenol ethoxylates (NPEs), derived from nonylphenol (NP), which is an alkylphenol. Octylphenol ethoxylates (OPEs), derived from octylphenol (OP), are also common. Also included in this group are bisphenol A (4,4'-isopropylidenediphenol), and the phenol- and butyl-phosphates. Bisphenol A is an organic compound used to make polycarbonate plastic and epoxy resins. Polycarbonate is used in eyeglass lenses, medical equipment, water bottles, CDs, DVDs, and many other consumer products. Among these uses are the coatings on the inside of food and other product cans, in industrial floorings, in automotive finishes, and in printed circuit boards. Many of these substances are of high concern due to potential estrogenic activity.

6. **Polyaromatic Hydrocarbons**- Polyaromatic hydrocarbons (PAHs) are compounds frequently associated with coal tars, crude oil, and refined fuels. In addition, compounds such as anthracene are used as a wood preservative, and p-cresol can be used in the production of other chemicals. PAHs have been determined to have impacts on human health and their distribution in the environment can originate at many sources.

7. **Per- and Poly-fluorinated alkyl substances (PFASs)** - PFASs are widely distributed, but are disproportionately found near facilities that manufacture PFASs or use PFASs in the manufacturing process. Examples of activities that may release these compounds include the following:

    - Manufacture of fluoropolymers
    - Surface treatment of textile, leather and carpets industries
    - Manufacture of surface treatment of food contact materials
    - Metal plating (mist suppression)
    - Application sites of aqueous fire-fighting foams (including airports and military facilities)
    - Manufacture of semi-conductors
    - Application of sludge originating from industrial facilities or the MUA treating discharge from those facilities that use or manufacture these perfluorinated compounds.

1.2 Goals of Study

This study was undertaken to determine the presence and typical concentrations of common CECs in four types of waste streams:

1. Wastewater discharge from sewersheds serving pharmaceutical processing industries, hospitals, residential and retirement communities, commercial areas, and other sewage sources.
2. Total combined wastewater influent and treated outfall discharge generated by three large POTW plants that treat waste from urban areas and utilize enhanced secondary treatment processes.
3. Wet and dried bio-solid sludge produced at the large POTW plants.
4. Landfill leachate.

The approach taken was to identify and sample wastes emanating from isolated sewersheds that have distinct sources of human or industrial wastes. These sewersheds included: residential area, hospitals, industrial areas that include pharmaceutical processing plants, retirement communities, and commercial areas. In addition, the influent, treated outfall water, and biosolids (wet and dried sludge) produced by three large POTWs, and leachate from three area landfills were sampled.

1.3 Important Caveats to this Study

Three important caveats apply when considering the results of this study; these caveats relate to the complex nature of human wastes and the nature of flow in sanitary sewer-pipes.

1. Human waste in sanitary sewer pipes flow as poorly mixed "pulses" or "flushes", rather than as well mixed solutions typical of natural systems such as rivers. The human wastes are highly variable in composition and concentrations in both time and space because they are subjected to considerable dilution by "non-waste" water that also enters a sewer (for example, waters from showers, clothes and dish washing). Only after a sufficiently large number of the individual "pulses" have traveled through and mixed in the various chambers and pumping stations will the waste approach a homogenous mixture. Ultimately the waste-stream reaches a treatment plant where the waste stream will be further homogenized by large-scale mixing. This mixing includes the recycling of a large proportion of wet-solids between primary and secondary treatment tanks. The results presented herein from the mixture of two grab samples collected in sewer-pipes should only be considered as potentially representing "typical" raw wastes; they are most properly evaluated in the sense of "presence-absence" of compounds collected at the ***instant*** samples were obtained. Samples collected at a different time may have vastly different concentrations. Likewise, it would require analysis of many sludge samples to produce a statistically significant "average" concentration for the solid material.

2. It is very difficult to analyze trace chemicals in human-waste streams as the wastes have a complex makeup of natural and anthropogenic compounds. Chemicals in wastewater

associate with three-phases: dissolved in water, bound to organic and inorganic solids, and associated with immiscible organic matter such as grease and oils. These phases can vary widely in proportion and can be difficult to separate for analysis. The concentrations presented in this work for liquids samples are assumed to represent the "dissolved" phase. Concentrations in the other phases may be vastly different.

3. Considering caveat #2 above, the complex nature of the wastewater results in a very large range of detection or reporting levels for compounds in the raw wastes. The use of internal standard methods employing mass-spectrometric analytic methods helps, but does not eliminate, interferences caused by the waste matrix. Generally, detection levels are lower in the more diluted wastes, reaching minimum levels in the treated outfall waters. The consequence is that the number of compounds identified as being present in a sample ("hits") may relate to the degree of concentration or diluteness of the waste. This effect is especially important when comparing the raw influent with treated outfall waters from POTWs.

2.0 Methods

Experimental methods were based on the character of the three areas in New Jersey that were chosen for evaluation under this study. Samples in the field were collected from 26 sites, intended to represent isolated areas of commercial, industrial (with and without pharmaceutical processing), retirement and residential communities, as well as landfill leachate and influent and effluent from the three receiving wastewater treatment plants.

Media sampled included water from wastewater samples taken from select locations of sewer systems upgradient of wastewater treatment plants (i.e., at manholes along the collection system), landfill leachate, and treatment plant influent and effluent, in addition to wet and dewatered sludge sampled from the wastewater treatment plants sludge processing unit operations. Sampling methods used in this study followed the procedures outlined in Chapter A6, Section A, of the National Field Manual for the Collection of Water-Quality Data, Book9, Handbooks for Water-Resources Investigations.[iii]

Analytical procedures followed USGS protocol with various methods similar to EPA methods for pharmaceuticals and other contaminants of emerging concern. Details regarding the analytical methods applied per analyte classification can be found in Section 2.3.

Perfluorinated compounds in the wastewater and sludge samples taken from the Area Z treatment facility were analyzed by MPI Research in State College, Pennsylvania. The analytical protocol was developed and certified by NJDEP Office of Quality Assurance by an audit procedure of the proprietary Standard Operating Procedure.

2.1 Experimental Design: Description of Three Areas Studied

Three zones within New Jersey were delineated to represent area that contributes wastewater to one of three POTW. The characterization of these areas differed in population density, industrial concentration and urbanization. Industries included business corridors, hospitals and "industrial parks" with and without pharmaceutical processing. In addition, residential areas within these three areas consisted of mixtures of retirement communities and typical residential developments. Table 1 shows the general characteristics of the contributing wastewater area and the isolated sub-sewersheds that were sampled as a part of this study. All samples were collected between February of 2010 and August of 2011.

Table 1: General area characteristics

				Sub-Sewersheds Classifications						
Area ID	**Overall Type**	**Area (mi^2)**	**Population Density (people per square mile)**	Hospital	Commercial	Industrial w/ Pharm	Retirement	Residential	Industrial	Other/ University
Z	Residential with small commercial areas	758	760	√	√	√	√	√		
Q	Urbanized	227	2,264	√	√		√	√	√√	
X	Urban and industrialized	323	2,508	√	√	√	√	√		√

Note: Two checkmarks indicate the presence of two sewersheds of that characteristic

2.1.2. Area Z

Area Z is primarily an area of residential communities and small commercial areas. The sub-sewersheds sampled were well isolated, that is, a location was found to sample that ensured each sub-sewershed generally represented a single type of human activity and waste source. Sub-sewersheds included a small residential community (1.45 mi^2), a large retirement community (5.87 mi^2), a business corridor (0.32 mi^2), a community hospital (approx. 590 beds), and a large industrial park (0.77 mi^2) that included a pharmaceutical blending and packaging plant. A 2010 NJDEP survey reported that approximately 5.8% of the total inflow to the Area Z POTW was attributed to various industrial sources, the remainder being basically from domestic residential waste sources. In addition, a 24-hour composite sample of the inflow and a 24-hour composite sample of the effluent from the receiving wastewater treatment plant were analyzed as well as samples of the wet sludge and dried filter cake obtained from the POTW. Table 2 contains information on characteristics associated with the Area wastewater treatment plants.

The Area Z treatment facility is the smallest of the three wastewater treatment plants, having a rated flow design of thirty-two million gallons per day (32 MGD) that employs activated-sludge

secondary processes to treat wastewater. Approximately 50% of the activated sludge is recycled and the sludge that is disposed of becomes an agricultural product.

2.1.3. Area Q

Area Q is highly-urbanized and contains high-density residential housing, numerous industrial areas and mixed resident-commercial-industrial communities. The sub-sewersheds sampled included a residential community (1.26 mi^2), a small retirement community (0.09 mi^2), a mixed commercial/residential area (0.6 mi^2), a large urban hospital, an industrial park that contains a pharmaceutical blending and packaging plant (0.28 mi^2), and an industrial park without pharmaceutical processing (0.56 mi^2). Apart from the commercial area, the sub-sewersheds were found to be well characterized and isolated; the commercial area sewershed was found to include a small residential community. The NJDEP 2010 Survey attributed about 3.9% of the total waste flow to the Sewershed Q POTW to industrial sources.

The Area Q treatment facility is a large plant (80 MGD) that utilizes activated-sludge secondary processes to treat wastewater. Liquid oxygen is also added in the secondary treatment to stimulate aerobic degradation. Approximately 30% of the activated sludge is recycled into the secondary treatment system each day. Sodium hypochlorite is added as a final disinfectant before the treated water is released to a major river. Biosolids generated at this plant are filter pressed and heat dried before being disposed of by incineration, composting, and by use as landfill cap. Table 2 contains information on characteristics associated with the Area POTWs.

2.1.4. Area X

Area X is highly urbanized and contains numerous industrial areas. The sampled sub-sewersheds included a small residential community (0.57 mi^2), a large retirement community (0.38 mi^2), a mixed residential/university area (1.42 mi^2), a large commercial district (3.9 mi^2), a mixed residential/hospital area (16.6 mi^2), and an industrial park with a pharmaceutical/consumer product blending and packaging facility. Apart from the hospital, the various sampled sub-sewersheds were found to be well isolated. The hospital waste stream, however, was found to be mixed with waste from a small residential area that entered before the sampling point. The NJDEP estimated that approximately 21% of the waste flow to the Area X treatment facility was from industrial sources.

The Area X treatment facility is a large plant (147 MGD) that includes an activated-sludge, secondary treatment process that utilizes liquid oxygen. Approximately 65% of the activated sludge is recycled daily. Sodium-hypochlorite is used as a final disinfection agent before the outfall water is released into another major river. Bio-solids are filter-belt pressed and heat dried and used as daily cover in the county landfill, or are incinerated to produce electricity. Table 2 contains information on characteristics associated with the Area wastewater treatment plants.

Table 2: Area Wastewater Treatment Plant Characteristics

Area	Type of Wastewater Treatment	Population served (2010 census)	Rated Flow Design	Flow on day of sampling (MGD)	Hydraulic Residence Time
Z	Secondary Aerobic	~600,000	32	23.7	12 Hours
Q	Secondary Aerobic Liquid Oxygen	~500,000	80	60.16	8-10 Hours
X	Secondary Aerobic Liquid Oxygen	~800,000	147	119.21	12 Hours

2.2 Field Methods

2.2.1 Sampling Stations

Each Area contained sampling stations located along the wastewater collection system at points that collect wastewater from delineated areas consisting of similar land use. In addition, three sampling stations within each Area included the locations where landfill leachate and sludge were collected. In addition to the landfill leachate and the sludge samples, there was a total of twenty-three sampling stations over the three Sewershed Areas (See Table 3).

Table 3: Sampling Stations by Area and Sewershed

Area[1]	Sewershed								
Z	Residential	Hospital	Retirement	Industrial w/Pharm.	Commercial	STP Inflow		STP Outflow	Sludge
Q	Residential	Hospital	Retirement	Industrial	Commercial	Industrial 2	STP Inflow	STP Outflow	Sludge
X	Residential	Hospital	Retirement	Industrial w/Pharm.	Commercial	University	STP Inflow	STP Outflow	Sludge

[1] *One landfill leachate sample was also collected from each Area.*
Areas are not ordered and are generally independently delineated.

2.2.2 Wastewater and Sludge Sample Collection

Sampling was conducted with the help of POTW personnel and USGS field crews experienced in handling and sampling raw wastes. Maps of sewer lines were consulted to find accessible manholes for each sewershed sampling location. These manholes were typically located where the sewer line from the targeted population area entered the main trunk sewer line (either at a final manhole or at a pump station associated with the sewershed). Waste was collected by lowering a pre-cleaned, stainless steel bucket on a polypropylene line. Upon retrieval, the waste was poured directly into a 4-L class-A cleaned glass bottle. One 4-L sample was collected from each location between the morning hours of 8 and 9 am, and a second sample in the afternoon between 4 and 5 pm. This scheme was employed to capture peak flows that occur in the morning from residential sources, and peak flow that occurs late in the workday from commercial and industrial sources. As described below, equal volumes of morning and afternoon wastes were combined for analysis. This routine was necessary due to budget constraints and the inability to safely obtain 24-hour composited samples at many of the man-hole locations. The capped sample jars were immediately placed on ice in a cooler and transported back to the USGS-NJ Water Science Center, where they were refrigerated before processing the following day.

Waste influent and treated outfall at the POTWs were 24-hour composite samples collected from the grit chamber and final outfall raceways. They were collected using an ISCO automatic sampler equipped with pre-cleaned Teflon inlet tubing and silicon pump tubing. Samples were collected in replicate and composited directly using 100 ml volume aliquots placed directly into class-A pre-cleaned 4-L glass bottles which were kept on ice. Upon retrieval, the bottles were capped, placed on ice, and returned to the laboratory for processing.

Wet solid samples were obtained directly from the solid-water separator or from the piles located at the outfall of the filter press at the POTWs, before any heat drying was applied. This waste reported in this study as being “wet” contained 5-10% liquid. Dried material was collected from piles that form directly at the end of the drying process. Material was scooped directly into pre-baked and cleaned glass sample jars equipped with a Teflon lid. No attempt was made to composite solid materials from different filter presses or stock piles. Immediately after collection, the solid materials were frozen upon return to the laboratory.

2.2.3 Landfill Leachate Collection

Landfill leachate that is not designed to infiltrate below the landfill facility is directed to the wastewater treatment facility in the area. Grab samples of leachate were collected at points of convergence on each landfill site.

2.3 Analytical Methods (by analyte classification)

The summary statistics for all analytes quantified for this study using the methods defined below, along with the associated lab reporting limits, can be found in Appendix A.

2.3.1 Pharmaceuticals

USGS Schedule 1433 was utilized to analyze the liquid media for fifty pharmaceutical analytes. The specific USGS methods (GCM90, GCM37, 21 and 23) are based on EPA Method 1694 and utilizes high performance liquid chromatography combined with tandem mass spectrometry (HPLC/MS/MS) using isotope dilution and internal standard quantitation techniques.[iv, v]

2.3.2 Pesticides

USGS Schedule 1433 was utilized to analyze the liquid media for twelve analytes that are considered a pesticide, an herbicide or a similar compound. These USGS specific methods, GCM37, GCM90 and 21, are based on EPA Method 1699 and utilize high resolution gas chromatography combined with a high-resolution mass spectrometry (HRGC/HRMS), employing isotope dilution and internal standard quantitation techniques.[vi,vii]

2.3.3 Sterols and Hormones

USGS Schedule 1433 was implemented to analyze the liquid media for five sterols and other aromatic organic compounds. This USGS specific method (GCM37) is based on EPA Method 1698 and utilizes isotope dilution and internal standard high-resolution gas chromatography combined with a high-resolution mass spectrometry (HRGC/HRMS).

USGS Method 2434 (Hormones in filtered water) was implemented to analyze the liquid media for 6 natural and 3 synthetic estrogens, 6 natural androgens, 1 natural and 1 synthetic progestin, 2 sterols, and the industrial chemical bisphenol A (BPA). The determined analytes include the seven hormones (17β-estradiol, 17α-ethinyl estradiol, estriol, estrone, equilin, 4-androstene-3,17-dione, and testosterone) under the Unregulated Contaminant Monitoring Regulation (UCMR 3) for public water systems (U.S. Environmental Protection Agency, 2011). The USGS methods[viii] were adapted from several sources including the US EPA Method 539. [ix]

2.3.4 Flavors and Fragrances

USGS Schedule 1433 was implemented to analyze the liquid media for thirteen flavors and fragrances. This USGS specific method GCM37 is a waste indicator, using filtered water, solid phase extraction, gas chromatography/mass spectrometry and is based on National Water Quality Laboratory (NWQL) Schedule 1433.

2.3.5 Polycyclic aromatic hydrocarbons (PAHs)

USGS Method GCM37 was implemented to analyze the liquid media for seventeen PAHs including anthracene, naphthalene, and benzo(a)pyrene. This USGS specific method GCM37 is a waste indicator, using filtered water, solid phase extraction, gas chromatography/mass spectrometry and is based on National Water Quality Laboratory (NWQL) Schedule 1433.

2.3.6 Alkylphenol ethoxylates (APEs)
USGS Method GCM37 was implemented to analyze the liquid media for fourteen APEs including bisphenol A, 4-tert-octylphenol and triphenyl phosphate. This USGS specific method GCM37 is a waste indicator, using filtered water, solid phase extraction, gas chromatography/mass spectrometry and is based on National Water Quality Laboratory (NWQL) Schedule 1433.

2.3.7 Per- and Poly-fluorinated alkyl substances (PFASs) Analysis of the liquid and solid matrices for the perfluorinated compounds was conducted by electrospray liquid-chromatography, mass spectrophotometric methods. Thirteen analytes were quantified in the water samples. Those analytes included nine (9) carboxylic acids (C4-C12), three (3) sulfonic acids (PFBS, PFOS, PFHS) and one (1) sulfonamide (PFOSA), a compound that breaks down to form PFOS. Solid samples quantified nine (9) compounds, omitting the C6 sulfonate, the C4 carboxylate and PFOSA. MPI Research in State College Pennsylvania, which was selected through the NJDEP solicitation process, developed the analytical protocol, which was then certified by NJDEP Office of Quality Assurance by an audit procedure of the proprietary Standard Operating Procedure at MPI.

3.0 Results (by analyte classification)

The maximum, minimum, median concentrations, and the range in reporting levels for the compounds measured in raw wastewater from the sewershed and POTW influent are listed in Appendix A. Because the analysis was performed by surrogate internal standard methods, each compound in each sample may have a unique detection level. Individual results for each sample is reported in Appendix B.

The wet- and dried-sludge materials were evaluated for the same chemical groups used for the liquid waste. However, fewer compounds were analyzed in the solids. Because each wet sample had different percentage of liquid, only generalizations can be made from wet-sludge concentrations. The relation between absolute abundance of analytes in the wet and dry samples, and percent water lost during drying, could not be determined with the data. Since multiple replicate samples were not collected, statistical representativeness cannot be implied in these results.

Emphasis is placed on the dried sludge materials for two reasons. First, a wide variation can exist in the percentage of water (by weight) present in wet samples, which can affect the measured concentrations assigned to the "solid phase" in the wet sample. Secondly, it is the dried materials that are most likely to enter the environment through land applications or by wind-borne transport.

3.1 Pharmaceuticals

Fifty-five (55) individual pharmaceutical compounds, classified into seven categories, were quantified for this study. The seven classifications include stimulants (4 compounds), pain

relievers (6 compounds), mood stabilizers (14 compounds), antimicrobials (6 compounds), opioids/barbiturates/muscle relaxers/anti-coagulants (15 compounds), anti-coagulants/blood pressure (BP) medications/anti-histamines (9 compounds) and one (1) anti-retroviral therapy drug.

3.1.1 Wastewater:

Overall, in the nineteen (19) samples taken from the wastewater sampling locations, every site had a detectable level of at least nine pharmaceutical compounds. Total concentrations of these pharmaceutical compounds ranged from 50 µg/L total pharmaceuticals in the Area X University site, up to 472 µg/L in the Area Z Retirement community. The Area Z Residential sewershed showed evidence of 409 µg/L, whereas the Area Q Industrial 2 contained nine (9) compounds totaling 119 µg/L.

Upon evaluation of the seven classifications of pharmaceutical compounds, a somewhat similar pattern of occurrences and concentrations emerges. Most samples contained at least one compound from each class of compounds, with exceptions in the Area X University, which had no detectable opioids/barbiturates/muscle relaxers/anti-coagulants and Area Z both Residential and Commercial, which also had no detectable levels of opioids/barbiturates/muscle relaxers/anti-coagulants.

The highest number of compounds classified (4) under the stimulant category was found in the Area Z Residential, Hospital and POTW influent. The other sampling stations contained between one (1) and three (3) stimulant compounds. The range of total stimulants was between 24 µg/L, found in the Area X University site, and 150 µg/L, found in the Area Z Commercial sewershed. Caffeine was by far the largest proportion of the total concentration of stimulants detected in all areas, accounting for between 70 and 100% of total mass of stimulant analytes that were detected.

Between two (2) and four (4) of the six (6) pain relievers were detected at all sampling stations, with total concentrations ranging between 4.65 µg/L in the Area Q Industrial 2 site and 327 µg/L. Area Z Residential and Retirement communities had the highest reported total concentrations, possessing 268 and 327 µg/L, respectively. Acetaminophen accounted for the largest proportion of total pain relievers detected, with between 54 and 97% of the total mass of the pain reliever analytes being detected in the Area X STP Inflow site and the Area Q Industrial 2 Site, respectively.

The mood-stabilizing compounds did not appear to be present more often than other classes, but often had a higher number of compounds detected. Between one (1) and six (6) compounds, with a range of total concentration between 0.178 and 23 µg/L was determined for the wastewater sampling stations, with the highest levels found in Area X Hospital wastewater. The most frequently detected mood stabilizers were citalopram and iminostilbene, with fourteen (14) and fifteen (15) detections over the nineteen (19) wastewater sites.

Out of the six (6) anti-microbials evaluated, triclosan and chloroxylenol were found in eighteen (18) of the nineteen (19) wastewater samples. Area Q Hospital had the highest total concentration of anti-microbials with 87 µg/L, but the other hospital and retirement communities

appeared similar in nature to the residential and other sewersheds, showing between 2 and 14 µg/L total antimicrobial analytes.

The fifteen compounds classified under the opioids/barbiturates/muscle relaxers/anti-coagulants class were detected in all but three sewersheds, with between one (1) and seven (7) compounds being detected. The most compounds were detected in the Area Q Industrial sample and this sample contained the highest total concentration of the overall classification and the highest single concentration of meperidine (38 µg/L). Across the nineteen (19) wastewater samples, the most frequently detected compounds were oxycodone (found in 12 of the 19 samples) and metaxalone (found in 8 of the 19 samples).

The results from the anti-coagulants/blood pressure (BP) medications/anti-histamines class showed that, sixteen of the nineteen wastewater sites had detectable levels of between one (1) and four (4) compounds. The most commonly detected of the anti-coagulants/blood pressure (BP) medications/anti-histamines class was diltiazem, in the wastewater taken from fourteen (14) sites, and verapamil and diphenhydramine, found in the wastewater taken from nine (9) sites.

3.1.2. Treated Effluent:

Overall, it appears that the wastewater treatment plants reduced the number and concentration of pharmaceuticals detected. However, the "important caveats" (Section 1.3) are to be seriously considered when evaluating the data, although reporting levels between the influent and the effluent samples were reported to be similar. When reviewing the data from the three different plants, keeping in mind that the samples were not necessarily well mixed nor representative of the same slug of media before and after treatment, it does appear that the treatment reduced the concentration of the compounds. In the Area Z POTW, the influent possessed twenty-five (25) compounds with a total of 232 µg/L, whereas the effluent contained five (5) compounds totaling 1.31 µg/L. For the Area Q influent, 23 compounds were detected, whereas in the effluent 32 compounds were detected, but the total concentration of all pharmaceutical compounds was reduced from 126 µg/L to 14 µg/L. The Area X influent also showed an increase in the number of compounds detected (from 14 in the influent to 39 in the effluent), but a reduced total concentration overall (from 116 µg/L in the influent to 13.5 µg/L in the effluent.)

3.1.3. Sludge:

Matrix interferences were especially pronounced during the analysis for the pharmaceutical compounds due to the total and dissolved solid content of the samples. This condition led to variations in the instrument reporting levels (IRLs) between samples.[1] In addition, the sludge was analyzed for a reduced number of parameters due to matrix interferences (eighteen overall, see Appendix D). Many of these compounds could not be assigned accurate detection limits and so the results were highly qualified. With the results that were provided, if these are treated as reliable, several statements regarding the presence of the pharmaceutical compounds may be inferred. First, all sludges, wet and dried, contained detectable levels of at least five compounds. The Area X dried sludge contained the largest total concentration, reporting over 19,000 µg/kg

[1] The Instrument Reporting Limit is a client driven value that is within the valid calibration range file of the instrument. The environmental samples that are analyzed in a specific matrix, in this case wastewater and sludge, vary greatly and require either dilution or concentration to allow the reporting of the parameter of interest at a concentration at or above the IRL and within the calibration range.

total pharmaceuticals, with 18,000 µg/kg being attributed to the anti-microbial triclosan. Area Z dried and Area Q wet sludge followed with the highest concentrations, also having the levels of triclosan account for much of the total. Twelve of the eighteen compounds were detected, with the anticonvulsant-mood stabilizer, carbamazepine, and the anti-histamine, diphenhydramine, accounting for the most frequently detected compounds.

3.2 Pesticides

The Pesticide/Herbicide class was comprised of twelve compounds (Appendix B, Table 2). Detected compounds within this class include N, N-diethyl-meta-toluamide (DEET) and piperonyl butoxide (PBO).

Groundwater and surface water standards exist for isophorone, pentachlorophenol, and chlorpyrifos. The only measurable level of these compounds was one detection of isophorone in Area Z commercial station sample, and this level was less than one-tenth the concentration of the set standard.

The Area Q retirement community sample required higher detection limits and the results were primarily flagged as being estimated. Due to that discrepancy, the analysis below does not include these results. However, the estimated values that are reported for this station are within the ranges of the other wastewater results, so this omission is not considered to bias conclusions.

3.2.1. Wastewater:

The analysis detected only five of the twelve compounds across the twenty-six wastewater sampling stations, including the landfill leachate. DEET was found in nineteen of the twenty wastewater samples, with concentrations ranging from 0.04 to a high of 21 µg/L found in the Area X residential station sample. PBO was detected in thirteen of the twenty wastewater station samples, with concentrations ranging from a low of 0.03 µg/L to a high of 1.75 µg/L found in the Area Q commercial station sample.

3.2.2. Sludge:

The sludge samples had instrument reporting levels (IRLs) that varied greatly between the samples. For instance, for the compound DEET, the IRL ranged from 152 µg/kg to 1020.5 µg/kg. This variation confounds a proper review of the data. However, looking at the results of the 9 common insecticides and pesticides that were analyzed, only thiobendazole (IRL not reported) was quantified at measurable levels. Area Z wet sludge contained 29.4 µg/kg of thiobendazole, whereas the dried sludge contained 38.3 µg /kg. Area Q wet sludge contained 31.65 µg/kg, whereas no detectable level was found in the dried sludge.

3.3 Sterols and Hormones

The water and sludge samples retrieved for this study were analyzed for the detection of levels of five sterols and seventeen hormones (Appendix B, Table 3). The sterols included cholesterol and other human related compounds, as well as other sterols and stanols related to plants, animal feed

and food additives. The seventeen hormones included those typically related to males (androgens) and females (estrogens), naturally or as hormone replacement therapies. Examples of hormones that were quantified for this study include androgens, such as 4-androstene-3,17-dione (androstenedione, a testosterone precursor) and cis-androsterone (another steroid hormone that affects masculine traits) and estrogens such as estriol and estrone. The total concentration of each of the seventeen compounds detected in the wastewater is presented in Figure 1.

Cholesterol is produced and excreted from humans, and is also present in high concentrations in eggs, milk, fats, and wool grease which can easily enter the waste system through food disposal and cloth washing. The only source of 3-beta-coprostanol is believed to be the fecal matter of human and other higher animal species. This compound may serve as a useful indicator of human waste (vs. non-human sources).

3.3.1. Wastewater:
Twenty water samples were collected at the various points of interest in the three sewersheds. Of the seventeen hormones, all sites had detectable levels of at least four compounds (the lowest being Area Z POTW inflow), but many of the sampling sites had detectable levels of nine or more compounds. Area Q Hospital sub-sewershed showed thirteen compounds, with a total mass of hormones equaling 6.2 µg/L (6,233 ng/L).

Two androgens, cis-androsterone and 4-androstene-3,17-dione were among the hormones that were detected at the highest concentrations and in the most locations. In 17 of the 18 locations where cis-androsterone was detected, the average concentration was 3,904 ng/L. 4-androstene-3,17-dione was detected in 18 of the 20 sites, with concentrations greater than 3,000 ng/L in the Area Z residential and the Area X Hospital.

17-alpha-estradiol, an estrogenic compound, was only detected in a single wastewater sample, and then at a relatively low concentration of 1.42 ng/L. Estriol and estrone, also estrogens, were detected in most wastewater samples in the range of 6.4 ng/L to 528 ng/L.

Analysis for the sterol compounds appeared to be compromised, potentially by matrix effects, as the results for three of the five compounds were all near the reporting level and were qualified as being estimated. Results for 3-beta-coprostanol and cholesterol did appear well above the stated reporting levels, but were still qualified as estimated. Cholesterol was found at the highest concentrations, with a range of 3.6 (in Area Q Industrial) to 190 µg/L (in Area Z Residential).

3.3.2. Treated Effluent:
For both the sterols and hormones, occasionally the analysis was not able to produce a reportable result and therefore would preclude a proper evaluation of the influent and effluent concentrations. Results for these compounds in effluent were obtained only for hormones and only in the Area Q POTW outfall, where cis-androsterone was reported to be 1,670 ng/L.

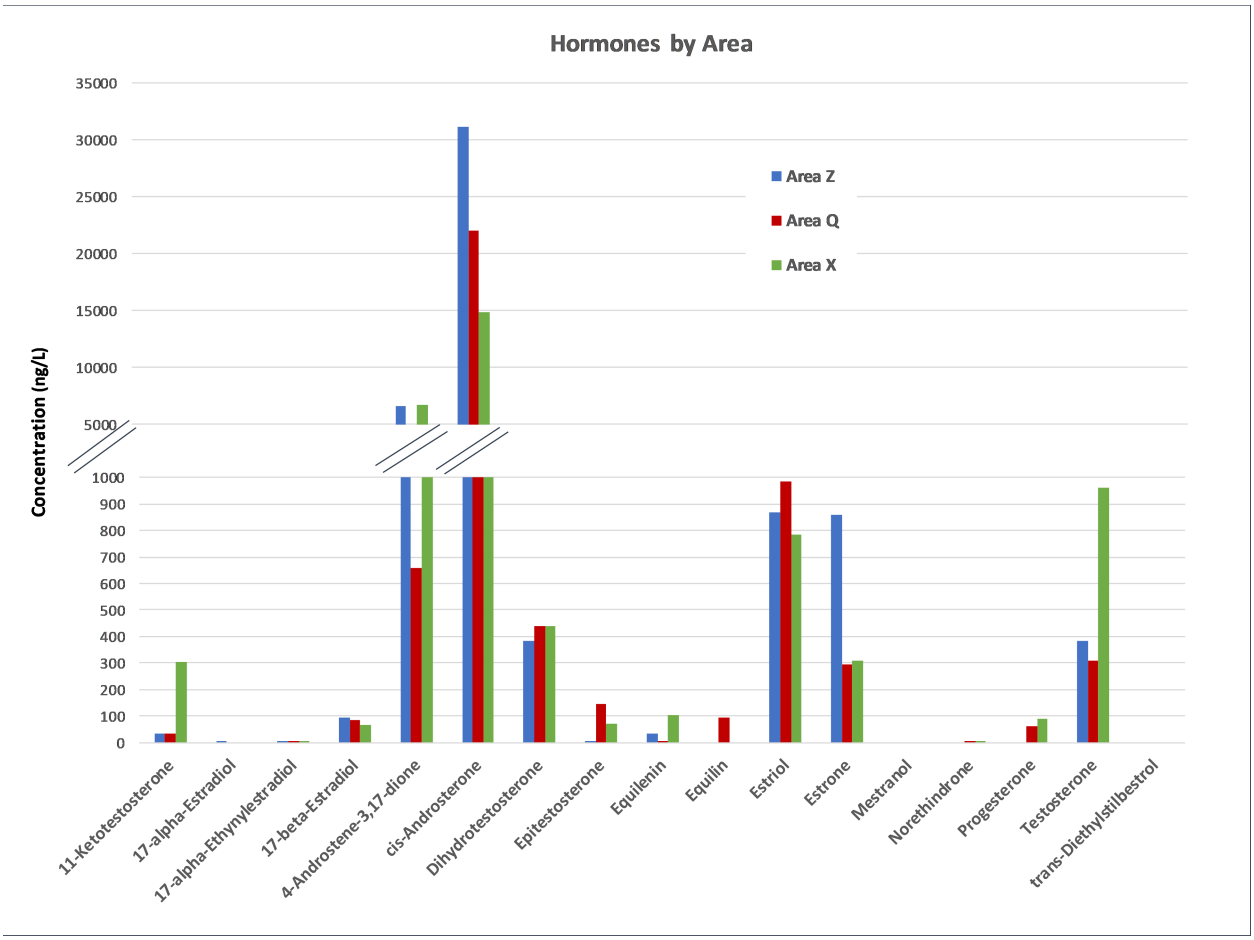

Figure 1: Hormone Concentrations in Wastewater by Area
Note: Those parameters with no bars were below the detection limit.

3.3.3. Landfill Leachate:

Samples for the landfill leachate were not analyzed for hormones and only Area X Landfill Leachate had reportable results for sterols. Those results showed relatively low levels of the four compounds that were detected.

3.4 Flavors and Fragrances

The wastewater, treated water, and landfill leachate were analyzed for thirteen compounds that were classified as flavors and fragrances. The wet and dried sludge samples were analyzed for ten of these compounds (See Appendix B, Table 4). These compounds include 3-methyl-1h-indole (Skatole), camphor, and menthol. Many of these compounds can occur naturally or can occur in wastewater due to the synthetic manufacture and use of these compounds. For instance, indole is found naturally in coal tar and feces, and is also synthetically manufactured to be a malodorant for the military.

These flavors and fragrances are unregulated and often are evaluated to determine a human influence on a water body. The total concentration of each of the thirteen compounds detected in the wastewater is presented in Figure 2.

The Area Q retirement community sample analysis resulted in higher detection limits and the data that were reported were primarily flagged as being estimated as a quantity below the detection limit. Due to this, the analysis below does not include the estimated results. However, the estimated values that are reported for this station are within the ranges of the other wastewater results, so this omission is not considered to bias conclusions.

3.4.1. Wastewater:
The twenty wastewater sites each contained detectable levels of between eight and twelve of the compounds that were quantified. The concentration of the flavors and fragrances in these wastewater samples was generally low (many less than 6 µg/L) in all but three of the compounds. The 5-methyl-1h-benzotriazole (BHA), menthol, and methyl salicylate was detected at higher levels (with maximums of 120, 1700, and 1100 µg/L, respectively). Menthol was detected at every wastewater station except at Area Q Industrial 2, and ranged from 6.9 to 1,700 µg/L.

3.4.2. Treated Effluent:
The number of flavors and fragrances, as well as the magnitude of the detection was reduced in the treated effluent. Area Z Outfall contained a low detection of a single compound, while the influent contained detectable levels of ten compounds. Area Q Outfall contained detectable levels of five flavors and fragrances at lower concentrations then the influent, which contained detectable levels of twelve compounds. Similar conditions were observed with the Area X Inflow and Outflow, with detectable levels of eleven compounds in the influent and six in the effluent.

3.4.3. Sludge:
The IRLs for flavors and fragrances in the three sludges, each of which has both wet and dry samples, ranged over nearly one order of magnitude, with IRLs between 152 and 456 µg/kg in the Area Z dried sludge and up to 1020 to 3061.5 µg/kg in the Area X dried sludge. As expected, the concentration of these compounds is higher in the dried sludge, with the concentration of HHCB (musk) of nearly 17,000 µg/kg in the Area X dried sludge. Area Q dried sludge contained 106,600 µg/kg of Skatole. Acetophenone was found in all three dried sludges in the range of 550.4 to 2121 µg/kg.

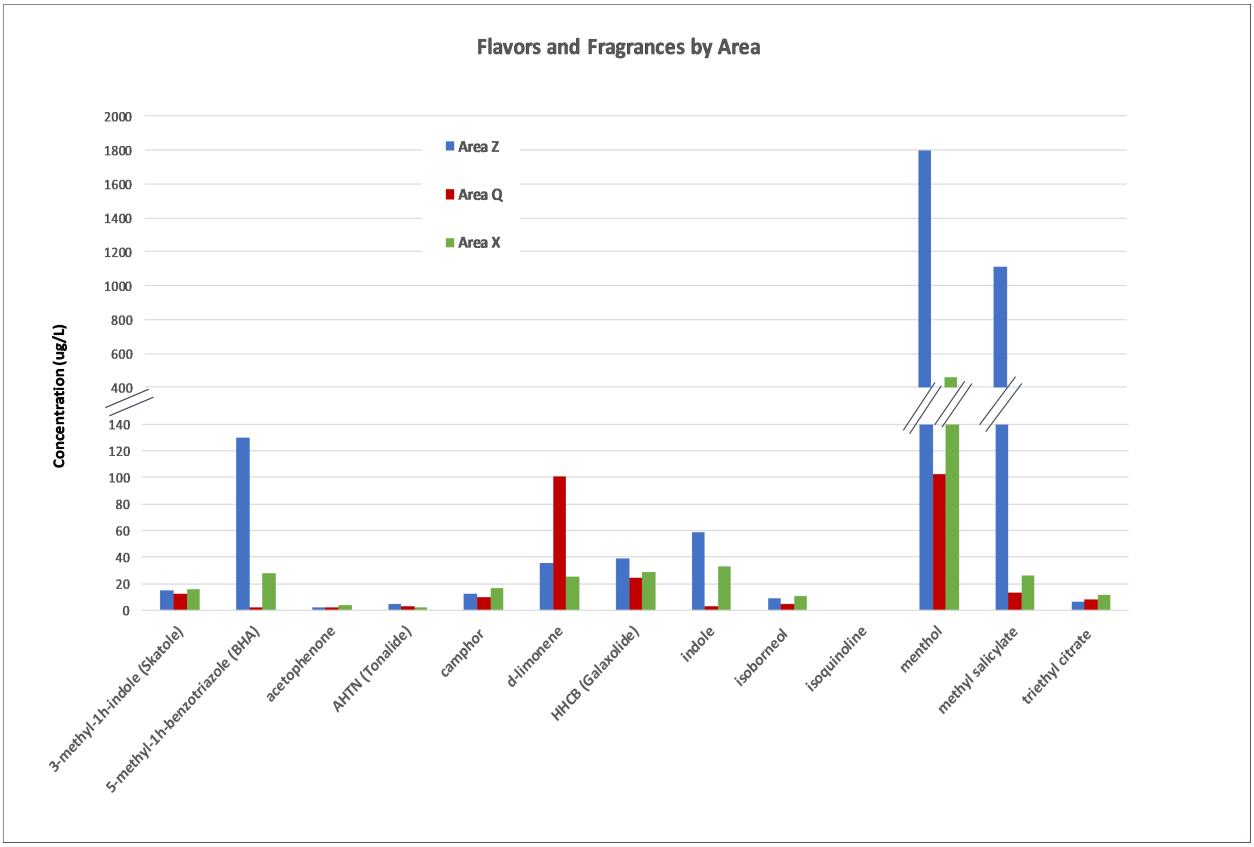

Figure 2: Flavors and Fragrances in Wastewater by Area
Note: Those parameters with no bars were below the reporting limit.

3.4.4. Landfill Leachate:

The analysis of the three samples taken from the landfill leachate showed few detections of these flavors and fragrances compounds. The Area Z leachate contained detections of two compounds and the Area Q landfill contained detectable levels of five compounds, all at concentrations below 2 µg/L. The leachate from the Area X landfill contained detectable levels of seven compounds, with 62 µg/L of camphor and 20 µg/L of menthol.

3.5 Phenols and Alkylphenol Ethoxylates (APEs)

Fourteen APE compounds were quantified during this study (See Appendix B, Table 5). These compounds include alkylphenols, alkylphenol ethoxylates, phosphates, and bisphenol A and are used in the manufacture of resins, polymers, fire-retardants and surfactants. Many of these substances are of concern due to their potential for estrogenic activity. The total concentration of each of the fourteen compounds detected in the wastewater is presented in Figure 3.

The EPA has set an Aquatic Life Ambient Water Quality Criteria for nonylphenol (NP2EO), to protect freshwater aquatic life and their uses, using a one-hour average of 28 µg/L to occur no

more than once every three years (acute criterion) and a four-day average of 6.6 μg/L to occur no more than once every three years, on average (chronic criterion).

The Area Q retirement community sample analysis resulted in higher detection limits and the data that were reported were primarily flagged as being estimated as a quantity below the detection limit. Due to this, the analysis below does not include the estimated results. However, the estimated values that are reported for this station are within the ranges of the other wastewater results, so this omission is not considered to bias conclusions.

3.5.1. Wastewater:

Across the three areas, each sample of untreated wastewater contained detectable levels of between five and ten of the fourteen compounds considered under the APE classification. The sum of all APEs ranged from 6.51 μg/L from the Area X residential station to 272.52 μg/L from the Area Z retirement community. The most commonly detected analytes included benzophenone, a UV-blocker, and tris(2-butoxyethyl) phosphate (TBEP), a flame retardant, which were found in all wastewater samples and had concentrations ranging from 0.23 μg/L to 3.3 μg/L for benzophenone and 1.3 to 260 μg/L for TBEP.

3.5.2. Treated Effluent:

Of the eight compounds entering the Area Z POTW, only three were detected in the effluent, and at lower levels than was measured in the influent. Although Area Q did see reduction in some of the eleven APE compounds measured in their influent, the decrease did not appear significant, with some concentrations increasing. However, as stated previously, this may be due in part to the non-homogeneity of the wastewater. Area X effluent also contained detectable levels of ten of the compounds; with levels of TBEP reported at 1.5 μg/L, although the influent to the plant contained 54 TBEP μg/L.

3.5.3. Sludge:

The range in concentrations of the suite of APEs in the sludge materials are listed in Appendix D and are shown in Figure 4. The sum-total values for all APEs ranged from 11,900 μg/kg in Area Q wet sludge to up to 433,000 μg/kg in the dried sludge of Area Z. The highest concentrations in the dried materials were for the sum of all isomers of 4-nonylphenol and sum of a 4-nonylphenol diethoxylate compounds. Specific isomers found to be present at high concentrations included: bis-phenol, bis(2-ethylhexyl) phthalate, various 4-nonyl and 4-octylphenol isomers, and the compound benzophenone.

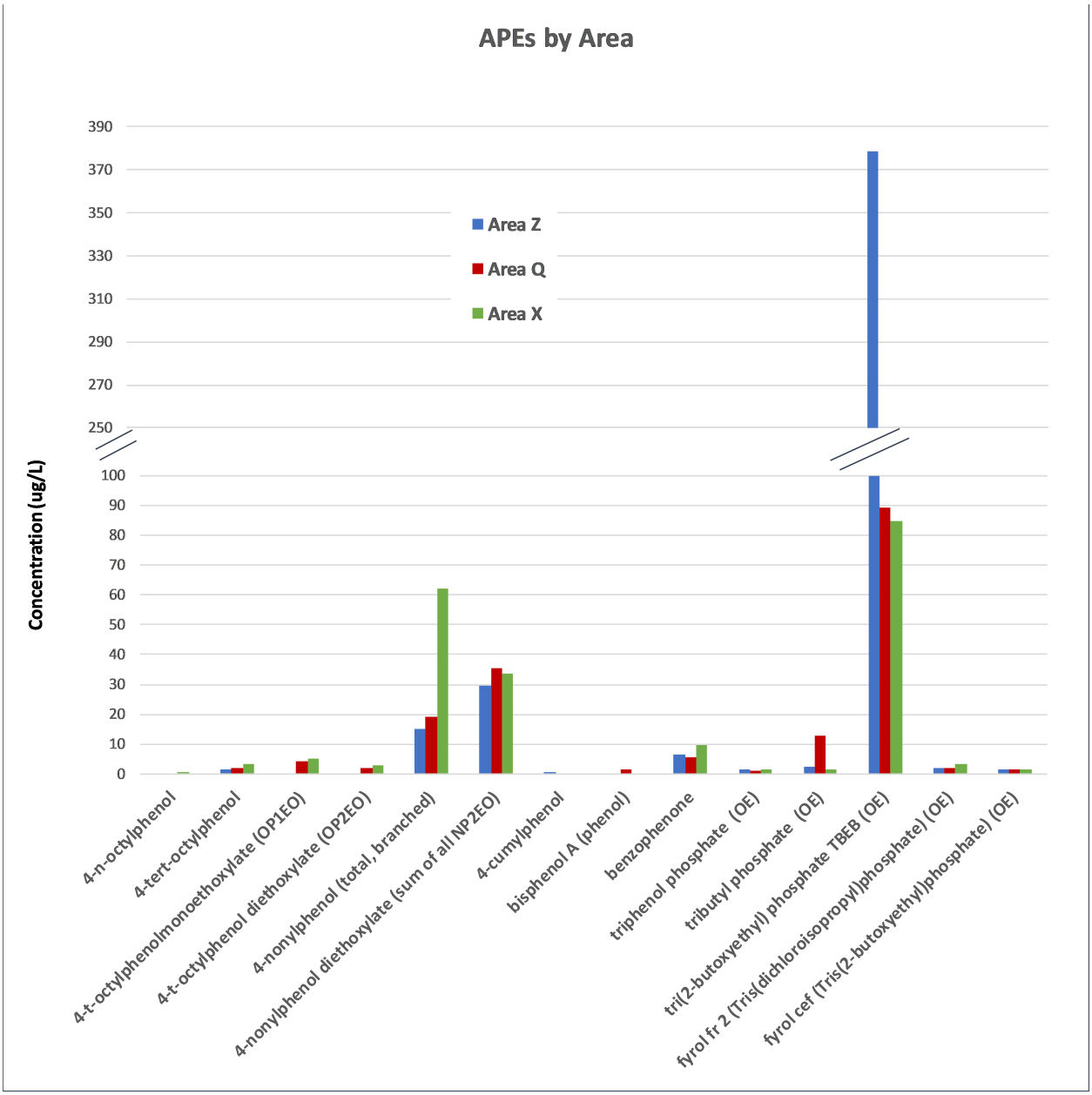

Figure 3: APEs Concentrations in Wastewater by Area

Note: Those parameters with no bars were below the reporting limit.

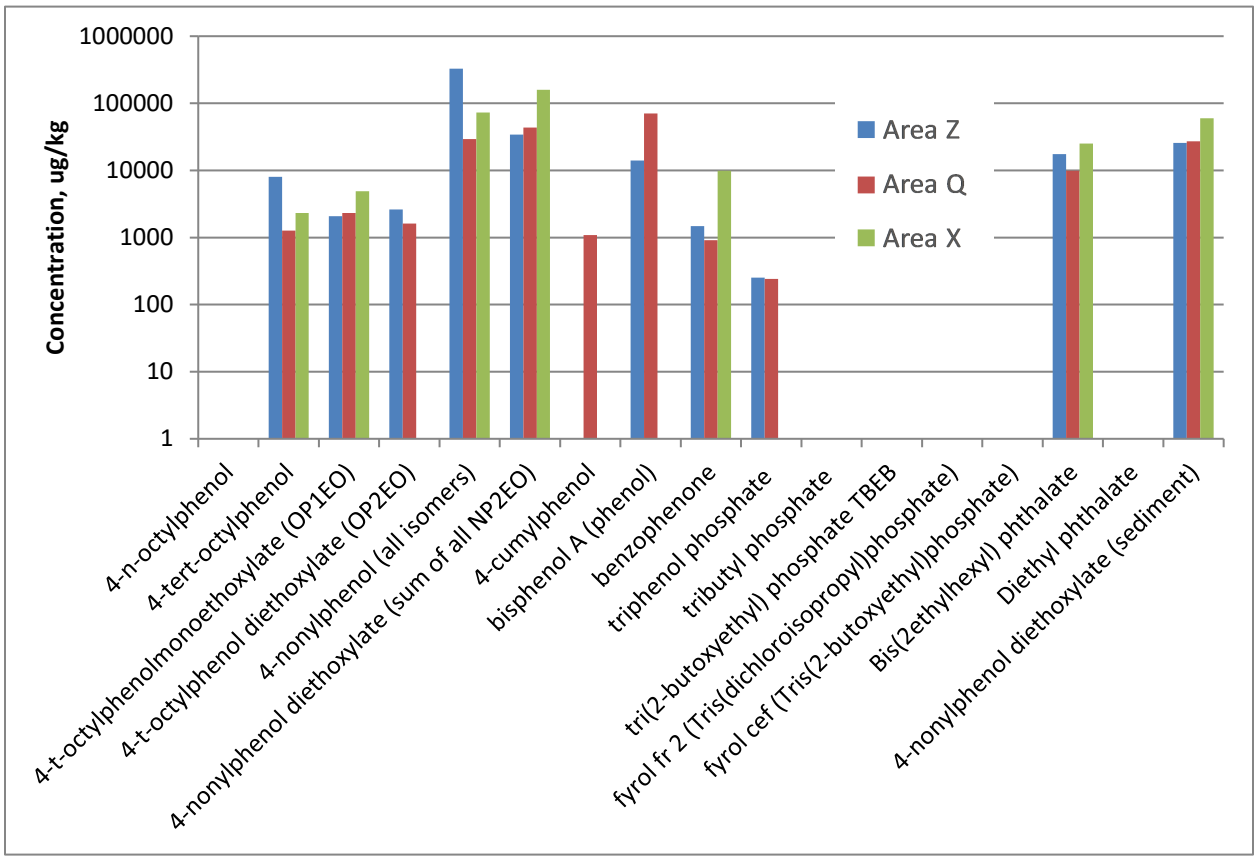

Figure 4: APE Concentrations in Dried Sludge
Note: Those parameters with no bars were below the reporting limit.

3.5.4. Landfill Leachate:

The three samples of landfill leachate contained between four and nine detectable APE compounds. Concentrations of these compounds were typically comparable to those found in other wastewater samples, except bisphenol A which was at relatively low concentrations in many of the wastewater samples (less than 0.31 µg/L), but were found at levels of 24, 160 and 470 µg/L in the landfill leachate of Area Z, Area Q, and Area X, respectively.

3.6 PAHs

Seventeen (17) PAH compounds were quantified in the wastewater, while fifteen compounds were quantified in the sludge for this study (Appendix B, Table 6 and Appendix D). These compounds include anthracene, benzo(a)pyrene, phenol, and naphthalene and can be formed during the incomplete combustion of coal, oil, gas, and garbage as well as emanating from manufacturing of the intermediates of dyes, solvents and mothballs. The total concentration of each of the thirteen compounds detected in the wastewater is presented in Figure 5. These

compounds present a concern given that the National Toxicology Program lists PAHs as being, "reasonably anticipated to be a human carcinogen."

Several of these compounds have EPA water quality criteria, and several compounds have New Jersey groundwater quality criteria or surface water criteria. Only one PAH exceeded any established criteria. Using the established NJDEP Ground Water Quality Standard for p-cresol (4-Methylphenol) of 50 μg/L[x], it becomes evident that five Area Z wastewater samples, two Area Q wastewater samples and two Area X samples exceeded that limit. There were no groundwater samples taken for this study to compare to this standard, so any comparison of wastewater results provides only minimal value. There were no finished water samples that were discharged, that exceeded this limit.

The Area Q retirement community sample analysis resulted in higher detection limits and the data were primarily flagged as being estimated. Due to that discrepancy, the analysis below does not include these results. However, the estimated values that are reported for this station are within the ranges of the other wastewater results, so this omission is not considered to bias conclusions.

3.6.1. Wastewater:
Detectable levels of at least three of the PAH compounds were found in all wastewater samples, with an Area Q commercial area detecting up to thirteen of the compounds. The total concentration of all PAHs measured ranged from 6.4 μg/L coming from the Area X university station up to 172 μg/L coming from the Area Z retirement station. The most commonly detected compounds were phenol and p-cresol, being found in every wastewater sample taken, with concentrations ranging from 2.3 to 92 μg/L for the phenol and 2.5 to 97 μg/L for the p-cresol.

3.6.2. Treated Effluent:
Of the eight compounds entering the Area Z wastewater treatment plant, none were detected in the effluent. Low levels of six compounds were detected in the Area Q effluent, with a total PAH concentration of 2.8 μg/L. In the Area X effluent, eight compounds were detected with a total PAH concentration of 2.7 μg/L. The p-cresol concentrations, notably higher before treatment, showed markedly low results in the finished water.

3.6.3. Sludge:
Between 8 and 11 of the compounds were present in measurable concentrations in the sludge samples taken from the three POTWs. Based on sum-total concentrations, the highest levels of PAHs were in materials collected from Area Q (228,000 μg/kg), followed by Area X (71,100 μg/kg) and Area Z (17,000 μg/kg). Individual compounds found to be present in the highest concentrations in the dried materials typically were p-cresol, 9,10-anthraquinone, and p-cresol. However, 9,10-anthraquinone, a compound used in dyes and for bleaching paper pulp, was found only in the material from Area X.

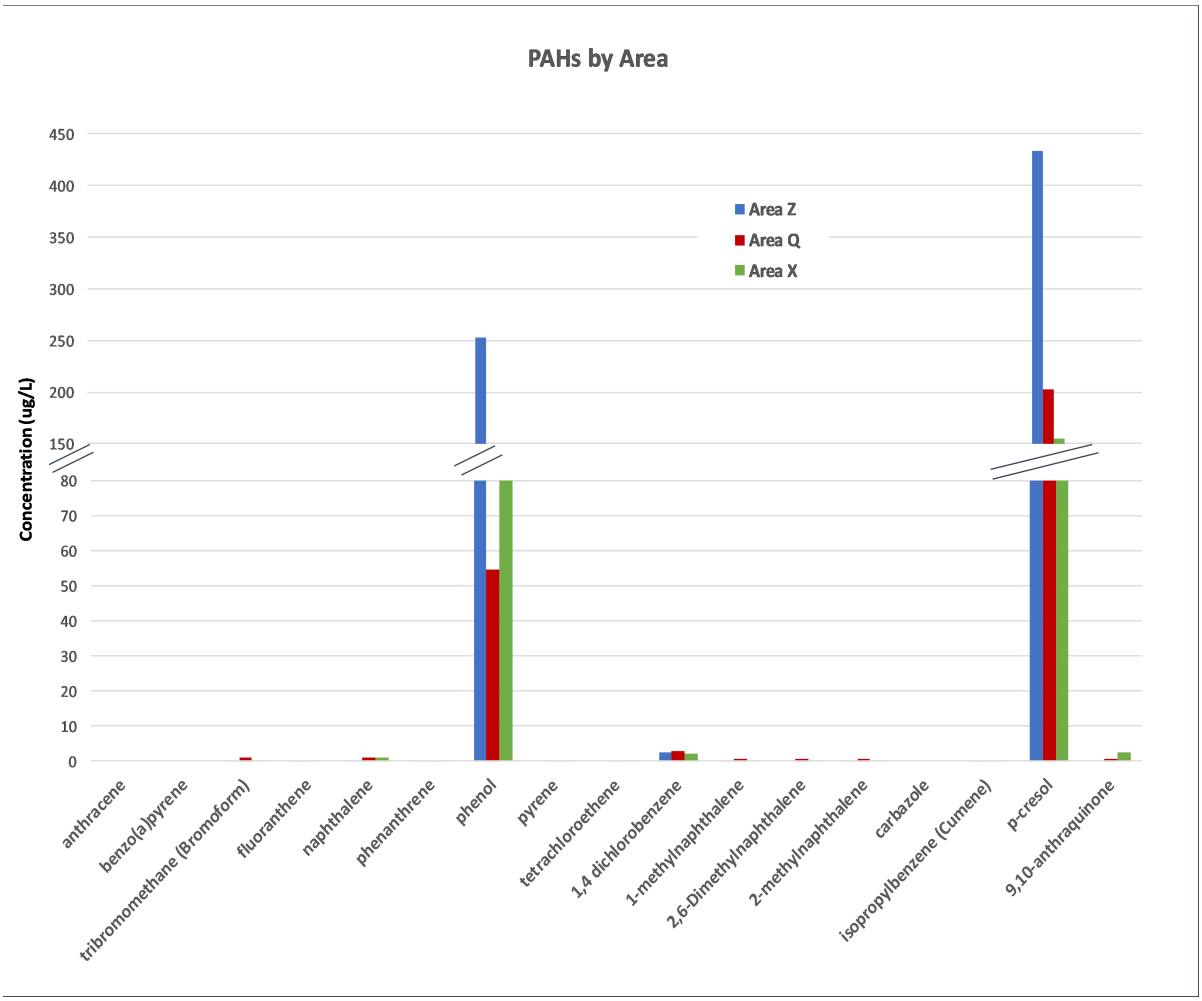

Figure 5: PAHs Concentrations in Wastewater by Area

3.7 Perfluorinated Alkyl Acids

Perfluorinated compounds in the wastewater, sludge, and finished water were analyzed in samples from Area Z only (Table 3). Eight perfluorinated carboxylic acids, with carbon chains from 5 to 12 carbons, and two sulfonic acids, PFBS and PFOS, were quantified in samples taken from six wastewater sampling stations in February of 2010. Samples of the raw and finished water taken on three dates (February 2010, March 2011 and August 2011) and were analyzed for the thirteen (13) compounds. One sample each of dried and wet filter cake samples, taken at the treatment plant, was analyzed.

The State of New Jersey's Ground Water Quality Standard for one perfluorinated compound, PFNA, is 10 ng/L based on a chronic (lifetime) drinking water exposure. The other compounds, many determined to be persistent in the environment, remain the subject of ongoing research and standard development efforts.

The limit of quantitation for wastewater samples was 25 ng/L and for sludge samples was 0.2 ng/g. The absence of a measurable concentration (a non-detect) does not definitively preclude the presence of the compound in the waste sample, only that the concentration may have been below the specific detection level for that sample.

3.7.1. Wastewater:

The two stations with detectable levels of one perfluorinated compound included the Area Z industrial with pharmaceutical processing station (PFBA= 26.6 ng/L) and the Area Z retirement community station (PFNA=117 ng/L). The influent to the wastewater treatment plant also contained detectable levels of PFBS and PFOA (Table 4).

3.7.2. Treated Effluent:

Each of the three samples taken of the influent and treated water at the Area Z wastewater treatment plant contained detectable levels of one perfluorinated compound. The levels in the influent were not always very different than the levels in the effluent. One reason this may be true is that traditional wastewater treatment has not been found to remove perfluorinated compounds. The results of the three sampling events and the perfluorinated compounds detected in those samples can be found in Table 4.

Table 4: Perfluorinated Compound Concentrations in the Influent and Effluent at Area Z POTW (ng/L)

	PFBS (ng/L)		C8 Acid (PFOA) (ng/L)	
Date	Influent	Effluent	Influent	Effluent
February 2010	94.5	88.2	ND	ND
March 2011	ND	ND	26.0	27.9
August 2011	ND	ND	82.3	49.2

Note: ND=non-detect

3.7.3. Sludge:

The wet filter cake contained detectable levels of seven of the thirteen compounds in the analysis, while the dried filter cake contained levels of ten of the thirteen perfluorinated compounds (reported detectable results found in Table 5).

Table 2: Perfluorinated Compound Concentration in Area Z Sludge (ng/g)

	C5 Acid	C6 Acid	C7 Acid	C8 Acid	C9 Acid	C10 Acid	C11 Acid	C12 Acid	PFBS	PFOS
Area Z Dried Product	3.80	1.39	0.39	8.48	4.28	3.63	2.66	0.90	1.22	14.50
Area Z Dried Product-Duplicate	3.49	1.38	0.36	7.82	4.04	3.48	2.77	0.93	1.15	15.50
Area Z Wet Filter cake	<0.2	0.31	<0.2	0.42	0.53	0.63	0.51	<0.2	0.54	2.68

4.0 Discussion

4.1 Reporting Levels

The detection levels in this study were compound specific and at times sample specific. Reporting levels for each compound often fell within large ranges. These very large ranges are the result of the complex nature of the wastes which produce interferences in positively identifying the compounds mass spectral signature and quantifying the amount of the contaminant present in the sample. Samples of treated outfall water (effluent) and dilute wastes have lower detection levels and reporting limits. High detection levels and reporting limits are characteristic of analyses from concentrated raw wastes and sludge. When chemistries of different wastes are compared, it is imperative the DL's, which differ among each sample, are considered. The absence of a measurable concentration (a non-detect) does not definitively preclude the presence of the compound in the waste sample, only that the concentration may have been below the specific level for that sample. Likewise, the presence of a compound in treated outfall water that was not detected in the sewage influent does not indicate that it was generated within the treatment process. Differences in detection levels often result in a higher number of compounds being reported for the treated POTW outfall samples when compared with the number reported for the influent sample.

During the evaluation of the samples retrieved for this study, for most cases, the designated instrument reporting limit (IRL) or laboratory reporting limit (LRL) was consistent for each compound when compared between all wastewater samples and landfill leachate samples. This however, was not true for the Area Q Retirement sample, where IRLs and LRLs for all compounds analyzed were set higher due to matrix interferences.

The reporting levels for the wet and dried sludge were documented with high variation and elevated levels that impacted the confidence of the result provided. However, many of the results were estimated lower than the reporting level consistently, providing a small measure of comparability between samples.

4.2 Sewershed type and media

The sampling sites selected in each of the three areas were intended to assess not only differences between the overall character of the area (Area Z as residential with small commercial areas, Area Q as urbanized, and Area X as urban and industrialized), but to assess the differences that may exist within the Areas, such as delineated areas with characteristics that describe residential, commercial, pharmaceutical, hospital and retirement communities and industrial sewersheds. Appendix C contains sample results in order of similar sewersheds.

4.2.1. Residential

The levels of APEs were generally found to exist in the mid to low range in the samples taken from the residential communities, compared with the other sewershed types. Total analytes detected ranged from 6 to 9, with other sewershed types ranging from 5 to 10 analytes.

However, when reviewing the total concentration of APEs in the residential areas, a comparatively lower range of 6.5-10 µg/L was found. In the other areas, all but two of the sample results were greater than 10 µg/L.

Levels of PAHs were not found to be different in the residential areas compared with the other sewershed types. However, the residential area in Area Z did possess a result for p-cresol that was among the four highest results recorded for all sewershed types in a single sample taken for this project.

The number and total mass of pesticides measured were found to be among the highest in the residential areas compared to any other sewershed type. Area X had the highest total mass of pesticides, with DEET accounting for the greatest proportion of the total.

The flavors and fragrances analyte count and total mass appeared to fall in the middle range of all the sewershed types.

Among the hormones, residential areas were found to possess the highest concentrations of testosterone, only surpassed by the University sewershed. The residential areas also showed the number of detected analytes were in the higher end of the range of all types of sewersheds.

Area Z residential area was found to have the highest levels of total sterols, but the total concentrations in the residential sewersheds of Areas Q and X fell in the mid-range of all areas.

The residential areas possessed among the highest analyte count and highest total mass of pharmaceuticals, with all areas dominated by caffeine.

4.2.2. Commercial

The analysis results from the commercial sewershed wastewaters did not indicate that these areas were large contributors of the compounds under study. A single reading of 12 µg/L of tributyl phosphate (OE) was the single highest result for that compound among the various sewershed uses, but the total APEs in this type of sewershed were within the lower range of total concentrations among sewersheds.

Among the PAH analytes, phenol and p-cresol dominated the total concentration of PAHs in the commercial areas, with the total PAH concentration in Area X being comprised of 70% p-cresol.

The total concentration of pesticides found in the commercial sewershed wastewater was within the middle of the range for total pesticides, with the largest number of detected analytes found in Area Z commercial, which contained DEET, isophorone, and piperonyl butoxide, but all at relatively low levels.

The range of the total concentration of flavors and fragrances was between 44 and 90 µg/L, whereas the range for all areas was between 20 and 165 µg/L. The number of flavors and fragrances detected was also similar to other areas, having between nine and eleven compounds present. The concentration of menthol in Area X Commercial was among the higher concentrations found.

The sterols were detected within similar ranges and analyte counts in all sewershed types. For the commercial areas, cholesterol and 3-beta-coprostanol were detected at levels at the higher end of the range, except for Area X Commercial, which was among the lowest.

Out of the seventeen hormones analyzed for this study, between five and eleven compounds were detected in the commercial sewersheds, with Area Q having the highest number and Area Z having the lowest. Cis-androsterone was elevated, showing levels of 5,020 and 3,800 ng/L in Areas Q and X, respectively.

The only notable pharmaceutical group within the commercial areas were the stimulants, with the highest detection of caffeine, among all sewersheds, detected in the Area Z commercial sewershed. In all three commercial sewersheds, caffeine accounted for between 84 and 98% of the total stimulant group. Other pharmaceuticals, such as acetaminophen (pain reliever) along with triclosan and chloroxylenol (both antimicrobials) were detected in all three commercial sewersheds, occurring at levels near mid-range among all sewersheds.

4.2.3. Industrial and Industrial with Pharmaceutical

Out of the fourteen APEs that were analyzed in this study, the samples taken within the Industrial/Industrial with Pharmaceuticals sewersheds contained between five (Area Z Industrial with Pharm) and ten (Area Q Industrial) compounds. This range was the range for all sewersheds. Total concentrations of APE were among the average, with only one detection of tri(2-butoxyethyl) phosphate TBEB (OE) being notable as the second highest concentration of any of the APEs.

Among the PAH analytes, phenol and p-cresol was detected at concentrations that were among the higher seen at all the sewersheds, most specifically in the Area Z Industrial sewershed with pharmaceutical industry. Area Q Industrial 2 had the highest reported result for p-cresol of all sewershed samples analyzed.

The number of pesticides and the total concentration of pesticides fell within the lower end of the range for all sewersheds. N,N-diethyl- meta-toluamide (DEET) was detected in three out of the four sewersheds.

Between eight and ten flavors and fragrances, out of a total of thirteen in the analysis, were detected in the four Industrial sewersheds. Although the average concentration for menthol across all sewersheds measured 135 µg/L, the level of menthol in the Area Z Industrial with Pharmaceuticals, 1,700 µg/L, was the highest concentration measured across all the sewersheds.

There were no notable distinctions for the sterols group or the hormone group among the differentiated types of sewersheds. Cholesterol and 3-beta-coprostanol again were the dominant compounds in the sterol group and cis-androsterone and 4-androstene-3,17-dione had the highest concentrations within the hormone group. Area Z Industrial with Pharmaceuticals had the highest total concentrations of both sterols and hormones among the four Industrial sewersheds.

The number and average concentrations of stimulants, pain relievers, mood stabilizers, and

antimicrobials were among the averages for the four classes of sewersheds. However, Area Q Industrial had the highest level of the opioid, meperidine (38.4 µg/L) and the highest level of the antihistamine, diphenhydramine (9.36 µg/L).

4.2.4. Hospital and Retirement Communities

The total concentration (6.034 µg/L to 272.5 µg/L) and the number of APEs (between seven and nine) detected in the Hospital and Retirement Community sewersheds were the highest among the types of sewersheds. A concentration of 260 µg/L of tri(2-butoxyethyl) phosphate (TBEB, flame retardant) was recorded in the Area Z Retirement sewershed. Total PAHs across the four types of sewersheds ranged from a low of 0.651 µg/L in the Area Q retirement community to a high of 272 µg/L in the Area Z retirement community.

The evaluation of PAHs in the hospital and retirement communities were similar to the other sewersheds, with phenol and p-cresol being detected in every sample. The Area X Hospital sewershed had the second highest number of PAHs detected, second only to the Area Q Commercial.

The pesticide concentrations were similar between classes of sewersheds. However, every sewersheds within the Hospital and Retirement Community group were determined to have detectable levels of the pesticide DEET in the sample, between 0.06 µg/L in the Area Q Hospital sewershed and 5.4 µg/L in the Area X Retirement sewershed.

Flavors and fragrances were detected at the same rate within the Hospitals and Retirement Communities as were in the other sewersheds. The Area Z Hospital had the highest total flavors and fragrance concentration within this group.

The detection and number of sterols in the Hospital and Retirement Community sewershed were similar to other sewersheds, with the Area Z Retirement Community claiming the highest total sterols in this group, containing over 50% of the total from cholesterol.

Four of the five sewersheds in the Hospital and Retirement group were reported to have total concentrations of hormones greater than 6,000 µg/L. The Residential and the Industrial classes only had one sewershed in the class that exceeded this level.

Caffeine and ibuprofen were again, the two pharmaceuticals that were determined to be in the upper ranges of the concentrations within this class. Area X Hospital also had the highest concentration (20.3 µg/L) of venlafaxine in the study. The Area Q Hospital had the single largest concentration (67 µg/L) of the antimicrobial triclosan.

4.3 Landfill leachate

The results for the samples taken of the landfill leachate contained levels of compounds in all classes. Areas Q and X reported relatively high levels of bisphenol A, and Area X also reported high concentrations of phenol. Within the pesticides, DEET was detected in all three landfill leachate samples, at levels one to two orders of magnitude above all other sewershed samples.

The pesticide isophorone was found in two of the three leachate samples, whereas that compound was only detected three times out of the remaining twenty-three sewersheds. However, the levels detected were well below the groundwater and surface water standards of 40,000 and 35,000 µg/L, respectively.

Samples taken from the Area X Landfill leachate contained the flavor and fragrances compound menthol at levels similar to the sewershed results. However, the level of camphor measured (62 µg/L) is the highest level of camphor to be reported in this study.

Sterols and hormones were not detected in the landfill leachate samples at any notable rate.

Of the many pharmaceuticals that were evaluated in this study, Area X was notable for the levels of oxycondone, carisoprodol (a muscle relaxant) and ibuprophen. In each case, Area X contained the highest levels measured in this study, with results one order of magnitude higher that detectable amounts in other sewersheds.

4.4. Wastewater treatment plants

In evaluating the results for the influent and effluent of the wastewater treatment plants, the varied detection limits attributed to interferences needs to be considered, particularly when including a value that is reported to be below the detection limit. Given the limited sample number, conclusions can only be considered preliminary.

It must also be restated that all results have been based on grab samples that may be expected to contain some measure of heterogeneity. These wastewater samples cannot be considered to be well mixed, and therefore may represent only a point in time, rather than the actual characterization of the wastewater in the system at this point.

4.4.1. Influent and Effluent

Detection levels did vary for the samples taken at the inflow and outflow of the wastewater treatment systems, with interference being a concern with the influent samples. This would occasionally cause a non-detect result where contaminant presence was likely. Therefore, given the limited number of samples and difficulties with the detection limits, results only provide a general observation for discussion.

In general, across the three wastewater treatment systems, the influent contained higher levels of contaminants than was detected in the samples taken at the outfall. The concentration of APEs decreased in the outfall results compared with the inflow, but was still found to be at detectable levels. The levels of PAHs also decreased in the outfall results, with not only the total concentrations of PAHs falling, but the total number of detectable analytes were reduced across all plants. Similarly, the concentrations of pesticides fell in all cases, however the number detected did increase in both Area Q and Area X. DEET was detected in all inflow and outflow samples, but in lower concentrations in the outflow. Piperonyl butoxide was detected in all inflow samples, and the outflow of Area Q and Area X. Area Z showed a non-detectable level of piperonyl butoxide. Results for the flavors and fragrances also showed regular reduction in

concentration and number of analytes detected. These results were similar to those for the sterol compounds.

The results for the hormone compounds were not consistent between facilities. Area Z inflow contained levels largely near or below the detection limits for most compounds, except for levels of estriol and estrone, which were 103 ng/L and 435 ng/L, respectively, in the influent sample. All hormone levels were below the detection limit in the outfall sample. Area Q had sample results that showed all analytes below detection in the inflow sample, but many analytes, particularly cis-androsterone, had notable concentrations present in the outfall samples. Area X had notable results for ten of the seventeen hormone compounds in the influent, but all levels were below the detection limit in the outfall sample.

The influent and effluent of the three treatment plants were analyzed for fifty-six medications. In the Area Z samples, the results showed that twenty-five compounds were detected in the influent sample, while only five were detected in the outfall sample. The total concentration of all medications in Area Z dropped from 231 µg/L to 1.31 µg/L. The number of analytes detected in Area Q went from twenty-three in the influent to thirty-two in the effluent, but overall total concentration of medication dropped from 125.5 µg/L to 13.77 µg/L. Area X had comparable results with fourteen compounds detected in the influent and thirty-nine detected in the effluent, while having the total concentration of medications drop from 116 µg/L to 13.45 µg/L after treatment.

4.3.2. Sludge

The issues of interferences leading to high detection limits along with the fact that all samples are grab samples and therefore not homogenous, is even more pronounced in the samples of sludge that were taken at all three wastewater treatment facilities. However, some understanding of the contaminant concentrations present in the sludge will inform the process of disposing of the sludge. All results from the analysis of the sludge were accompanied by high detection limits. Many data points were qualified as being estimated.

The dried sludge consistently showed higher levels of contaminants, when detected, compared to the wet sludge. However, since the detection limits for the dried sludge were always higher than the wet sludge, this occasionally lead to several results of non-detectable levels in the dried sludge when there were detectable levels in the wet sludge.

5.0 Conclusion

The results of this study provide an initial insight into the many manmade compounds that can be found in our wastewater. Human consumption and human use leads to the presence of many of these compounds in the wastewater system and often in the treatment plant effluents, sludge and landfill leachates. Typically, many of the compounds studied here were greatly reduced in concentration before the water was discharged to the environment. However, given their status as “emerging contaminants”, there is a need for an increased understanding of the concentrations and loads that the human population is contributing and that the public treatment works can treat.

The results comparing the various sewersheds characterized by the nature of the land use did not provide evidence of a signature chemical profile. The results evaluated on a sample basis did provide information on chemical profiles that were common to wastewater impacted by any human activity.

Although multiple compounds were detected in many of the samples taken for this study, there are many more compounds that originate from human consumption or use that could enter the environment through the wastewater treatment system. It is through additional studies that knowledge will be gained on the prevalence and the significance of those compounds.

6.0 Appendices

Appendix A: Summary Statistics
Appendix B: Area Results- By Site
Appendix C: Area Results- By Site Category
Appendix D: Sludge

7.0 References

[i] U.S. Environmental Protection Agency (EPA) Office of Water, Occurrence of Contaminants of Emerging Concern in Wastewater from Nine Publicly Owned Treatment Works, August 2009.

[ii] EPA, OW/ORD Emerging Contaminants Workgroup, DRAFT "Aquatic Life Criteria for Contaminants of Emerging Concern, Part 1, General Challenges and Recommendations", 2008. http://www.epa.gov/sites/production/files/2015-08/documents/white_paper_aquatic_life_criteria_for_contaminants_of_emerging_concern_part_i_general_challenges_and_recommendations_1.pdf Accessed online 3/10/2015.

[iii] Wilde, F.D.,Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., eds., 2004 with updates through 2009, Processing of water samples (ver. 2.2): U.S. Geological Survey, 206, accessed 12/20/2017, at http://pubs.water.usgs.gov/twri9A4/.

[iv] Zaugg, D.D., Smith, S.G., Schroeder, M.P., Barber, L.B., and Burkhardt, M.R, 2002, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory---Determination of wastewater compounds by polystyrene-divinylbenzene solid-phase extraction and capillary-column gas chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01-4186, 37p.

[v] Zaugg, S.D., Phillips, P.J., and Smith, S.G., 2014. Analysis of pharmaceutical and other organic wastewater compounds in filtered and unfiltered water samples by gas chromatography/mass spectrometry: U.S. Geological Survey Open-File Report 2013-1297, 24p.

[vi] Zaugg, 2002.

[vii] Zaugg, 2013.

[viii] Foreman, W.T., Gray, J.L., ReVello, R.C., Lindley, C.E., Losche, S.A., and Barber, L.B, 2012, Determination of steroid hormones and related compounds in filtered and unfiltered water by solid-phase extraction, derivation, and gas chromatography with tandem mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, chap. B9, 118 p.

[ix] U.S. Environmental Protection Agency (U.S. EPA), Determination of Hormones in Drinking Water by Solid Phase Extraction (SPE) and Liquid Chromatogrphy (LC-ESI-MS/MS), Version 1.0, November 2010.

[x] NJDEP, Ground Water Quality Standards- Class IIA by Constituent, 2018. Accessed 3/6/2018 at: http://www.nj.gov/dep/standards/ground%20water.pdf

Appendix A- Summary Statistics

Table 1 – Pharmaceuticals

Stimulants (µg/L)

Compound name	Waste			Reporting level		POTW Outfall			Reporting level	
	Max.	Min.	Median	Max.	Min.	Max.	Min.	Median	Max.	Min.
caffeine	140	24	79	95	0.060	0.33	0.2	0.27	0.20	0.060
cotinine	0.49	0.095	0.24	0.038	0.038	0.13	0.10	0.11	0.038	0.038
1,7 dimethylxanthine (Paraxanthine)	18	0	7.5	0.10	0.10	0.92	0.92	0.92	0.10	0.10
dextromethorphan	0.68	0.29	0.50	10	0.16	0.071	0.071	0.071	0.16	0.16
Anti-inflammatory (µg/L)										
acetaminophen	290	4.5	49	1.9	0.64	0	0	--	0.64	0.64
ibuprofen	39	3.9	18	1.9	0.64	0	0	--	0.64	0.64
antipyrine	0	0	--	10	0.32	0.50	0.50	0.50	0.32	0.32
celecoxib	0	0	--	10	0.64	0.24	0.11	0.18	0.64	0.64
lidocane	3.2	0.12	0.50	3.2	0.08	0.74	0.36	0.55	0.08	0.08
tramadol	3.4	0.42	0.84	10	0.04	0.76	0.32	0.54	0.04	0.04

Antidepressants/Anti-seizure (µg/L)

Compound name	Waste			Reporting level		POTW Outfall			Reporting level	
	Max.	Min.	Median	Max.	Min.	Max.	Min.	Median	Max.	Min.
fluoxetine	0	0	--	1.9	0.64	0	0	--	0.64	0.64
primidone	1.4	0.14	0.54	10	0.32	0.24	0.13	0.18	0.32	0.32
2-ethyl-2-phenylmalonamide	0	0	--	10	0.10	0.24	0.21	0.23	0.10	0.10
venlafaxine	20	1.1	1.9	14	1.3	3.3	1.7	2.50	0.04	0.04
amitriptyline	0	0	--	2.0	0.16	0	0	--	0.16	0.16
temazepam	0	0	--	10	0.32	0.30	0.24	0.27	0.32	0.32
carbamazepine	2.3	0.10	0.57	10	0.16	0.45	0.33	0.388	0.16	0.16
diazepam	0.046	0.046	0.046	10	0.16	0	0	--	0.16	0.16
phendimetrazine	0	0	--	2.9	0.65	0.33	0.33	0.33	0	0
citalopram	3.5	0.074	0.44	2.4	0.23	0.17	0.17	0.17	0.08	0.080
iminostilbene	5.5	0.10	0.57	10	0.080	0.18	0.077	0.13	0.08	0.080
methylphenidate	0	0	--	14	0.91	0	0	--	0.08	0.080
oxcarbazepine	0.49	0.39	0.44	0.96	0.32	0.49	0.25	0.37	0.32	0.32
phenytoin	0.77	0.067	0.22	10	0.16	0.30	0.22	0.26	0.16	0.16
verapamil	9.0	0.86	0.085	10	0.080	2.0	0.30	0.059	0.080	0.080
Antibiotic (µg/L)										
sulfamethoxazole	0.088	0.024	0.043	0.16	0.16	0.012	0.011	0.012	0.16	0.16
trimethoprim	0.22	0.054	0.080	0.034	0.034	0.083	0.037	0.060	0.034	0.034
triclosan	67	1.0	3.2	0.20	0.20	0.60	0.50	0.55	0.20	0.20
chloroxylenol	20	0.16	1.6	10	10	0.95	0.42	0.69	0.08	0.080
fluconazole	0	0	--	10	0.16	0.77	0.62	0.69	0.16	0.16
griseofulvin	0.41	0.12	0.20	10	0.32	0.14	0.055	0.096	0.32	0.32

Opioid/narcotic (µg/L)										
Compound name	**Waste**			**Reporting level**		**POTW Outfall**			**Reporting level**	
	Max.	**Min.**	**Median**	**Max.**	**Min.**	**Max.**	**Min.**	**Median**	**Max.**	**Min.**
norpropoxyphene	0	0	--	10	0.32	0	0	--	0.32	0.32
phenobarbital	3.6	0.12	0.26	10	0.16	0.27	0.19	0.23	0.16	0.16
dihydrocodeine	0	0	--	10	0.16	0.042	0.042	0.041	0.16	0.16
meperidine	380	380	380	180	0.080	0	0	--	0.080	0.080
meprobamate	0	0	--	5.7	0.32	0.80	0.80	0.80	1.96	0.32
pentobarbital	0	0	--	10	0.16	0	0	--	0.16	0.16
propofol	1.8	0.062	0.17	10	0.04	0.081	0.080	0.081	0.04	0.040
CHIRALD	0.76	0.019	0.39	5.1	0.16	0	0	--	0.16	0.16
codeine	0.65	0.071	0.29	10	0.32	0.27	0.21	0.24	0.32	0.32
butalbital	0.064	0.064	0.064	10	0.16	0.14	0.077	0.11	0.16	0.16
hydrocodone	0.36	0.20	0.28	10	0.32	0.064	0.047	0.055	0.32	0.32
metaxalone	0.83	0.13	0.29	10	0.080	1.0	0.29	0.67	0.080	0.080
methadone	0	0	--	10	0.080	0.062	0.062	0.062	0.080	0.080
oxycodone	0.59	0.20	0.42	10	0.32	0.55	0.28	0.41	0.32	0.32
carisoprodol	0	0	--	10	0.16	0.37	0.37	0.37	0.16	0.16
methocarbamol	13	0.74	7.0	1.2	0.64	1.2	0.72	0.94	0.64	0.64

Blood medicine (µg/L)										
Compound name	**Waste**			**Reporting level**		**POTW Outfall**			**Reporting level**	
	Max.	**Min.**	**Median**	**Max.**	**Min.**	**Max.**	**Min.**	**Median**	**Max.**	**Min.**
diltiazem	14	4.0	0.14	10	0.040	2.0	0.41	0.30	0.040	0.040
warfarin	0	0	0	0.080	0.080	0	0	--	0.080	0.080
pentoxifylline	3.0	0.38	0.17	10	0.32	2.0	0.28	0.088	0.32	0.32
dehydroifedipine	0	0	0	0.080	0.080	0	0	--	0.080	0.080
verapamil	9.0	0.86	0.085	10	0.080	2.0	0.30	0.059	0.080	0.080
ticlopidine	0	0	--	20	0.080	0	0	--	0.080	0.080
Asthma (µg/L)										
albuterol	0	0	--	0.080	0.080	0	0	--	0.080	0.080
diphenhydramine	9.4	0.85	1.6	5.4	0.080	0.78	0.73	0.76	0.080	0.080
chlorpheniramine	0	0	--	10	0.080	0	0	--	0.080	0.080
Retro-viral (µg/L)										
efavirenz	0.59	0.067	0.21	10	0.32	0.13	0.10	0.12	0.32	0.32
Total	1037	424	184			13.8	1.31	13.4		

Table 2 - Insecticide/pesticide (µg/L)										
Compound name	Waste			Reporting level		POTW Outfall			Reporting level	
	Max.	Min.	Median	Max.	Min.	Max.	Min.	Median	Max.	Min.
isophorone	0.33	0.33	0.33	0.47	0.080	0.15	0.080	0.12	0.15	0.08
pentachlorophenol	m	m	--	48	16	0	0	--	0	0
diazinon	0	0	--	0.48	0.16	0	0	--	0.16	0.16
bromacil	0.15	0.15	0.15	3.6	0.36	0.27	0.27	0.27	0.36	0.36
prometon	0	0	--	0.36	0.12	0	0	--	0.12	0.12
metolachlor	0.012	0.012	0.012	0.54	0.08	0.019	0.019	0.019	0.08	0.08
chlorpyrifos	0	0	--	5.6	0.16	0	0	--	0.16	0.16
N,N-diethyl- meta-toluamide (deet)	21	0.038	0.82	0.06	0.06	0.55	0.038	0.26	0	0
carbaryl	0	0	--	1.1	0.38	0	0	--	0.38	0.38
metalaxyl	0	0	--	0.36	0.12	0	0	--	0.12	0.12
thiabendazole	0	0	--	0.06	0.06	0	0	--	0.06	0.06
piperonyl butoxide	1.8	0.049	0.26	10	0.08	0.11	0.034	0.071	0.08	0.08
Total	23	0.58	1.01			0.74	0.038	0.73		

Table 3 – Sterols (µg/L)										
Compound name	Waste			Reporting level		POTW outfall			Reporting level	
	Max.	Min.	Median	Max.	Min.	Max.	Min.	Median	Max.	Min.
3-beta-coprostanol	80	1.6	17	5.4	1.8	0.32	0.32	0.32	1.8	1.8
3-t-butyl-4-hydroxyanisole	0.32	0.061	0.19	24	8.0	0.062	0.062	0.062	8.0	8.0
b-sitosterol	16	1.3	6.2	12	4.0	0	0	--	4.0	4.0
cholestrol	190	3.6	46	6.0	2.0	0.45	0.45	0.45	2.0	2.0
b-stigmastanol	3.0	0.20	1.1	2.6	2.6	0	0	--	2.6	2.6
Total	289	6.8	71			0.83	0.83	0.062		

Table 4 - Flavors/Fragrances (µg/L)										
Compound name	**Waste**			**Reporting level**		**POTW Outfall**			**Reporting level**	
	Max.	**Min.**	**Median**	**Max.**	**Min.**	**Max.**	**Min.**	**Median**	**Max.**	**Min.**
3-methyl-1h-indole (Skatole)	6.0	0.34	1.75	0.11	0.036	0.021	0.021	0.021	0.036	0.036
isoquinoline	0	0	--	1.1	0.046	0	0	--	0.20	0.046
menthol	1700	5.5	23	8.0	8.0	0	0	--	0.71	0.32
methyl salicylate	1100	0.097	1.2	0.044	0.044	0	0	--	0.044	0.044
triethyl citrate	2.7	0.24	1.1	1.14	0.38	1.5	0.60	1.1	0.38	0.38
5-methyl-1h-benzotriazole (BHA)	120	0.62	13	3.6	1.2	1.7	0.94	1.3	1.2	1.2
acetophenone	1.7	0.21	0.40	1.1	0.40	0.24	0.24	0.24	0.40	0.40
AHTN -(Tonalide)	1.7	0.052	0.35	0.028	0.028	0.24	0.18	0.21	0.028	0.028
camphor	7.2	0.36	1.4	0.044	0.044	0.047	0.047	0.047	0.044	0.044
d-limonene	59	0.62	2.8	0.24	0.080	0	0	--	0.080	0.08
HHCB (Galaxolide)	10	0.16	3.8	0.156	0.052	3.9	0.034	2.2	0.052	0.052
indole	20	0.063	4.5	1.0	0.08	0	0	--	0.080	0.08
isoborneol	6.6	0.14	0.83	1.1	0.18	0	0	--	0.40	0.18
Total[1]	3035	8.40	55			7.7	2.1	4.8		--

Table 5 - APE - Phenols and Phosphates (µg/L)										
Compound name	**Waste**			**Reporting level**		**POTW outfall**			**Reporting level**	
	Max.	**Min.**	**Median**	**Max.**	**Min.**	**Max.**	**Min.**	**Median**	**Max.**	**Min.**
4-n-octylphenol	0	0	--	0.48	0.16	0	0	--	0.16	0.16
4-tert-octylphenol	0.97	0.064	0.30	0.14	0.14	0.48	0.19	0.34	0.14	0.14
4-t-octylphenol diethoxylate (OP2EO)	0.93	0.31	0.45	45	1.0	1.2	1.0	1.1	1.0	1.0
4-t-octylphenolmonoethoxylate (OP1EO)	2.0	0.39	1.0	2.3	1.0	0.52	0.52	0.52	1.0	1.0
4-cumylphenol	0.22	0.22	0.22	0.32	0.060	0	0	--	0.06	0.06
4-nonylphenol (total, branched)	32	2.1	5.2	14	2.0	3.7	1.2	2.0	2.0	2.0
4-nonylphenol diethoxylate (sum NP2EO)	9.9	0.80	4.1	6.6	6.6	4.9	4.9	4.9	5.0	5.0
benzophenone	2.6	0.18	1.2	0.24	0.08	0.21	0.18	0.20	0.08	0.08
triphenol phosphate	0.31	0.055	0.20	0.36	0.12	0.22	0.14	0.18	0.12	0.12
fyrol fr 2 (Tris(dichloroisopropyl) phosphate)	0.62	0.053	0.35	0.16	0.16	0.68	0.42	0.55	0.16	0.16
fyrol cef (Tris(2-butoxyethyl)phosphate)	0.41	0.11	0.22	0.10	0.10	0.29	0.24	0.27	0.10	0.10
tri(2-butoxyethyl) phosphate TBEB	260	0.55	7.1	2.4	0.80	8.0	0.19	1.5	0.80	0.8
tributyl phosphate	12	0.032	0.19	0.16	0.16	0.33	0.024	0.20	0.16	0.16
bisphenol A (phenol)	0.36	0.15	0.21	6.0	2.0	0.44	0.44	0.44	2.0	2.0
Total	322	5.01	18.4			18.3	1.40	13.4		

Table 6 – PAHs (µg/L)										
Compound name	**Waste**			**Reporting level**		**POTW Outfall**			**Reporting level**	
	Max.	**Min.**	**Median**	**Max.**	**Min.**	**Max.**	**Min.**	**Median**	**Max.**	**Min.**
anthracene	0	0	--	0.084	0.028	0	0	--	0.028	0.028
benzo(a)pyrene	0	0	--	1.7	0.05	0	0	--	0.050	0.05
fluoranthene	0.078	0.013	0.035	0.15	0.024	0.010	0.010	0.010	0.024	0.024
naphthalene	0.82	0.021	0.077	0.45	0.04	0.014	0.014	0.014	0.040	0.04
phenanthrene	0.17	0.0073	0.048	0.096	0.032	0	0	--	0.032	0.032
pyrene	0.037	0.019	0.026	0.46	0.042	0.011	0.011	0.011	0.042	0.042
tetrachloroethene	0.17	0.0019	0.038	0.36	0.12	0.033	0.025	0.029	0.12	0.12
1-methylnapthalene	0.41	0.0075	0.048	0.022	0.022	0	0	--	0.022	0.022
2,6-Dimethylnaphthalene	0.58	0.021	0.034	0.06	0.06	0	0	--	0.060	0.06
2-methylnaphthalene	0.58	0.0077	0.051	0.036	0.036	0	0	--	0.036	0.036
isopropylbenzene (Cumene)	0.11	0.012	0.024	0.3	0.3	0.012	0.012	0.012	0.30	0.30
tribromomethane (Bromoform)	0.73	0.0043	0.060	0.22	0.1	0.074	0.012	0.043	0.10	0.10
phenol	92	0.19	10.5	0.48	0.16	1.9	1.5	1.7	0.16	0.16
1,4 dichlorobenzene	1.2	0.046	0.27	0.12	0.04	0.89	0.41	0.65	0.04	0.04
carbazole	0	0	--	0.32	0.03	0	0	--	0.03	0.03
p-cresol	97	0.16	19	0.24	0.08	0.35	0.22	0.29	0.08	0.08
9,10-anthraquinone	2.4	0.68	1.54	1.1	0.16	0.28	0.13	0.21	0.16	0.16
Total	196	1.20	33			3.6	2.3	2.9		

Appendix B - Area Results
By Site

Table 1 - Pharmaceuticals
(µg/L)

	stimulant				pain reliever					
	caffeine	1,7 dimethylxanthine (Paraxanthine)	cotinine	dextromethorphan	acetaminophen (Paracetamol)	ibuprofen	antipyrine (phenazone)	celecoxib	lidocane	tramadol
Area Z Residential	120	1.1834	0.2034	0.602	226	39	--	--	3.2	--
Area Z Hospital	79	13.3783	0.2533	0.675	112	38.8	--	--	1.98	0.789
Area Z Commercial	140	9.2241	0.3291	--	62.5	--	--	--	0.606	2.27
Area Z Indust w/Pharm	50	0.2617	--	0.389	182	21.5	--	--	0.531	1.04
Area Z Retirement	95	12.2921	0.2425	--	290	32.4	--	--	1.64	3.35
Area Z STP Inflow	78	13.3084	0.4871	0.29	91	33.2	--	--	0.55	1.48
Area Z STP Outfall	0.2	0.9162	0.101	--	--	--	--	--	--	--
Area Q Residential	97	7.143	0.3375	--	45.9	24.2	--	--	0.612	0.844
Area Q Hospital	40	17.5317	0.143	--	98.9	21.8	--	--	0.496	0.778
Area Q Retirement**	49	0.546	0.1022	--	20.7	10.3	--	--	0.373	1.08
Area Q Industrial	33	5.1487	0.1348	--	42.4	10.7	--	--	0.439	0.659
Area Q Industrial 2	110	0.4969	0.1339	--	4.53	--	--	--	0.122	--
Area Q Commercial	68	1.1691	0.256	--	80.1	14.6	--	--	--	--
Area Q STP Inflow	43	7.4953	0.3266	--	50.6	15.9	--	--	0.261	0.531
Area Q STP Outfall	0.27	--	--	--	--	--	--	0.244	0.363	0.761
Area X University	24	--	--	--	15.4	4.47	--	--	--	0.418
Area X Indust w/Pharm	120	8.9766	0.0947	--	20.4	3.91	--	--	0.291	--
Area X Residential	100	9.4004	0.1441	--	8.86	5.36	--	--	0.187	--
Area X Retirement	91	13.8753	0.1893	--	46.7	6.09	--	--	0.499	--
Area X Commercial	78	14.2191	0.2447	--	46	18.6	--	--	0.344	--
Area X Hospital	96	9.043	0.309	--	68.1	17.7	--	--	1.16	--
Area X STP Inflow	63	1.1189	0.4099	--	24	20	--	--	0.445	--
Area X STP Outfall	0.33	--	0.1253	0.0711	--	--	0.504	0.106	0.744	0.323
Area Z Landfill Leachate	--	--	--	--	--	11.2	--	--	6.34	--
Area Q Landfill Leachate	--	--	0.0136	--	--	24	--	--	4.05	--
Area X Landfill Leachate	--	--	0.1387	--	--	147	--	--	12.3	--

After treatment

Matrix interference

-- Result below reporting level

Table 1 - Pharmaceuticals
(µg/L)

	mood stabilizer													
	fluoxetine	carbamazepine	diazepan(m - Benzodiazepine - Vallium)	phendimetrazine	citalopram	iminostilbene	methylphenidate	oxcarbazepine (oxacarbaxepineanti)	phenytoin	primidone	2-ethyl-2-phenylmalonamide	venlafaxine	amitriptyline	temazepam
Area Z Residential	--	0.743	--	--	3.48	0.4	--	--	--	--	--	--	--	--
Area Z Hospital	--	2.34	--	--	0.38	1.26	--	0.394	--	--	--	--	--	--
Area Z Commercial	--	0.713	--	--	0.763	--	--	--	--	--	--	--	--	--
Area Z Indust w/Pharm	--	--	--	--	1.12	0.414	--	--	--	1.42	10	--	--	--
Area Z Retirement	--	2.18	--	--	1.1	0.807	--	--	0.767	0.8	--	1.83	--	--
Area Z STP Inflow	--	0.453	--	--	0.853	0.41	--	--	0.387	0.801	--	1.39	--	--
Area Z STP Outfall	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Area Q Residential	--	0.565	--	--	0.203	0.481	--	--	0.222	0.372	--	--	--	--
Area Q Hospital	--	--	--	--	0.188	--	--	--	0.142	0.136	--	--	--	--
Area Q Retirement**	--	--	--	--	--	--	--	0.488	--	--	--	--	--	--
Area Q Industrial	--	--	0.0461	--	0.0743	0.101	--	--	0.417	0.147	--	1.95	--	--
Area Q Industrial 2	--	--	--	--	--	--	--	--	--	--	--	1.1	--	--
Area Q Commercial	--	--	--	--	--	0.72	--	--	--	--	--	--	--	--
Area Q STP Inflow	--	0.166	--	--	0.14	0.435	--	--	0.218	0.207	--	--	--	--
Area Q STP Outfall	--	0.45	--	--	0.168	0.18	--	0.489	0.3	0.235	0.244	3.33	--	0.303
Area X University	0.00	0.191	--	--	0.134	0.13	--	--	0.0671		--	1.26	--	--
Area X Indust w/Pharm	--	0.102	--	--	0.0758	--	--	--	--	--	--	--	--	--
Area X Residential	--	1.12	--	--	--	1.73	--	--	--	--	--	--	--	--
Area X Retirement	--	0.361	--	--	--	1.24	--	--	0.219	0.703	--	13.7	--	--
Area X Commercial	--	0.593	--	--	--	5.5	--	--	0.158	--	--	4.69	--	--
Area X Hospital	--	0.263	--	--	1.27	0.844	--	--	--	--	--	20.3	--	--
Area X STP Inflow	--	--	--	--	0.496	0.566	--	--	--	--	--	--	--	--
Area X STP Outfall	--	0.326	--	0.326	0.17	0.0769	--	0.252	0.22	0.132	0.209	1.66	--	0.236
Area Z Landfill Leachate	--	--	--	--	--	0.302	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	0.273	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--	--	--	1.91	--	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 1 - Pharmaceuticals
(µg/L)

	antibiotic		antimicrobial				opioid					
	sulfamethoxazole	trimethoprim	triclosan	chloroxylenol	fluconazole	griseofulvin	norpropoxyphene	codeine	hydrocodone	methadone	dihydrocodeine	meperidine (Pethidine)
Area Z Residential	0.0294	0.0783	8	--	--	--	--	--	--	--	--	--
Area Z Hospital	0.0883	0.2153	3.5	9.74	--	--	--	--	--	--	--	--
Area Z Commercial	--	--	7.5	3.07	--	--	--	--	--	--	--	--
Area Z Indust w/Pharm	0.16	0.0809	3.3	1.27	--	--	--	--	--	--	--	--
Area Z Retirement	0.0546	0.1063	7.5	1.55	--	--	--	0.652	--	--	--	--
Area Z STP Inflow	0.0282	0.0698	3.8	0.792	--	--	--	0.378	--	--	--	--
Area Z STP Outfall	0.0122	0.083	--	--	--	--	--	--		--	--	--
Area Q Residential	0.0298	--	4.8	1.63	--	0.408	--	0.425	--	--	--	--
Area Q Hospital	--	--	67	19.9	--	--	--	0.0705	0.202	--	--	--
Area Q Retirement**	--	--	2.5	0.162	--	--	--	--	--	--	--	--
Area Q Industrial	--	--	1	0.86	--	--	--	0.141	--	--	--	38.4
Area Q Industrial 2	--	--	--	2.68	--	--	--	--	--	--	--	--
Area Q Commercial	0.0241	0.0542	3.2	2.9	--	--	--	0.264	--	--	--	--
Area Q STP Inflow	0.0429	--	2.1	1.16	--	--	--	0.294	--	--	--	--
Area Q STP Outfall	0.0112	0.0372	0.5	0.421	0.617	0.136	--	0.268	0.0635	--	--	--
Area X University	--	--	1.6	1.64	--	0.204	--	--	--	--	--	--
Area X Indust w/Pharm	--	--	2.7	0.2	--	0.122	--	--	--	--	--	--
Area X Residential	--	--	3.2	0.246	--	--	--	--	--	--	--	--
Area X Retirement	0.0523	--	3.1	1.04	--	--	--	--	--	--	--	--
Area X Commercial	--	--	3.3	3.06	--	--	--	--	0.362	--	--	--
Area X Hospital	0.0681	--	2.7	0.762	--	--	--	--	--	--	--	--
Area X STP Inflow	--	--	2.2	1.69	--	--	--	--	--	--	--	--
Area X STP Outfall	--	--	0.6	0.953	0.766	0.055	--	0.208	0.0466	0.0623	0.0415	--
Area Z Landfill Leachate	0.0118	--	--	--	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	0.034	--	--	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--	--	--	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 1 - Pharmaceuticals
(µg/L)

	barbituate			muscle relaxant			anti-anxiety	anesthetic	anti-coagulant
	butalbital	phenobarbital	pentobarbital	metaxalone	carisoprodol	methocarbamol	meprobamate	propofol	ticlopidine
Area Z Residential	--	--	--	--	--	--	--	--	--
Area Z Hospital	--	--	--	0.188	--	--	--	0.975	--
Area Z Commercial	--	--	--	--	--	--	--	--	--
Area Z Indust w/Pharm	--	--	--	--	--	--	--	0.368	--
Area Z Retirement	--	0.63	--	--	--	13.2	--	0.188	--
Area Z STP Inflow	--	0.314	--	--	--	--	--	0.0992	--
Area Z STP Outfall	--	--	--	--	--		--	--	--
Area Q Residential	--	0.123	--	0.425	--	--	--	--	--
Area Q Hospital	--	--	--	--	--	--	--	1.78	--
Area Q Retirement**	--	--	--	--	--	--	--	--	--
Area Q Industrial	0.0639	3.6	--	0.29	--	--	--	0.0621	--
Area Q Industrial 2	--	--	--	--	--	--	--	--	--
Area Q Commercial	--	--	--	--	--	--	--	0.0682	--
Area Q STP Inflow	--	0.199	--	0.281	--	0.74	--	--	--
Area Q STP Outfall	0.138	0.269	--	0.29	--	1.16	--	0.081	--
Area X University	--	--	--	--	--	--	--	--	--
Area X Indust w/Pharm	--	0.204	--	0.132	--	--	--	--	--
Area X Residential	--	--	--	--	--	--	--	--	--
Area X Retirement	--	--	--	0.48	--	--	--	0.165	--
Area X Commercial	--	--	--	0.275	--	--	--	0.463	--
Area X Hospital	--	--	--	--	--	--	--	0.0786	--
Area X STP Inflow	--	--	--	0.827	--	--	--	0.0922	--
Area X STP Outfall	0.077	0.187	--	1.04	0.367	0.72	0.798	0.0803	0.08
Area Z Landfill Leachate	--	--	--	--	--	--	--	0.627	--
Area Q Landfill Leachate	--	0.859	--	--	--	--	--	1.29	--
Area X Landfill Leachate	--	--	--	--	30.6	--	--	--	0.424

After treatment

Matrix interference

-- Result below reporting level

Table 1 - Pharmaceuticals
(µg/L)

			BP med			anti-coagulant	vasodialator & anti-inflammatory	broncho-dilator	antihistimine		HIV Drug
	oxycodone	CHIRALD	diltiazem	dehydroifedipine	verapamil	warfarin	pentoxifylline	albuterol	diphenhydramine	chlorpheniramine	efavirenz
Area Z Residential	--	--	--	--	--	--	--	--	5.92	--	--
Area Z Hospital	--	--	3.98	--	--	--	--	--	1.2	--	--
Area Z Commercial	--	--	--	--	--	--	--	--	2.06	--	0.585
Area Z Indust w/Pharm	--	--	1.21	--	--	--	--	--	1.51	--	--
Area Z Retirement	--	--	2.42	--	**0.858**	--	--	--	2.75	--	--
Area Z STP Inflow	0.593	--	0.951	--	**0.316**	--	--	--	1.58	--	--
Area Z STP Outfall	--	--		--	--	--		--	--	--	--
Area Q Residential	0.491	--	0.475	--	**0.311**	--	--	--	--	--	--
Area Q Hospital	0.466	--	0.306	--	--	--	--	--	--	--	0.32
Area Q Retirement**	0.434	--	0.397	--	**0.58**	--	--	--	0.849	--	--
Area Q Industrial	0.199	--	3.55	--	**0.182**	--	0.206	--	9.36	--	--
Area Q Industrial 2	0.198	--	0.108	--	--	--	--	--	--	--	--
Area Q Commercial	--	--	--	--	--	--	--	--	--	--	0.305
Area Q STP Inflow	0.367	--	0.451	--	**0.256**	--	0.378	--	--	--	--
Area Q STP Outfall	0.548	--	0.408	--	**0.297**	--	--	--	0.782	--	0.131
Area X University	--	--	--	--	--	--	--	--	--	--	0.0665
Area X Indust w/Pharm	--	--	0.258	--	**0.134**	--	--	--	--	--	0.117
Area X Residential	0.467	--	0.591	--	--	--	--	--	1.6	--	--
Area X Retirement	0.331	--	0.979	--	**0.299**	--	--	--	--	--	--
Area X Commercial	0.444	0.0189	0.389	--	**0.0849**	--	0.172	--	--	--	--
Area X Hospital	0.383	--	--	--	--	--	--	--	--	--	--
Area X STP Inflow	0.406	0.761	--	--	--	--	--	--	--	--	--
Area X STP Outfall	0.281	--	0.298	--	**0.0587**	--	0.0884		0.732	--	0.101
Area Z Landfill Leachate	--	--	--	--	--	0.08	--	0.08	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	--	--	--	--
Area X Landfill Leachate	6.47	--	--	--	--	--	--	--	--	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 2 - Pesticides, Insecticides, Herbicides and Fungicides

(µg/L)

	isophorone	pentachlorophenol	diazinon	bromacil	prometon	metolachlor	chlorpyrifos	N,N-diethyl- meta-toluamide (deet)	carbaryl	metalaxyl	thiabendazole	piperonyl butoxide
Area Z Residential	--	--		--				1.2				0.261
Area Z Hospital	--	--	--	--	--	--	--	0.25	--	--	--	--
Area Z Commercial	0.33	--	--	--	--	--	--	0.33	--	--	--	0.224
Area Z Indust w/Pharm	--	--	--	--	--	--	--	--	--	--	--	0.982
Area Z Retirement	--	--	--	--	--	--	--	0.82	--	--	--	
Area Z STP Inflow	--	--	--	--	--	--	--	0.62	--	--	--	0.424
Area Z STP Outfall	--	--	--	--	--	--	--	0.038	--	--	--	
Area Q Residential	--	--	--	--	--	--	--	1.6	--	--	--	0.275
Area Q Hospital	--	--	--	--	--	--	--	0.06	--	--	--	--
Area Q Retirement**	--	--	--	--	--	--	--	0.87	--	--	--	--
Area Q Industrial	--	--	--	--	--	--	--	0.13	--	--	--	
Area Q Industrial 2	--	--	--	--	--	--	--	0.038	--	--	--	--
Area Q Commercial	--	--	--	--	--	--	--	0.57	--	--	--	1.75
Area Q STP Inflow	--	--	--	--	--	--	--	1.3	--	--	--	0.299
Area Q STP Outfall	0.08	--	--	--	--	--	--	0.55	--	--	--	0.108
Area X University	--	--	--	--	--	--	--	0.2	--	--	--	0.755
Area X Indust w/Pharm	--	--	--	--	--	0.012	--	0.27	--	--	--	--
Area X Residential	--	--	--	--	--	--	--	21	--	--	--	0.0487
Area X Retirement	--	--	--	--	--	--	--	5.3	--	--	--	0.0869
Area X Commercial	--	--	--	--	--	--	--	2	--	--	--	0.0701
Area X Hospital	--	--	--	--	--	--	--	2.7	--	--	--	0.0968
Area X STP Inflow	--	--	--	0.15	--	--	--	2.8	--	--	--	0.262
Area X STP Outfall	0.15	--	--	0.27	--	0.019	--	0.26	--	--	--	0.0342
Area Z Landfill Leachate	0.48	--	--	--	--	--	--	30	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	29	--	--	--	--
Area X Landfill Leachate	0.5	--	--	--	--	--	--	38	--	--	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 3 - Sterols and Hormones

(µg/L)

	Sterols					Hormones								
	3-beta-coprostanol	3-t-butyl-4-hydroxyanisole	b-sitosterol	cholestrol	b-stigmastanol	11-Ketotestosterone (ng/L)	17-alpha-Estradiol (ng/L)	17-alpha-Ethynylestradiol (ng/L)	17-beta-Estradiol (ng/L)	4-Androstene-3,17-dione (ng/L)	cis-Androsterone (ng/L)	Dihydrotestosterone (ng/L)	Epitestosterone (ng/L)	Equilenin (ng/L)
Area Z Residential	78	0.32	16	190	3	7.1	<0.80	<0.80	48.1	3,860	11,300	210	<4.0	19.8
Area Z Hospital	18	0.21	10	62	1.4	<2.0	<0.80	<0.80	15.7	62.4	7,730	<37.8	<4.0	<5.9
Area Z Commercial	50	--	16	120	2.7	<2.0	1.42	<0.80	<0.80	10.5	<0.80	<4.0	2.6	<2.0
Area Z Indust w/Pharm	37	--	11	66	1.8	16.4	<0.80	<0.80	12.8	796	4,950	95.5	<12.5	14.2
Area Z Retirement	68	0.32	11	100	1.5	10.8	<0.80	<0.80	16.1	1,870	7,160	77.9	<8.0	<7.2
Area Z STP Inflow	32	0.31	5.8	51	0.79	<2.0	<0.80	0.79	<0.80	<7.37	<0.80	<4.0	4.2	<2.0
Area Z STP Outfall	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Area Q Residential	19	--	6.9	51	1.1	6.7	<0.80	<0.80	17.3	90.2	3,700	168	41.2	<2.0
Area Q Hospital	6	0.15	3	15	0.58	3.9	<0.80	1.8	28.1	177	5,250	24.7	23.3	2.8
Area Q Retirement**	35	--	7.4	56	1.2	5.5	<0.80	<0.80	7.82	10.8	2,120	47	12.3	<2.0
Area Q Industrial	4.9	--	3.3	8.3	0.72	6.2	<0.80	<0.80	9.09	210	2,500	27.2	17.1	<2.0
Area Q Industrial 2	1.8	0.061	1.5	3.6	--	<2.0	<0.80	<0.80	2.22	27.4	1,740	33.2	<4.0	<2.0
Area Q Commercial	80	0.12	14	84	3	4.3	<0.80	<0.80	10.9	88.7	5,020	97.2	40.1	<2.0
Area Q STP Inflow	14	--	4.7	27	0.8	--	--	--	--	--	--	--	--	--
Area Q STP Outfall	0.32	--	--	0.45	--	6.8	<0.80	1.46	8.335	52.55	1670	43.15	13.75	<2.0
Area X University	1.6	0.078	1.3	4	0.2	<2.0	<0.80	1.26	4.34	5.44	1.36	<4.0	<4.0	<2.0
Area X Indust w/Pharm	5.3	--	2.3	8.3	0.3	25.5	<0.80	<0.80	5.36	836	2,130	59.6	<26.7	4.7
Area X Residential	16	--	6.7	40	1.1	52.5	<0.80	<0.80	9.34	607	1,950	84.9	22.8	44.6
Area X Retirement	13	--	3.1	29	0.81	77.6	<0.80	<0.80	10.7	<16.7	596	<68.8	<4.0	<4.9
Area X Commercial	6	0.17	2.4	14	0.56	36.5	<0.80	<0.80	10.6	206	3,800	95	<4.0	20.6
Area X Hospital	18	--	6.6	63	1.5	38.1	<0.80	<0.80	9.81	3,390	3,390	102	19.1	14.2
Area X STP Inflow	9.5	0.21	5.4	17	1.1	64.3	<0.80	<0.80	7.35	222	1,710	61.6	<12.2	14.6
Area X STP Outfall	--	0.062	--	1	--	--	--	--	--	--	--	--	--	--
Area Z Landfill Leachate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Area X Landfill Leachate	0.99	--	1.6	1.2	1.1	--	--	--	--	--	--	--	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 3 - Sterols and Hormones

(µg/L)

	Hormones (continued)							
	Equilin (ng/)	Estriol (ng/L)	Estrone (ng/L)	Mestranol (ng/L)	Norethindrone (ng/L)	Progesterone (ng/L)	Testosterone (ng/L)	trans-Diethylstilbestrol (ng/L)
Area Z Residential	<2,310	337	129	<0.80	<0.80	<8.0	154	<0.80
Area Z Hospital	<61.3	118	31.5	<0.80	<0.80	<8.0	14.2	<0.80
Area Z Commercial	<4.0	79.8	103	<0.80	<0.80	<8.0	<0.80	<0.80
Area Z Indust w/Pharm	<4,390	169	97.3	<0.80	<0.80	<8.0	75	<0.80
Area Z Retirement	<792	62.4	64.9	<0.80	<0.80	<8.0	140	<0.80
Area Z STP Inflow	<11.8	103	435	<0.80	<0.80	<8.0	<0.80	<0.80
Area Z STP Outfall	--	--	--	--	--	--	--	--
Area Q Residential	<620	192	43.4	<0.80	<0.80	8.9	55.5	<0.80
Area Q Hospital	<889	528	137	<0.80	2.06	27.3	27.1	<0.80
Area Q Retirement**	<4.0	34.7	23.3	<0.80	<0.80	6.6	18.3	<0.80
Area Q Industrial	<154	29.7	25.4	<0.80	<0.80	7.2	45.2	<0.80
Area Q Industrial 2	<4.0	6.4	4.62	<0.80	<0.80	<8.0	11.3	<0.80
Area Q Commercial	92.3	192	35.1	<0.80	<0.80	12	116	<0.80
Area Q STP Inflow	--	--	--	--	--	--	--	--
Area Q STP Outfall	<4.0	<2.0	27.2	<0.80	<0.80	<8.0	37.1	<0.80
Area X University	<4.0	<2.0	23.5	<0.80	<0.80	<8.0	<0.80	<0.80
Area X Indust w/Pharm	<641	45.2	24.6	<0.80	<0.80	<8.0	72.7	<0.80
Area X Residential	<2,650	81.6	57.4	<0.80	<0.80	16.1	95.8	<0.80
Area X Retirement	<4.0	169	<40.7	<0.80	<0.80	11.3	48.7	<0.80
Area X Commercial	<728	114	47.4	<0.80	<0.80	13.9	27.2	<0.80
Area X Hospital	<728	155	74	<0.80	0.41	28	215	<0.80
Area X STP Inflow	<926	144	31.4	<0.80	<0.80	10.2	47.2	<0.80
Area X STP Outfall	--	--	--	--	--	--	--	--
Area Z Landfill Leachate	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 4 - Flavors and Fragrances

(µg/L)

	3-methyl-1h-indole (Skatole)	5-methyl-1h-benzotriazole (BHA)	acetophenone	AHTN -(Tonalide) Acetyl hexamethyl tetrahydronapthalene	camphor	d-limonene	HHCB (Galaxolide) Hexahdrohexamethylcyclopentabenzopyran	indole	isoborneol	isoquinoline	menthol	methyl salicylate	triethyl citrate
Area Z Residential	1.6	--	0.4	1.7	5.4	12	10	18	5.9	--	23	5	1.3
Area Z Hospital	4.6	120	--	0.21	3.4	1.6	3.5	14	0.54	--	15	1.1	0.83
Area Z Commercial	1.2	9.5	0.55	0.48	1.4	4.1	4.4	--	0.64	--	20	1.2	0.61
Area Z Indust w/Pharm	2	--	0.55	0.91	0.94	14	8.8	0.36	--	--	1700	1100	0.93
Area Z Retirement	2.8	--	0.42	0.76	1.7	2	5.5	12	0.91	--	26	3.1	1.5
Area Z STP Inflow	3.1	--	0.31	0.52	--	1.6	6.4	14	0.68	--	17	0.56	1.1
Area Z STP Outfall	--	--	--	--	--	--	0.034	--	--	--	--	--	--
Area Q Residential	1.7	--	0.36	0.58	2.6	2.3	5.1	--	1.4	--	30	0.56	0.82
Area Q Hospital	0.73	--	0.24	0.62	1	3.2	2.2	0.23	0.19	--	15	1.3	0.44
Area Q Retirement**	1	--	0.46	0.18	1	3.5	3.5	--	--	--	17	0.6	1.4
Area Q Industrial	0.34	--	0.3	0.052	0.66	11	0.59	0.24	0.61	--	5.5	--	0.67
Area Q Industrial 2	1.3	--	0.28	--	0.57	4.7	0.16	--	0.77	--	--	8.1	2.7
Area Q Commercial	3.8	--	--	0.76	2.5	17	8.1	--	1.3	--	16	2.3	1
Area Q STP Inflow	3.4	0.62	0.44	0.28	1.3	59	2.3	2.9	0.55	--	19	0.22	0.76
Area Q STP Outfall	0.02	1.7	--	0.24	--	--	2.2	--	--	--	--	--	0.6
Area X University	0.49	14	0.28	0.055	0.36	0.76	0.74	0.063	0.14	--	6.9	0.097	0.24
Area X Indust w/Pharm	0.84	13	0.21	0.1	1.4	0.62	3.6	--	--	--	130	0.73	0.73
Area X Residential	0.85	--	0.29	0.41	2.4	1.4	4.6	6.4	1.1	--	29	20	1.7
Area X Retirement	3.5	--	0.42	0.35	2.4	2.4	3.7	2.3	0.89	--	42	0.87	1.9
Area X Commercial	6	--	0.39	0.29	1.4	1.9	3.9	20	0.85	--	53	0.6	1.5
Area X Hospital	1.8	--	0.44	0.33	1.8	1.2	3.6	--	0.83	--	38	1.6	1.6
Area X STP Inflow	2.5	--	1.7	0.35	7.2	17	5	4.5	6.6	--	160	2.3	2.5
Area X STP Outfall	--	0.94	0.24	0.18	0.047	--	3.9	--	--	--	--	--	1.5
Area Z Landfill Leachate	0.16	--	1.4	--	--	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	0.89	--	--	1.1	0.11	--	--	--	2.2	--	1.4
Area X Landfill Leachate	2.6	--	9	0.13	62	13	0.59	--	--	--	20	--	--

After treatment

Matrix interference

-- Result below reporting level

Table 5 - Alkylphenol Ethoxylates (APE)

(µg/L)

	4-n-octylphenol	4-tert-octylphenol	4-t-octylphenolmonoethoxylate (OP1EO)	4-t-octylphenol diethoxylate (OP2EO)	4-nonylphenol (total, branched)	4-nonylphenol diethoxylate (sum of all NP2EO)	4-cumylphenol	bisphenol A (phenol)	benzophenone	triphenol phosphate (OE)	tributyl phosphate (OE)	tri(2-butoxyethyl) phosphate TBEB (OE)	fyrol fr 2 (Tris(dichloroisopropyl)phosphate) (OE)	fyrol cef (Tris(2-butoxyethyl)phosphate) (OE)
Area Z Residential	--	--	--	--	--	5.3		--	1.4	0.26	--	2.6	0.49	0.28
Area Z Hospital	--	--	--	--	--	3.6	0.22	--	0.44	0.14	--	36	0.21	0.2
Area Z Commercial		0.3	--	--	--	5.6		--	0.83	0.31	1.5	3.2	0.62	0.41
Area Z Indust w/Pharm	--	--	--	--	4.1	5.1	--	--	1.4	0.12	--	68	--	--
Area Z Retirement	--	0.5	--	--	--	9.9	--	--	1.3	0.28	0.42	260	0.35	0.27
Area Z STP Inflow	--	0.61	--	--	10	--	--	--	1.3	0.22	0.54	8.5	0.54	0.21
Area Z STP Outfall	--	--	--	--	1.2	--	--	--	--	--	0.024	0.19	--	
Area Q Residential		0.3	--	--	4.8	3.9	--	0.21	1.3	0.22	0.071	2.5	0.46	0.27
Area Q Hospital	--	0.064	--	--	--	5.1	--	0.15	0.42	0.092	0.032	48	0.086	0.11
Area Q Retirement**	--	0.22	0.62	0.48	--	2.9	--	0.36	0.84	0.19	0.074	0.55	0.37	0.27
Area Q Industrial	--	0.074	--	0.41	2.1	2.5		0.16	0.47	0.055	0.12	11	0.053	0.12
Area Q Industrial 2	--	0.72	--	0.92	4.7	3.3	--	0	0.18	0.15	--	3.4	0.21	0.28
Area Q Commercial	--	--	1.5	--	--	6.1	--	--	1.2	0.18	12	1.8	0.11	0.15
Area Q STP Inflow	--	0.46	1.4	--	5.7	6.6	--	0.31	0.82	0.14	0.15	14	0.31	0.2
Area Q STP Outfall	--	0.19	0.52	1	2	4.9	--	0.44	0.21	0.14	0.2	8	0.42	0.29
Area X University	0.16	0.12	0.39	0.31	2.4	2.3	--	--	0.23	0.11	0.071	8.8	0.27	0.13
Area X Indust w/Pharm	--	0.16	--	0.4	2.2	0.8	--	--	0.4	0.1	0.065	3.2	0.26	0.14
Area X Residential	--	--	0.94	--	--	1.8	--	--	2.4	0.24	--	1.3	0.54	0.23
Area X Retirement	--	0.97	1	--	32	9.7	--	--	1.4	0.24	0.2	6.2	0.41	0.22
Area X Commercial	0.16	0.3	0.9	--	6.2	4.1	--	--	1.1	0.2	0.19	1.5	0.34	0.2
Area X Hospital	--	0.59	--	--	5.5	3.1	--	--	1.4	0.22	0.23	8	0.5	0.26
Area X STP Inflow	--	0.8	2	0.93	10	6.7	--	--	2.6	0.22	0.37	54	0.46	0.3
Area X STP Outfall	--	0.48	--	1.2	3.7	4.9	--	--	0.18	0.22	0.33	1.5	0.68	0.24
Area Z Landfill Leachate	--	0.78	--	--	--	--	--	24	1.2	--	1.3	2.7	0.097	--
Area Q Landfill Leachate	--	1.2	--	--	--	--	--	160	0.79	--	--	3.8	--	--
Area X Landfill Leachate	--	0.8	--	--	12	--	2.4	470	3.3	--	0.71	2	0.13	0.34

After treatment

Matrix interference

-- Result below reporting level

Appendix C - Area Results

By Site Category

Table 1 - Pharmaceuticals

(µg/L)

	stimulant				pain reliever					
	caffeine	1,7 dimethylxanthine (Paraxanthine)	cotinine	dextromethorphan	acetaminophen (Paracetamol)	ibuprofen	antipyrine (phenazone)	celecoxib	lidocane	tramadol
Residential & University										
Area Z Residential	120	1.1834	0.2034	0.602	226	39	--	--	3.2	--
Area Q Residential	97	7.143	0.3375	--	45.9	24.2	--	--	0.612	0.844
Area X Residential	100	9.4004	0.1441	--	8.86	5.36	--	--	0.187	--
Area X University	24	--	--	--	15.4	4.47	--	--	--	0.418
Commercial										
Area Z Commercial	140	9.2241	0.3291	--	62.5	--	--	--	0.606	2.27
Area Q Commercial	68	1.1691	0.256	--	80.1	14.6	--	--	--	--
Area X Commercial	78	14.2191	0.2447	--	46	18.6	--	--	0.344	--
Industrial with Pharmaceuticals										
Area Z Indust w/Pharm	50	0.2617	--	0.389	182	21.5	--	--	0.531	1.04
Area Q Industrial	33	5.1487	0.1348	--	42.4	10.7	--	--	0.439	0.659
Area Q Industrial 2	110	0.4969	0.1339	--	4.53	--	--	--	0.122	--
Area X Indust w/Pharm	120	8.9766	0.0947	--	20.4	3.91	--	--	0.291	--
Hospitals and Retirement Communities										
Area Z Hospital	79	13.3783	0.2533	0.675	112	38.8	--	--	1.98	0.789
Area Z Retirement	95	12.2921	0.2425	--	290	32.4	--	--	1.64	3.35
Area Q Hospital	40	17.5317	0.143	--	98.9	21.8	--	--	0.496	0.778
Area Q Retirement**	49	0.546	0.1022	--	20.7	10.3	--	--	0.373	1.08
Area X Hospital	96	9.043	0.309	--	68.1	17.7	--	--	1.16	--
Area X Retirement	91	13.8753	0.1893	--	46.7	6.09	--	--	0.499	--
Landfill Leachate										
Area Z Landfill Leachate	--	--	--	--	--	11.2	--	--	6.34	--
Area Q Landfill Leachate	--	--	0.0136	--	--	24	--	--	4.05	--
Area X Landfill Leachate	--	--	0.1387	--	--	147	--	--	12.3	--
Wastewater Treatment										
Area Z STP Inflow	78	13.3084	0.4871	0.29	91	33.2	--	--	0.55	1.48
Area Z STP Outfall	0.2	0.9162	0.101	--	--	--	--	--	--	--
Area Q STP Inflow	43	7.4953	0.3266	--	50.6	15.9	--	--	0.261	0.531
Area Q STP Outfall	0.27	--	--	--	--	--	--	0.244	0.363	0.761
Area X STP Inflow	63	1.1189	0.4099	--	24	20	--	--	0.445	--
Area X STP Outfall	0.33	--	0.1253	0.0711	--	--	0.504	0.106	0.744	0.323

After treatment

Matrix interference

-- Result below reporting level

Table 1 - Pharmaceuticals

(µg/L)

	mood stabilizer													
	fluoxetine	carbamazepine	diazepan(m - Benzodiazepine - Vallium)	phendimetrazine	citalopram	iminostilbene	methylphenidate	oxcarbazepine (oxacarbaxepineanti)	phenytoin	primidone	2-ethyl-2-phenylmalonamide	venlafaxine	amitriptyline	temazepam
Residential & University														
Area Z Residential	--	0.743	--	--	3.48	0.4	--	--	--	--	--	--	--	--
Area Q Residential	--	0.565	--	--	0.203	0.481	--	--	0.222	0.372	--	--	--	--
Area X Residential	--	1.12	--	--	--	1.73	--	--	--	--	--	--	--	--
Area X University	0.00	0.191	--	--	0.134	0.13	--	--	0.0671		--	1.26	--	--
Commercial														
Area Z Commercial	--	0.713	--	--	0.763	--	--	--	--	--	--	--	--	--
Area Q Commercial	--	--	--	--	--	0.72	--	--	--	--	--	--	--	--
Area X Commercial	--	0.593	--	--	--	5.5	--	--	0.158	--	--	4.69	--	--
Industrial with Pharmaceuticals														
Area Z Indust w/Pharm	--	--	--	--	1.12	0.414	--	--	--	1.42	10	--	--	--
Area Q Industrial	--	--	0.0461	--	0.0743	0.101	--	--	0.417	0.147	--	1.95	--	--
Area Q Industrial 2	--	--	--	--	--	--	--	--	--	--	--	1.1	--	--
Area X Indust w/Pharm	--	0.102	--	--	0.0758	--	--	--	--	--	--	--	--	--
Hospitals and Retirement Communities														
Area Z Hospital	--	2.34	--	--	0.38	1.26	--	0.394	--	--	--	--	--	--
Area Z Retirement	--	2.18	--	--	1.1	0.807	--	--	0.767	0.8	--	1.83	--	--
Area Q Hospital	--	--	--	--	0.188	--	--	--	0.142	0.136	--	--	--	--
Area Q Retirement**	--	--	--	--	--	--	--	0.488	--	--	--	--	--	--
Area X Hospital	--	0.263	--	--	1.27	0.844	--	--	--	--	--	20.3	--	--
Area X Retirement	--	0.361	--	--	--	1.24	--	--	0.219	0.703	--	13.7	--	--
Landfill Leachate														
Area Z Landfill Leachate	--	--	--	--	--	0.302	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	0.273	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--	--	--	1.91	--	--	--
Wastewater Treatment														
Area Z STP Inflow	--	0.453	--	--	0.853	0.41	--	--	0.387	0.801	--	1.39	--	--
Area Z STP Outfall	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Area Q STP Inflow	--	0.166	--	--	0.14	0.435	--	--	0.218	0.207	--	--	--	--
Area Q STP Outfall	--	0.45	--	--	0.168	0.18	--	0.489	0.3	0.235	0.244	3.33	--	0.303
Area X STP Inflow	--	--	--	--	0.496	0.566	--	--	--	--	--	--	--	--
Area X STP Outfall	--	0.326	--	0.326	0.17	0.0769	--	0.252	0.22	0.132	0.209	1.66	--	0.236

After treatment
Matrix interference
-- Result below reporting level

Table 1 - Pharmaceuticals

(µg/L)

	antibiotic		antimicrobial				opioid					
	sulfamethoxazole	trimethoprim	triclosan	chloroxylenol	fluconazole	griseofulvin	norpropoxyphene	codeine	hydrocodone	methadone	dihydrocodeine	meperidine (Pethidine)
Residential & University												
Area Z Residential	0.0294	0.0783	8	--	--	--	--	--	--	--	--	--
Area Q Residential	0.0298	--	4.8	1.63	--	0.408	--	0.425	--	--	--	--
Area X Residential	--	--	3.2	0.246	--	--	--	--	--	--	--	--
Area X University	--	--	1.6	1.64	--	0.204	--	--	--	--	--	--
Commercial												
Area Z Commercial	--	--	7.5	3.07	--	--	--	--	--	--	--	--
Area Q Commercial	0.0241	0.0542	3.2	2.9	--	--	--	0.264	--	--	--	--
Area X Commercial	--	--	3.3	3.06	--	--	--	--	0.362	--	--	--
Industrial with Pharmaceuticals												
Area Z Indust w/Pharm	0.16	0.0809	3.3	1.27	--	--	--	--	--	--	--	--
Area Q Industrial	--	--	1	0.86	--	--	--	0.141	--	--	--	38.4
Area Q Industrial 2	--	--	--	2.68	--	--	--	--	--	--	--	--
Area X Indust w/Pharm	--	--	2.7	0.2	--	0.122	--	--	--	--	--	--
Hospitals and Retirement Communities												
Area Z Hospital	0.0883	0.2153	3.5	9.74	--	--	--	--	--	--	--	--
Area Z Retirement	0.0546	0.1063	7.5	1.55	--	--	--	0.652	--	--	--	--
Area Q Hospital	--	--	67	19.9	--	--	--	0.0705	0.202	--	--	--
Area Q Retirement**	--	--	2.5	0.162	--	--	--	--	--	--	--	--
Area X Hospital	0.0681	--	2.7	0.762	--	--	--	--	--	--	--	--
Area X Retirement	0.0523	--	3.1	1.04	--	--	--	--	--	--	--	--
Landfill Leachate												
Area Z Landfill Leachate	0.0118	--	--	--	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	0.034	--	--	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--	--	--	--	--
Wastewater Treatment												
Area Z STP Inflow	0.0282	0.0698	3.8	0.792	--	--	--	0.378	--	--	--	--
Area Z STP Outfall	0.0122	0.083	--	--	--	--	--	--		--	--	--
Area Q STP Inflow	0.0429	--	2.1	1.16	--	--	--	0.294	--	--	--	--
Area Q STP Outfall	0.0112	0.0372	0.5	0.421	0.617	0.136	--	0.268	0.0635	--	--	--
Area X STP Inflow	--	--	2.2	1.69	--	--	--	--	--	--	--	--
Area X STP Outfall	--	--	0.6	0.953	0.766	0.055	--	0.208	0.0466	0.0623	0.0415	--

After treatment
Matrix interference
-- Result below reporting level

Table 1 - Pharmaceuticals

(µg/L)

	barbituate			muscle relaxant			anti-anxiety	anesthetic	anti-coagulant
	butalbital	phenobarbital	pentobarbital	metaxalone	carisoprodol	methocarbamol	meprobamate	propofol	ticlopidine
Residential & University									
Area Z Residential	--	--	--	--	--	--	--	--	--
Area Q Residential	--	0.123	--	0.425	--	--	--	--	--
Area X Residential	--	--	--	--	--	--	--	--	--
Area X University	--	--	--	--	--	--	--	--	--
Commercial									
Area Z Commercial	--	--	--	--	--	--	--	--	--
Area Q Commercial	--	--	--	--	--	--	--	0.0682	--
Area X Commercial	--	--	--	0.275	--	--	--	0.463	--
Industrial with Pharmaceuticals									
Area Z Indust w/Pharm	--	--	--	--	--	--	--	0.368	--
Area Q Industrial	0.0639	3.6	--	0.29	--	--	--	0.0621	--
Area Q Industrial 2	--	--	--	--	--	--	--	--	--
Area X Indust w/Pharm	--	0.204	--	0.132	--	--	--	--	--
Hospitals and Retirement Communities									
Area Z Hospital	--	--	--	0.188	--	--	--	0.975	--
Area Z Retirement	--	0.63	--	--	--	13.2	--	0.188	--
Area Q Hospital	--	--	--	--	--	--	--	1.78	--
Area Q Retirement**	--	--	--	--	--	--	--	--	--
Area X Hospital	--	--	--	--	--	--	--	0.0786	--
Area X Retirement	--	--	--	0.48	--	--	--	0.165	--
Landfill Leachate									
Area Z Landfill Leachate	--	--	--	--	--	--	--	0.627	--
Area Q Landfill Leachate	--	0.859	--	--	--	--	--	1.29	--
Area X Landfill Leachate	--	--	--	--	30.6	--	--	--	0.424
Wastewater Treatment									
Area Z STP Inflow	--	0.314	--	--	--	--	--	0.0992	--
Area Z STP Outfall	--	--	--	--	--		--	--	--
Area Q STP Inflow	--	0.199	--	0.281	--	0.74	--	--	--
Area Q STP Outfall	0.138	0.269	--	0.29	--	1.16	--	0.081	--
Area X STP Inflow	--	--	--	0.827	--	--	--	0.0922	--
Area X STP Outfall	0.077	0.187	--	1.04	0.367	0.72	0.798	0.0803	0.08

After treatment
Matrix interference
-- Result below reporting level

Table 1 - Pharmaceuticals

(µg/L)

	oxycodone	CHIRALD	BP med			anti-coagulant	vasodialator & anti-inflammatory	broncho-dilator	antihistimine		HIV Drug
			diltiazem	dehydroifedipine	verapamil	warfarin	pentoxifylline	albuterol	diphenhydramine	chlorpheniramine	efavirenz
Residential & University											
Area Z Residential	--	--	--	--	--	--	--	--	5.92	--	--
Area Q Residential	0.491	--	0.475	--	**0.311**	--	--	--	--	--	--
Area X Residential	0.467	--	0.591	--	--	--	--	--	1.6	--	--
Area X University	--	--	--	--	--	--	--	--	--	--	0.0665
Commercial											
Area Z Commercial	--	--	--	--	--	--	--	--	2.06	--	0.585
Area Q Commercial	--	--	--	--	--	--	--	--	--	--	0.305
Area X Commercial	0.444	0.0189	0.389	--	**0.0849**	--	0.172	--	--	--	--
Industrial with Pharmaceuticals											
Area Z Indust w/Pharm	--	--	1.21	--	--	--	--	--	1.51	--	--
Area Q Industrial	0.199	--	3.55	--	**0.182**	--	0.206	--	9.36	--	--
Area Q Industrial 2	0.198	--	0.108	--	--	--	--	--	--	--	--
Area X Indust w/Pharm	--	--	0.258	--	**0.134**	--	--	--	--	--	0.117
Hospitals and Retirement Communities											
Area Z Hospital	--	--	3.98	--	--	--	--	--	1.2	--	--
Area Z Retirement	--	--	2.42	--	**0.858**	--	--	--	2.75	--	--
Area Q Hospital	0.466	--	0.306	--	--	--	--	--	--	--	0.32
Area Q Retirement**	0.434	--	0.397	--	**0.58**	--	--	--	0.849	--	--
Area X Hospital	0.383	--	--	--	--	--	--	--	--	--	--
Area X Retirement	0.331	--	0.979	--	**0.299**	--	--	--	--	--	--
Landfill Leachate											
Area Z Landfill Leachate	--	--	--	--	--	0.08	--	0.08	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	--	--	--	--
Area X Landfill Leachate	6.47	--	--	--	--	--	--	--	--	--	--
Wastewater Treatment											
Area Z STP Inflow	0.593	--	0.951	--	**0.316**	--	--	--	1.58	--	--
Area Z STP Outfall	--	--		--	--	--		--	--	--	--
Area Q STP Inflow	0.367	--	0.451	--	**0.256**	--	0.378	--	--	--	--
Area Q STP Outfall	0.548	--	0.408	--	**0.297**	--	--	--	0.782	--	0.131
Area X STP Inflow	0.406	0.761	--	--	--	--	--	--	--	--	--
Area X STP Outfall	0.281	--	0.298	--	**0.0587**	--	0.0884		0.732	--	0.101

After treatment

Matrix interference

-- Result below reporting level

Table 2 - Pesticides, Insecticides, Herbicides and Fungicides

(µg/L)

	isophorone	pentachlorophenol	diazinon	bromacil	prometon	metolachlor	chlorpyrifos	N,N-diethyl- meta-toluamide (deet)	carbaryl	metalaxyl	thiabendazole	piperonyl butoxide
Residential & University												
Area Z Residential	--	--		--				1.2				0.261
Area Q Residential	--	--	--	--	--	--	--	1.6	--	--	--	0.275
Area X Residential	--	--	--	--	--	--	--	21	--	--	--	0.0487
Area X University	--	--	--	--	--	--	--	0.2	--	--	--	0.755
Commercial												
Area Z Commercial	0.33	--	--	--	--	--	--	0.33	--	--	--	0.224
Area Q Commercial	--	--	--	--	--	--	--	0.57	--	--	--	1.75
Area X Commercial	--	--	--	--	--	--	--	2	--	--	--	0.0701
Industrial with Pharmaceuticals												
Area Z Indust w/Pharm	--	--	--	--	--	--	--	--	--	--	--	0.982
Area Q Industrial	--	--	--	--	--	--	--	0.13	--	--	--	
Area Q Industrial 2	--	--	--	--	--	--	--	0.038	--	--	--	--
Area X Indust w/Pharm	--	--	--	--	--	0.012	--	0.27	--	--	--	--
Hospitals and Retirement Communities												
Area Z Hospital	--	--	--	--	--	--	--	0.25	--	--	--	--
Area Z Retirement	--	--	--	--	--	--	--	0.82	--	--	--	
Area Q Hospital	--	--	--	--	--	--	--	0.06	--	--	--	--
Area Q Retirement**	--	--	--	--	--	--	--	0.87	--	--	--	--
Area X Hospital	--	--	--	--	--	--	--	2.7	--	--	--	0.0968
Area X Retirement	--	--	--	--	--	--	--	5.3	--	--	--	0.0869
Landfill Leachate												
Area Z Landfill Leachate	0.48	--	--	--	--	--	--	30	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	29	--	--	--	--
Area X Landfill Leachate	0.5	--	--	--	--	--	--	38	--	--	--	--
Wastewater Treatment												
Area Z STP Inflow	--	--	--	--	--	--	--	0.62	--	--	--	0.424
Area Z STP Outfall	--	--	--	--	--	--	--	0.038	--	--	--	
Area Q STP Inflow	--	--	--	--	--	--	--	1.3	--	--	--	0.299
Area Q STP Outfall	0.08	--	--	--	--	--	--	0.55	--	--	--	0.108
Area X STP Inflow	--	--	--	0.15	--	--	--	2.8	--	--	--	0.262
Area X STP Outfall	0.15	--	--	0.27	--	0.019	--	0.26	--	--	--	0.0342

After treatment

Matrix interference

-- Result below reporting level

Table 3
Sterols and Hormones
(µg/L)

	Sterols				
	3-beta-coprostanol	3-t-butyl-4-hydroxyanisole	b-sitosterol	cholestrol	b-stigmastanol
	Residential & University				
Area Z Residential	78	0.32	16	190	3
Area Q Residential	19	--	6.9	51	1.1
Area X Residential	16	--	6.7	40	1.1
Area X University	1.6	0.078	1.3	4	0.2
	Commercial				
Area Z Commercial	50	--	16	120	2.7
Area Q Commercial	80	0.12	14	84	3
Area X Commercial	6	0.17	2.4	14	0.56
	Industrial with Pharmaceuticals				
Area Z Indust w/Pharm	37	--	11	66	1.8
Area Q Industrial	4.9	--	3.3	8.3	0.72
Area Q Industrial 2	1.8	0.061	1.5	3.6	--
Area X Indust w/Pharm	5.3	--	2.3	8.3	0.3
	Hospitals and Retirement Communities				
Area Z Hospital	18	0.21	10	62	1.4
Area Z Retirement	68	0.32	11	100	1.5
Area Q Hospital	6	0.15	3	15	0.58
Area Q Retirement**	35	--	7.4	56	1.2
Area X Hospital	18	--	6.6	63	1.5
Area X Retirement	13	--	3.1	29	0.81
	Landfill Leachate				
Area Z Landfill Leachate	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--
Area X Landfill Leachate	0.99	--	1.6	1.2	1.1
	Wastewater Treatment				
Area Z STP Inflow	32	0.31	5.8	51	0.79
Area Z STP Outfall	--	--	--	1	--
Area Q STP Inflow	14	--	4.7	27	0.8
Area Q STP Outfall	0.32	--	--	0.45	--
Area X STP Inflow	9.5	0.21	5.4	17	1.1
Area X STP Outfall	--	0.062	--	1	--

After treatment

Matrix interference

-- Result below reporting level

Table 3
Sterols and Hormones
(µg/L)

	Hormones								
	11-Ketotestosterone (ng/L)	17-alpha-Estradiol (ng/L)	17-alpha-Ethynylestradiol (ng/L)	17-beta-Estradiol (ng/L)	4-Androstene-3,17-dione (ng/L)	cis-Androsterone (ng/L)	Dihydrotestosterone (ng/L)	Epitestosterone (ng/L)	Equilenin (ng/L)
Residential & University									
Area Z Residential	7.1	<0.80	<0.80	48.1	3,860	11,300	210	<4.0	19.8
Area Q Residential	6.7	<0.80	<0.80	17.3	90.2	3,700	168	41.2	<2.0
Area X Residential	52.5	<0.80	<0.80	9.34	607	1,950	84.9	22.8	44.6
Area X University	<2.0	<0.80	1.26	4.34	5.44	1.36	<4.0	<4.0	<2.0
Commercial									
Area Z Commercial	<2.0	1.42	<0.80	<0.80	10.5	<0.80	<4.0	2.6	<2.0
Area Q Commercial	4.3	<0.80	<0.80	10.9	88.7	5,020	97.2	40.1	<2.0
Area X Commercial	36.5	<0.80	<0.80	10.6	206	3,800	95	<4.0	20.6
Industrial with Pharmaceuticals									
Area Z Indust w/Pharm	16.4	<0.80	<0.80	12.8	796	4,950	95.5	<12.5	14.2
Area Q Industrial	6.2	<0.80	<0.80	9.09	210	2,500	27.2	17.1	<2.0
Area Q Industrial 2	<2.0	<0.80	<0.80	2.22	27.4	1,740	33.2	<4.0	<2.0
Area X Indust w/Pharm	25.5	<0.80	<0.80	5.36	836	2,130	59.6	<26.7	4.7
Hospitals and Retirement Communities									
Area Z Hospital	<2.0	<0.80	<0.80	15.7	62.4	7,730	<37.8	<4.0	<5.9
Area Z Retirement	10.8	<0.80	<0.80	16.1	1,870	7,160	77.9	<8.0	<7.2
Area Q Hospital	3.9	<0.80	1.8	28.1	177	5,250	24.7	23.3	2.8
Area Q Retirement**	5.5	<0.80	<0.80	7.82	10.8	2,120	47	12.3	<2.0
Area X Hospital	38.1	<0.80	<0.80	9.81	3,390	3,490	102	19.1	14.2
Area X Retirement	77.6	<0.80	<0.80	10.7	<16.7	596	<68.8	<4.0	<4.9
Landfill Leachate									
Area Z Landfill Leachate	--	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--	--
Wastewater Treatment									
Area Z STP Inflow	<2.0	<0.80	0.79	<0.80	<7.37	<0.80	<4.0	4.2	<2.0
Area Z STP Outfall	--	--	--	--	--	--	--	--	--
Area Q STP Inflow	--	--	--	--	--	--	--	--	--
Area Q STP Outfall	6.8	<0.80	1.46	8.34	52.545	1670	43.15	13.75	<2.0
Area X STP Inflow	64.3	<0.80	<0.80	7.35	222	1,710	61.6	<12.2	14.6
Area X STP Outfall	--	--	--	--	--	--	--	--	--

Table 3
Sterols and Hormones
(µg/L)

	Hormones (continued)							
	Equilin (ng/)	Estriol (ng/L)	Estrone (ng/L)	Mestranol (ng/L)	Norethindrone (ng/L)	Progesterone (ng/L)	Testosterone (ng/L)	trans-Diethylstilbestrol (ng/L)
	Residential & University							
Area Z Residential	<2,310	337	129	<0.80	<0.80	<8.0	154	<0.80
Area Q Residential	<620	192	43.4	<0.80	<0.80	8.9	55.5	<0.80
Area X Residential	<2,650	81.6	57.4	<0.80	<0.80	16.1	95.8	<0.80
Area X University	<4.0	<2.0	23.5	<0.80	<0.80	<8.0	<0.80	<0.80
	Commercial							
Area Z Commercial	<4.0	79.8	103	<0.80	<0.80	<8.0	<0.80	<0.80
Area Q Commercial	92.3	192	35.1	<0.80	<0.80	12	116	<0.80
Area X Commercial	<728	114	47.4	<0.80	<0.80	13.9	27.2	<0.80
	Industrial with Pharmaceuticals							
Area Z Indust w/Pharm	<4,390	169	97.3	<0.80	<0.80	<8.0	75	<0.80
Area Q Industrial	<154	29.7	25.4	<0.80	<0.80	7.2	45.2	<0.80
Area Q Industrial 2	<4.0	6.4	4.62	<0.80	<0.80	<8.0	11.3	<0.80
Area X Indust w/Pharm	<641	45.2	24.6	<0.80	<0.80	<8.0	72.7	<0.80
	Hospitals and Retirement Communities							
Area Z Hospital	<61.3	118	31.5	<0.80	<0.80	<8.0	14.2	<0.80
Area Z Retirement	<792	62.4	64.9	<0.80	<0.80	<8.0	140	<0.80
Area Q Hospital	<889	528	137	<0.80	2.06	27.3	27.1	<0.80
Area Q Retirement**	<4.0	34.7	23.3	<0.80	<0.80	6.6	18.3	<0.80
Area X Hospital	<728	155	74	<0.80	0.41	28	215	<0.80
Area X Retirement	<4.0	169	<40.7	<0.80	<0.80	11.3	48.7	<0.80
	Landfill Leachate							
Area Z Landfill Leachate	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	--	--	--	--	--	--
Area X Landfill Leachate	--	--	--	--	--	--	--	--
	Wastewater Treatment							
Area Z STP Inflow	<11.8	103	435	<0.80	<0.80	<8.0	<0.80	<0.80
Area Z STP Outfall	--	--	--	--	--	--	--	--
Area Q STP Inflow	--	--	--	--	--	--	--	--
Area Q STP Outfall	<4.0	<2.0	27.2	<0.80	<0.80	<8.0	37.1	<0.80
Area X STP Inflow	<926	144	31.4	<0.80	<0.80	10.2	47.2	<0.80
Area X STP Outfall	--	--	--	--	--	--	--	--

Table 4 - Flavors and Fragrances

(µg/L)

	3-methyl-1h-indole (Skatole)	5-methyl-1h-benzotriazole (BHA)	acetophenone	AHTN -(Tonalide) Acetyl hexamethyl tetrahydronapthalene	camphor	d-limonene	HHCB (Galaxolide) Hexahdrohexamethylcyclopentabenzopyran	indole	isoborneol	isoquinoline	menthol	methyl salicylate	triethyl citrate
Residential & University													
Area Z Residential	1.6	--	0.4	1.7	5.4	12	10	18	5.9	--	23	5	1.3
Area Q Residential	1.7	--	0.36	0.58	2.6	2.3	5.1	--	1.4	--	30	0.56	0.82
Area X Residential	0.85	--	0.29	0.41	2.4	1.4	4.6	6.4	1.1	--	29	20	1.7
Area X University	0.49	14	0.28	0.055	0.36	0.76	0.74	0.063	0.14	--	6.9	0.097	0.24
Commercial													
Area Z Commercial	1.2	9.5	0.55	0.48	1.4	4.1	4.4	--	0.64	--	20	1.2	0.61
Area Q Commercial	3.8	--	--	0.76	2.5	17	8.1	--	1.3	--	16	2.3	1
Area X Commercial	6	--	0.39	0.29	1.4	1.9	3.9	20	0.85	--	53	0.6	1.5
Industrial with Pharmaceuticals													
Area Z Indust w/Pharm	2	--	0.55	0.91	0.94	14	8.8	0.36	--	--	1700	1100	0.93
Area Q Industrial	0.34	--	0.3	0.052	0.66	11	0.59	0.24	0.61	--	5.5	--	0.67
Area Q Industrial 2	1.3	--	0.28	--	0.57	4.7	0.16	--	0.77	--	--	8.1	2.7
Area X Indust w/Pharm	0.84	13	0.21	0.1	1.4	0.62	3.6	--	--	--	130	0.73	0.73
Hospitals and Retirement Communities													
Area Z Hospital	4.6	120	--	0.21	3.4	1.6	3.5	14	0.54	--	15	1.1	0.83
Area Z Retirement	2.8	--	0.42	0.76	1.7	2	5.5	12	0.91	--	26	3.1	1.5
Area Q Hospital	0.73	--	0.24	0.62	1	3.2	2.2	0.23	0.19	--	15	1.3	0.44
Area Q Retirement**	1	--	0.46	0.18	1	3.5	3.5	--	--	--	17	0.6	1.4
Area X Hospital	1.8	--	0.44	0.33	1.8	1.2	3.6	--	0.83	--	38	1.6	1.6
Area X Retirement	3.5	--	0.42	0.35	2.4	2.4	3.7	2.3	0.89	--	42	0.87	1.9
Landfill Leachate													
Area Z Landfill Leachate	0.16	--	1.4	--	--	--	--	--	--	--	--	--	--
Area Q Landfill Leachate	--	--	0.89	--	--	1.1	0.11	--	--	--	2.2	--	1.4
Area X Landfill Leachate	2.6	--	9	0.13	62	13	0.59	--	--	--	20	--	--
Wastewater Treatment													
Area Z STP Inflow	3.1	--	0.31	0.52	--	1.6	6.4	14	0.68	--	17	0.56	1.1
Area Z STP Outfall	--	--	--	--	--	--	0.034	--	--	--	--	--	--
Area Q STP Inflow	3.4	0.6	0.44	0.28	1.3	59	2.3	2.9	0.55	--	19	0.22	0.76
Area Q STP Outfall	0.021	1.7	--	0.24	--	--	2.2	--	--	--	--	--	0.6
Area X STP Inflow	2.5	--	1.7	0.35	7.2	17	5	4.5	6.6	--	160	2.3	2.5
Area X STP Outfall	--	0.9	0.24	0.18	0.047	--	3.9	--	--	--	--	--	1.5

After treatment

Matrix interference

-- Result below reporting level

Table 5 - Alkylphenol Ethoxylates (APE)

(µg/L)

	4-n-octylphenol	4-tert-octylphenol	4-t-octylphenolmonoethoxylate	4-t-octylphenol diethoxylate (OP2EO)	4-nonylphenol (total, branched)	4-nonylphenol diethoxylate (sum of all NP2EO)	4-cumylphenol	bisphenol A (phenol)	benzophenone	triphenol phosphate (OE)	tributyl phosphate (OE)	tri(2-butoxyethyl) phosphate TBEB (OE)	fyrol fr 2 (Tris(dichloroisopropyl)phosphate) (OE)	fyrol cef (Tris(2-butoxyethyl)phosphate) (OE)
Residential & University														
Area Z Residential	--	--	--	--	--	5.3		--	1.4	0.26	--	2.6	0.49	0.28
Area Q Residential		0.3	--	--	4.8	3.9	--	0.21	1.3	0.22	0.071	2.5	0.46	0.27
Area X Residential	--	--	0.94	--	--	1.8	--	--	2.4	0.24	--	1.3	0.54	0.23
Area X University	0.16	0.12	0.39	0.31	2.4	2.3	--	--	0.23	0.11	0.071	8.8	0.27	0.13
Commercial														
Area Q Commercial	--	--	1.5	--	--	6.1	--	--	1.2	0.18	12	1.8	0.11	0.15
Area X Commercial	0.16	0.3	0.9	--	6.2	4.1	--	--	1.1	0.2	0.19	1.5	0.34	0.2
Industrial with Pharmaceuticals														
Area Q Industrial	--	0.074	--	0.41	2.1	2.5		0.16	0.47	0.055	0.12	11	0.053	0.12
Area Q Industrial 2	--	0.72	--	0.92	4.7	3.3	--	0	0.18	0.15	--	3.4	0.21	0.28
Area X Indust w/Pharm	--	0.16	--	0.4	2.2	0.8	--	--	0.4	0.1	0.065	3.2	0.26	0.14
Hospitals and Retirement Communities														
Area Q Hospital	--	0.064	--	--	--	5.1	--	0.15	0.42	0.092	0.032	48	0.086	0.11
Area Q Retirement**	--	0.22	0.62	0.48	--	2.9	--	0.36	0.84	0.19	0.074	0.55	0.37	0.27
Area X Hospital	--	0.59	--	--	5.5	3.1	--	--	1.4	0.22	0.23	8	0.5	0.26
Area X Retirement	--	0.97	1	--	32	9.7	--	--	1.4	0.24	0.2	6.2	0.41	0.22
Landfill Leachate														
Area Z Landfill Leachate	--	0.78	--	--	--	--	--	24	1.2	--	1.3	2.7	0.097	--
Area Q Landfill Leachate	--	1.2	--	--	--	--	--	160	0.79	--	--	3.8	--	--
Area X Landfill Leachate	--	0.8	--	--	12	--	2.4	470	3.3	--	0.71	2	0.13	0.34
Wastewater Treatment														
Area Q STP Inflow	--	0.46	1.4	--	5.7	6.6	--	0.31	0.82	0.14	0.15	14	0.31	0.2
Area Q STP Outfall	--	0.19	0.52	1	2	4.9	--	0.44	0.21	0.14	0.2	8	0.42	0.29
Area X STP Inflow	--	0.8	2	0.93	10	6.7	--	--	2.6	0.22	0.37	54	0.46	0.3
Area X STP Outfall	--	0.48	--	1.2	3.7	4.9	--	--	0.18	0.22	0.33	1.5	0.68	0.24

After treatment

Matrix interference

-- Result below reporting level

Table 6 - Polyaromatic Hydrocarbons (PAHs)

(µg/L)

	anthracene	benzo(a)pyrene	tribromomethane (Bromoform)	fluoranthene	naphthalene	phenanthrene	phenol	pyrene	tetrachloroethene	1,4 dichlorobenzene	1-methylnaphthalene	2,6-Dimethylnaphthalene	2-methylnaphthalene	carbazole	isopropylbenzene (Cumene)	p-cresol	9,10-anthraquinone
Residential & University																	
Area Z Residential	--	--	0.29	--	--	0.066	19	--	--	0.24	--	--	--	--	--	82	--
Area X Residential	--	--	--	--	0.074	--	8	--	--	--	--	--	--	--	--	3.1	--
Area X University	--	--	0.18	--	0.021	0.012	3.3	--	0.074	--	0.0075	0.021	0.0077	--	--	2.8	--
Commercial																	
Area Q Commercial	--	--	0.73	0.013	0.31	0.17	10	0.037	0.17	0.45	0.41	0.58	0.58	--	0.038	13	--
Area X Commercial	--	--	--	--	0.048	--	26	--	0.0019	0.14	--	--	0.02	--	0.026	62	--
Industrial with Pharmaceuticals																	
Area Q Industrial 2	--	--	0.22	--	0.45	--	11	--	0.052	0.47	--	--	--	--	--	95	--
Area X Indust w/Pharm	--	--	0.1	--	0.022	0.0073	2.3	--	--	0.058	--	--	--	--	--	9.1	--
Hospitals and Retirement Communities																	
Area X Hospital	--	--	0.016	--	0.066	0.024	9.2	--	0.037	0.19	0.019	--	0.036	--	0.012	25	--
Area X Retirement	--	--	0.0043	--	--	--	7.3	--	0.0086	0.28	--	--	--	--	--	12	--
Landfill Leachate																	
Area Z Landfill Leachate	--	--	--	--	--	--	1.1	--	--	0.92	--	--	--	--	0.23	--	0.37
Area Q Landfill Leachate	0.51	--	--	0.077	0.17	--	2.7	--	--	1.7	0.37	0.37	0.25	--	0.2	0.65	0.47
Area X Landfill Leachate	0.63	0.041	--	0.27	4.1	1.4	140	0.24	0.023	2.2	1.5	--	2.4	--	0.49	39	0.89
Wastewater Treatment																	
Area Q STP Inflow	--	--	0.045	0.023	0.18	0.054	8.3	--	0.039	0.66	0.048	0.03	0.067	--	0.019	10	0.68
Area Q STP Outfall	--	--	0.074	0.01	--	--	1.9	0.011	0.025	0.41	--	--	--	--	--	0.35	0.13
Area X STP Inflow	--	--	0.023	--	0.82	0.041	26	0.019	0.078	0.78	0.075	--	0.097	--	0.11	41	2.4
Area X STP Outfall	--	--	0.012	--	0.014	--	1.5	--	0.033	0.89	--	--	--	--	0.012	0.22	0.28

After treatment

Matrix interference

-- Result below reporting level

Appendix D
Sludge

Analyte in Sediment (Sludge) APE - Phenols and Phosphates (µg/Kg)	Area Z Sludge (Wet Weight)	Area Z Filter (Dried Weight)	Area Q Sludge (Wet Weight)	Area Q (Dried Weight)	Area X Sludge (Wet Weight)	Area X (Dried Weight)
4-n-octylphenol	--	--	--	--	--	--
4-tert-octylphenol	3,903.00	8,055.00	75.40	1,264.00	321.80	2,315.00
4-t-octylphenolmonoethoxylate (OP1EO)	--	2,087.00	184.30	2,319.00	324.20	4,900.00
4-t-octylphenol diethoxylate (OP2EO)	387.00	2,624.00	141.10	1,608.00	233.10	--
4-nonylphenol (all isomers)	100,000.00	327,300.00	1,847.00	29,270.00	8,790.00	72,730.00
4-nonylphenol diethoxylate (sum of all NP2EO)	7,200.00	34,140.00	3,011.00	43,380.00	8,785.00	158,700.00
4-cumylphenol	--	--	--	1,090.00	--	--
bisphenol A (phenol)	334.40	14,000.00	5,354.00	70,400.00	405.90	--
benzophenone	260.20	1,486.00	54.38	909.40	511.00	9,846.00
triphenol phosphate	61.62	252.20	--	241.40	88.86	--
tributyl phosphate	--	--	--	--	--	--
tri(2-butoxyethyl) phosphate TBEB	2,020.00	--	--	--	--	--
fyrol fr 2 (Tris(dichloroisopropyl)phosphate)	255.20	--	--	--	--	--
fyrol cef (Tris(2-butoxyethyl)phosphate)	--	--	--	--	--	--
Bis(2ethylhexyl) phthalate	3,715.00	*17,410.00*	1,229.00	9,856.00	1,812.00	25,150.00
Diethyl phthalate	--	--	--	--	--	--
4-nonylphenol diethoxylate (sediment)	4,939.00	*25,580.00*	--	27,210.00	--	59,700.00
Totals:	123,075.42	432,934.20	11,896.18	187,547.80	21,271.86	333,341.00
PAHs (µg/Kg)	**Area Z Sludge (Wet Weight)**	**Area Z Filter (Dried Weight)**	**Area Q Sludge (Wet Weight)**	**Area Q (Dried Weight)**	**Area X Sludge (Wet Weight)**	**Area X (Dried Weight)**
anthracene	73.46	212	6.414	104.4	--	--
benzo(a)pyrene	185.9	609.9	14.01	136	--	146.2
fluoranthene	548.1	2893	52.89	990.8	49.61	752.5
naphthalene	--	--	--	--	--	--
phenanthrene	285.8	1484	30.1	735.5	75.62	392.1
phenol	--	3219	--	--	--	6641
pyrene	562.8	3576	47.29	879	--	968
1,4 dichlorobenzene	222.3	121.4	16.27	376.7	159.4	220.3
1-methylnapthalene	35.36	209.7	--	--	--	--
2,6-Dimethylnaphthalene	65.21	469.8	17.8	224.5	--	96.66
2-methylnaphthalene	--	185.5	--	--	--	--
carbazole	--	--	--	--	--	--
isopropylbenzene (Cumene)	--	--	--	--	--	--
p-cresol	--	4020	19020	224600	29490	20240
9,10-anthraquinone	--	--	--	--	2339	41670

Insecticide/pesticide (µg/Kg)	Area Z Sludge (Wet Weight)	Area Z Filter (Dried Weight)	Area Q Sludge (Wet Weight)	Area Q (Dried Weight)	Area X Sludge (Wet Weight)	Area X (Dried Weight)
isophorone	--	--	--	--	--	--
diazinon	--	--	--	--	--	--
bromacil	--	--	--	--	--	--
prometon	--	--	--	--	--	--
metolachlor N.N-diethyl-meta-toluamide	--	--	--	--	--	--
chlorpyrifos	--	--	--	--	--	--
N,N-diethyl- meta-toluamide (deet)	--	--	--	--	--	--
atrazine	--	--	--	--	--	--
thiabendazole	29.39	38.3	**31.65**	--	--	--
Flavors/Fragrances (µg/Kg)	**Area Z Sludge (Wet Weight)**	**Area Z Filter (Dried Weight)**	**Area Q Sludge (Wet Weight)**	**Area Q (Dried Weight)**	**Area X Sludge (Wet Weight)**	**Area X (Dried Weight)**
3-methyl-1h-indole (Skatole)	49.2	1085	8477	106600	4983	9552
acetophenone	--	786.5	102.8	550.4	433	2121
AHTN - Acetyl hexamethyl tetrahydronapthalene	1386	4352	121.5	1620	324.8	4577
camphor	41.04	--	--	120.7	71.94	--
d-limonene	3277	465.4	446.5	9038	3545	4019
HHCB (musk) Hexahdrohexamethylcyclopentabenzopyran (enzopyran)	23510	58300	1177	16650	10390	169400
indole	1029	13930	193.3	3358	446.2	5583
isoborneol	--	--	--	--	--	--
isoquinoline	--	--	--	--	--	--
menthol	473.5	--	--	--	473.9	1589