

King County Surface Waters Contaminants of Emerging Concern Survey

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What are CECs and how are they different than EDCs?

- Endocrine Disrupting Chemicals, aka “EDCs”
 - Theo Colburn, 1996 publication of “Our Stolen Future”
 - Intersex fish issue
- Contaminants of Emerging Concern aka “CECs”
 - Pharmaceuticals and Personal Care products (PPCPs)
 - DEET
 - Many EDCs are CECs, but not all CECs are EDCs
 - Concerns vary depending on the compound:
 - Antibiotics and antibiotic resistance
 - Diclofenac (anti-inflammatory drug) and liver injuries to endangered Indian vultures
 - Impacts to aquatic life – altered reproductive timing

CECs as Pollutants

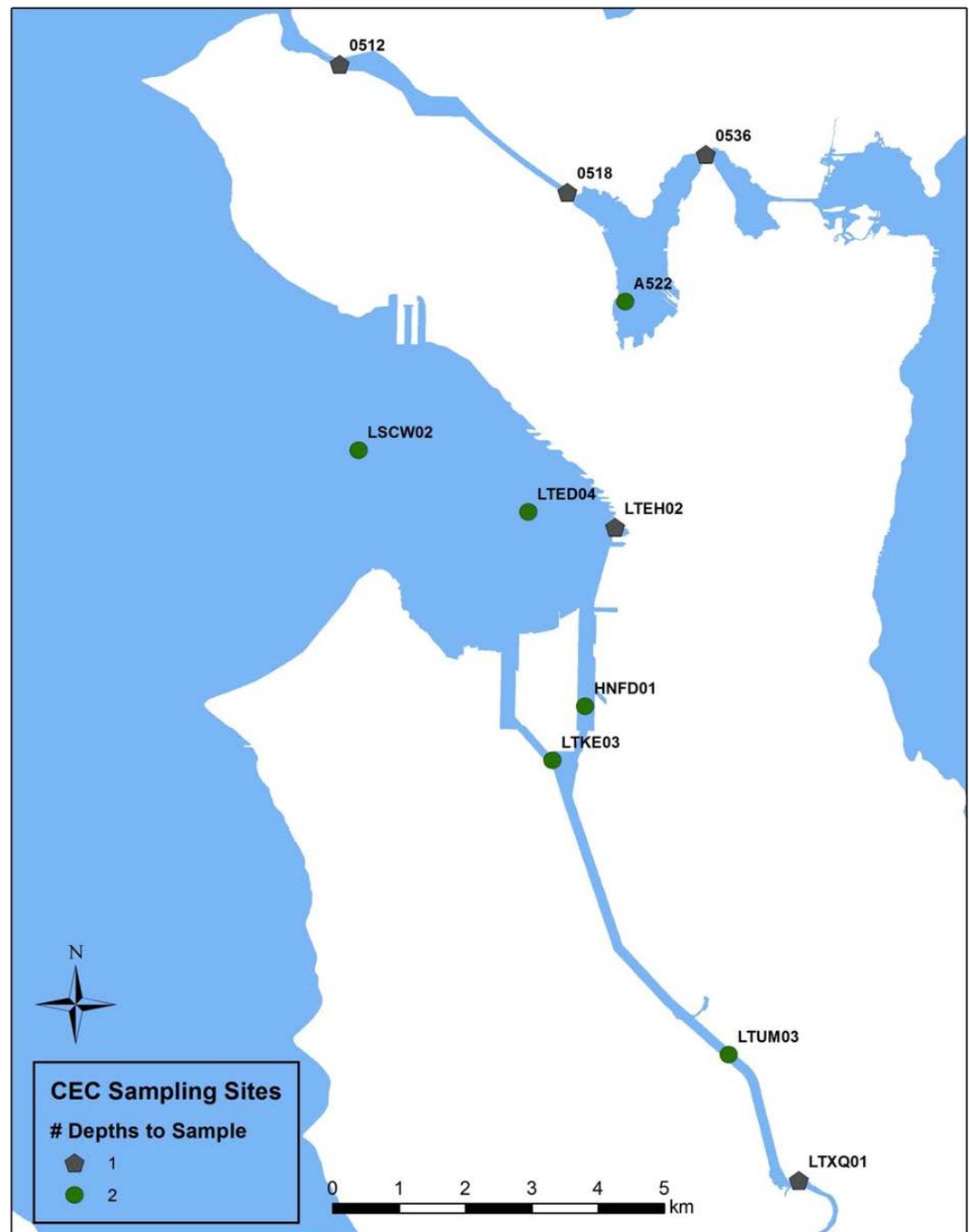
- CECs as a group have more diverse mechanisms and modes of action than EDCs/hormones
- Chemical properties highly variable –
 - Range from highly degradable to persistent in the environment
 - Analyte list only limited by analytical technology
- Stormwater, wastewater, agriculture, CSO and septic sources:
 - Human, veterinary, poultry, livestock, and industrial
 - Both legal and illicit drugs and their metabolites
 - Some herbicides and pesticides
- No regulatory standards for CECs

CEC Survey Purpose and Design

- Increasing regional attention on CECs from the public and federal/regional agencies
- Baseline study recommended by Scientific and Technical review team
- Develop information on CECs in King County ambient waters:
 - 3 dry-weather sampling events
 - Baseline to aid in developing wastewater tracer(s) recommendation in the future

Sampling Locations

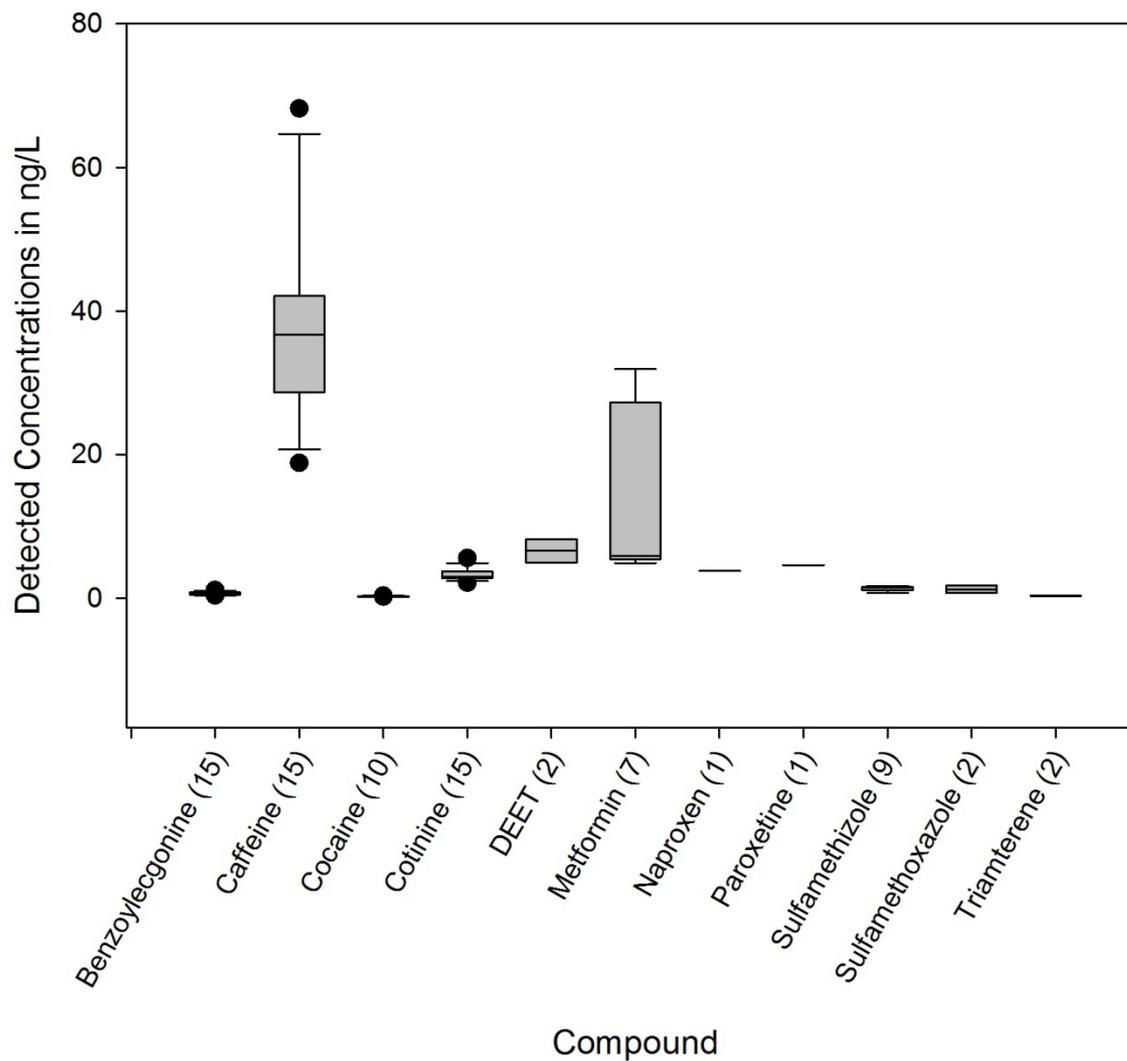
- 4 Lake Union Ship Canal
- 4 Duwamish
- 3 Elliott Bay
 - Some with multiple depths
 - 1m and near bottom



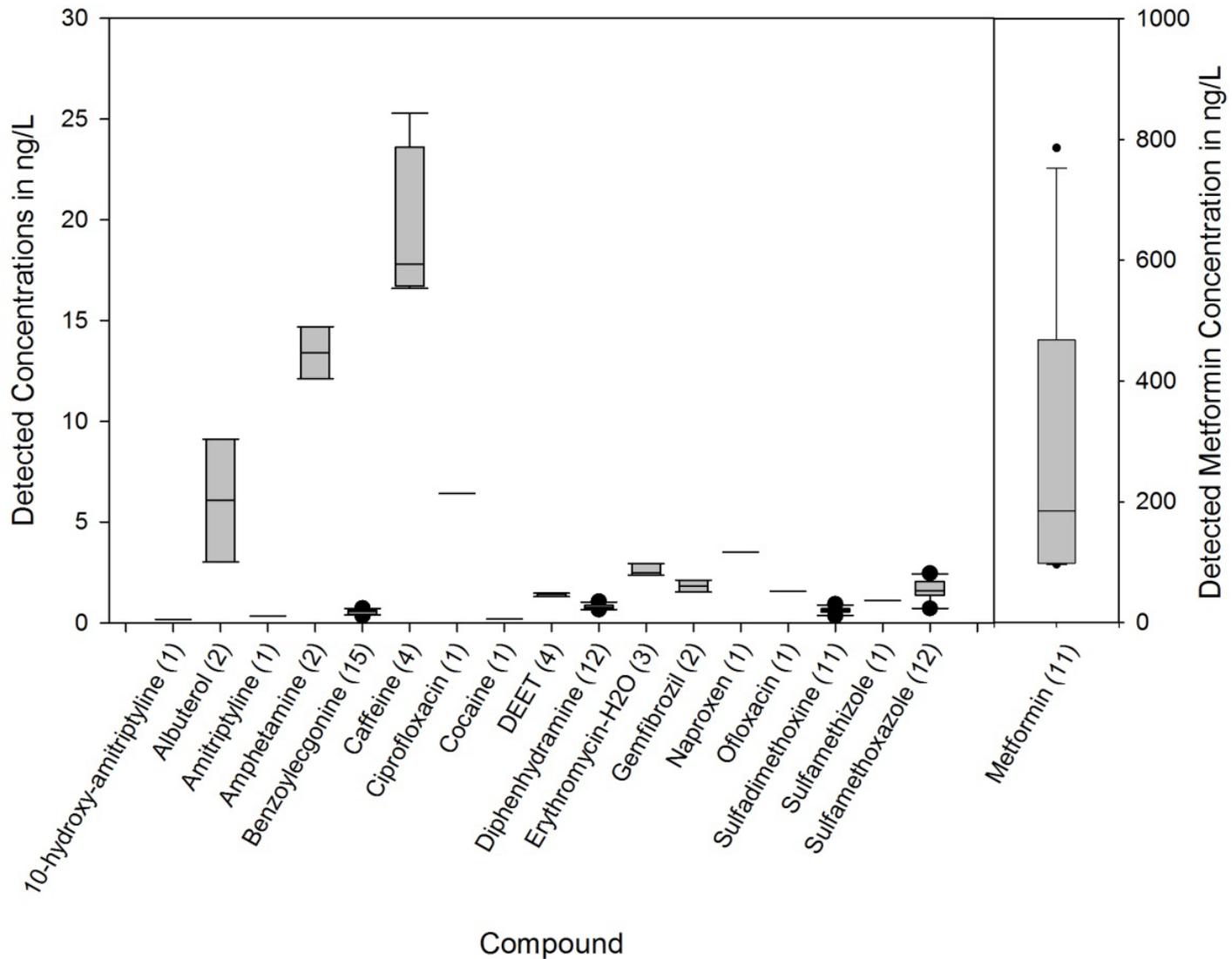
Sampling/Analytical Methods

- Sampled by KCEL-FSU via R/V Liberty
- Analyzed by contract laboratory for:
 - 100 pharmaceuticals
 - 12 pharmaceutical metabolites
 - 20 pyrethroid insecticides
 - DEET
 - Cocaine and nicotine (and metabolites)
 - 139 different CECs total
- Method performance reviewed along with blanks

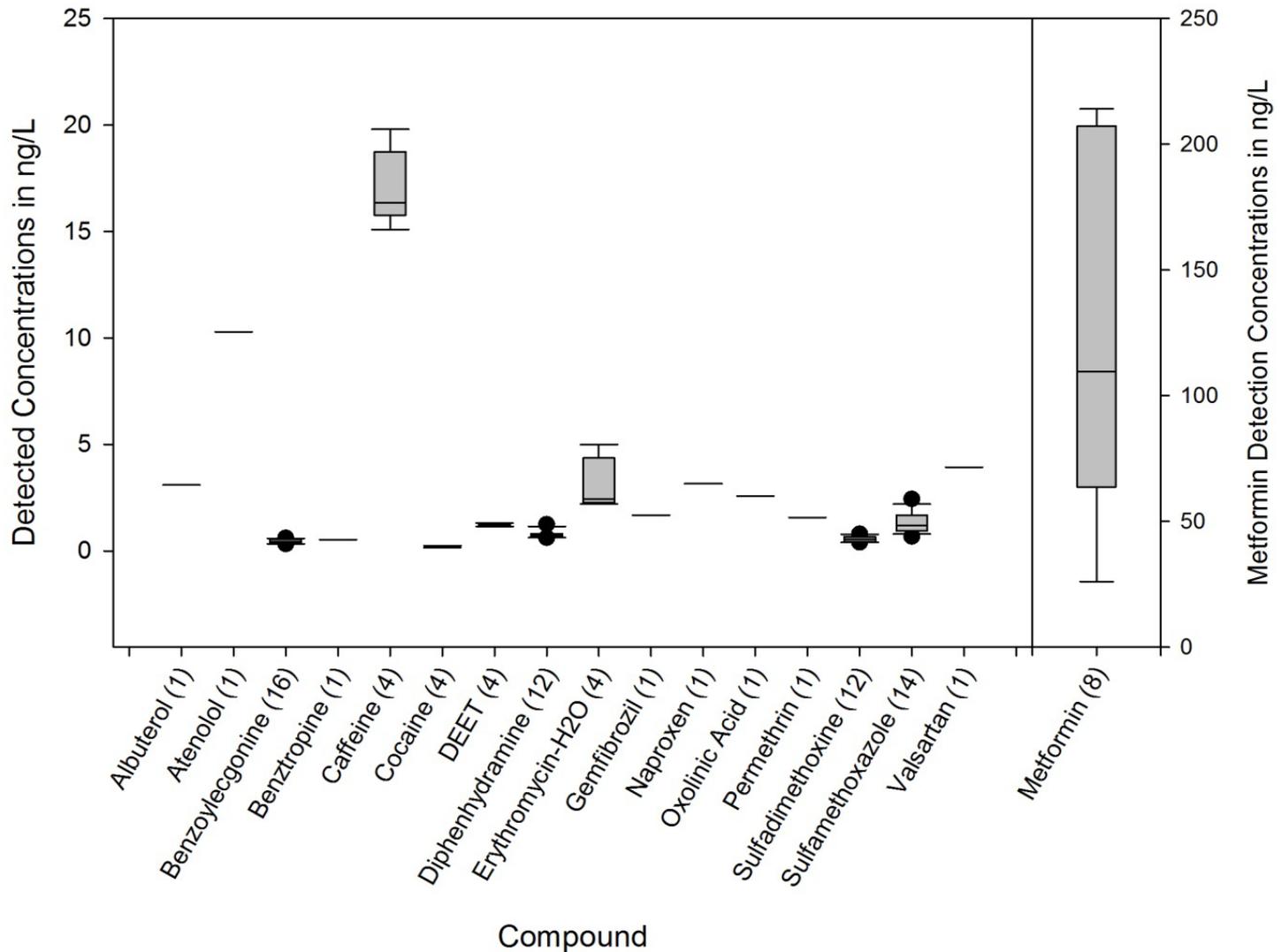
Lake Union Ship Canal Detected Compounds (N=15)



Elliott Bay Detected Compounds (N=15)



Duwamish Waterway Detected Compounds (N=21)



Noteworthy detected CECs

- Caffeine in Lake Union/Ship Canal,
 - Present but at much lower concentration in Duwamish and Elliott Bay
- Metformin (diabetes drug) in Lake Union/Ship Canal, Elliott Bay and Duwamish
 - Most widespread with highest concentrations
 - Some equipment and method blank issues
- DEET in most samples
 - But also problems with method and equipment blanks
- Blank contamination issues make distinguishing differences and measuring small concentrations challenging.
 - But indicative of the very widespread & pervasive nature of these compounds
- Cocaine and main metabolite in all waters
- Many sulpha antibiotics including some which are exclusively for veterinary use
 - E.g. Sulfadimethoxine detected in Duwamish and Elliott Bay

Next steps

- Complete synthesis of results
 - Include some metrics of magnitude of detections when available
 - Human doses, ecological toxicity
- Draft report (completed)
- Final CEC Report
- Develop recommendations for potential wastewater/CSO tracer(s)
 - No one unique single chemical, more of a methodological approach



| Parameter | Type |
|--------------------------|--|
| 10-hydroxy-amitriptyline | antidepressant, Amitriptyline metabolite |
| Albuterol | Antiasthmatic |
| Amitriptyline | Tricyclic antidepressant |
| Amphetamine | Stimulant, medicinal and recreational drug |
| Atenolol | Beta blocker, antihypertensive |
| Benzoylcegonine | Main metabolite cocaine |
| Benztropine | Anticholinergic, parkinson's medication |
| Caffeine | Stimulant |
| Ciprofloxacin | Fluoroquinolone antibiotic |
| Cocaine | Illicit opiate |
| Cotinine | Nicotine metabolite |
| DEET | Insect repellent |
| Diphenhydramine | Antihistamine |
| Erythromycin-H2O | Macrolide antibiotic metabolite |
| Gemfibrozil | Antilipemic |
| Metformin | Diabetes management |
| Naproxen | Non steroidal anti-inflammatory |
| Ofloxacin | Fluoroquinolone antibiotic |
| Oxolinic Acid | quinolone antibiotic |
| Paroxetine | SSRI |
| Permethrin | Synthetic pyrethroid |
| Sulfadimethoxine | Sulfonamide antibiotic |
| Sulfamethizole | Sulfonamide antibiotic |
| Sulfamethoxazole | Sulfonamide antibiotic |
| Triamterene | Sodium channel blocking diuretic |
| Valsartan | Angiotensin receptor blocker for high blood pressure and CHF |