Supplementary Material

1. Sewer system

The sewer systems in this area mainly consist of several gravity pipes (A-C, B-C, C-D, E-D, F-G) and a pressure pipe (D-F). The flow direction for each pipe is demonstrated in Fig. S1. As shown in Fig. S1, sewage collected from pipe A-C and pipe B-C converge in point C and flow into the pump station near point D. Sewage collected from pipe E-D also inflow into the pump station. A pressure pipe starting from the pump station and ending at point F transports sewage from the pump station to the downstream gravity pipe F-G. There is an energy dissipation well in the junction of the pressure and gravity pipes. Together with sewage collected by pipe F-G, sewage from this residential area is transported into the downstream wastewater treatment station. In addition, there is a septic tank for each household and it connects to branch pipes that are located underground in various alleys. The star symbol in Fig. S1 marks the site with the highest concentration of GHGs in this area.

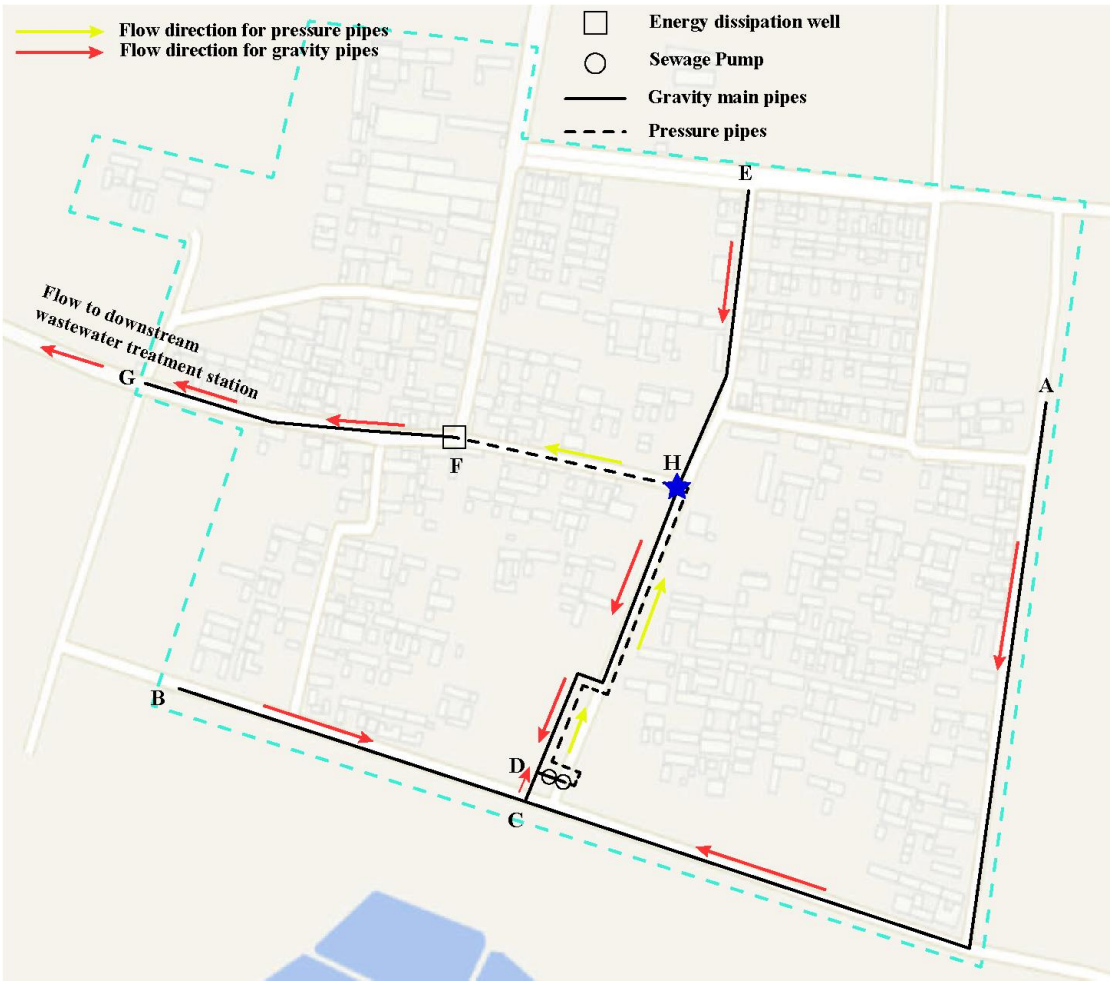

Figure. S1 Sewer pipe distribution

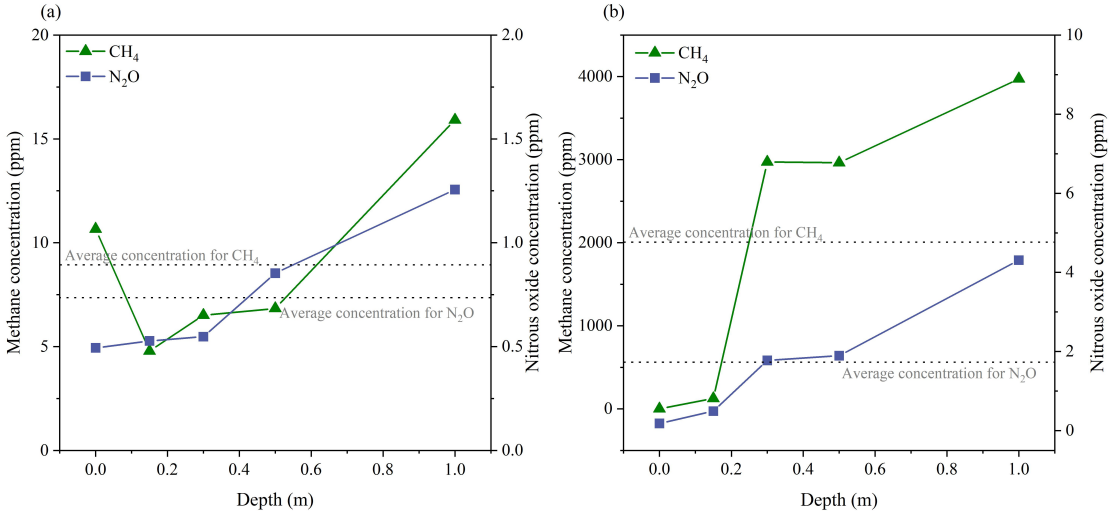

Figure. S2 Greenhouse gas concentrations at different depths of manholes. (a) Site 1; (b) Site 2.

Table S1 Pipe type, CH_4 and N_2O concentrations, CH_4 and N_2O flux rates, $\delta^{13}CH_4$ and $\delta^{13}CO_2$ stable isotopic compositions of all samples in the studied area

Sites	Pipe type	Greenhouse gas concentration (ppm)		flux rate (mg/h)		$\delta^{13}CH_4$ (‰)	$\delta^{13}CO_2$ (‰)
		CH_4	N_2O	CH_4	N_2O		
w-1	Main	61.35	0.58	0.00	0.02	-63.65	-22.19
w-10	Main	22.45	0.45	-	-	-	-
w-100	Main	178.11	1.17	53.89	0.23	-66.39	-24.95
w-100-12	Main	2.84	0.54	-	-	-	-
w-100-13	Main	2.72	0.45	-	-	-	-
w-100-15	Main	5.56	0.48	-	-	-	-
w-100-16	Main	1.94	0.75	-	-	-	-
w-100-17	Main	6.87	0.63	-	-	-	-
w-100-18	Main	61.68	1.78	-	-	-	-
w-100-14	Main	27.11	3.67	-	-	-	-
w-11	Main	90.99	1.30	-	-	-	-
w-12	Main	69.54	0.57	-	-	-	-
w-13	Main	387.39	2.00	-	-	-	-
w-134	Main	148.91	0.85	-	-	-	-
w-14	Main	467.58	2.26	-	-	-	-
w-15	Main	443.91	2.80	-	-	-	-
w-16	Main	460.94	2.61	1835.94	0.28	-64.75	-21.67
w-3	Main	230.99	3.42	-	-	-	-
w-6	Main	152.19	1.48	-	-	-	-
w-82	Main	31.77	0.88	0.00	0.00	-72.26	-19.00
w-83	Main	147.20	1.78	-	-	-	-
W-84	Main	59.00	0.95	-	-	-	-
w-85	Main	169.86	1.51	-	-	-	-
w-86	Main	398.47	2.43	-	-	-	-
w-87	Main	349.62	1.60	696.28	0.10	-68.80	-22.42
w-89	Main	731.81	3.02	-	-	-	-
w-90	Main	4115.34	7.44	-	-	-	-
w-91	Main	6944.06	4.39	6156.32	0.37	-60.23	-28.51
w-92	Main	68.86	2.34	-	-	-	-
w-93	Main	55.20	1.97	-	-	-	-
w-94	Main	640.04	2.58	-	-	-	-
w-95	Main	629.63	1.91	-	-	-	-
w-99-10	Main	113.82	0.66	-	-	-	-
w-99-11	Main	96.85	1.64	-	-	-	-
w-99-12	Main	32.19	0.71	0.00	0.00	-64.61	-21.42
w-99-13	Main	146.49	0.87	-	-	-	-
w-99-15	Main	32.33	2.13	-	-	-	-
w-99-18	Main	187.84	0.96	-	-	-	-

w-99-19	Main	587.18	1.94	-	-	-	-
w-99-22	Main	55.36	0.67	-	-	-	-
w-99-23	Main	851.24	2.98	0.00	0.21	-64.14	-28.03
w-99-24	Main	641.25	1.04	-	-	-	-
w-99-25	Main	566.44	2.28	-	-	-	-
w-99-27	Main	83.09	0.98	-	-	-	-
w-99-7	Main	33.33	0.64	-	-	-	-
w-99-8	Main	193.67	1.01	-	-	-	-
w-99-9	Main	112.56	0.63	-	-	-	-
w-100-1	Branch	10.11	1.32	-	-	-	-
w-100-10	Branch	259.75	2.00	-	-	-	-
w-100-7	Branch	1.86	0.26	-	-	-	-
w-100-9b	Branch	20.50	0.54	-	-	-	-
w-100-9c	Branch	679.31	2.40	-	-	-	-
w-100-9d	Branch	399.67	1.81	-	-	-	-
w-100-9f3	Branch	91.79	0.81	-	-	-	-
w-16-1	Branch	355.39	2.62	-	-	-	-
w-16-3	Branch	108.73	1.65	-	-	-	-
w-16-3a	Branch	100.33	1.67	-	-	-	-
w-16-4	Branch	447.86	2.39	-	-	-	-
w-16-4a	Branch	2.31	0.59	-	-	-	-
w-16-6	Branch	107.96	0.71	-	-	-	-
w-3-2	Branch	155.79	2.52	-	-	-	-
w-3-3	Branch	97.14	1.56	-	-	-	-
w-3-5	Branch	83.09	2.75	-	-	-	-
w-3-7b	Branch	96.79	1.05	-	-	-	-
w-75	Branch	102.44	2.30	-	-	-	-
w-78	Branch	77.60	1.66	-	-	-	-
w-83-5	Branch	294.26	1.87	-	-	-	-
w-84-1	Branch	422.83	3.22	-	-	-	-
w-85-11	Branch	12.87	0.26	-	-	-	-
w-85-13	Branch	66.00	1.14	-	-	-	-
w-85-13b	Branch	2.67	0.47	-	-	-	-
w-85-15	Branch	32.91	0.72	-	-	-	-
w-85-15a	Branch	58.44	1.33	-	-	-	-
w-85-17	Branch	89.61	1.29	-	-	-	-
w-85-6	Branch	43.89	0.79	-	-	-	-
w-85-9	Branch	177.14	3.12	197.43	0.43	-66.72	-24.36
w-86-1	Branch	15.48	0.51	-	-	-	-
w-86-5	Branch	132.86	1.92	-	-	-	-
w-87-1	Branch	79.27	1.22	-	-	-	-
w-87-7	Branch	187.68	0.91	-	-	-	-

w-89-4	Branch	23.05	1.89	-	-	-	-
w-89-6	Branch	3.19	0.85	-	-	-	-
w-89-8	Branch	464.78	2.00	-	-	-	-
w-89-8b	Branch	11.43	0.52	-	-	-	-
w-91-4	Branch	72.05	2.75	-	-	-	-
w-91-6	Branch	12.36	1.14	-	-	-	-
w-91-7	Branch	79.12	4.82	-	-	-	-
w-93-2	Branch	5.25	0.72	-	-	-	-
w-93-4	Branch	72.09	2.06	-	-	-	-
w-93-5	Branch	77.79	2.75	-	-	-	-
w-93-6	Branch	13.10	1.22	-	-	-	-
w-95-2	Branch	363.94	1.98	-	-	-	-
w-95-4	Branch	1568.96	1.91	-	-	-	-
w-95-5a	Branch	142.82	2.15	-	-	-	-
w-95-5b	Branch	52.69	1.73	-	-	-	-
w-95-5c	Branch	8.84	0.71	-	-	-	-
w-99-12c	Branch	408.50	1.61	-	-	-	-
w-99-12d	Branch	98.44	1.70	-	-	-	-
w-99-12e	Branch	69.03	0.82	-	-	-	-
w-99-12f	Branch	84.04	0.90	-	-	-	-
w-99-12f2	Branch	72.23	1.70	-	-	-	-
w-99-12g	Branch	144.74	1.35	-	-	-	-
w-99-12h	Branch	71.62	1.70	-	-	-	-
w-99-12i	Branch	156.76	1.23	-	-	-	-
w-99-12j	Branch	8.55	0.51	-	-	-	-
w-99-12j2	Branch	37.10	0.85	-	-	-	-
w-99-14	Branch	153.71	0.79	-	-	-	-
w-99-16	Branch	84.62	1.27	-	-	-	-
w-99-16e	Branch	309.40	1.64	-	-	-	-
w-99-2	Branch	51.33	1.07	13.45	0.07	-56.10	-20.68
w-99-25b	Branch	5.85	0.00	23.17	0.33	-62.32	-22.33
w-99-25c	Branch	36.36	0.74	-	-	-	-
w-99-2b	Branch	315.46	2.07	-	-	-	-

Table S2 S_p and R^2 values for emission flux measurement sites

Sites	CH_4			N_2O		
	S_p	R^2	E_F	S_p	R^2	E_F
w-1	6.2320	0.19187	0.00	0.0038	0.9997	0.02
w-16	17.2240	0.9815	1835.94	0.0576	0.9972	0.28
w-82	-0.6212	0.8354	0.00	-0.0184	0.9642	0.00
w-87	6.5322	0.9572	696.28	0.0195	0.9993	0.10

w-91	57.756	0.9916	6156.32	0.0753	0.9689	0.37
w-100	30.332	0.986	53.89	0.0462	0.9675	0.23
w-99-2	0.1262	0.9518	13.45	0.0149	0.9675	0.07
w-99-23	6.0564	0.2133	0.00	0.0422	0.9705	0.21
w-99-25b	0.2174	0.9639	23.17	0.0666	0.9696	0.33
w-85-9	1.8522	0.9524	197.43	0.0881	0.9345	0.43
w-99-12	-1.5707	0.6186	0.00	-0.0012	0.5158	0.00