Electronic Supplementary Material (ESI) for Environmental Science: Water Research & Technology.

ELECTRONIC SUPPLEMENTARY MATERIAL

Increase in anthropogenic antibiotic resistance markers in water supplied by overhead tank based-water distribution system

Section ESI.1 Prevalence of pathogens in building samples:

The highest levels of DNA marker for *Legionella pneumophila*, *mip*, were detected in a newer building (Resid10-I) during both the monsoon and winter sampling event. During the summer sampling event, all the building samples and 16% of OHT samples had *mip* gene copies. During the monsoon sampling event, 66% of academic, 100% of administrative, 100% of recreational, and 75% of residential building samples, and 50% of OHT samples had *mip* gene copies. In winter, two building samples (Admin170-I and Resid10-I) had an order of magnitude higher levels of *mip* relative to the OHTs, suggesting growth of *L. pneumophila* within the DWDS (Fig. S12). During the winter sampling event, none of the academic, 33% of administrative, none of recreational, 8% of residential building samples, and none of the OHT samples had *mip* gene copies. Among the samples collected in winter, none of the OHT samples and few building samples had the DNA marker for *Mycobacterium avium* (Admin170-I, Resid170-I, Acad60-I and II, Resid60-II, Resid10-I, Rec10-I, and Acad10-I, Fig. S13). In summer, four out of six OHT samples, and building sample from 77% of academic, 66% of administrative, 66% of recreational, and 66% of residential buildings had the DNA marker for *M. avium* (Fig. 4). In monsoon, one OHT sample had the DNA marker for *M. avium* in contrast to the 33% of academic, 33% of administrative, 66% of recreational, and 58% of residential building samples.

Section ESI.2 Physicochemical parameters and their correlation with the total bacterial count, ARGs, and opportunistic pathogens:

In summer, the highest levels of iron (>500 ppb) were found in two buildings (Acad60-I and Resid60-II) and highest levels of Zn and Pb were found in Resid170-I (Table S5). In winter, the academic building, Acad60-I, had the highest level of Cu, Fe, and Pb. In monsoon, Cr levels were higher in Admin170-I, Acad60-I Rec10-I, and Acad10-I, whereas, Resid10-I had a higher level of Cu. Other metals such Pb and Zn were higher in Rec10-I and Acad10-I, respectively.

Total bacterial count, as indicated by the levels of 16S rRNA gene copies, in building samples for buildings that were <10 years old correlated positively (Spearman's rank correlation) with nitrate (p-value = 0.002, r = 0.56), turbidity (p-value = 0.021, r = 0.44), Cu (p-value = 0.005, r = 0.52), and Pb (p-value = 0.011, r = 0.48). Whereas, in buildings that were 50-60 years old, Zn (p-value = 0.008, r = 0.42), Cu (p-value <0.01, r = 0.63), and Pb (p-value = 0.03, r = 0.35) were positively correlated with total bacterial count. For the buildings >170 years old, turbidity (p-value = 0.05, r = 0.46) and sulphate (p-value = 0.039, r = 0.49) positively correlated with the total bacterial count. The levels of iron, lead, and chromium in building samples from building that are >170 years old were statistically positively correlated with the levels of *mip* gene copies (p-value = 0.002, r = 0.67 for Fe, p-value = 0.0001, r = 0.77 for Pb, p-value = 0.0002, r = 0.76 for Cr; Spearman's rank correlation). Only Fe levels were statistically significantly and positively correlated with DNA marker for *M. avium* in <10 years old buildings (p-value = 0.01, r= 0.44, Spearman's rank correlation).

Overall, heavy metals (Fe, Pb, and Cr) and nitrate and pH were positively correlated to with *ycc*T gene copies. The levels of sulphate were negatively correlated with the levels of *ycc*T gene copies (p-value = 0.05, r = -0.45754, Spearman's rank correlation) for buildings that were >170 years old. A similar trend was noticed in old buildings that were 50 – 60 years old:

the levels of *ycc*T gene copies positively correlated with Fe (p-value = 0.03, r=0.36), Pb (p-value = 0.01, r= 0.39) and Cr (p=0.002, r=0.49), nitrate (p= 0.01, r= 0.42) and pH (p-value = 0.04, r= 0.34). In case of new buildings (<10 years old), the levels of *ycc*T gene copies positively correlated with Fe (p-value =0.05, r=0.37), Pb (p-value = 0.006, r= 0.51), Cr (p-value =0.0001, r=0.67), nitrate (p-value = 0.05, r= 0.38) and pH (p-value = 0.02, r= 0.42) (Spearman's rank correlation).

Overall, Zn, Cu, Pb and nitrate, pH and turbidity were correlated with the levels of *sul*1 gene copies (p-value = 0.02, r = 0.22 for Zn, p-value = 0.0001, r = 0.37 for Cu, p-value < 0.01, r = 0.41 for Pb, p-value = 0.001, r = 0.31 for nitrate, p-value = 0.01, r = 0.24 for pH, p-value = 0.03, r = 0.24 for turbidity; Spearman's rank correlation). The highest increase in the levels of *int*I1 gene copies was observed in two academic buildings (Acad60-I, Acad10-I) and one residential building (Resid10-I) during the summer sampling event and it correlated significantly with chloride levels (p-value = 0.03, r = 0.412; Spearman's rank coefficient) (Fig. 5).

Section ESI.3 Effect of pipe length on water quality, antibiotic resistance gene, and class 1 integron-integrase gene

In buildings that were >170 years, pipe length correlated with *sul*1 (p-value= 0.01, r= 0.57) and *int*I1 (p-value= 0.04, r= 0.46) and negatively correlated with turbidity (p-value= 0.01, r= -0.56) (Spearman's rank correlation coefficient). In buildings that were 50-60 years, pipe length correlated positively with nitrate (p-value= 0.001, r= 0.51) and sulphate (p-value= 0.005, r= 0.45) and negatively with *int*I1 (p-value= 0.02, r= -0.36) and pH (p-value< 0.001, r= -0.77). In buildings that were <10 years, pipe length correlated negatively with nitrate (p-value= 0.02, r= -0.42) (Spearman's rank correlation coefficient).

Table S1 Detailed information of the OHTs and buildings that were sampled

Overhead-Tanks				Buildings					
Identity*	**Year of construction**	**Capacity (KL)**	**Pipe length from nearest tap (m)**	**Identity***	**Building age**	**Type**	**Typical number of residents for residential buildings**	**Pipe and tap materials**	**Pipe length from OHT** (m)**
OHT1	1982	525	~35	Admin170-I	Very old buildings (>170 years)	Administration		CI+GI	~400
OHT2	1982	500	~45	Resid170-I		Residential	4-6		~250
OHT3	2007	500	~60	Acad60-I	Old buildings (50-60 years)	Academics		CI+GI	~400
OHT4	2011	525	~230	Acad60-II					~400
OHT5	2014	500	~35	Resid60-I		Residential	4-6		~450
OHT6	2014	500	~40	Resid60-II					~700
				Rec10-I	New	Recreational		GI & CP	~600

	Acad10-I	buildings	Academics		brass+	~420
	Resid10-I	(<10	Residential	2-4	UPVC+	~500
		years)			CPVC	

*In case of OHTs, the suffixed numbers represent each of the 6 different targeted OHTs. In case of buildings, the prefixes – Acad, Resid, and Admin – represent the space utilization of the buildings: Academic, Residential, and Administrative work respectively. The number that follows the space utilization prefix represents the building age to the nearest decade. The suffixes – I, II – are the index number for each of the buildings within the same space utilization and building age category. Pipe materials – CI= cast iron, GI= galvanized iron, CP brass= chrome plated brass, UPVC= unplasticized polyvinyl chloride, CPVC= chlorinated polyvinyl chloride. Summer (water temperature range: 24°C – 26°C; ambient temperature range: 28°C – 34°C, relative humidity: 30%-35%), winter (water temperature range: 16°C – 18°C; ambient temperature range: 6°C – 11°C, relative humidity: 60%-62%), and monsoon (water temperature range: 23°C – 25°C; ambient temperature range: 25°C – 30°C, relative humidity: 80%-95%).

**The pipe length was calculated using the construction drawing of the DWDS (Fig. S1), and the estimates are accurate upto 3 m.

Table S2 Primer sequences for the qPCR to target select pathogens and genetic markers

Targeted genes/ ARGs/ pathogens*	Primer sequence	References	Analytical LOQ (GC/µL)
16S rRNA	5'- CGGTGAATACGTTCYCGG- 3' 5'- GGWTACCTTGTTACGACTT- 3'	1	1000
*sul*1	5'- CGCACCGGAAACATCGCTGCAC- 3' 5'- TGAAGTTCCGCCGCAAGGCTCG- 3'	2	10
*sul*2	5'- GAATAAATCGCTCATCATTTTCGG- 3' 5'- CGAATTCTTGCGGTTTCTTTCAGC- 3'	2	100
*bla*OXA-1	5'-CAAGCCAAAGGCACGATAGT- 3' 5'-ACGATTGCCTCCCTCTTGAA- 3'	3	10
*erm*F	5'-CGACACAGCTTTGGTTGAAC-3' 5'-GGACCTACCTCATAGACAAG-3'	4	10
*int*I1	5'-GGGTCAAGGATCTGGATTTCG-3' 5'-ACATGCGTGTAAATCATCGTCG-3'	2	10
L. pneumophila (*mip*)	5'-AAAGGCATGCAAGACGCTATG-3'	5	10

	5'-GAAACTTGTTAAGAACGTCTTTCATTTG-3'		
	Probe: FAM-TGGCGCTCAATTGGCTTTAACCGA-BHQ		
M. avium (16S rRNA gene)	5'-AGAGTTTGATCCTGGCTCAG-3' 5'-ACCAGAAGACATGCGTCTTG-3'	5	10
*E. coli (ycc*T*)*	5'- GCATCGTGACCACCTTGA-3' 5'- CAGCGTGGTGGCAAAA-3'	6	1000

* The annealing temperature for all reactions was 60ºC. The overall qPCR assay contained DNA sample, the forward and reverse primers (500nM), PowerUp™ SYBR™ Green Master Mix (Applied Biosystems, USA) and molecular biology grade water. The total volume of all the qPCR reactions was 7µL and the qPCR was done using the Rotor-Gene Q® (Qiagen®, Hilden, Germany). The amplification efficiency ranged from 80% to 110% and the correlation coefficient of the standard curve 0.95 to 0.99.

Table S3 Correlation matrix of Spearman's rank correlation coefficients between the levels of targeted genes and physicochemical parameters for all building samples combined (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

	16S rRNA	*sul*1	*int*I1	*E. coli*	*M. avium*	*L. pneumophila*	pH	Conductivity	Turbidity	Chloride	Nitrate	Sulphate	Chloride to Sulphate Mass Ratio	Iron	Lead	Copper	Zinc	Chromium
*sul*1	0.71****																	
*int*I1	0.80****	0.78****																
E. coli	0.1	0.18	-0.09															
M. avium	-0.09	0	-0.18	0.24*														
L. pneumophila	0.31**	0.40***	0.11	0.59****	0.32**													
pH	0.25*	0.25*	0.29**	0.17	-0.07	0.17												
Conductivity	0.15	0.13	0.19	0.17	-0.28*	0	0.06											
Turbidity	0.21	0.13	0.2	-0.05	-0.08	-0.17	0.12	0.15										
Chloride	0.01	0.15	0.06	0.19	0.18	0.18	-0.1	0.25*	-0.13									
Nitrate	0.36***	0.32**	0.28*	0.34**	0.05	0.30**	-0.16	0.40***	0.06	0.23*								
Sulphate	0.09	0.16	0.16	-0.02	0.09	0.07	-0.2	0.26*	-0.01	0.82****	0.28*							
Chloride to Sulphate Mass Ratio	-0.25*	-0.07	-0.25*	0.30**	0.12	0.13	0	0.09	-0.18	0.40***	-0.04	-0.02						
Iron	0.03	0.08	-0.12	0.42***	0.29**	0.55****	0.06	-0.16	-0.11	0.06	0.07	-0.06	0.02					
Lead	0.35**	0.36***	0.16	0.44****	0.23*	0.66****	0.27*	0.02	0.03	0.29**	0.13	0.19	0.2	0.44****				
Copper	0.52****	0.46****	0.49****	0.13	0	0.17	0.22*	0.36**	0.22*	0.19	0.24*	0.26*	0.05	-0.19	0.42****			
Zinc	0.2	0.17	0.18	0.13	0.03	0.18	0.18	0.2	0.11	0.23*	0.02	0.30**	-0.05	0.07	0.53****	0.55****		
Chromium	0.1	0.15	-0.13	0.58****	0.30**	0.68****	0.01	-0.13	-0.22	0.17	0.17	-0.01	0.19	0.57****	0.52****	-0.01	0.06	
Pipe Length	-0.1	-0.06	-0.11	0.09	-0.02	-0.04	-0.34**	0.36**	-0.29**	0.44****	0.21	0.49****	0.12	0.15	-0.07	-0.02	-0.08	-0.09

Table S4 Values of pH, conductivity and turbidity in OHT and building samples collected over three seasons

Sample ID*	Summer			Monsoon			Winter		
	pH	Conductivity (µS/cm²)	Turbidity (NTU)	pH	Conductivity (µS/cm²)	Turbidity (NTU)	pH	Conductivity (µS/cm²)	Turbidity (NTU)
OHT1	8.04	534	1.26	8.01	530	1.38	7.91	498	2.12
OHT2	8.05	503	1.45	8.04	510	1.5	7.85	476	1.88
OHT3	8.06	480	1.8	8.02	509	1.56	7.67	482	1.34
OHT4	8.16	523	1.57	8.19	519	1.75	7.81	501	1.23
OHT5	8.02	506	2.27	8.01	505	1.98	7.79	500	1.56
OHT6	8.07	628	1.8	8.09	573	1.76	7.85	510	1.77
Admin170-Ia	8.01	491	2.86	8.05	612	1.95	8.03	515	3.21
Admin170-Ib	8.05	468	1.31	8.03	606	1.26	8.01	509	2.76
Admin170-Ic	8.04	461	2.06	8.08	578	1.87	8.06	511	2.29
Resid170-Ia	8.03	465	1.29	8.01	588	10.29	8.09	459	4.31
Resid170-Ib	8.06	472	15.3	8.04	576	5.44	8.11	487	3.83
Resid170-Ic	8.04	421	2.03	8.09	556	7.86	8.08	450	3.11

Acad60-Ia	8.02	504	4.24	8.05	600	8.6	8.04	491	3.69
Acad60-Ib	7.97	483	14.1	8.03	604	12.03	8.03	494	4.3
Acad60-Ic	8.05	502	2.52	8.06	601	4.25	8.05	491	3.81
Acad60-IIa	8.12	566	2.03	8.09	631	5.2	8.09	543	2.42
Acad60-IIb	8.16	523	3.25	8.17	628	7.4	8.15	539	2.09
Acad60-IIc	8.3	525	0.987	8.23	611	2.65	8.12	523	1.29
Resid60-Ia	7.62	503	3.01	8.01	559	1.78	7.59	512	2.76
Resid60-Ib	7.78	522	1.25	8.01	541	2.3	7.99	509	1.02
Resid60-Ic	7.89	533	0.931	8.02	545	2.08	7.84	511	2.11
Resid60-IIa	7.97	585	1.64	7.99	567	4.23	7.98	566	1.53
Resid60-IIb	7.96	602	9.83	7.81	585	2.98	7.91	587	3.12
Resid60-IIc	7.97	597	1.47	7.88	589	2.66	7.89	586	2.99
Resid10-Ia	8.03	529	0.928	8.01	540	1.2	8.1	520	3.83
Resid10-Ib	8.06	540	1.18	8.19	588	5.4	8.04	532	2.56
Resid10-Ic	8.09	514	1.17	8.17	619	2.09	8.03	525	5.22
Rec10-Ia	8.07	552	1.13	8.11	534	2.33	8.04	549	1.76

Rec10-Ib	8.02	542	1.39	8.13	567	2.1	8.01	541	1.51
Rec10-Ic	8.06	550	2.41	8.11	565	2.57	8.06	547	1.88
Acad10-Ia	8.07	477	1.51	8.09	587	10.43	7.99	505	1.64
Acad10-Ib	8.09	498	1.65	8.05	610	9.11	7.96	520	1.95
Acad10-Ic	8.09	503	8.23	8.08	575	7.41	7.99	515	1.33

*The prefixes are the OHT and building identities as enumerated in Table S1. The suffixes – a, b, c – represent the three different taps sampled from each building.

Table S5 Values of anions (chloride, nitrate and sulphate) in the OHT and building samples collected over three seasons

Sample ID*	**Summer**				**Monsoon**				**Winter**			
	Cl^- (mg/L)	**NO_3^- (mg/L)**	**SO_4^{--} (mg/L)**	**CSMR**	**Cl^- (mg/L)**	**NO_3^- (mg/L)**	**SO_4^{--} (mg/L)**	**CSMR**	**Cl^- (mg/L)**	**NO_3^- (mg/L)**	**SO_4^{--} (mg/L)**	**CSMR**
OHT1	11.12	14.62	26.25	0.42	4.29	1.34	5.22	**0.82**	8.92	0.61	15.13	**0.59**
OHT2	10.21	7.56	22.08	0.46	15.84	16.16	28.23	**0.56**	13.86	0.00	27.01	**0.51**
OHT3	3.88	0.80	8.06	0.48	1.83	0.00	3.58	**0.51**	2.33	1.28	3.75	**0.62**

OHT4	6.86	0.84	10.54	**0.65**	8.22	0.91	12.11	**0.68**	7.37	0.68	9.90	**0.74**
OHT5	17.70	16.58	25.40	**0.70**	17.65	12.98	24.33	**0.73**	12.82	0.00	22.88	**0.56**
OHT6	6.41	0.66	10.41	**0.62**	1.84	0.00	3.58	**0.51**	13.23	1.13	22.33	**0.59**
Admin170-Ia	2.54	0.86	4.31	**0.59**	9.38	11.93	23.11	0.41	3.39	0.96	9.83	0.35
Admin170-Ib	2.41	0.52	3.83	**0.63**	8.64	11.68	22.59	0.38	2.48	1.22	7.72	0.32
Admin170-Ic	2.20	0.52	3.46	**0.64**	6.76	0.50	18.18	0.37	2.59	1.21	8.05	0.32
Resid170-Ia	3.04	0.50	7.45	0.41	1.79	1.26	3.54	**0.51**	2.50	1.25	7.76	0.32
Resid170-Ib	3.30	1.28	7.61	0.43	1.90	1.27	3.55	**0.54**	3.86	1.08	8.80	0.44
Resid170-Ic	3.91	1.51	9.65	0.40	2.83	2.14	5.34	**0.53**	3.61	1.18	10.03	0.36
Acad60-Ia	3.84	1.51	9.51	0.40	2.95	2.16	5.70	**0.52**	4.24	0.92	10.43	0.41
Acad60-Ib	13.98	0.56	22.49	**0.62**	8.61	11.09	20.30	0.42	10.65	0.00	23.51	0.45
Acad60-Ic	13.72	0.57	22.21	**0.62**	3.99	2.20	7.61	**0.52**	11.43	0.00	25.05	0.46
Acad60-IIa	15.39	0.80	3.47	**4.43**	4.25	1.72	8.98	0.47	3.70	0.87	8.01	0.46
Acad60-IIb	3.02	0.73	3.07	**0.98**	1.80	0.55	3.51	**0.51**	6.12	0.00	14.02	0.44
Acad60-IIc	3.00	0.73	3.05	**0.98**	3.35	2.20	7.85	0.43	9.32	0.00	20.22	0.46
Resid60-Ia	6.29	4.95	14.21	0.44	13.10	15.01	28.66	0.46	6.91	0.00	17.44	0.40

Resid60-Ib	7.38	7.65	16.61	0.44	6.00	4.30	13.00	0.46	2.42	1.20	4.06	**0.60**
Resid60-Ic	6.82	7.24	15.35	0.44	12.54	14.57	28.17	0.45	6.32	0.00	11.88	**0.53**
Resid60-IIa	13.04	14.08	22.91	**0.57**	12.40	11.57	23.56	**0.53**	2.12	1.24	8.80	0.24
Resid60-IIb	14.96	18.96	27.77	**0.54**	13.88	12.99	24.88	**0.56**	2.14	1.25	8.84	0.24
Resid60-IIc	13.93	16.13	25.09	**0.56**	13.74	12.92	25.55	**0.54**	7.81	0.00	15.97	0.49
Resid10-Ia	11.33	12.67	9.68	**1.17**	13.13	11.68	24.60	**0.53**	2.95	1.20	10.56	0.28
Resid10-Ib	11.26	10.57	8.66	**1.30**	13.18	11.75	24.68	**0.53**	2.24	1.19	8.17	0.27
Resid10-Ic	9.30	8.48	7.55	**1.23**	13.42	12.18	25.01	**0.54**	2.58	1.20	9.16	0.28
Rec10-Ia	5.45	0.56	16.19	0.34	12.37	0.00	22.09	**0.56**	12.71	0.00	20.72	**0.61**
Rec10-Ib	4.96	0.57	16.17	0.31	13.36	0.00	24.73	**0.54**	6.87	1.08	12.86	**0.53**
Rec10-Ic	4.56	0.60	14.96	0.30	12.60	0.00	22.67	**0.56**	9.49	1.17	17.33	**0.55**
Acad10-Ia	6.16	2.89	21.28	0.29	10.46	9.58	22.48	0.47	12.99	0.00	21.55	**0.60**
Acad10-Ib	7.13	6.83	21.15	0.34	10.38	9.47	22.47	0.46	12.82	0.00	21.30	**0.60**
Acad10-Ic	7.00	4.67	18.68	0.37	10.45	9.29	22.77	0.46	2.54	1.15	4.29	**0.59**

* The prefixes are the OHT and building identities as enumerated in Table S1. The suffixes – a, b, c – represent the three different taps sampled from each building. CSMR >0.5, indicating high corrosivity in water is highlighted in bold typeface.

Table S6 Values of heavy metals (Fe, Pb, Cu, Zn and Cr) in OHT and building samples collected over three seasons

Sample ID*	Summer					Monsoon					Winter				
	Fe (µg/L)	Pb (µg/L)	Cu (µg/L)	Zn (µg/L)	Cr (µg/L)	Fe (µg/L)	Pb (µg/L)	Cu (µg/L)	Zn (µg/L)	Cr (µg/L)	Fe (µg/L)	Pb (µg/L)	Cu (µg/L)	Zn (µg/L)	Cr (µg/L)
OHT1	**340.644**	5.469	1.353	33.894	6.553	18.788	0.947	1.596	156.26	1.241	3.408	5.079	1.397	225.93	0.565
OHT2	**338.913**	7.274	0.854	10.05	5.877	14.376	0.261	1.945	22.269	0.995	29.912	1.959	0.795	8.457	0.786
OHT3	266.303	5.063	0.638	20.076	5.882	49.828	1.519	2.644	13.945	0.678	2.967	0.279	0.856	5.852	0.565
OHT4	294.514	5.294	1.938	11.783	5.849	97.997	1.908	2.835	34.838	0.409	22.503	0.972	4.192	231.15	1.346
OHT5	**371.035**	6.413	1.01	2.83	6.256	28.042	0	1.74	9.085	1.743	257.31	4.073	2.92	7.768	0.767
OHT6	**356.821**	7.39	3.263	15.791	7.434	1.23	0.445	7.52	78.254	1.877	149.26	1.448	8.458	33.516	0.593
Admin170-Ia	253.927	6.498	3.141	10.778	6.758	27.627	**13.12**	19.249	514.71	1.717	4.309	0.269	5.021	37.981	0.854
Admin170-Ib	248.757	8.117	6.59	256.753	7.202	32.358	6.461	4.288	507.87	2.147	23.6	1.393	3.182	37.323	0.653
Admin170-	262.964	**14.923**	1.575	47.082	5.418	140.228	7.93	104.89	258.47	2.371	40.622	7.648	5.528	177.53	0.913

Ic															
Resid170-Ia	258.576	**14.99**	5.486	606.459	5.557	14.691	8.754	8.459	457.81	0.862	13.409	0.777	1.408	23.669	0.6
Resid170-Ib	**306.746**	**14.37**	0.795	35.211	6.011	13.306	2.675	15.442	142.63	1.357	39.606	4.232	9.849	304.84	0.683
Resid170-Ic	**305.645**	**10.666**	1.981	69.009	5.897	14.466	2.146	15.078	122.32	1.13	23.583	0.628	2.293	53.662	0.583
Acad60-Ia	**425.584**	**15.248**	20.059	194.598	5.895	61.89	1.71	4.105	162.92	0.387	34.227	1.228	3.502	285.47	0.641
Acad60-Ib	**507.51**	**10.594**	5.727	338.292	5.78	5.008	5.255	34.883	205.16	1.841	23.037	7.957	12.55	232.74	1.774
Acad60-Ic	286.931	**11.722**	15.498	117.795	6.643	10.715	0.628	2.649	104.49	2.351	154.99	2.094	0.811	208.03	1.256
Acad60-IIa	**338.172**	8.617	1.569	170.617	6.939	139.895	7.2	72.711	272.23	1.002	6.454	0.279	1.932	37.003	0.607
Acad60-IIb	**324.286**	9.441	1.284	67.174	5.677	64.06	4.994	75.093	229.81	1.852	20.075	0.926	1.831	83.838	0.644
Acad60-IIc	285.531	**11.174**	1.894	52.394	5.665	**306.3**	9.817	14.328	380.65	0.88	36.942	1.326	1.68	49.211	0.822
Resid60-Ia	**385.107**	7.917	5.016	475.997	5.712	5.971	**11.58**	23.894	762.72	1.572	18.17	1.979	3.179	323.4	0.546
Resid60-Ib	**317.104**	4.846	0.756	124.329	6.226	5.305	2.123	29.721	115.26	1.548	45.872	0.931	1.94	97.841	0.689
Resid60-Ic	**302.095**	6.017	2.157	241.029	6.07	34.298	3.522	15.096	104.05	0.87	78.608	2.785	5.916	195.71	0.8

Resid60-IIa	**370.373**	7.901	3.106	106.101	6.395	20.838	9.063	40.328	353.64	0.315	196.83	0.427	0.646	23.006	0.435
Resid60-IIb	**884.805**	8.207	2.334	14.477	6.078	22.718	0.013	1.296	19.748	1.602	152.17	0.266	0.536	38.687	0.478
Resid60-IIc	**411.453**	**11.653**	2.734	94.701	6.069	26.521	0.503	11.87	86.542	0.659	98.964	0.865	0.903	6.169	0.48
Resid10-Ia	**302.423**	6.327	7.38	35.804	4.718	16.929	**11.33**	114.6	164.73	1.422	62.629	3.584	3.328	16.84	0.874
Resid10-Ib	**314.38**	5.949	4.725	40.59	5.43	30.537	8.458	77.193	127.73	0.591	60.053	0.417	2.841	15.283	0.4
Resid10-Ic	**305.651**	9.703	6.458	34.052	5.753	22.706	4.786	59.564	246.14	2.111	152.58	1.335	9.94	25.548	1.285
Rec10-Ia	**311.722**	7.771	5.959	128.221	6.491	**1410.65**	**16.1**	7.926	1630.3	0.527	42.012	3.575	1.616	311.42	1.485
Rec10-Ib	**306.467**	8.116	2.439	231.69	6.257	17.693	**90.75**	148.05	640.43	2.406	34.29	1.758	2.417	281.64	0.676
Rec10-Ic	**336.992**	4.944	2.333	107.33	5.857	10.423	**25.63**	333.88	716.92	0.357	47.808	3.649	3.611	349.51	0.786
Acad10-Ia	**323.102**	5.021	4.742	305.282	5.67	**643.1**	**18.92**	69.832	2283.1	1.278	3.373	0.681	1.38	11.527	0.832
Acad10-Ib	**302.239**	8.899	1.535	100.049	3.733	19.639	**17.48**	33.394	312.1	1.956	3.822	3.304	1.264	11.527	0.734
Acad10-Ic	**441.286**	**12.649**	1.782	317.351	5.9	135.375	**46.64**	161.32	2137.9	2.193	3.114	0.129	2.384	5.526	0.878

* The prefixes are the identities of the OHTs and buildings as enumerated in Table S1. The suffixes – a, b, c – represent the three different taps sampled from each building

When the levels of any heavy metal exceeded the WHO[7] standards and BIS[8] the values are written in bold typeface.

Table S7 Values of total organic carbon (mg/L) in OHT and building samples collected over two seasons

Sample ID*	**Monsoon**	**Winter**
OHT1	4.265	10.15
OHT2	7.95	10.5
OHT3	7.15	10.05
OHT4	5.9	9.35
OHT5	7.35	12.35
OHT6	5.95	11
Admin170-Ia	6.4	7.55
Admin170-Ib	5.95	10.3
Admin170-Ic	5.55	10.6
Resid170-Ia	6.4	11.8
Resid170-Ib	6.25	9.85
Resid170-Ic	8.15	10.25
Acad60-Ia	7.1	9.85
Acad60-Ib	5.2	9.35
Acad60-Ic	6.2	10.5
Acad60-IIa	7.1	10.85
Acad60-IIb	5.85	10.6
Acad60-IIc	5.75	11.1
Resid60-Ia	6.45	12.3
Resid60-Ib	6.2	12.95

Resid60-Ic	7.85	11.7
Resid60-IIa	8.5	10.4
Resid60-IIb	7.1	11
Resid60-IIc	6.65	10.2
Resid10-Ia	6.3	9.5
Resid10-Ib	6.45	11.25
Resid10-Ic	8.7	12.1
Rec10-Ia	10.4	19.8
Rec10-Ib	8.7	16.4
Rec10-Ic	8.15	9.65
Acad10-Ia	8.25	5.5
Acad10-Ib	8.2	4.456
Acad10-Ic	8.6	5.95

* The prefixes are the OHT and building identities as enumerated in Table S1. The suffixes – a, b, c – represent the three different taps sampled from each building.

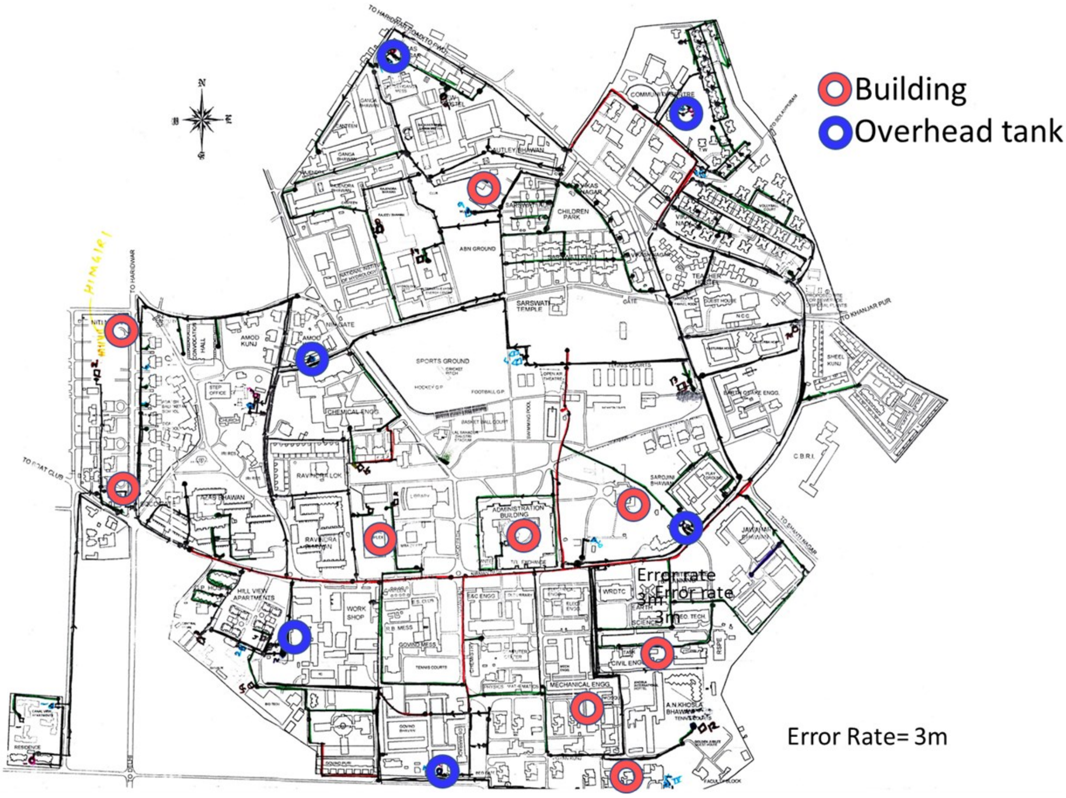


Fig. S1. Map of sampled OHT-based DWDS. This map was provided by the water supply authorities of the residential campus targeted in this research in the year 2019. The blue and red circles on the map indicate the location of all OHTs and buildings that were sampled, respectively. This map was last updated on 2018.

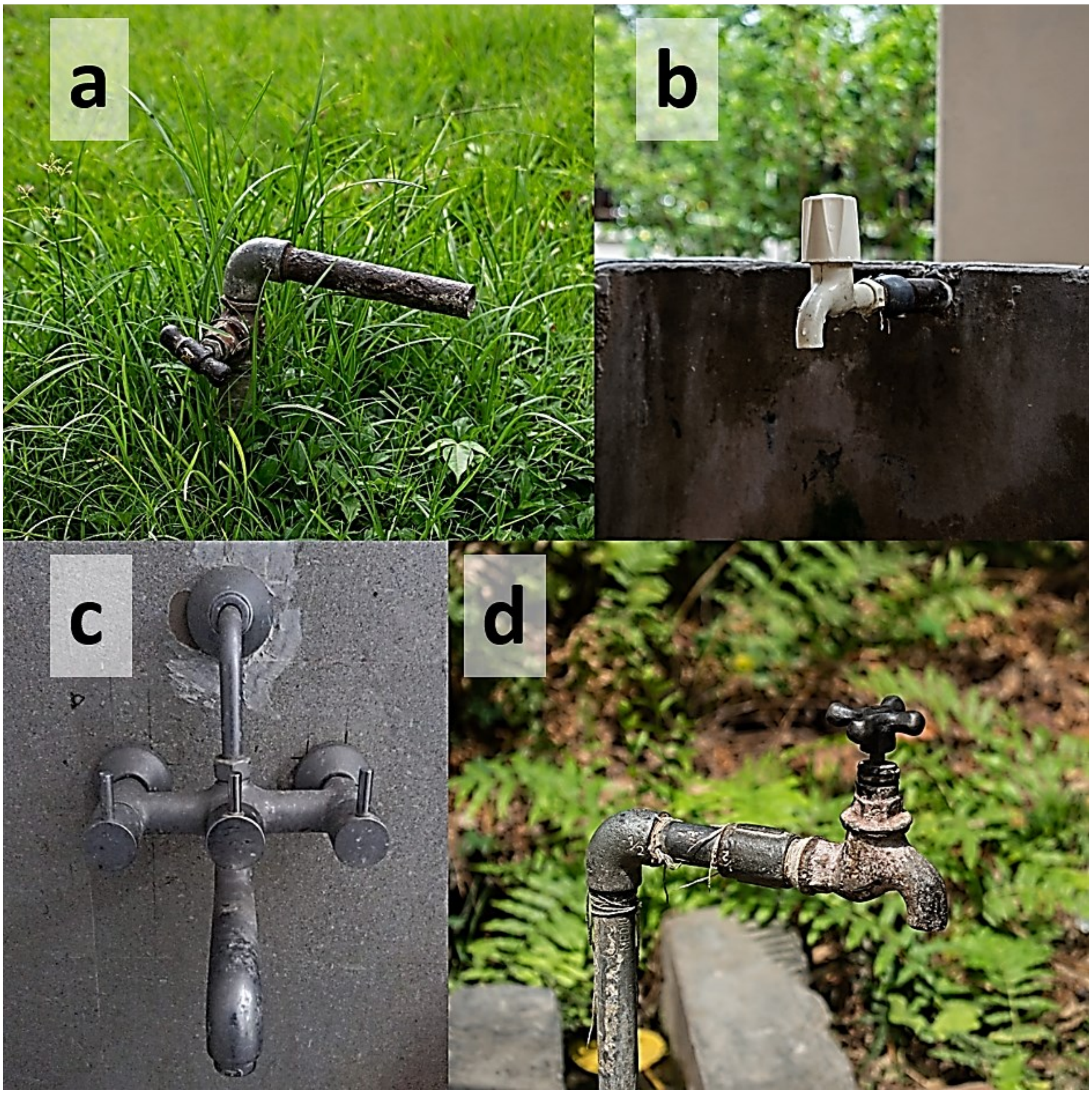


Fig. S2: Different kinds of pipe and fixture materials used in the OHT-based DWDS. **a**. Galvanized iron pipe and fixture; **b**. Galvanized iron pipe and PVC fixture, **c**. Galvanized iron pipe with chromium-plated brass fixtures; and **d**. Galvanized iron pipe with cast iron fixture**.** Ca**s**t iron taps and pipes are not uncommon in the residential campus targeted in this research, even as chromium-plated brass and galvanized iron were also used in some buildings.

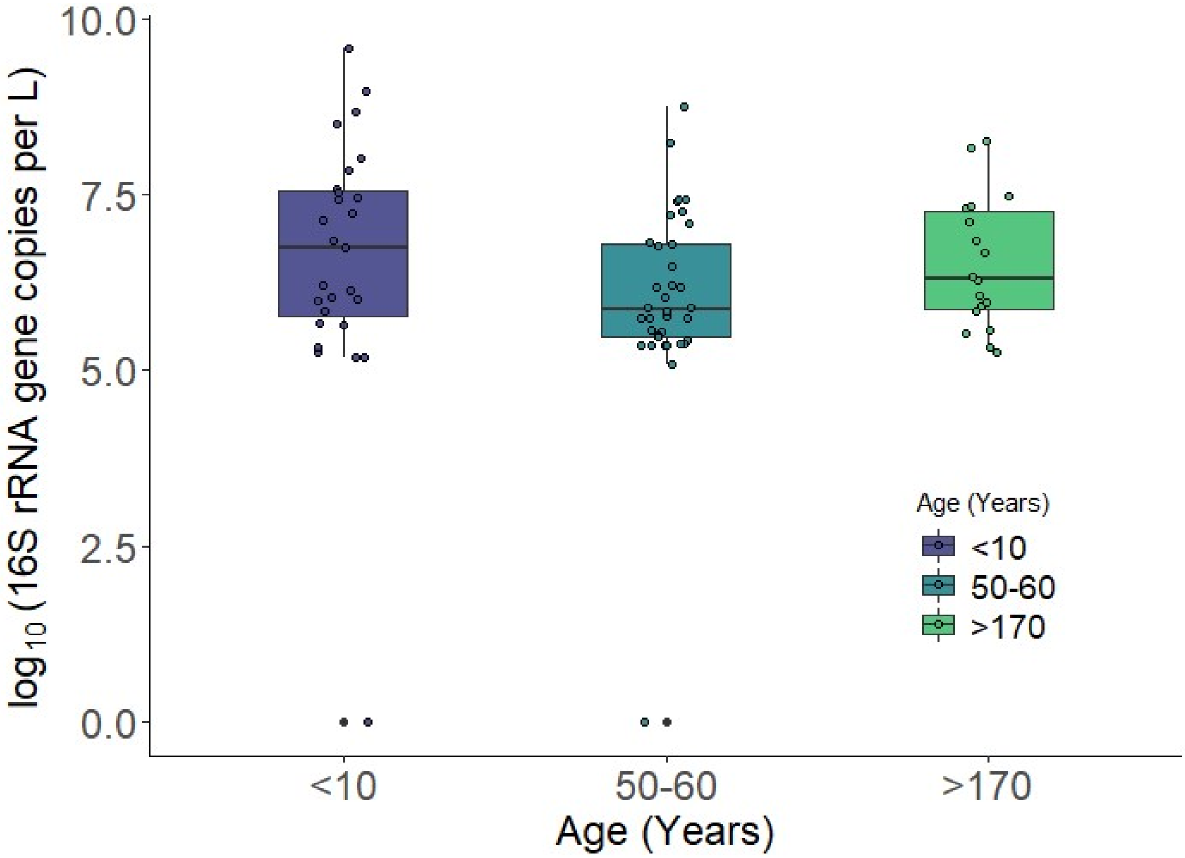


Fig. S3. Total bacterial count in building tap water samples. The y-axis represents 16S rRNA gene copies per L of sampled water on log10 scale. The x-axis represents building samples (n=81) that were collected from three building age groups (<10 years, 50-60 years, >170 years).

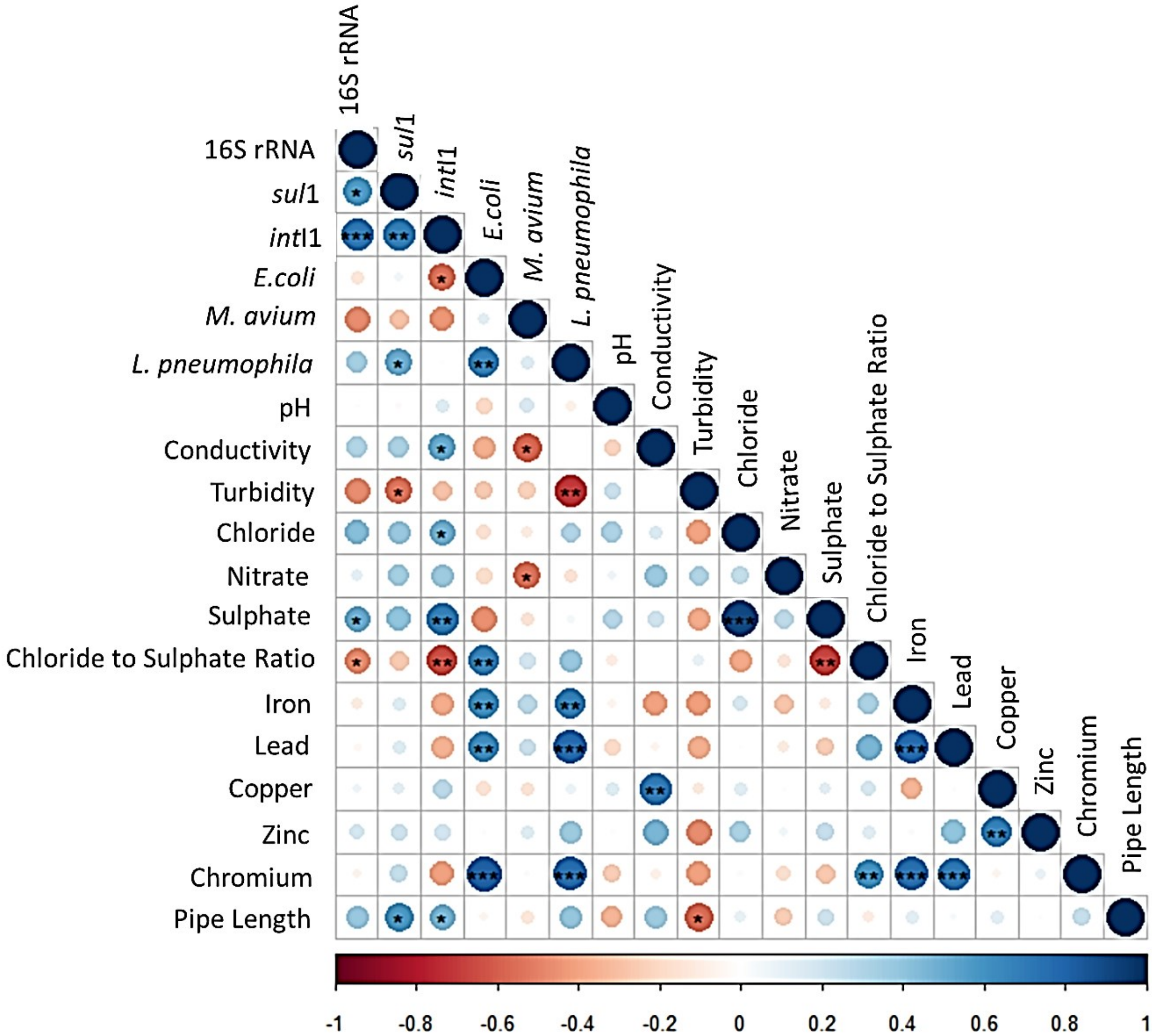


Fig. S4. Correlogram of Spearman's rank correlation coefficients computed between the levels of targeted genes and physicochemical parameters in all samples from buildings that were >170 years (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001)

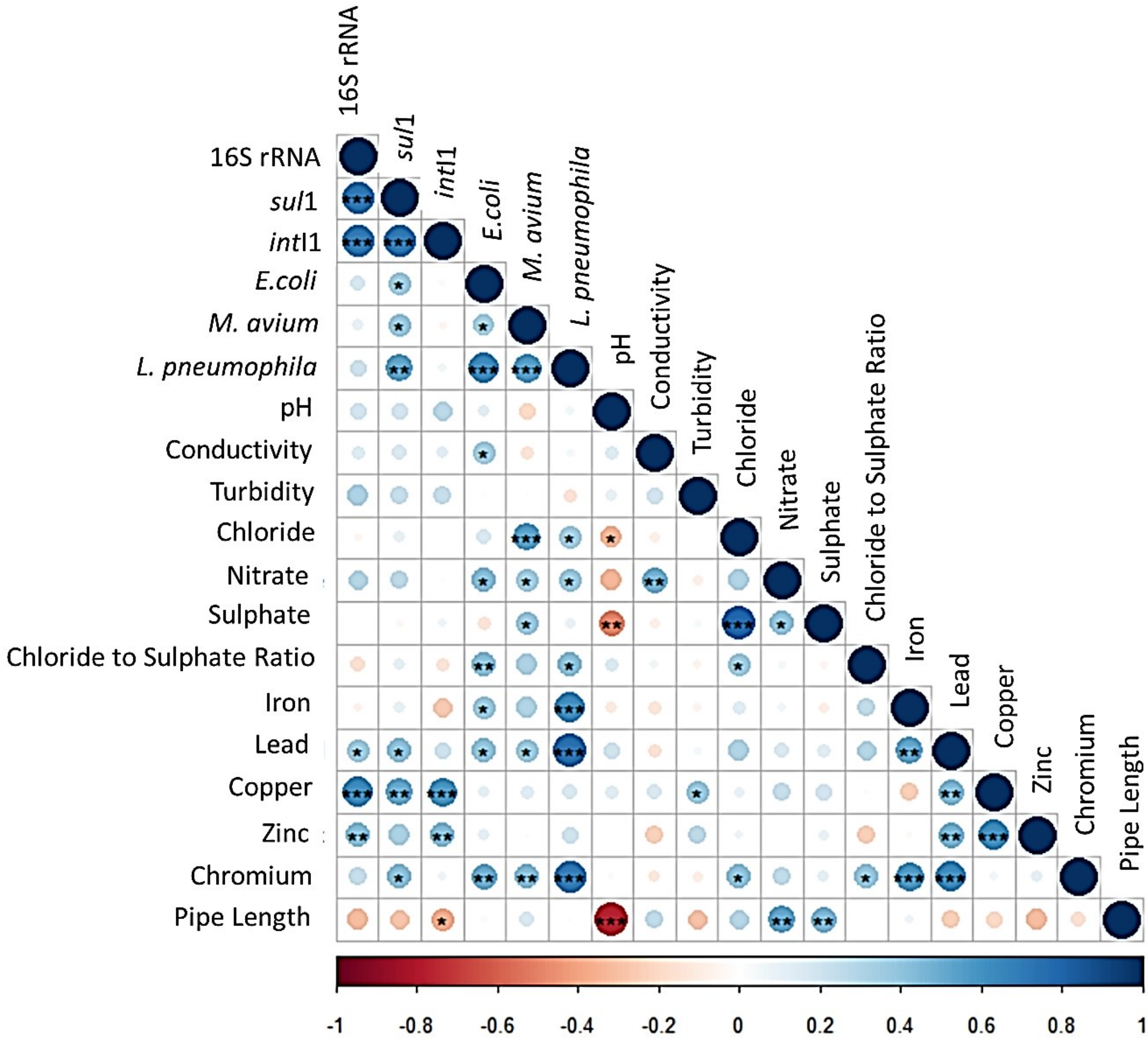


Fig. S5. Correlogram of Spearman's rank correlation coefficients computed between the levels of targeted genes and physicochemical parameters in all samples from buildings that were 50-60 years old (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

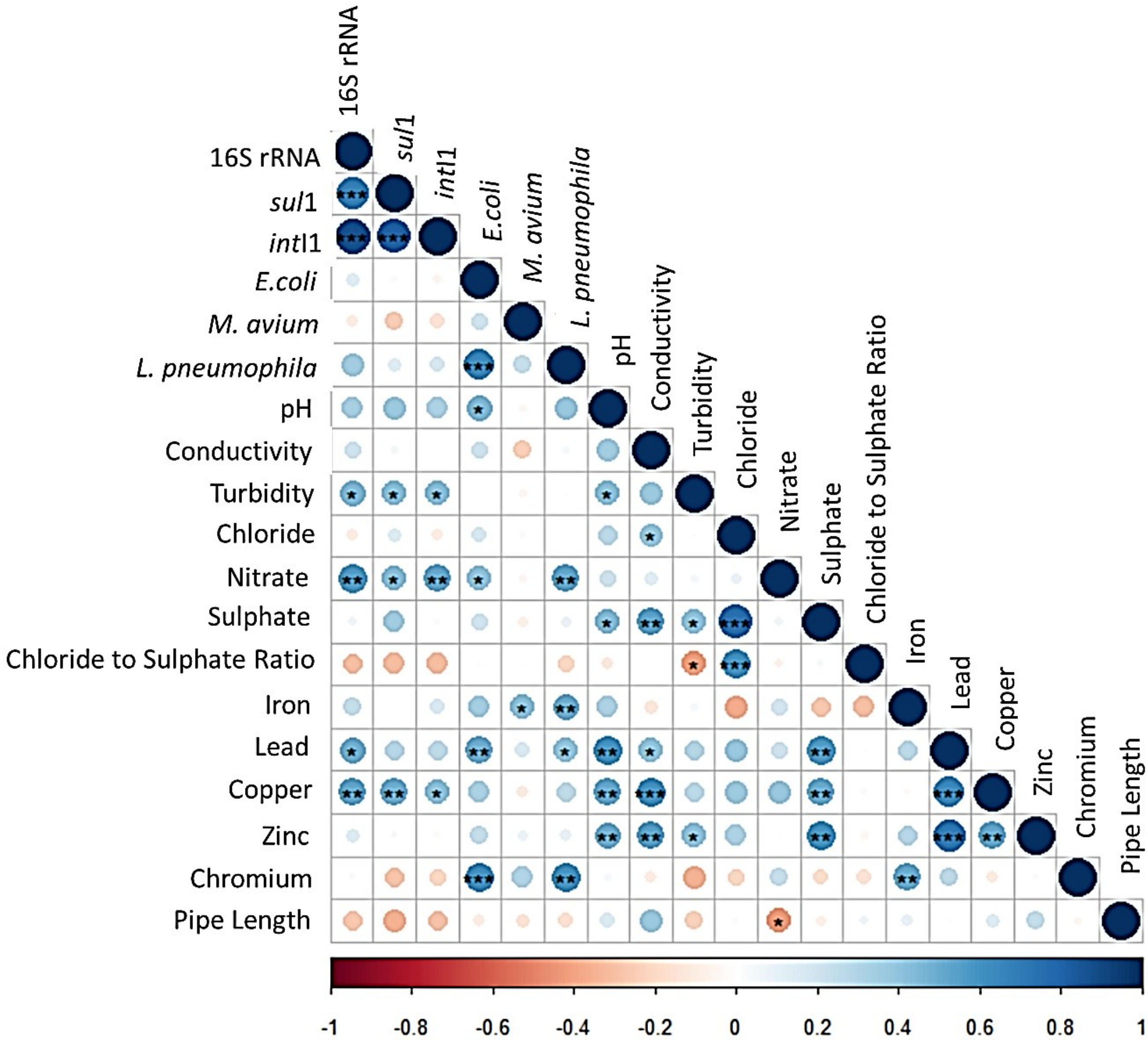


Fig. S6. Correlogram of Spearman's rank correlation coefficients computed between the levels of targeted genes and physicochemical parameters in all samples from buildings that were <10 years old (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

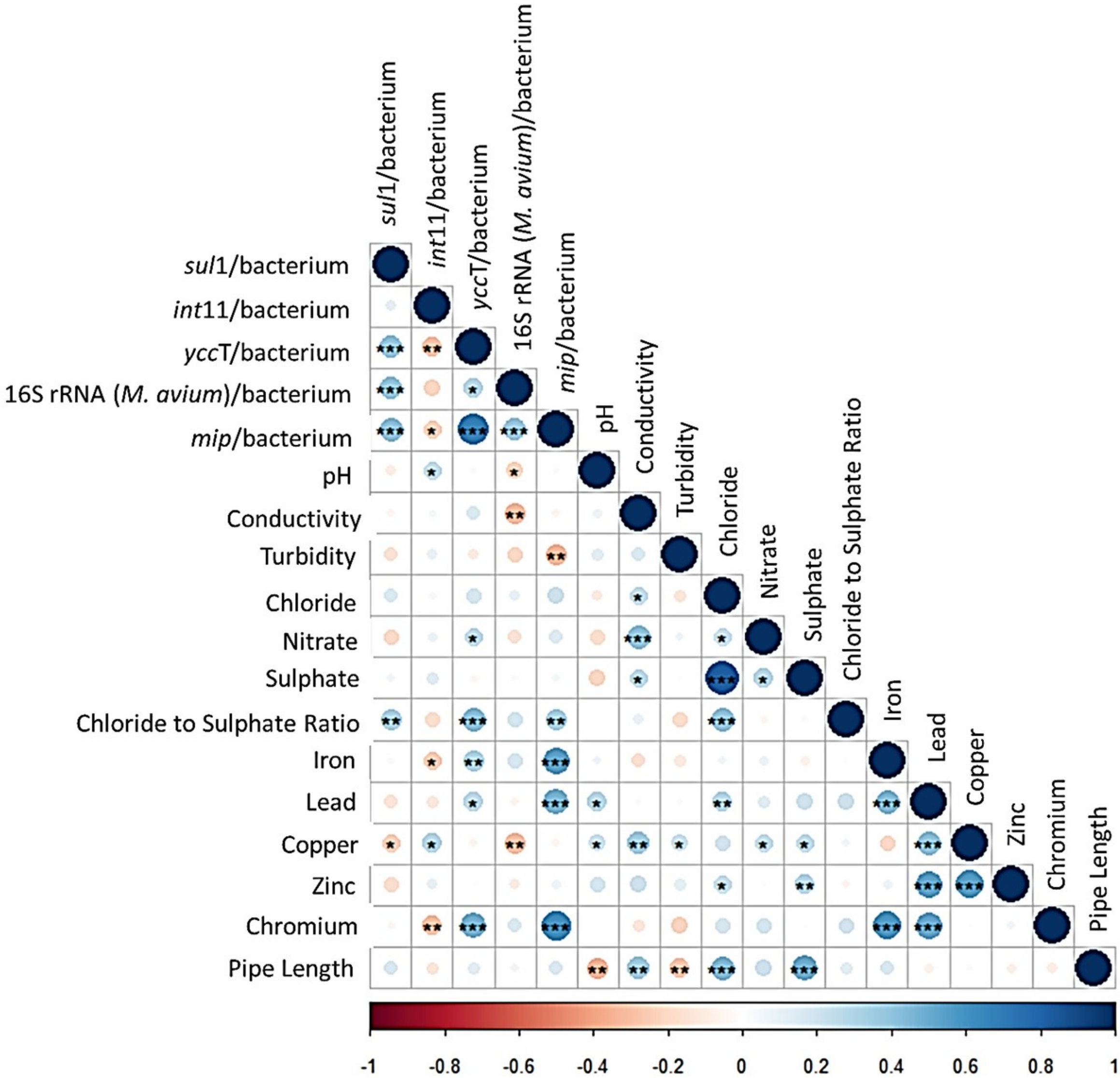


Fig. S7. **Correlogram between water quality parameters, relative levels of opportunistic pathogens, *sul*1, and *int*I1:** Spearman's rank correlation coefficients between the relative levels of targeted genes and physicochemical parameters for all building samples (n=81) combined (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

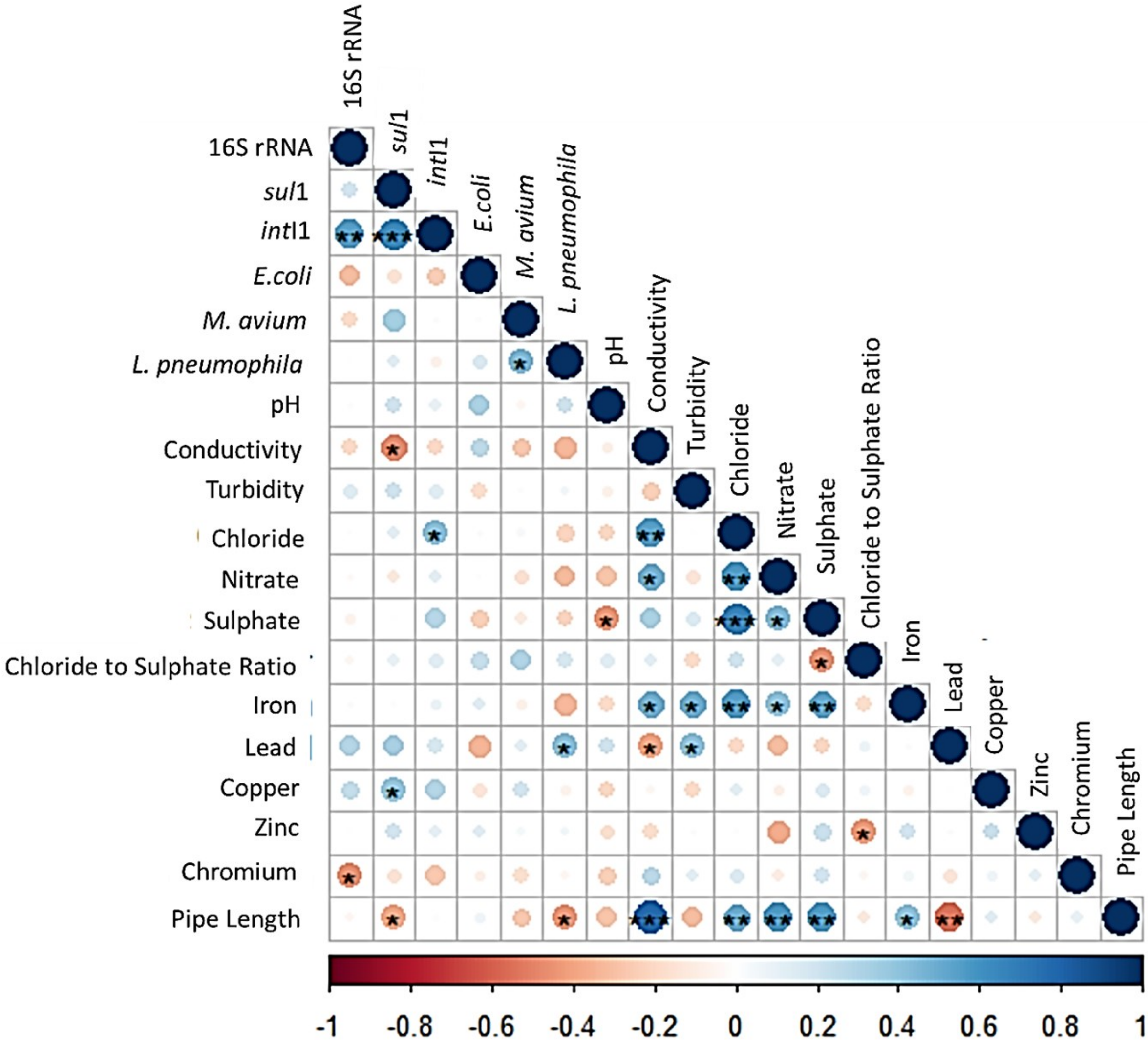


Fig. S8. Correlogram of Spearman's rank correlation coefficients computed between the levels of targeted genes and physicochemical parameters in all building samples that were collected during summer (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

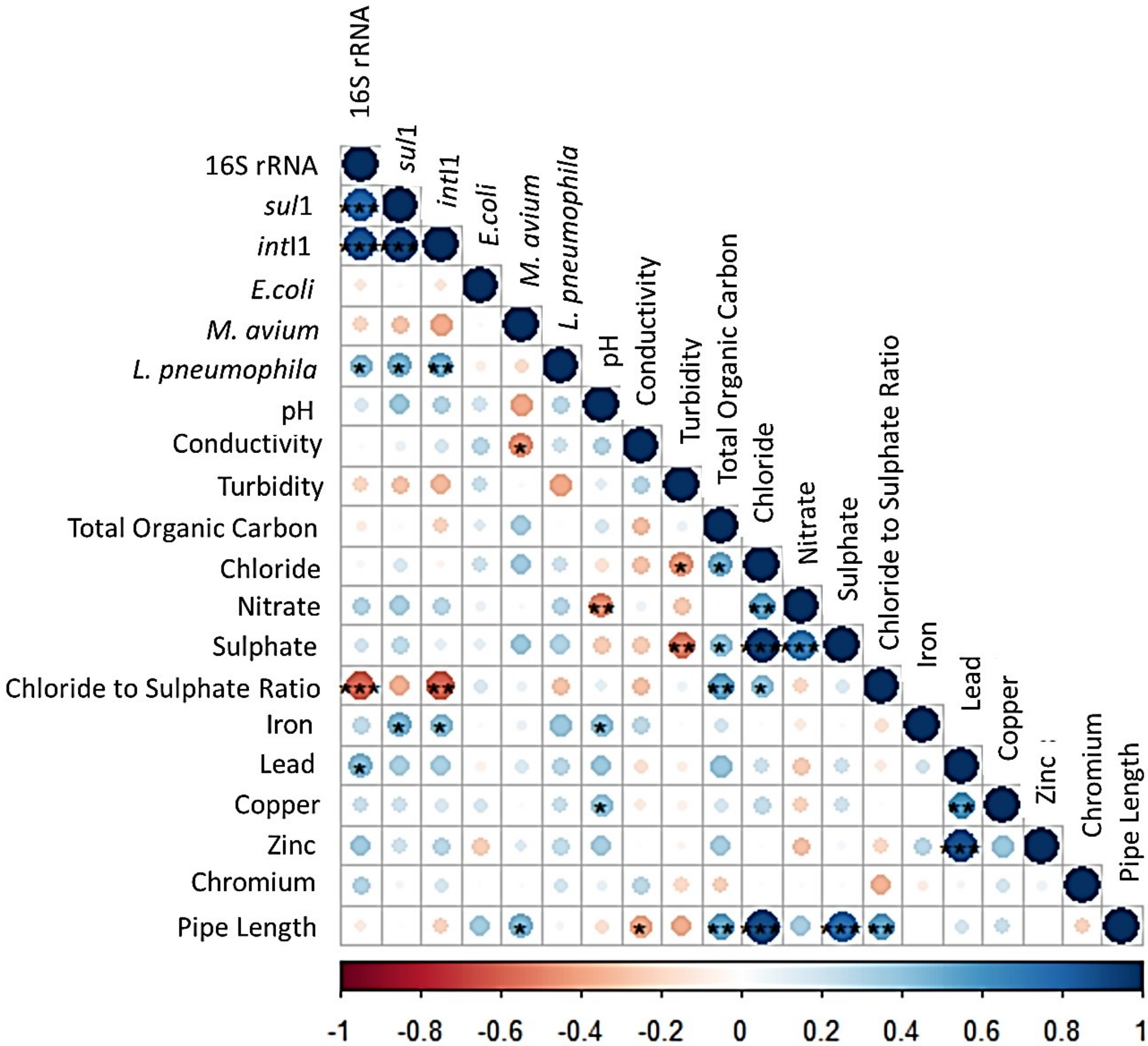


Fig. S9. Correlogram of Spearman's rank correlation coefficients computed between the levels of targeted genes and physicochemical parameters in all building samples that were collected during monsoon (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

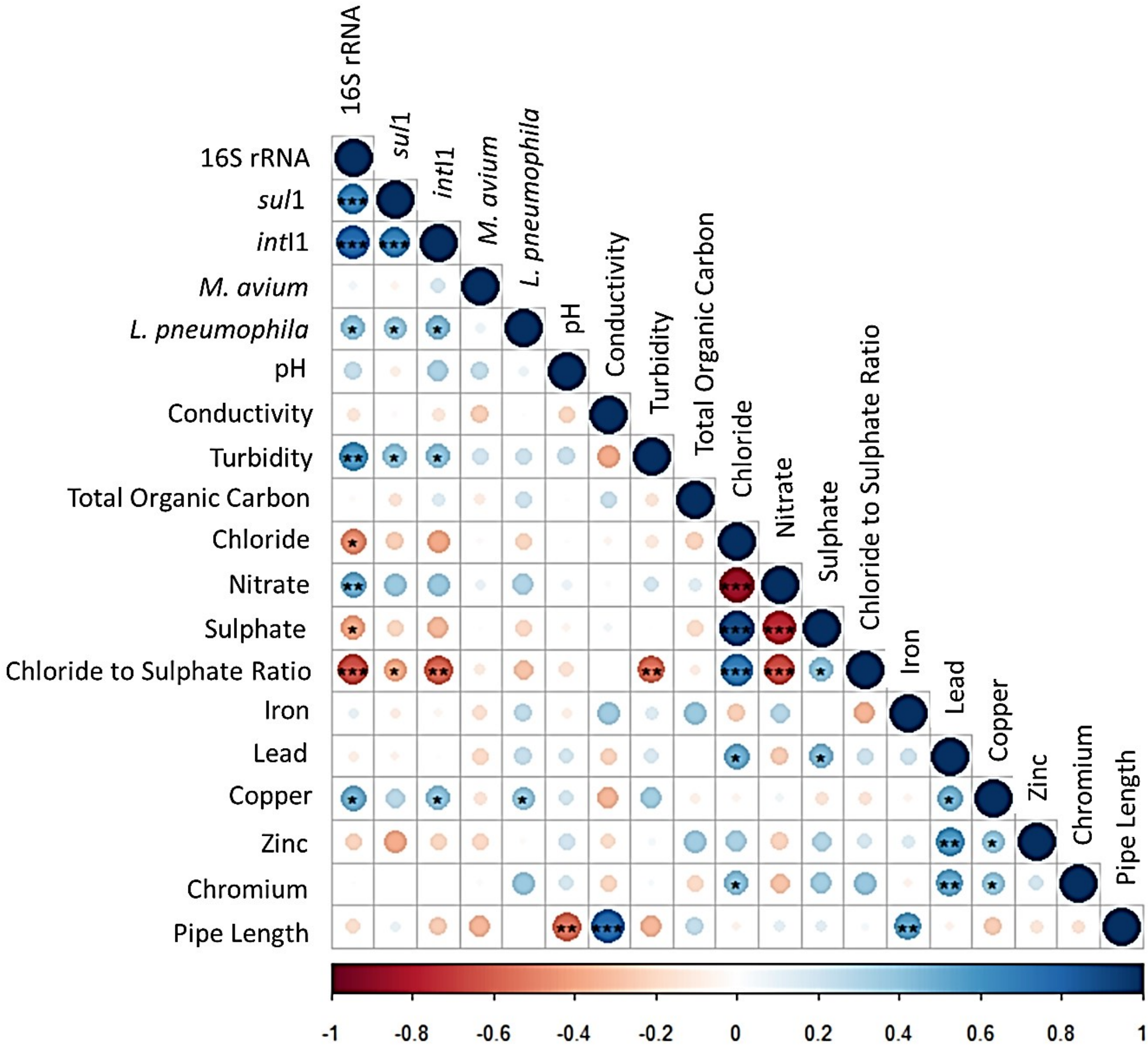


Fig. S10. Correlogram of Spearman's rank correlation coefficients computed between the levels of targeted genes and physicochemical parameters in all building samples that were collected during winter (*: P-value < 0.05, **: P-value < 0.01, ***: P-value < 0.001).

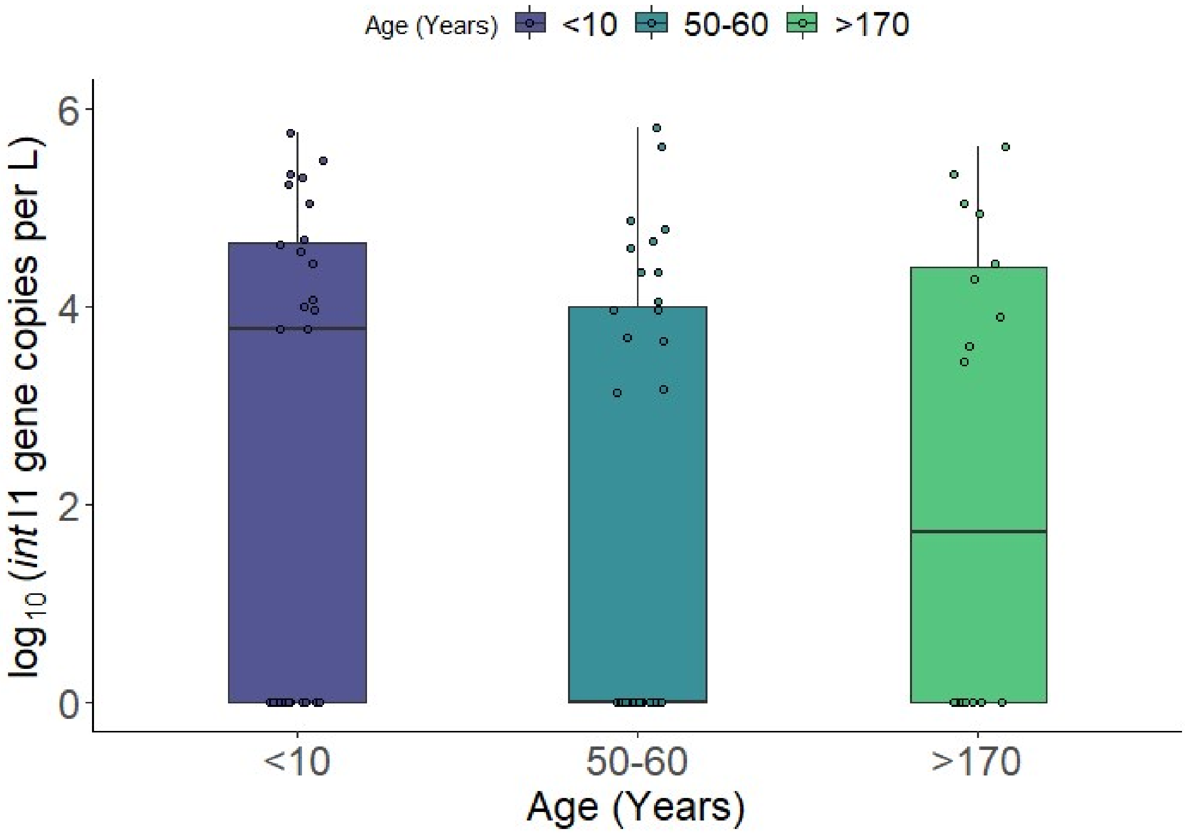


Fig. S11. Levels of *int*I1 gene copies in building tap water samples: The y-axis represents *int*I1 gene copies per L of sampled water on log10 scale. The x-axis represents the age of the buildings these samples were collected from (<10 years, 50-60 years, >170 years).

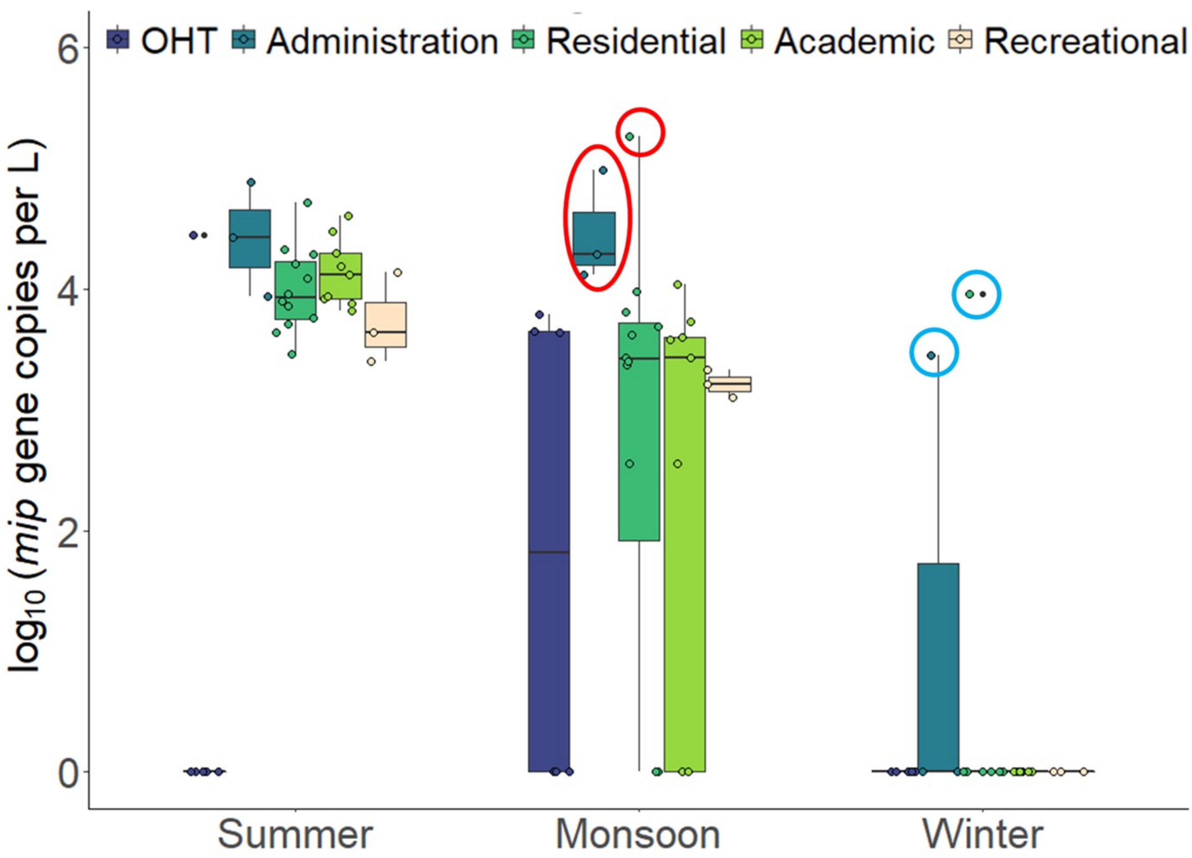


Fig. S12. Levels of *mip* gene copies in building tap water samples: The y-axis represents *mip* gene copies per L of sampled water on log10 scale. The x-axis shows the different kinds of buildings (administration, residential, academics, recreational) that were sampled, resolved across the three seasons. Red and blue circles show the buildings samples (Resid170-I and Resid10-I) in monsoon and winter respectively with the higher values relative to OHT samples.

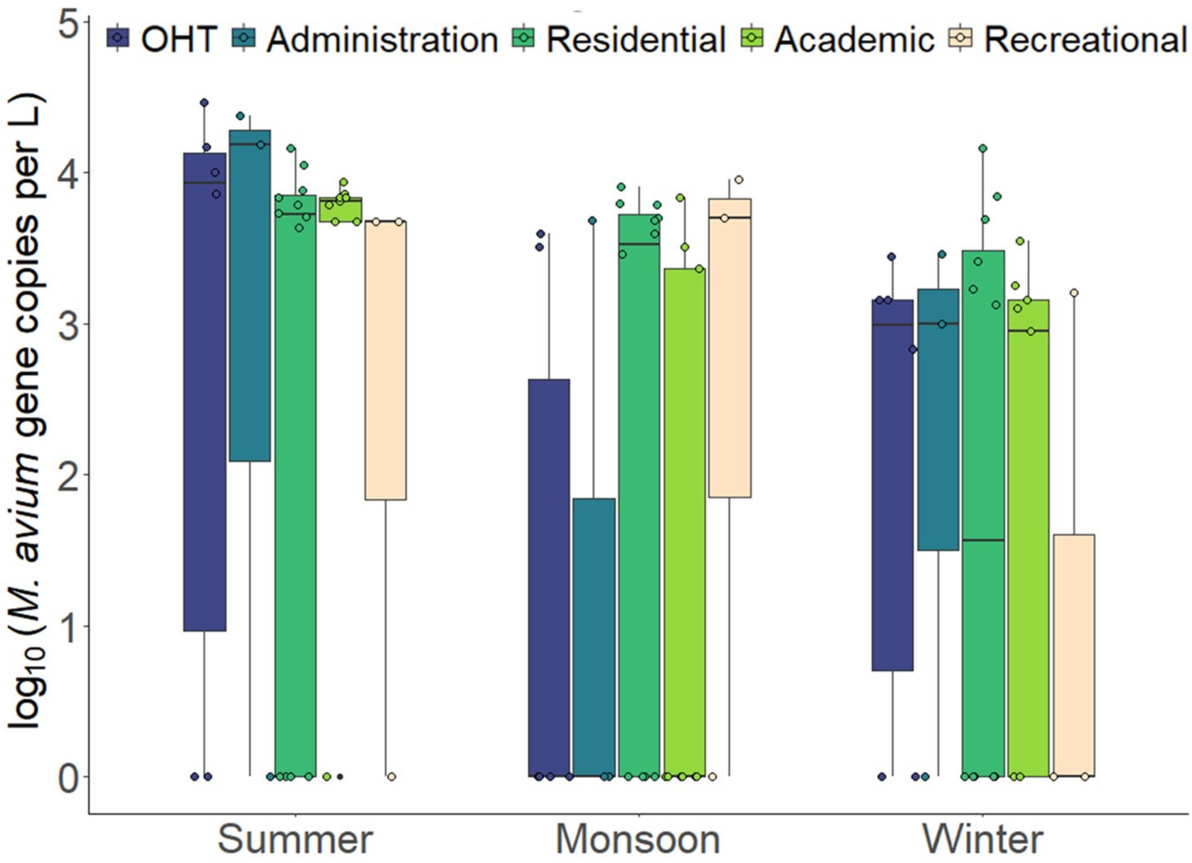


Fig. S13. Levels of *M. avium* gene copies in building tap water samples: The y-axis represents gene copies of DNA marker of *M. avium* per L of sampled water on log10 scale. The x-axis represents buildings (n=81) samples that were collected from OHT and different buildings (administration, residential, academics, recreational) in three different seasons.

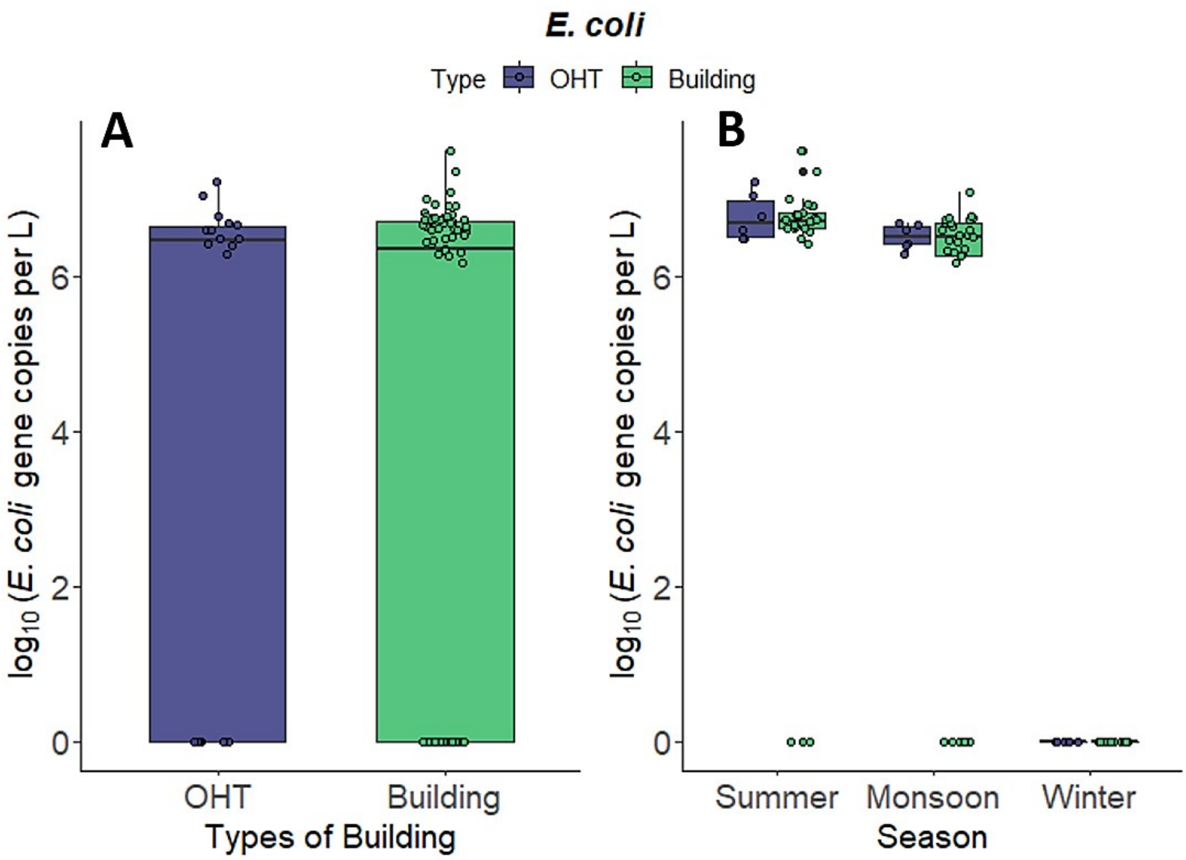


Fig. S14. Levels of *E. coli* (*ycc*T) gene copies in tap water samples: The y-axis represents *ycc*T gene copies per L water on log10 scale. In **A**, the x-axis represents building (n=81) and OHT samples (n=18) that were collected over three seasons. In **B**, the levels of *ycc*T gene copies in OHT and building samples are resolved for the three different sampling seasons.

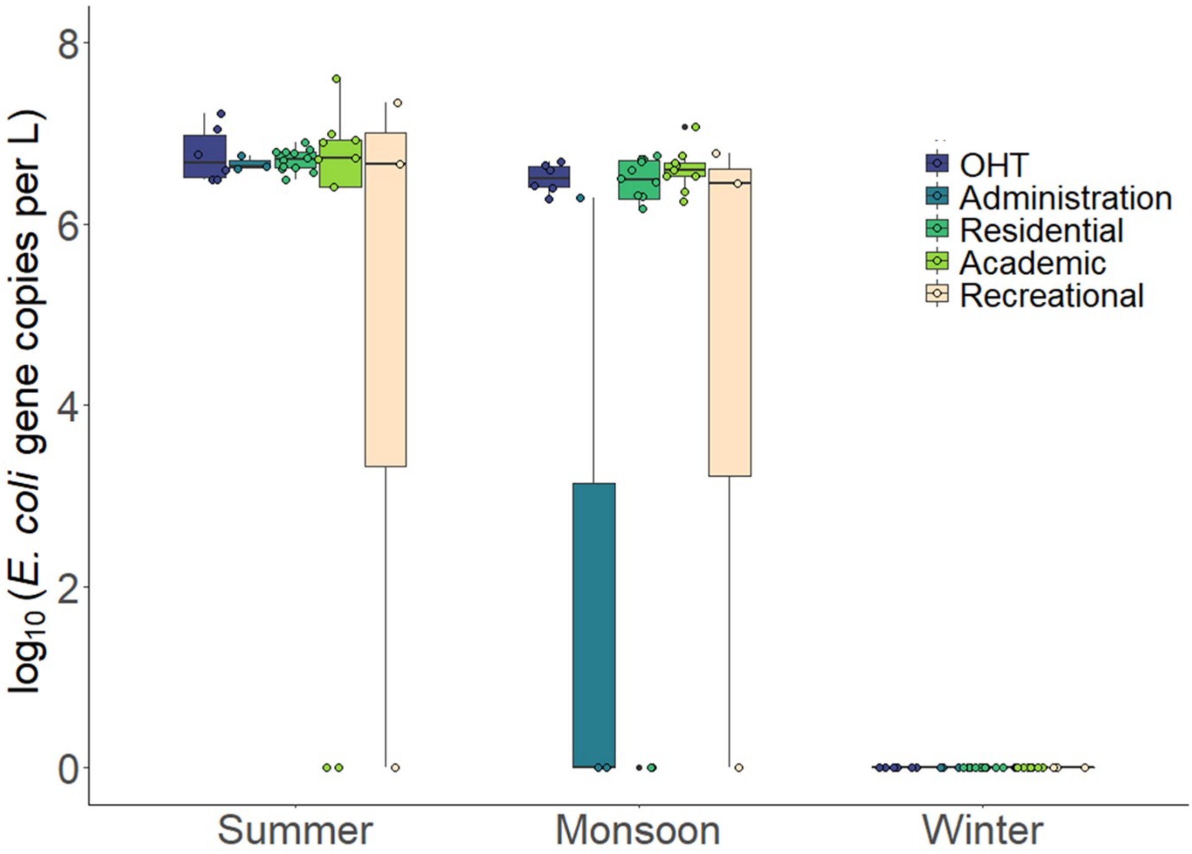
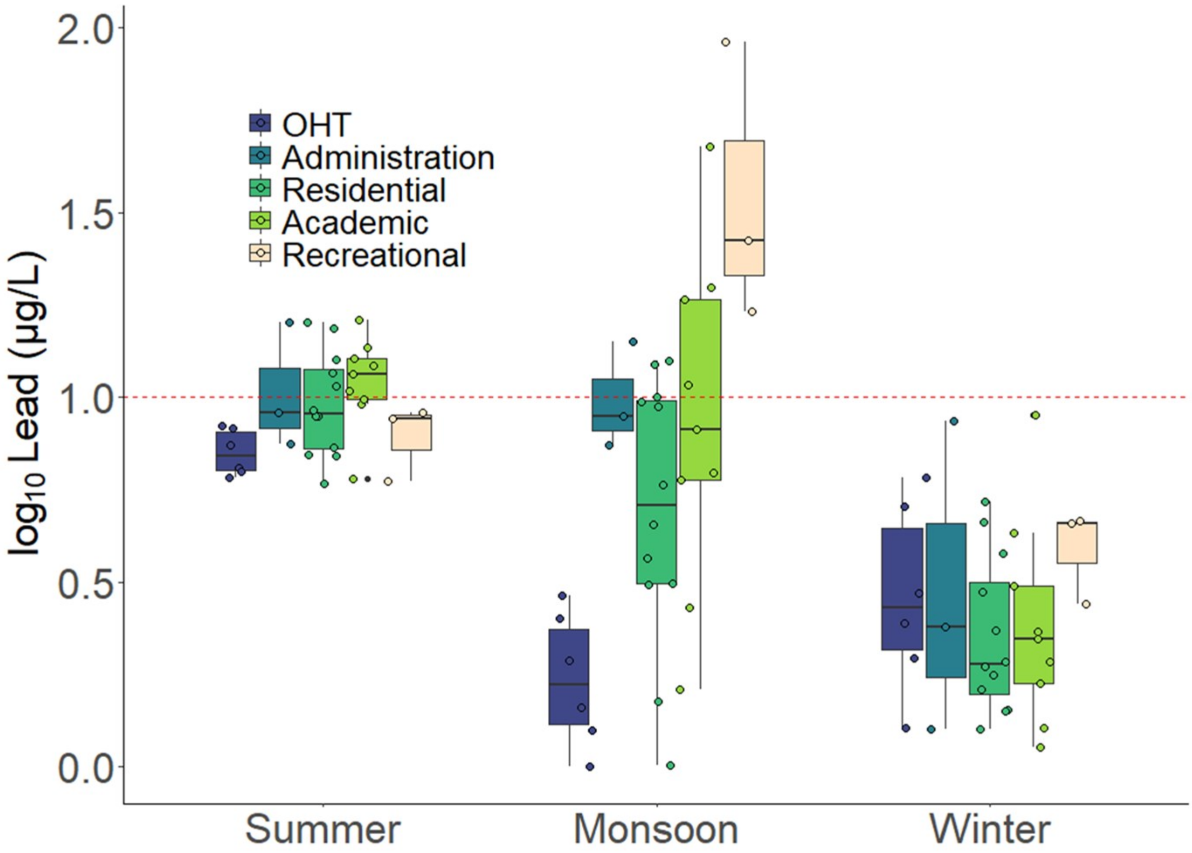


Fig. S15. Levels of *E. coli* (*ycc*T) gene copies in building tap water samples according to space utilization: The y-axis represents *ycc*T gene copies per L of sampled water on log10 scale. The x-axis represents the samples that were collected from OHT (n=18) and different buildings (n=81), resolved according to the space utilization (administration, residential, academics, recreational) in three sampling seasons).



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196

197 **Fig. S16**. The values of Pb (µg/L) in OHT and building samples resolved across the three
198 different sampling seasons. Red dashed line represents the WHO[7] guidelines for Pb levels in
199 drinking water.

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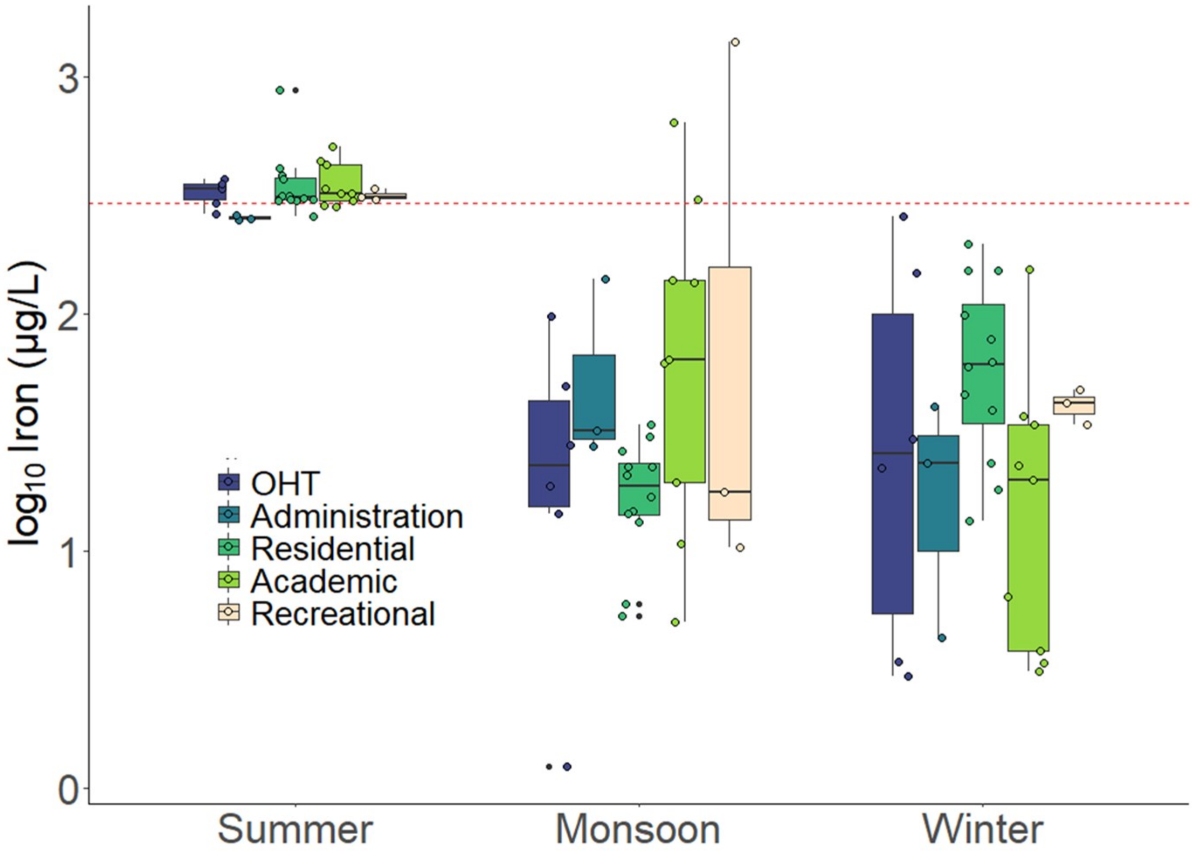


201 **Fig. S17**. The values of Fe (µg/L) in OHT and building samples resolved across the three
202 different sampling seasons. Red line represents the WHO[7] standards for Fe levels in drinking
203 water.

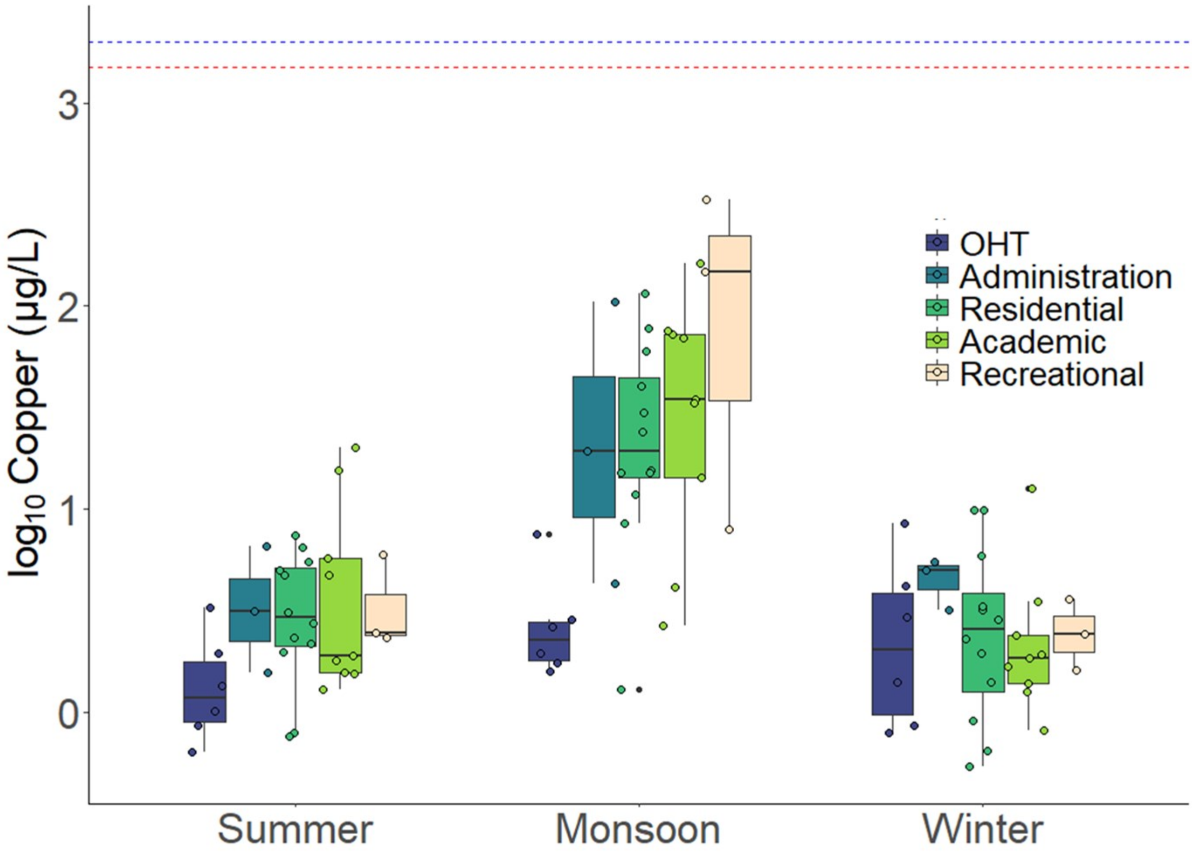
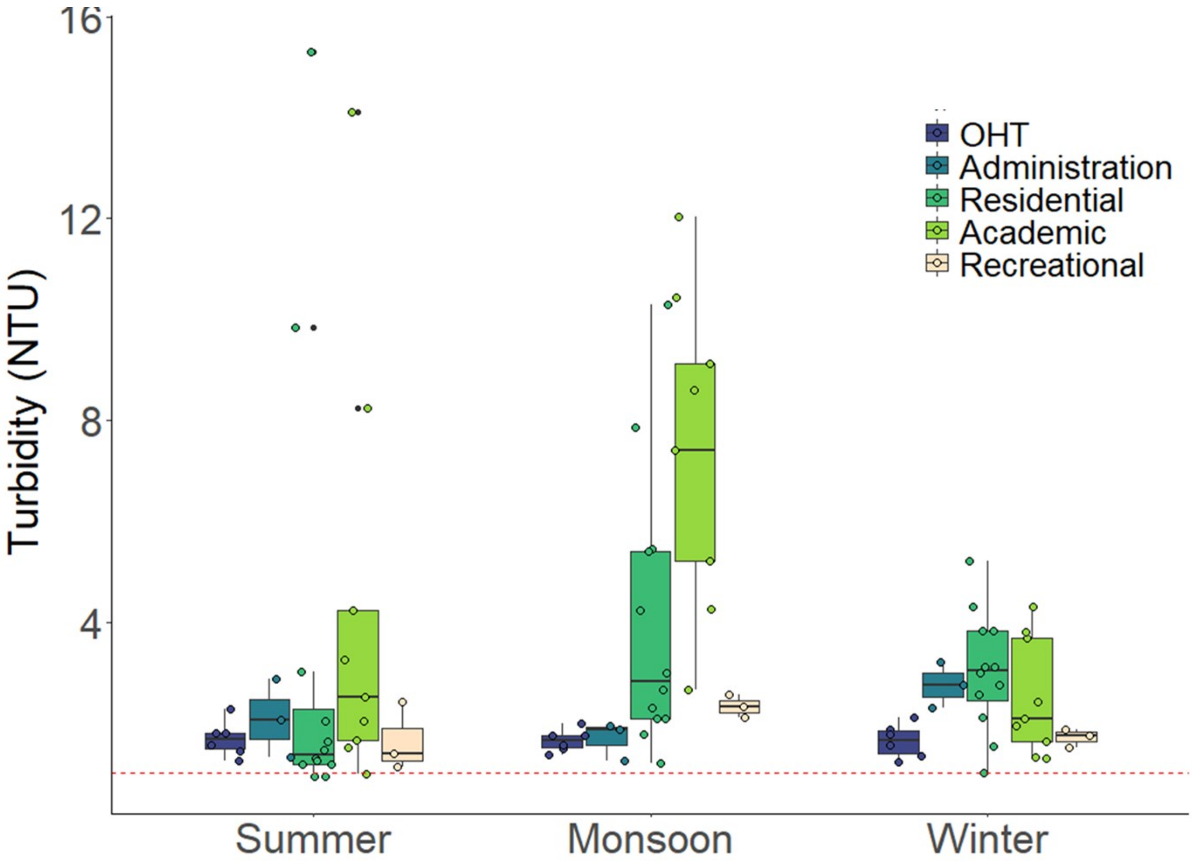


Fig. S18. The values of Cu (µg/L) in OHT and building samples resolved across the three different sampling seasons. Red and blue dashed line represent the WHO[7] and BIS[8] guidelines for Cu levels in drinking water, respectively.

211 

212 **Fig. S19**. The turbidity (NTU) values of OHT and building samples resolved across the three

213 different sampling seasons. Red dashed line represents the WHO (<1 NTU) [7] for turbidity in

214 drinking water.

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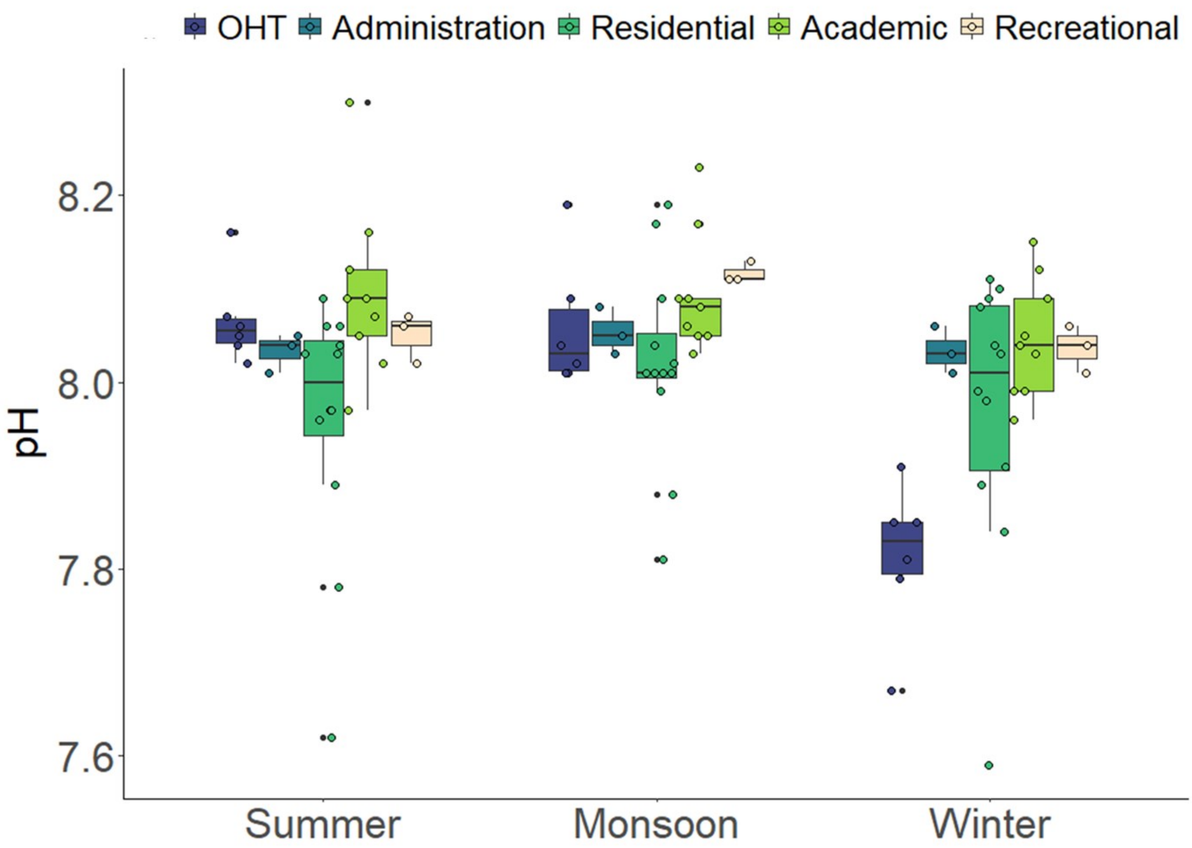

Fig. S20. The pH values of the OHT and building samples resolved across the three different sampling seasons.

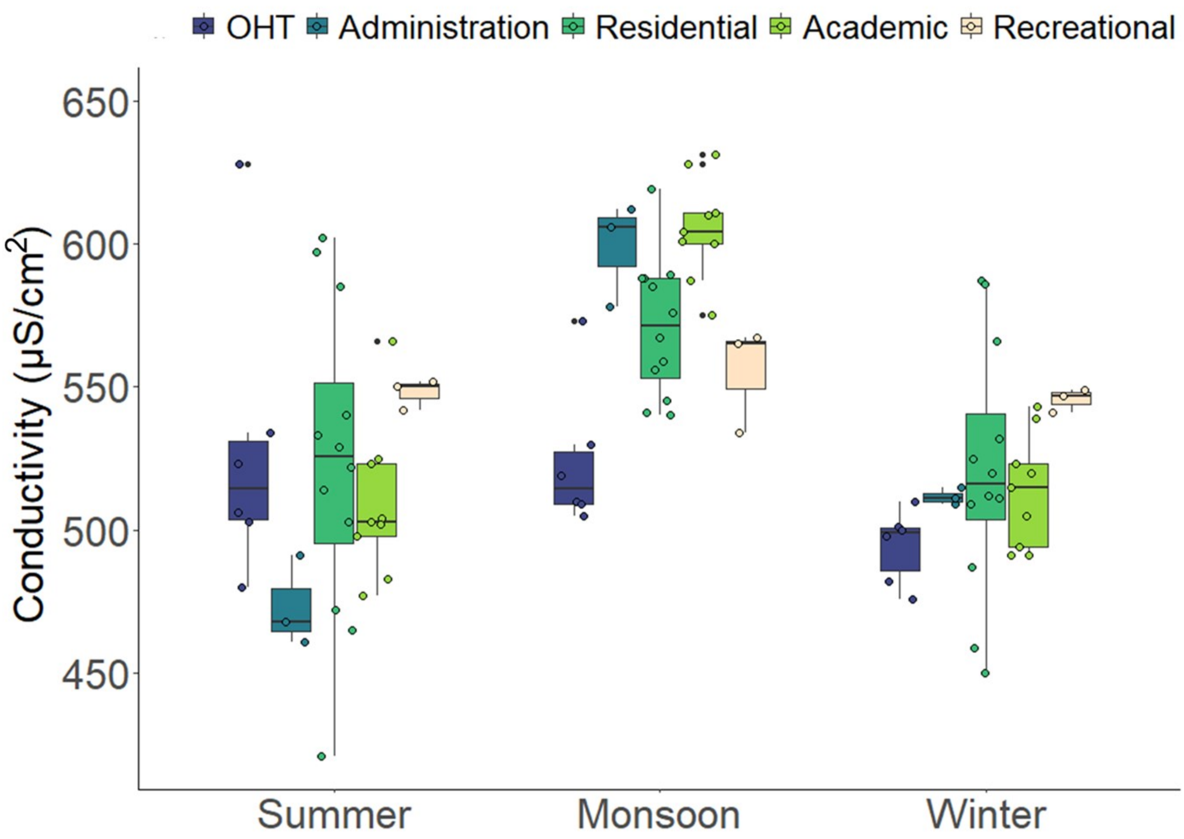

Fig. S21. The values of conductivity (µS/cm^2) of OHT and building samples resolved across the three different sampling seasons.

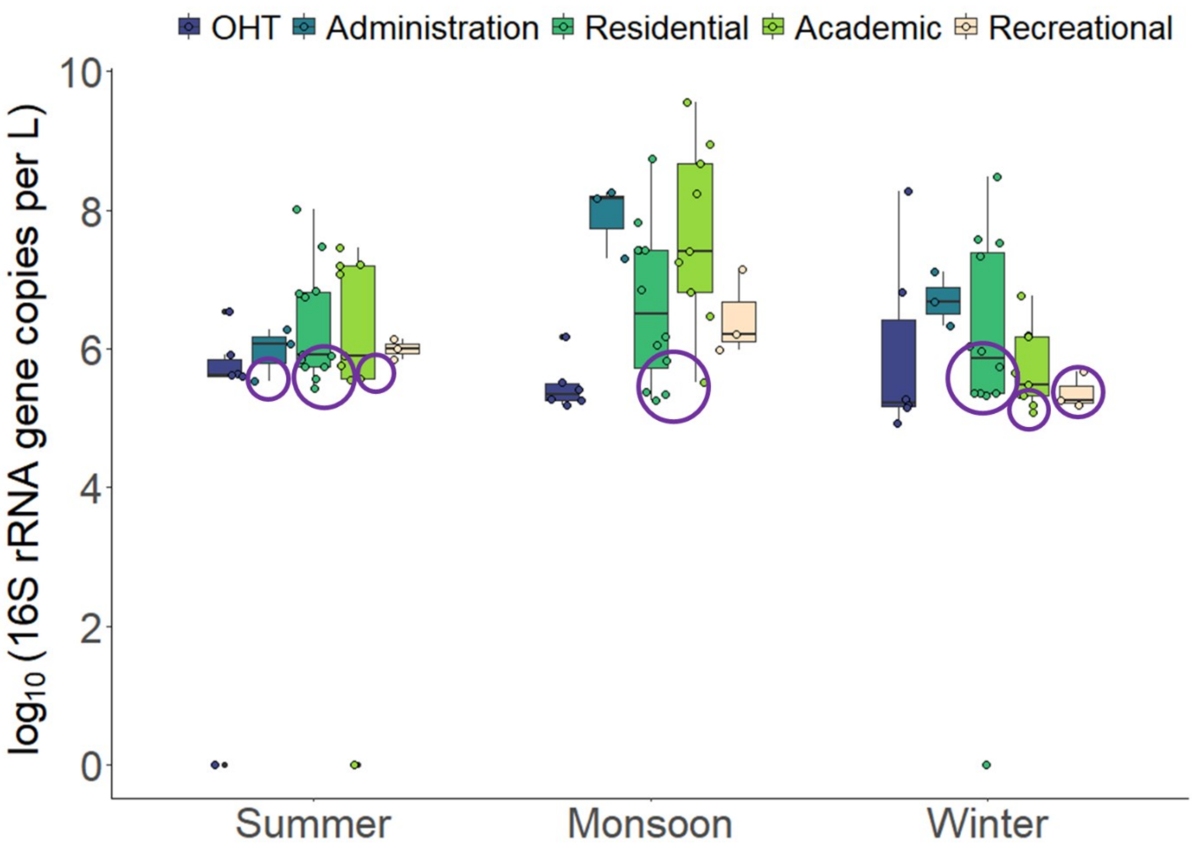

Fig. S22. Building samples, where the levels of 16S rRNA gene copies remained comparable to that in OHT samples. The y-axis represents 16S rRNA gene copies per L of sampled water on log10 scale. Purple circles represent the samples which did not have significant increase relative to OHT samples in different seasons.

References.

1 M. T. Suzuki, L. T. Taylor and E. F. DeLong, Quantitative analysis of small-subunit rRNA genes in mixed microbial populations via 5 ’-nuclease assays, *Appl. Environ. Microbiol.*, 2000, **66**, 4605–4614.

2 M. F. Lee, C. F. Peng, H. J. Hsu and H. S. Toh, Use of inverse PCR for analysis of Class 1 Integrons carrying an unusual 3′ conserved segment structure, *Antimicrob. Agents Chemother.*, 2011, **55**, 943–945.

3 M. Wajid, M. K. Saleemi, Y. Sarwar and A. Ali, Detection and characterization of multidrug-resistant *Salmonella enterica* serovar infantis as an emerging threat in poultry farms of Faisalabad, Pakistan, *J. Appl. Microbiol.*, 2019, **127**, 248–261.

4 J. Chen, Z. Yu, F. C. Michel, T. Wittum and M. Morrison, Development and application of real-time PCR assays for quantification of *erm* genes conferring resistance to macrolides-lincosamides-streptogramin B in livestock manure and manure management systems, *Appl. Environ. Microbiol.*, 2007, **73**, 4407–4416.

5 H. Wang, M. Edwards, J. O. Falkinham and A. Pruden, Occurrence of *Legionella spp.*, *Mycobacterium spp.*, *Pseudomonas aeruginosa*, and Amoeba hosts in two chloraminated drinking water distribution systems, *Appl. Environ. Microbiol.*, 2012, **78**, 6285–6294.

6 N. Hembach, F. Schmid, J. Alexander, C. Hiller, E. T. Rogall and T. Schwartz, Occurrence of the *mcr*-1 colistin resistance gene and other clinically relevant antibiotic resistance genes in microbial populations at different municipal wastewater treatment plants in Germany, *Front. Microbiol.*, 2017, **8**, 1–11.

7 World Health Organisation, *Guidelines for drinking-water quality, 4th edition: 1st addendum*, 2017.

8 Bureau of Indian Standards, *Indian Standard: Drinking water- Specification (second revision)*, 2012.