SUPPORTING INFORMATION:

1. **Table SI-1.** List of 110 analytes and 19 surrogates for USGS NWQL pharmaceutical compounds in filtered water, with Chemical Abstracts Service (**CAS**) registry numbers and laboratory reporting limits (**LRL**; in ng/L) at the time of sample analysis.
2. **Table SI-2.** Recovery statistics for pharmaceutical surrogates used in HPLC MS/MS pharmaceutical analytical method.
3. **Table SI-3.** Mean and relative percent difference (RPD; %) for concentrations (µg L-1) of carbamazepine and sulfamethoxazole detected by ELISA in duplicate samples of WWTF effluent, in-stream (IS) surface-water (SW), in-stream hyporheic-water (IS-S, shallow; IS-I, Intermediate), and groundwater (LB, left bank; RB, right bank) during October 2012. “nd” and “--” indicate “not detected” and “not applicable,” respectively. Method detection limits were 0.02 µg L-1 for both analytes.
4. **Table SI-4.** Mean and relative percent difference (RPD; %) for concentrations (µg L-1) of carbamazepine and sulfamethoxazole detected by ELISA in duplicate samples of WWTF effluent, in-stream (IS) surface-water (SW), in-stream hyporheic-water (IS-S, shallow; IS-I, Intermediate), and groundwater (LB, left bank; RB, right bank) during December 2012. “nd” and “--” indicate “not detected” and “not applicable,” respectively. Method detection limits were 0.02 µg L-1 for both analytes.
5. **Table SI-5.** Concentrations of pharmaceuticals (ng L-1) detected in WWTF effluent, surface-water (SW) and left‑bank‑piezometer (LB) groundwater samples collected during October 2012. Non-detect compounds are denoted by “nd.” Values in red are estimated.
6. **Table SI-6.** Concentrations of pharmaceuticals (ng L-1) detected in WWTF effluent, surface-water (SW) and left‑bank‑piezometer (LB) groundwater samples collected during December 2012. Non-detect compounds are denoted by “nd.” Values in red are estimated.
7. **Table SI-7.** Summary of Red-Ox parameters detected in in-stream shallow (IS-S) hyporheic samples and left‑bank‑piezometer (LB) groundwater samples collected in December 2012. “nd” indicates not detected.
8. **Figure SI-1.** Longitudinal (A) and vertical (B) gradients in water levels (NAVD88) in left bank piezometers in row 2 and in surface water and nested in-stream piezometers at network D10 during December 2012 sampling event. The deep piezometer at this position did not produce water and is not shown.

**Table SI-1.** List of 110 analytes and 19 surrogates for USGS NWQL method pharmaceutical compounds in filtered water, with Chemical Abstracts Service (**CAS**) registry numbers and laboratory reporting limits (**LRL**; in ng/L).

|  |  |  |
| --- | --- | --- |
| **Parameter Name** | **CAS Number** | **LRL** |
| **1,7-dimethylxanthine (p-xanthine)** | 611-59-6 | 87 |
| **10-hydroxy-amitriptyline** | 64520-05-4 | 8.3 |
| **Abacavir** | 136470-78-5 | 8.2 |
| **Acetaminophen** | 103-90-2 | 7.1 |
| **Acetaminophen-d3 (surrogate)** | - | N/A |
| **Acyclovir** | 59277-89-3 | 22 |
| **Albuterol (salbutamol)** | 18559-94-9 | 6.0 |
| **Albuterol-d9 (surrogate)** | - | N/A |
| **Alprazolam** | 28981-97-7 | 21 |
| **Amitriptyline** | 50-48-6 | 37 |
| **Amphetamine** | 300-62-9 | 8.1 |
| **Amphetamine-d6 (surrogate)** | - | N/A |
| **Antipyrine** | 60-80-0 | 116 |
| **Atenolol** | 29122-68-7 | 13 |
| **Atrazine** | 1912-24-9 | 19 |
| **Benztropine** | 86-13-5 | 15 |
| **Betamethasone** | 378-44-9 | 114 |
| **Bupropion** | 34911-55-2 | 17 |
| **Caffeine** | 58-08-2 | 90 |
| **Caffeine (trimethyl-13c3) (surrogate)** | - | N/A |
| **Carbamazepine** | 298-46-4 | 4.1 |
| **Carisoprodol** | 78-44-4 | 12 |
| **Chlorpheniramine** | 132-22-9 | 4.6 |
| **Cimetidine** | 51481-61-9 | 27 |
| **Citalopram** | 59729-33-8 | 6.5 |
| **Clonidine** | 4205-90-7 | 60 |
| **Codeine** | 76-57-3 | 88 |
| **Codeine-d6 (surrogate)** | 371151-94-9 | N/A |
| **Cotinine** | 486-56-6 | 6.3 |
| **Cotinine-d3 (surrogate)** | - | N/A |
| **Dehydronifedipine** | 67035-22-7 | 24 |
| **Desmethyldiltiazem** | - | 12 |
| **Desvenlafaxine** | 93413-62-8 | 7.4 |
| **Dextromethorphan** | 125-71-3 | 8.2 |
| **Diazepam (valium)** | 439-14-5 | 2.2 |
| **Diazepam-d5 surrogate (surrogate)** | 65854-76-4 | N/A |
| **Diltiazem** | 42399-41-7 | 10 |
| **Diltiazem-d3 (surrogate)** | - | N/A |
| **Diphenhydramine** | 147-24-0 | 5.7 |
| **Diphenhydramine-d3 (surrogate)** | - | N/A |
| **Duloxetine** | 116539-59-4 | 36 |
| **Erythromycin** | 114-07-8 | 53 |
| **Ezetimibe** | 163222-33-1 | 63 |
| **Fadrozole** | 102676-47-1 | 7.3 |
| **Famotidine** | 76824-35-6 | 10 |
| **Fenofibrate** | 49562-28-9 | 6.2 |
| **Fexofenadine** | 83799-24-0 | 19 |
| **Fluconazole** | 86386-73-4 | 71 |
| **Fluoxetine** | 54910-89-3 | 26 |
| **Fluoxetine-d6 (surrogate)** | - | N/A |
| **Fluticasone** | 90566-53-3 | 4.6 |
| **Fluvoxamine** | 54739-18-3 | 53 |
| **Glipizide** | 29094-61-9 | 34 |
| **Glyburide** | 10238-21-8 | 3.9 |
| **Hydrocodone** | 125-29-1 | 10 |
| **Hydrocodone-d3 (surrogate)** | - | N/A |
| **Hydrocortisone** | 50-23-7 | 147 |
| **Hydroxyzine** | 68-88-2 | 7.4 |
| **Iminostilbene** | 256-96-2 | 145 |
| **Ketoconazole** | 65277-42-1 | 113 |
| **Lamivudine** | 134678-17-4 | 16 |
| **Lidocaine** | 137-58-6 | 15 |
| **Loperamide** | 53179-11-6 | 11 |
| **Loratadine** | 79794-75-5 | 6.9 |
| **Lorazepam** | 846-49-1 | 116 |
| **Meprobamate** | 57-53-4 | 86 |
| **Metaxalone** | 1665-48-1 | 15 |
| **Metformin** | 657-24-9 | 13 |
| **Parameter Name** | **CAS Number** | **LRL** |
| **Methadone** | 76-99-3 | 7.6 |
| **Methadone-d9 (surrogate)** | - | N/A |
| **Methocarbamol** | 532-03-6 | 8.7 |
| **Methotrexate** | 59-05-2 | 52 |
| **Methyl-1h-benzotriazole** | 29385-43-1 | 141 |
| **Metoprolol** | 51384-51-1 | 27 |
| **Morphine** | 57-27-2 | 14 |
| **Nadalol** | 42200-33-9 | 80 |
| **Nevirapine** | 129618-40-2 | 15 |
| **Nicotine** | 54-11-5 | 57 |
| **Nizatidine** | 76963-41-2 | 19 |
| **Nordiazepam** | 1088-11-5 | 41 |
| **Norethindrone** | 68-22-4 | 10 |
| **Norfluoxetine** | 56161-73-0 | 199 |
| **Norfluoxetine-d6 (surrogate)** | - | N/A |
| **Norsertraline** | 87857-41-8 | 192 |
| **Norverapamil** | 67018-85-3 | 8.5 |
| **Omeprazole** | - | 5.6 |
| **Orlistat** | 96829-58-2 | 52 |
| **Oseltamivir** | 196618-13-0 | 14 |
| **Oxazepam** | 604-75-1 | 140 |
| **Oxycodone** | 76-42-6 | 24 |
| **Oxycodone-d3 (surrogate)** | - | N/A |
| **Paroxetine** | 61869-08-7 | 20 |
| **Penciclovir** | 39809-25-1 | 40 |
| **Pentoxifylline** | 6493-05-6 | 9.3 |
| **Phenazopyridine** | 94-78-0 | 13 |
| **Phendimetrazine** | 634-03-7 | 31 |
| **Phenytoin** | 57-41-0 | 188 |
| **Piperonyl butoxide** | 51-03-6 | 3.0 |
| **Prednisolone** | 50-24-8 | 150 |
| **Prednisone** | 53-03-2 | 168 |
| **Promethazine** | 60-87-7 | 50 |
| **Propoxyphene** | 469-62-5 | 17 |
| **Propranolol** | 525-66-6 | 26 |
| **Pseudoephedrine** | - | 11 |
| **Pseudoephedrine-d3 surrogate (surrogate)** | - | N/A |
| **Quinine** | 130-95-0 | 79 |
| **Raloxifene** | 84449-90-1 | 9.7 |
| **Ranitidine** | 66357-35-5 | 192 |
| **Sertraline** | 79617-96-2 | 16 |
| **Sitagliptin** | 790712-60-6 | 97 |
| **Sulfadimethoxine** | 122-11-2 | 65 |
| **Sulfamethizole** | 144-82-1 | 104 |
| **Sulfamethoxazole** | 723-46-6 | 26 |
| **Sulfamethoxazole-(phenyl-13c6) (surrogate)** | - | N/A |
| **Tamoxifen** | 10540-29-1 | 52 |
| **Temazepam** | 846-50-4 | 18 |
| **Temazepam-d5 (surrogate)** | - | N/A |
| **Theophylline** | 58-55-9 | 41 |
| **Thiabendazole** | 148-79-8 | 4.1 |
| **Thiabendazole-d4 (surrogate)** | - | N/A |
| **Tiotropium** | 186691-13-4 | 43 |
| **Tramadol** | 27203-92-5 | 15 |
| **Triamterene** | 396-01-0 | 5.2 |
| **Trimethoprim** | 738-70-5 | 19 |
| **Trimethoprim-d9 (surrogate)** | - | N/A |
| **Valacyclovir** | 124832-26-4 | 163 |
| **Venlafaxine** | 93413-69-5 | 4.4 |
| **Verapamil** | 52-53-9 | 15 |
| **Warfarin** | 81-81-2 | 6.0 |

**Table SI-2.** Recovery statistics for pharmaceutical surrogates used in HPLC MS/MS pharmaceutical analytical method.

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter Name** | **Range** | **Mean** | **RSD** |
| **Acetaminophen-d3** | 101-188 | 128 | 15 |
| **Albuterol-d9** | 102-123 | 110 | 4 |
| **Amphetamine-d6** | 96-109 | 102 | 3 |
| **Caffeine (trimethyl-13c3)** | 88-115 | 100 | 5 |
| **Codeine-d6** | 100-161 | 124 | 10 |
| **Cotinine-d3** | 97-109 | 102 | 3 |
| **Diazepam-d5 surrogate** | 99-112 | 105 | 3 |
| **Diltiazem-d3** | 85-110 | 97 | 7 |
| **Diphenhydramine-d3** | 30-110 | 101 | 12 |
| **Fluoxetine-d6** | 58-113 | 95 | 12 |
| **Hydrocodone-d3** | 90-117 | 103 | 5 |
| **Methadone-d9** | 90-113 | 105 | 4 |
| **Norfluoxetine-d6** | 80-113 | 98 | 7 |
| **Oxycodone-d3** | 98-137 | 112 | 7 |
| **Pseudoephedrine-d3 surrogate** | 92-105 | 99 | 3 |
| **Sulfamethoxazole-(phenyl-13c6)** | 88-150 | 117 | 9 |
| **Temazepam-d5** | 93-113 | 102 | 3 |
| **Thiabendazole-d4** | 102-126 | 114 | 5 |
| **Trimethoprim-d9** | 93-107 | 102 | 3 |

**Table SI-3.** Mean and relative percent difference (RPD; %) for concentrations (µg L-1) of carbamazepine and sulfamethoxazole detected by ELISA in duplicate samples of WWTF effluent, in-stream (IS) surface-water (SW), in-stream hyporheic-water (IS-S, shallow; IS-I, Intermediate), and groundwater (LB, left bank; RB, right bank) during October 2012. “nd” and “--” indicate “not detected” and “not applicable,” respectively. Method detection limits were 0.02 µg L-1 for both analytes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SAMPLE ID** | **Carbamazepine** | | **Sulfamethoxazole** | |
| **concentration** | **RPD** | **concentration** | **RPD** |
| **U50-RB** | 0.03 | 4.0 | 0.09 | 20.6 |
| **U50-IS-SW** | 1.18 | 13.4 | 1.47 | 10.0 |
| **U50-IS-S** | 0.39 | 12.0 | 1.35 | 9.0 |
| **U50-LB-T1-R2** | 0.03 | 4.0 | Nd | -- |
| **U50-LB-T2-R2** | nd | -- | Nd | -- |
| **WWTF EFFLUENT** | 0.98 | 5.1 | 1.65 | 0.4 |
| **D10-RB** | 0.27 | 6.7 | 1.59 | 10.5 |
| **D10-IS-SW** | 0.99 | 1.1 | 1.46 | 2.8 |
| **D10-IS-S** | 0.61 | 2.0 | 1.33 | 2.5 |
| **D10-IS-I** | 0.19 | 21.2 | 0.82 | 2.4 |
| **D10-LB-T1-R1** | 0.41 | 0.8 | 1.69 | 0.0 |
| **D10-LB-T1-R2** | 0.27 | 3.7 | 1.56 | 1.1 |
| **D10-LB-T1-R3** | 0.06 | 3.2 | 0.45 | 6.5 |
| **D10-LB-T1-R4** | 0.03 | 2.1 | 0.12 | 7.5 |
| **D10-LB-T1-R5** | nd | -- | nd | -- |
| **D10-LB-T2-R1** | 0.40 | 11.0 | 1.74 | 12.7 |
| **D10-LB-T3-R1** | 0.38 | 4.0 | 0.89 | 0.4 |
| **BLANK** | nd | -- | nd | -- |

**Table SI-4.** Mean and relative percent difference (RPD; %) for concentrations (µg L-1) of carbamazepine and sulfamethoxazole detected by ELISA in duplicate samples of WWTF effluent, in-stream (IS) surface-water (SW), in-stream hyporheic-water (IS-S, shallow; IS-I, intermediate), and groundwater (LB, left bank; RB, right bank) during December 2012. “nd” and “--” indicate “not detected” and “not applicable,” respectively. Method detection limits were 0.02 µg L-1 for both analytes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SAMPLE ID** | **Carbamazepine** | | **Sulfamethoxazole** | |
|  | **concentration** | **RPD** | **concentration** | **RPD** |
| **U80-RB** | 0.02 | 7.4 | nd | -- |
| **U80-IS-SW** | nd | -- | nd | -- |
| **U80-IS-S** | 0.04 | 5.9 | nd | -- |
| **U80-LB-T1-R2** | nd | -- | 0.12 | 2.4 |
| **U80-LB-T1-R1** | 0.02 | 1.6 | nd | -- |
| **U50-RB** | 0.06 | -- | nd | -- |
| **U50-IS-SW** | nd | -- | 0.03 | 7.7 |
| **U50-IS-S** | 0.04 | 9.5 | nd | -- |
| **U50-LB-T1-R1** | 0.03 | 3.5 | 0.05 | 1.4 |
| **U50-LB-T1-R2** | 0.03 | 5.2 | nd | -- |
| **U50-LB-T1-R3** | 0.08 | 9.7 | nd | -- |
| **U50-LB-T2-R1** | 0.02 | 6.7 | nd | -- |
| **U50-LB-T2-R2** | nd | -- | 0.03 | 23.1 |
| **U50-LB-T2-R3** | nd | -- | 0.04 | 18.2 |
| **WWTF EFFLUENT** | 0.75 | 12.9 | 2.21 | 9.4 |
| **D10-RB** | 0.09 | 1.1 | 0.21 | 0.6 |
| **D10-IS-SW-REP1** | 0.79 | 5.8 | 2.03 | 2.6 |
| **D10-IS-SW-REP2** | 0.77 | 18.9 | 2.49 | 9.9 |
| **D10-IS-SW-REP3** | 0.76 | 20.5 | 2.47 | 5.0 |
| **D10-IS-S** | 0.29 | 2.6 | 1.31 | 0.8 |
| **D10-LB-T1-R1-REP1** | 0.18 | 10.1 | 0.60 | 8.8 |
| **D10-LB-T1-R1-REP2** | 0.21 | 0.8 | 0.55 | 14.0 |
| **D10-LB-T1-R1-REP3** | 0.21 | -- | 0.44 | 12.0 |
| **D10-LB-T1-R2** | 0.18 | 4.0 | 0.49 | 17.9 |
| **D10-LB-T1-R3** | 0.03 | 6.8 | 0.28 | 3.5 |
| **D10-LB-T1-R4** | 0.04 | 1.6 | 0.02 | 7.3 |
| **D10-LB-T1-R5** | nd | -- | 0.03 | 1.2 |
| **D10-LB-T2-R1** | 0.16 | 4.2 | 0.27 | 5.0 |
| **D10-LB-T2-R2** | 0.17 | 4.3 | 0.27 | 0.6 |
| **D10-LB-T3-R1** | 0.22 | -- | 0.13 | 6.5 |
| **D10-LB-T3-R2** | 0.22 | 7.4 | 0.22 | 5.8 |
| **BLANK** | nd | -- | nd | -- |

**Table SI-5.** Concentrations of pharmaceuticals (ng L-1) detected in WWTF effluent, surface-water (SW) and left‑bank‑piezometer (LB) groundwater samples collected in October 2012. Non-detect compounds are denoted by “nd.” Values in red are estimated.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **Reporting Limit** | **U50-SW** | **U50-LB-T1-R2** | **U50-LB-T2-R2** | **WWTF Effluent** | **D10-SW** | **D10-LB-T1-R1** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T3-R1** | **D10 -LB Detection**  **Frequency (%)** |
| **1,7-dimethylxanthine** | **87** | 258 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **10-hydroxy-amitriptyline** | **8.3** | 9.31 | nd | nd | 15.8 | 8.17 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Abacavir** | **8.2** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Acetaminophen** | **7.1** | nd | nd | nd | nd | nd | nd | 14.4 | nd | 20.9 | nd | 11.2 | nd | **42.9** |
| **Acyclovir** | **22** | 981 | nd | nd | 1360 | 1410 | 134 | 36.4 | nd | 59.1 | 13.5 | 25.2 | nd | **71.4** |
| **Albuterol (salbutamol)** | **6** | 15.2 | nd | nd | 25.1 | 19 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Alprazolam** | **21** | 2.98 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Amitriptyline** | **37** | nd | nd | nd | **7.93** | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Amphetamine** | **8.1** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Antipyrine** | **116** | nd | nd | nd | nd | nd | nd | nd | nd | 8.58 | nd | nd | nd | **14.3** |
| **Atenolol** | **13** | 463 | nd | nd | 721 | 671 | nd | nd | nd | 15.4 | nd | nd | nd | **14.3** |
| **Atrazine** | **19** | nd | 28 | 28 | nd | nd | 35.3 | 32.9 | **17.9** | 41.1 | **11.1** | 37.5 | 29.2 | **100.0** |
| **Benztropine** | **15** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Betamethasone** | **114** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Bupropion** | **17** | 59.5 | nd | nd | 113 | 73.4 | 4.59 | nd | nd | 28.4 | 4.3 | nd | 10.5 | **57.1** |
| **Caffeine** | **90** | 340 | nd | 13.8 | 56.9 | 68.2 | 157 | 26.1 | 11.8 | 56.4 | nd | 73.4 | 58.9 | **85.7** |
| **Carbamazepine** | **4.1** | nd | 42.1 | 19.7 | 354 | 361 | 275 | 204 | 45.6 | 177 | 13.8 | 276 | 275 | **100.0** |
| **Carisoprodol** | **12** | 25.4 | nd | nd | 21.8 | 19.6 | 179 | 15.1 | nd | 34.2 | nd | 115 | 127 | **71.4** |
| **Chlorpheniramine** | **4.6** | nd | nd | nd | 3.36 | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Cimetidine** | **27** | **143** | nd | nd | **215** | **220** | nd | nd | nd | **45.4** | nd | nd | nd | **14.3** |
| **Citalopram** | **6.5** | 58.1 | nd | nd | 118 | 46.5 | nd | nd | nd | 10.2 | nd | nd | nd | **14.3** |
| **Clonidine** | **60** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Codeine** | **88** | 74.7 | nd | nd | 88.5 | 79 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Cotinine** | **6.3** | 53.9 | 30.4 | 32.2 | 80.5 | 85.5 | nd | nd | 11 | 41.1 | nd | nd | nd | **28.6** |
| **Dehydronifedipine** | **24** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Desmethyldiltiazem** | **12** | nd | nd | nd | **9.46** | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Desvenlafaxine** | **7.4** | 1000 | nd | nd | 1760 | 1580 | nd | nd | nd | 627 | 64.9 | 12.1 | 152 | **57.1** |
| **Dextromethorphan** | **8.2** | 12 | nd | nd | 24.8 | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Diazepam (valium)** | **2.2** | nd | nd | nd | nd | nd | nd | 0.15 | nd | nd | nd | nd | nd | **14.3** |
| **Diltiazem** | **10** | nd | nd | nd | 12.7 | 4.27 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Diphenhydramine** | **5.7** | 137 | nd | nd | 249 | 203 | nd | nd | nd | 5.02 | 1.46 | nd | nd | **28.6** |
| **Duloxetine** | **36** | nd | nd | nd | **4.58** | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Erythromycin** | **53** | nd | nd | nd | 4.28 | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Ezetimibe** | **63** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fadrozole** | **7.3** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Famotidine** | **10** | **107** | nd | nd | **125** | **152** | nd | nd | nd | **31.3** | nd | nd | nd | **14.3** |
| **Fenofibrate** | **6.2** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fexofenadine** | **19** | 2110 | nd | nd | 3400 | 2340 | nd | nd | nd | 795 | 87.2 | nd | nd | **28.6** |
| **Fluconazole** | **71** | 95.3 | nd | nd | 144 | 150 | 116 | 81.8 | nd | 73.2 | nd | 80.1 | 88.3 | **71.4** |
| **Fluoxetine** | **26** | **7.91** | nd | nd | **9.56** | **7.14** | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fluticasone** | **4.6** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fluvoxamine** | **53** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Glipizide** | **34** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Glyburide** | **3.9** | 5.58 | nd | nd | 6.55 | 6.48 | 3.15 | 1.95 | nd | nd | nd | 2.49 | 3.76 | **57.1** |
| **Hydrocodone** | **10** | 20.1 | nd | nd | 30.3 | 17.9 | nd | nd | nd | nd | nd | nd | nd | **0.0** |

**Table SI-5.** (cont.)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **Reporting Limit** | **U50-SW** | **U50-LB-T1-R2** | **U50-LB-T2-R2** | **WWTF Effluent** | **D10-SW** | **D10-LB-T1-R1** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T3-R1** | **D10 -LB Detection**  **Frequency (%)** |
| **Hydrocortisone** | **147** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Hydroxyzine** | **7.4** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Iminostilbene** | **145** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Ketoconazole** | **113** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Lamivudine** | **16** | nd | nd | nd | nd | nd | nd | nd | 7.56 | nd | nd | nd | nd | **14.3** |
| **Lidocaine** | **15** | 121 | 9.8 | nd | 124 | 121 | 79.4 | 63.6 | 4.39 | 91.5 | 8.96 | 71.6 | 68.2 | **100.0** |
| **Loperamide** | **11** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Loratadine** | **6.9** | 1.74 | nd | nd | 2.44 | 1.32 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Lorazepam** | **116** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Meprobamate** | **86** | 57.5 | nd | 21.1 | 98.4 | 83.3 | 132 | 98.8 | nd | 62.4 | nd | nd | 115 | **57.1** |
| **Metaxalone** | **15** | **118** | nd | nd | **146** | **143** | **56.1** | nd | nd | **41.2** | nd | nd | **23.3** | **42.9** |
| **Metformin** | **13** | 2850 | nd | nd | 3310 | 3530 | 153 | nd | nd | 136 | 14.1 | 302 | 157 | **71.4** |
| **Methadone** | **7.6** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Methocarbamol** | **8.7** | 401 | 12.1 | nd | 595 | 566 | 258 | 132 | 54.1 | 174 | 18.9 | 149 | 27.5 | **100.0** |
| **Methotrexate** | **52** | nd | nd | nd | nd | nd | nd | nd | nd | **14** | **12.1** | nd | nd | **28.6** |
| **Methyl-1h-benzotriazole** | **141** | 1940 | 448 | 231 | 2620 | 2740 | 2260 | 1810 | 352 | 1310 | 128 | 2160 | 1980 | **100.0** |
| **Metoprolol** | **27** | 100 | nd | nd | 110 | 78.9 | nd | nd | nd | 27.7 | 4.64 | 6.92 | nd | **42.9** |
| **Morphine** | **14** | 58.7 | nd | nd | 93.8 | 87.3 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Nadalol** | **80** | 40.4 | nd | nd | 60.8 | 43.6 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Nevirapine** | **15** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Nicotine** | **57** | nd | 14.2 | 14.1 | nd | nd | nd | 17.2 | nd | nd | 13.4 | nd | nd | **28.6** |
| **Nizatidine** | **19** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Nordiazepam** | **41** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Norethindrone** | **10** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Norfluoxetine** | **199** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Norsertraline** | **192** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Norverapamil** | **8.5** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Omeprazole** | **5.6** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Orlistat** | **52** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Oseltamivir** | **14** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Oxazepam** | **140** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Oxycodone** | **24** | 24.5 | nd | nd | 42.1 | 33.7 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Paroxetine** | **20** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Penciclovir** | **40** | nd | nd | nd | nd | 252 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Pentoxifylline** | **9.3** | 17.2 | nd | nd | 3.76 | 3.58 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Phenazopyridine** | **13** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Phendimetrazine** | **31** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Phenytoin** | **188** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 120 | nd | **14.3** |
| **Piperonyl butoxide** | **3** | nd | nd | nd | nd | 2.58 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Prednisolone** | **150** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Prednisone** | **168** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Promethazine** | **50** | nd | nd | nd | nd | nd | nd | nd | nd | **13.3** | nd | nd | nd | **14.3** |
| **Propoxyphene** | **17** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Propranolol** | **26** | 41.8 | nd | nd | 64.2 | 53.5 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Pseudoephedrine** | **11** | 23 | nd | nd | 52.3 | 59 | nd | 3.52 | nd | 12.5 | nd | nd | nd | **28.6** |
| **Quinine** | **79** | nd | nd | nd | 19.9 | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Raloxifene** | **9.7** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |

**Table SI-5.** (cont.)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **Reporting Limit** | **U50-SW** | **U50-LB-T1-R2** | **U50-LB-T2-R2** | **OUTFALL** | **D10-SW** | **D10-LB-T1-R1** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T3-R1** | **D10 -LB Detection**  **Frequency (%)** |
| **Ranitidine** | **192** | **218** | nd | nd | **326** | **228** | nd | nd | nd | **14.9** | nd | nd | nd | **14.3** |
| **Sertraline** | **16** | **10.1** | nd | nd | **31.6** | **18.6** | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Sitagliptin** | **97** | **5.36** | nd | nd | **8.22** | **5.71** | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Sulfadimethoxine** | **65** | 18.4 | nd | nd | nd | nd | nd | 7.65 | nd | nd | nd | 4.4 | nd | **28.6** |
| **Sulfamethizole** | **104** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Sulfamethoxazole** | **26** | **453** | 45.4 | nd | **654** | **1050** | 989 | 614 | 328 | 368 | 34.6 | 308 | 274 | **100.0** |
| **Tamoxifen** | **52** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Temazepam** | **18** | 75.9 | nd | nd | 102 | 92.3 | 45.3 | nd | nd | 40.6 | nd | 38.2 | 34.3 | **57.1** |
| **Theophylline** | **41** | **75.3** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Thiabendazole** | **4.1** | **9.34** | nd | nd | **7.42** | 10.3 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Tiotropium** | **43** | nd | nd | nd | nd | **36.3** | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Tramadol** | **15** | 298 | nd | nd | 474 | 394 | 56 | 19.4 | nd | 281 | 29.6 | 77.9 | 74 | **85.7** |
| **Triamterene** | **5.2** | 105 | nd | nd | 163 | 178 | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Trimethoprim** | **19** | 224 | nd | nd | 370 | 312 | nd | nd | nd | 9.01 | nd | nd | nd | **14.3** |
| **Valacyclovir** | **163** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Venlafaxine** | **4.4** | 158 | nd | nd | 309 | 179 | nd | nd | nd | 90.1 | 9.65 | nd | nd | **28.6** |
| **Verapamil** | **15** | nd | nd | nd | 2.24 | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Warfarin** | **6** | nd | 2.02 | 2.34 | nd | nd | **15.8** | **11.6** | **8.64** | **6.7** | **5.6** | **16.8** | 15.2 | **100.0** |
| **Compounds Detected (#)** |  | **48** | **9** | **8** | **53** | **48** | **18** | **19** | **10** | **34** | **18** | **20** | **18** |  |
| **Compounds Detected (%)** |  | **43.6** | **8.2** | **7.3** | **48.2** | **43.6** | **16.4** | **17.3** | **9.1** | **30.9** | **16.4** | **18.2** | **16.4** |  |
| **ΣConc (ng L-1)** |  | **13424** | **632** | **362** | **18751** | **17825** | **4949** | **3191** | **841** | **4762** | **476** | **3888** | **3513** |  |

**Table SI-6.** Concentrations of pharmaceuticals (ng L-1) detected in WWTF effluent, surface-water (SW) and left‑bank‑piezometer (LB) groundwater samples collected in December 2012. Non-detect compounds are denoted by “nd.” Values in red are estimated.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **Reporting Limit** | **U80-SW** | **U50-IS-S** | **U50-SW** | **WWTF Effluent** | **D10-IS-S** | **D10-SW-REP1** | **D10-SW-REP2** | **D10-SW-REP3** | **D10-LB-T1-R1-REP1** | **D10-LB-T1-R1-REP2** | **D10-LB-T1-R1-REP3** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T2-R2** | **D10-LB-T3-R1** | **D10-LB-T3-R2** | **D10 -LB Detection**  **Frequency (%)** |
| **1,7-dimethylxanthine** | **87** | 33.2 | 42.7 | nd | 20.6 | nd | 233 | nd | nd | 29.2 | 207 | nd | nd | nd | nd | nd | nd | 79.7 | 162 | nd | **36.4** |
| **10-hydroxy-amitriptyline** | **8.3** | nd | nd | nd | 18 | nd | 63.6 | 11.8 | 28.4 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Abacavir** | **8.2** | nd | nd | nd | nd | nd | 1.23 | 5.02 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Acetaminophen** | **7.1** | nd | nd | nd | 6.62 | 5.37 | nd | nd | nd | nd | 61.8 | nd | nd | nd | 8.24 | nd | nd | 22.3 | 18.3 | 26.3 | **45.5** |
| **Acyclovir** | **22** | nd | nd | nd | 947 | nd | 1590 | 738 | 1150 | 3.16 | nd | 20.1 | nd | nd | nd | nd | nd | nd | nd | nd | **18.2** |
| **Albuterol (salbutamol)** | **6** | nd | nd | nd | **15.8** | nd | **49.1** | **10.6** | **19.1** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Alprazolam** | **21** | nd | nd | nd | nd | 3.31 | 9.36 | nd | 4.17 | nd | 3.91 | 2 | nd | nd | nd | nd | 1.92 | nd | nd | nd | **27.3** |
| **Amitriptyline** | **37** | nd | nd | nd | **11.1** | nd | **35.3** | **11.6** | **20** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Amphetamine** | **8.1** | nd | nd | nd | nd | nd | 5.44 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Antipyrine** | **116** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Atenolol** | **13** | nd | nd | nd | **478** | nd | **1610** | **250** | **665** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Atrazine** | **19** | 42.2 | 11.2 | 41.5 | 21.9 | 26.1 | 69.1 | 11.1 | 27 | 7.06 | 61.4 | 26.7 | 25.7 | 5.88 | 9.78 | 8.48 | 19.6 | 38.1 | 23.9 | 12.8 | **100.0** |
| **Benztropine** | **15** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Betamethasone** | **114** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Bupropion** | **17** | nd | nd | nd | 103 | 40.5 | 345 | 57.2 | 159 | 3.05 | 16.3 | nd | 14.3 | nd | nd | nd | 13.1 | 4.57 | 17.1 | 10.7 | **63.6** |
| **Caffeine** | **90** | 85.2 | 104 | nd | 15.1 | 139 | 609 | 16.5 | 91 | 89.3 | 733 | 104 | 56.5 | nd | nd | 28.6 | 64.7 | 287 | 540 | 144 | **81.8** |
| **Carbamazepine** | **4.1** | 2.79 | 32.1 | 3.01 | 183 | 219 | 621 | 95.2 | 244 | 48.1 | 485 | 225 | 168 | 22.4 | 37 | 2.89 | 178 | 279 | 313 | 165 | **100.0** |
| **Carisoprodol** | **12** | nd | **7.8** | nd | **6.46** | **22.3** | **19.7** | **4.1** | **9.77** | **6.78** | **56.5** | **23.6** | **22.5** | **19.8** | **19.9** | **13** | **31.1** | **47.5** | **35.4** | **18.4** | **100.0** |
| **Chlorpheniramine** | **4.6** | nd | nd | nd | nd | nd | 9.53 | 4.17 | 5.98 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Cimetidine** | **27** | nd | nd | nd | **200** | **5.94** | **688** | **101** | **271** | nd | nd | nd | nd | nd | nd | nd | nd | nd | **6.73** | **5.99** | **18.2** |
| **Citalopram** | **6.5** | nd | nd | nd | 98.1 | nd | 316 | 94.8 | 180 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Clonidine** | **60** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Codeine** | **88** | nd | nd | nd | 116 | nd | 447 | 59 | 174 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Cotinine** | **6.3** | 6.08 | nd | 6.03 | 77.7 | nd | 267 | 38 | 103 | nd | 4.6 | nd | 2.36 | 5.94 | 8.48 | nd | nd | 4.4 | 6.39 | 3.05 | **63.6** |
| **Dehydronifedipine** | **24** | nd | nd | nd | nd | nd | 10.3 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Desvenlafaxine** | **7.4** | 1.36 | 7.58 | nd | 1320 | 57.1 | 4120 | 726 | 1810 | nd | nd | nd | nd | nd | nd | nd | 16.1 | 5.88 | 281 | 131 | **36.4** |
| **Dextromethorphan** | **8.2** | nd | nd | nd | 34.9 | nd | 124 | 29.6 | 56.5 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 1.5 | **9.1** |
| **Diazepam (valium)** | **2.2** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Diltiazem** | **10** | nd | nd | nd | **5.34** | nd | **23.5** | **10.5** | **25.8** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Diphenhydramine** | **5.7** | nd | nd | nd | 286 | nd | 925 | 173 | 400 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Duloxetine** | **36** | nd | nd | nd | nd | nd | **3.28** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Erythromycin** | **53** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Ezetimibe** | **63** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fadrozole** | **7.3** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Famotidine** | **10** | nd | nd | nd | **207** | nd | **510** | **116** | **243** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fenofibrate** | **6.2** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fexofenadine** | **19** | **6.47** | **8.95** | **7.24** | **1720** | **10.7** | **5140** | **991** | **2610** | nd | nd | **7.5** | nd | nd | nd | nd | nd | **8.62** | **24.4** | **29.8** | **36.4** |
| **Fluconazole** | **71** | 5.09 | nd | nd | 114 | 75.3 | 331 | 64.2 | 148 | nd | 111 | 49.3 | 49.4 | nd | nd | nd | 33.8 | 42.4 | 68.8 | 40.6 | **63.6** |
| **Fluoxetine** | **26** | nd | nd | nd | **6.89** | nd | **10.3** | **19.2** | **13.4** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fluticasone** | **4.6** | nd | nd | nd | 0.6 | nd | nd | nd | 0.7 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Fluvoxamine** | **53** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |
| **Glipizide** | **34** | nd | nd | nd | nd | nd | **24.8** | nd | nd | nd | **8.55** | nd | nd | nd | nd | nd | nd | nd | nd | nd | **9.1** |
| **Glyburide** | **3.9** | nd | nd | nd | 7.1 | 3.99 | 25.8 | 4.24 | 9.36 | nd | 4.67 | 2.62 | 1.64 | nd | nd | nd | 2.32 | 2.69 | 2.96 | 2.24 | **63.6** |
| **Hydrocodone** | **10** | nd | nd | nd | 36.8 | 17.7 | 83.4 | 21.4 | 45.5 | nd | 6.94 | nd | nd | nd | nd | nd | 8.85 | nd | 12.5 | 14.6 | **36.4** |
| **Hydrocortisone** | **147** | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | **0.0** |

**Table SI-6.** (cont.)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **Reporting Limit** | **U80-SW** | **U50-IS-S** | **U50-SW** | **OUTFALL** | **D10-IS-S** | **D10-SW-REP1** | **D10-SW-REP2** | **D10-SW-REP3** | **D10-LB-T1-R1-REP1** | **D10-LB-T1-R1-REP2** | **D10-LB-T1-R1-REP3** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T2-R2** | **D10-LB-T3-R1** | **D10-LB-T3-R2** | **D10 -LB Detection**  **Frequency (%)** |
| **Hydroxyzine** | **7.4** | ND | ND | ND | 2.72 | ND | 8.05 | 2.28 | 5.04 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Iminostilbene** | **145** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Ketoconazole** | **113** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Lamivudine** | **16** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Lidocaine** | **15** | ND | 10.6 | ND | 72.6 | 131 | 251 | 37.8 | 98.9 | 23.7 | 214 | 98.7 | 55.7 | 3.55 | 4.48 | ND | 61.6 | 54.5 | 88.1 | 56.4 | **90.9** |
| **Loperamide** | **11** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Loratadine** | **6.9** | ND | ND | ND | 1.48 | ND | 2.55 | 1.99 | 2.13 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Lorazepam** | **116** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Meprobamate** | **86** | ND | 23.8 | ND | 56.4 | ND | 161 | 39.3 | 65.7 | 30.2 | 155 | ND | 49.2 | ND | 66.7 | 43.4 | ND | 122 | 116 | 60.9 | **72.7** |
| **Metaxalone** | **15** | ND | ND | ND | **141** | **12.1** | **469** | **65.4** | **180** | **4.54** | **49.8** | **19.6** | ND | ND | ND | ND | ND | ND | **10.6** | **4.42** | **45.5** |
| **Metformin** | **13** | 8.75 | 2.49 | 8.23 | 5380 | 176 | 7810 | 3540 | 5160 | 30.7 | 134 | 87 | 2.32 | ND | ND | ND | 117 | 47.6 | 33.4 | 100 | **72.7** |
| **Methadone** | **7.6** | ND | ND | ND | ND | ND | 5.88 | 2.71 | 4.29 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Methocarbamol** | **8.7** | ND | 10.1 | ND | 423 | 32.4 | 1350 | 240 | 593 | ND | 213 | 96.2 | 64.6 | ND | ND | ND | 21.7 | 32.2 | ND | 12.7 | **54.5** |
| **Methotrexate** | **52** | ND | ND | ND | ND | **27.7** | ND | ND | ND | ND | **36.8** | **27.8** | **28** | ND | **22.7** | **34.2** | ND | ND | **48** | ND | **54.5** |
| **Methyl-1h-benzotriazole** | **141** | 58.9 | 261 | 62.6 | 889 | 1710 | 2920 | 592 | 1320 | 402 | 2620 | 1480 | 1120 | 151 | 198 | ND | 1080 | 1620 | 1600 | 893 | **90.9** |
| **Metoprolol** | **27** | ND | ND | ND | 130 | 24.3 | 457 | 74.8 | 192 | ND | 5.88 | ND | ND | ND | ND | ND | 5.85 | ND | ND | 7.68 | **27.3** |
| **Morphine** | **14** | ND | ND | ND | 108 | ND | 326 | 66.4 | 138 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Nadalol** | **80** | ND | ND | ND | 40.2 | ND | 149 | 22.2 | 62.4 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Desmethyldiltiazem** | **12** | ND | ND | ND | **8.65** | ND | **27.4** | **7.14** | **19.3** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Nevirapine** | **15** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Nicotine** | **57** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Nizatidine** | **19** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Nordiazepam** | **41** | ND | ND | ND | 4.25 | 2.88 | 12.3 | ND | ND | ND | 3.26 | ND | ND | ND | ND | ND | ND | ND | 2.33 | ND | **18.2** |
| **Norethindrone** | **10** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Norfluoxetine** | **199** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Norsertraline** | **192** | ND | ND | ND | ND | ND | **29.4** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Norverapamil** | **8.5** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Omeprazole** | **5.6** | ND | ND | ND | **4.71** | ND | **15.4** | ND | **5.45** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Orlistat** | **52** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Oseltamivir** | **14** | ND | ND | ND | ND | ND | 10.3 | 3.58 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Oxazepam** | **140** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Oxycodone** | **24** | ND | ND | ND | 26.6 | 12.6 | 81.8 | 14.4 | 34.6 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Paroxetine** | **20** | ND | ND | ND | **2.09** | ND | **5.33** | ND | **4.76** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Penciclovir** | **40** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Pentoxifylline** | **9.3** | ND | ND | ND | 4.45 | ND | ND | ND | ND | ND | ND | 3.85 | ND | ND | ND | ND | ND | ND | ND | ND | **9.1** |
| **Phenazopyridine** | **13** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Phendimetrazine** | **31** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Phenytoin** | **188** | ND | ND | ND | ND | ND | **143** | ND | **13.8** | ND | **86.1** | ND | ND | ND | ND | ND | ND | ND | **90.7** | ND | **18.2** |
| **Piperonyl butoxide** | **3** | ND | ND | ND | ND | ND | **6.52** | 3.59 | **5.29** | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.25 | ND | **9.1** |
| **Prednisolone** | **150** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Prednisone** | **168** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Promethazine** | **50** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Propoxyphene** | **17** | ND | ND | ND | ND | ND | ND | ND | 0.81 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1.89 | 1.37 | **18.2** |
| **Propranolol** | **26** | ND | ND | ND | 63.8 | ND | 203 | 38.5 | 84.1 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Pseudoephedrine** | **11** | ND | 2.7 | ND | 16.9 | ND | 61.5 | 9.32 | 23.4 | ND | 12 | 5.57 | ND | ND | ND | ND | ND | 3.43 | ND | 3.47 | **36.4** |

**Table SI-6.** (cont.)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound** | **Reporting Limit** | **U80-SW** | **U50-IS-S** | **U50-SW** | **OUTFALL** | **D10-IS-S** | **D10-SW-REP1** | **D10-SW-REP2** | **D10-SW-REP3** | **D10-LB-T1-R1-REP1** | **D10-LB-T1-R1-REP2** | **D10-LB-T1-R1-REP3** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T2-R2** | **D10-LB-T3-R1** | **D10-LB-T3-R2** | **D10 -LB Detection**  **Frequency (%)** |
| **Quinine** | **79** | ND | ND | ND | ND | ND | 13.2 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Raloxifene** | **9.7** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Ranitidine** | **192** | ND | ND | ND | **707** | ND | **2200** | **476** | **1030** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Sertraline** | **16** | ND | ND | ND | **10.1** | **2.32** | **29.7** | **15.6** | **19.3** | ND | ND | ND | ND | ND | ND | ND | **2.26** | ND | ND | ND | **9.1** |
| **Sitagliptin** | **97** | ND | ND | ND | **6.9** | ND | **21.7** | **3.81** | **9.57** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Sulfadimethoxine** | **65** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Sulfamethizole** | **104** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Sulfamethoxazole** | **26** | ND | ND | ND | 900 | 1100 | 3280 | 419 | 1220 | 151 | 1600 | 732 | 537 | 159 | 13.8 | ND | 297 | 324 | 481 | 239 | **90.9** |
| **Tamoxifen** | **52** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Temazepam** | **18** | ND | ND | ND | 73.3 | 57.4 | 241 | 41.1 | 95.4 | ND | 94.1 | 45.2 | ND | ND | ND | ND | 28.1 | ND | 39.5 | ND | **36.4** |
| **Theophylline** | **41** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Thiabendazole** | **4.1** | ND | ND | ND | 11.4 | ND | 37.3 | 6.57 | 13.4 | ND | 4.07 | ND | ND | ND | ND | ND | ND | ND | 2.84 | ND | **18.2** |
| **Tiotropium** | **43** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Tramadol** | **15** | ND | 16 | ND | 424 | 300 | 1440 | 231 | 606 | 28.9 | 216 | 109 | 26.4 | ND | ND | ND | 114 | 69 | 112 | 65.1 | **72.7** |
| **Triamterene** | **5.2** | ND | ND | ND | 107 | ND | 371 | 49.4 | 139 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 6.44 | ND | **9.1** |
| **Trimethoprim** | **19** | ND | ND | ND | 355 | ND | 1220 | 187 | 524 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Valacyclovir** | **163** | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Venlafaxine** | **4.4** | ND | ND | ND | 261 | 4.6 | 947 | 161 | 413 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 4.42 | ND | **9.1** |
| **Verapamil** | **15** | ND | ND | ND | ND | ND | 0.72 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | **0.0** |
| **Warfarin** | **6** | ND | **1.3** | ND | **3.65** | **8.23** | **11.1** | **1.82** | **4.42** | **2.27** | **18.8** | **9.82** | **5.2** | **5.42** | **7.3** | **5.27** | **9.3** | **11.3** | **9.63** | **6.53** | **100.0** |
| **110** |  | **10** | **15** | **6** | **57** | **28** | **68** | **55** | **59** | **15** | **29** | **21** | **17** | **8** | **11** | **7** | **20** | **21** | **31** | **26** |  |
| **%Detects** |  | **9.1** | **13.6** | **5.5** | **51.8** | **25.5** | **61.8** | **50.0** | **53.6** | **13.6** | **26.4** | **19.1** | **15.5** | **7.3** | **10.0** | **6.4** | **18.2** | **19.1** | **28.2** | **23.6** |  |
| **SConc** |  | **250** | **542** | **129** | **16292** | **4228** | **42638** | **10017** | **20601** | **860** | **7223** | **3176** | **2229** | **373** | **396** | **136** | **2106** | **3106** | **4161** | **2057** |  |

**Table SI-7.** Summary of Red-Ox parameters detected in in-stream shallow (IS-S) hyporheic samples and left‑bank‑piezometer (LB) groundwater samples collected in December 2012. “nd” indicates not detected.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter (units)** | **Reporting Limit** | **U80-IS-S** | **U80-LB-T1-R1** | **U80-LB-T1-R2** | **U50-IS-S** | **U50-LB-T1-R1** | **U50-LB-T1-R2** | **U50-LB-T1-R3** | **U50-LB-T2-R1** | **U50-LB-T2-R2** | **U50-LB-T2-R3** | **D10-IS-S** | **D10-LB-T1-R1** | **D10-LB-T1-R2** | **D10-LB-T1-R3** | **D10-LB-T1-R4** | **D10-LB-T1-R5** | **D10-LB-T2-R1** | **D10-LB-T2-R2** | **D10-LB-T3-R1** | **D10-LB-T3-R2** |
| **Oxygen (mg/L)** | **0.05** | 0.3 | 0.1 | 0.2 | 0.1 | 0.4 | 2.0 | 1.0 | 0.2 | 0.2 | 0.5 | 0.3 | 0.5 | 0.3 | 2.0 | 0.8 | 0.6 | 0.6 | 1.0 | 0.8 | 0.4 |
| **Iron (FeII) (mg/L)** | **0.01** | 0.06 | nd | 0.03 | 0.10 | 0.86 | 0.50 | 0.60 | 0.80 | 0.02 | 0.02 | nd | 0.06 | nd | 0.38 | 0.29 | nd | nd | 0.02 | 0.12 | 0.26 |
| **Sulfide (mg/L)** | **0.01** | nd | nd | nd | 0.02 | nd | nd | 0.02 | nd | nd | nd | 0.02 | nd | 0.02 | 0.15 | 0.05 | 0.02 | 0.02 | nd | 0.03 | nd |
| **pH** | **---** | 7.71 | 7.69 | 7.45 | 7.15 | 7.73 | 7.50 | 7.32 | 7.73 | 7.47 | 7.53 | 7.76 | 7.37 | 7.74 | 7.48 | 7.44 | 7.30 | 7.52 | 7.69 | 7.50 | 7.29 |
| **Temperature (°C)** | **---** | 6.8 | 10.5 | 12.5 | 5.4 | 10.9 | 12.0 | 13.3 | 11.3 | 12.6 | 12.8 | 15.7 | 12.9 | 12.8 | 13.4 | 13.2 | 12.3 | 12.6 | 13.3 | 12.8 | 13.5 |
| **Specific conductivity (µS)** | **---** | 821 | 618 | 645 | 1084 | 765 | 779 | 794 | 746 | 739 | 750 | 807 | 727 | 282 | 775 | 393 | 807 | 757 | 749 | 828 | 768 |

**Figure SI-1.** Longitudinal (A) and vertical (B) gradients in water levels (NAVD88) in left bank piezometers in row 2 and in surface water and nested in-stream piezometers at network D10 during December 2012 sampling event. The deep piezometer at this position did not produce water and is not shown.

