Supplementary material

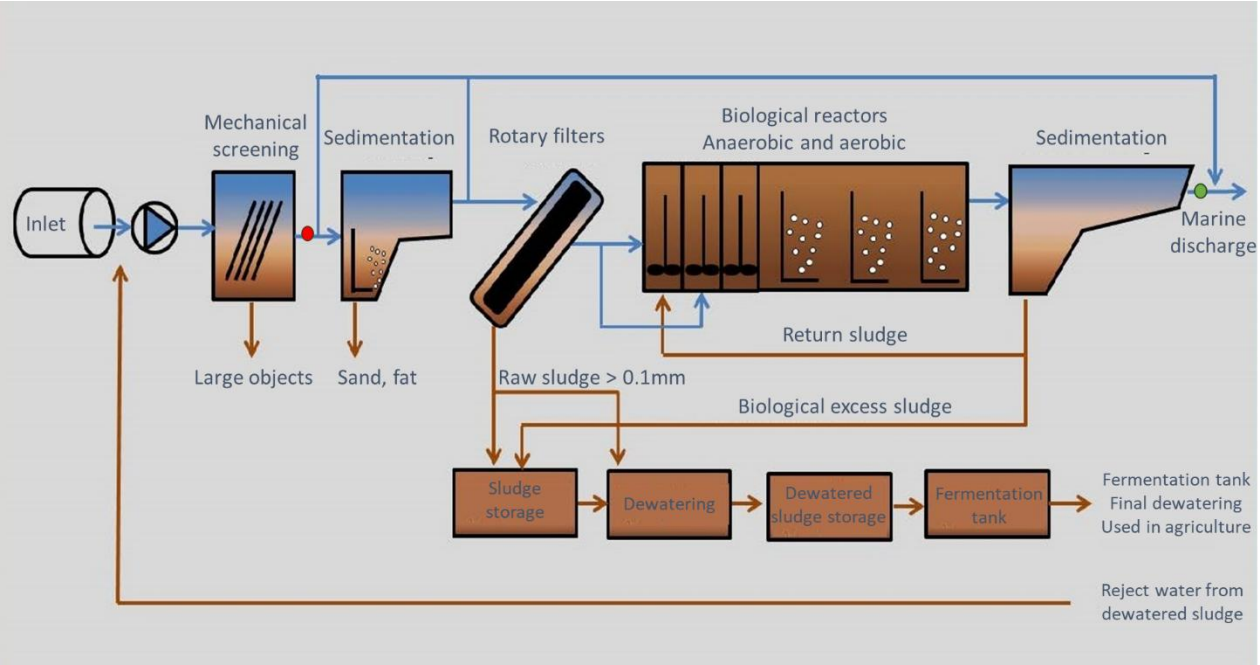

Fig S1. Schematic representation of the wastewater treatment plan IVAR Central Wastewater Treatment Plant Nord-Jæren. Red and green dots show influent and effluent sample collection points, respectively.

Tables

Supplementary material

Table S1. List of pharmaceutical compounds selected for this study, NSAID = non-steroidal anti-inflammatory drug.

Abbreviation	Name	Therapeutic group
ACE	Acetaminophen	NSAID
ACR	Acridine	Topical antiseptic
AMT	Amitriptyline	Antidepressant
ATE	Atenolol	Antihypertensive (beta blocker)
ATORVA	Atorvastatin	HMG-CoA reductase inhibitors (statins)
ATZ	Atrazine	Herbicide
BTA	Benzotriazole	Antimicrobial activity
MBTA	Methyl-1H-benzotriazole	Anti-icing fluids/detergent/building block for UV-
CAF	Caffeine	Stimulant
CBZ	Carbamazepine	Antiepileptic
CBZ-EPO	Carbamazepine-10,11-epoxide	Antiepileptic
CPM	Chlorphenamine	Antihistamine
CIP	Ciprofloxacin	Antibiotics
DCF	Diclofenac	NSAID
5H-DCF	5-hydroxy diclofenac	NSAID
FLU	Fluoxetine	Antidepressant

IBP	Ibuprofen	NSAID
LOS	Losartan	High blood pressure (hypertension)
DMPA	Medroxy progesterone 17-acetate	Hormonal therapy
MET	Metoprolol	Beta-blocker
DEET	N,N-diethyl-meta-toluamide	Insect repellent products
NTP	Nortriptyline	Antidepressant
PRE	Prednisolone	Corticosteroid
RN	Ranitidine	Decrease stomach acid production
SMV	Simvastatin	HMG-CoA reductase inhibitors (statins)
SDX	Sulfadoxine	Ultra-long-lasting sulfonamide
SMZ	Sulfametaxazole	Antibiotic
TMP	Trimetoprim	Antibiotic
TCPP	Tris (1-chloro-2-propyl) phosphate	Flame retardant and plasticizer
WAF	Warfarin	Anticoagulant (blood thinner)

Table S2 – PNEC values from the NORMAN database system. Ecotoxicological Database from NORMAN Database System

Table S3 – Concentrations of targeted analytes in influent and effluent samples collected at a Norwegian wastewater treatment plant. Values reported as ng/L. LOD = limit of detection.

Compound	**LOD**	**Influent**			**Effluent**		
Acetaminophen	2.88	94.49	87.33	67.19	< LOD	-	-
Acridine	3.60	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Amitriptylene	1.12	3.80	4.50	6.49	6.46	4.75	7.51
Atenolol	0.48	113.80	-	-	0.60	-	-
Atorvastatin	0.20	682.30	-	-	< LOD	-	-
Atrazine	0.39	21.76	-	-	< LOD	-	-
Benzotriazole	1.54	430.27	-	-	10.89	-	-
Methyl-1H-benzotriazole	0.70	339.90	-	-	5.50	-	-
Caffeine	3.05	88559	26657	28983	47.33	92.43	70.06
Carbamazepine	2.91	76.37	81.95	69.44	76.21	64.99	59.57
Carbamazepine-10,11-epoxide	9.33	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Chlorphenamine	0.18	0.67			< LOD		
Ciprofloxacin	5.60	11.27	14.44	24.01	6.26	5.58	11.79
Diclofenac	5.74	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
5-hydroxy diclofenac	7.54	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Fluoxetine	0.50	7.83			< LOD		
Ibuprofen	132.24	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD

Losartan	1.31	6.06	8.16	5.41	8.54	10.38	22.28
Medroxy progesterone 17-acetate	54.00	< LOD	-	-	< LOD	-	-
Metoprolol	3.95	425.21	515.32	456.89	360.45	565.29	239.40
N,N-diethyl-meta-toluamide	1.10	40.65	30.45	29.46	37.07	36.43	71.18
Nortriptyline	0.01	4.45	-	-	0.42	-	-
Prednisolone	14.88	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Ranitidine	0.24	2.24	-	-	< LOD	-	-
Simvastatin	1.59	19.49	-	-	< LOD	-	-
Sulfadoxine	1.76	0.00	-	-	< LOD	-	-
Sulfametaxazole	1.36	101.09	-	-	< LOD	-	-
Trimetoprim	0.16	5.20	9.07	9.51	2.74	7.01	6.65
Tris (1-chloro-2-propyl) phosphate	24.44	216.02	159.46	172.26	313.14	423.99	677.19
Warfarin	1.26	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD

Table S4 – Potential classification of pharmaceuticals for removal requirements in European wastewater treatment plants.

	Compound name	CAS No	Therapeutic group
Category 1	Amisulprid	71675-85-9	antipsychotic
	Carbamazepine	298-46-4	anticonvulsant/antiepileptic
	Citalopram	59729-33-8	antidepressant
	Clarithromycin	81103-11-9	antibiotic
	Diclofenac	15307-86-5	anti-inflammatories
	Hydrochlorothiazide	58-93-5	thiazide diuretic (treat high blood pressure)
	Metoprolol	37350-58-6	beta-blocker (treat high blood pressure)
	Venlafaxine	93413-69-5	antidepressant
Category 2	Benzotriazole	95-14-7	antimicrobial activity
	Candesartan	139481-59-7	angiotensin II receptor blocker (treat high blood pressure)
	Irbesartan	138402-11-6	angiotensin II receptor blocker (treat high blood pressure)
	mixture of 4-Methylbenzotriazole and 6-methylbenzotriazole	29878-31-7 and 136-85-6	Anti-icing fluids/detergent

*The regulation continues with a note which specifies that the percentage of removal should be calculated for at least six substances and the number of substances in category 1 should be twice the number of substances in category 2. If this cannot be achieved, there is the possibility that the authority might designate other substances to calculate the minimum percentage of removal.

Appendix A - QA/QC of the chemical analyses

Influent and effluent samples were analysed on an Agilent 6490 mass spectrometer and Agilent 1290 HPLC system (Santa Clara, CA, USA). The analytical column was Acquity UPLC BEH C18 1.7 µm. The mobile phases were water and acetonitrile, both containing 0.1 % formic acid. The flow rate was 0.4 mL/min, with injection volumes of 2.5 µL. The gradient method conditions were the followings: start with 0 % acetonitrile at 0 min, then ascend to 100% acetonitrile after 11 min, and hold at 100% for 5 min. For the water samples, three blanks, one matrix blank, and two spiked matrix samples were analysed.

For analytes with no significant blank signals, the limit of detection (LOD) was set at three times the noise of the chromatograms. For analytes with a significant blank signal, the LOD was calculated as the average of the blanks plus three times the standard deviation of the blanks.