

Supplementary information

**POSSIBLE IMPACTS OF COVID-19 PANDEMIC ON DOMESTIC
WASTEWATER CHARACTERISTICS IN KUWAIT**

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Table of statistical summary of daily flow data (2015–2020)

Statistic	2015	2016	2017	2018	2019	2020	5 years	6 years
Mean	508087.82	554 349.49	577 031.31	583 567.53	585 857.28	610 447.94	561 774.62	569 901.64
Standard Error	1635.98	1495.19	908.75	1741.36	1503.11	1622.01	950.27	922.04
Median	505349.00	555 865.00	577 826.00	582 433.00	585 848.00	612 130.00	567 701.00	574 920.00
Mode	487148.00	N/A	573 820.00	N/A	N/A	591 955.00	487 148.00	487 148.00
Standard Deviation	31255.32	28 604.63	17 361.68	33 268.61	28 716.88	31 030.79	40 606.50	43 168.61
Sample Variance	976894803.82	818 224 726.80	301 427 933.51	1 106 800 157.41	824 659 124.42	962 909 955.13	1 648 888 175.57	1 863 529 146.26
Kurtosis	-0.10	8.60	1.29	21.28	2.53	16.13	3.24	3.10
Skewness	0.21	0.47	0.43	3.06	0.09	1.78	-0.07	0.02
Range	180816.00	359 492.00	127 329.00	356 271.00	251 744.00	354 374.00	469 906.00	469 906.00
Minimum	409168.00	388 435.00	529 328.00	502 070.00	485 981.00	492 087.00	388 435.00	388 435.00
Maximum	589984.00	747 927.00	656 657.00	858 341.00	737 725.00	846 461.00	858 341.00	858 341.00
Sum	185452056.00	202 891 912.00	210 616 429.00	213 002 149.00	213 837 909.00	223 423 945.00	1 025 800 455.00	1 249 224 400.00
Count	365.00	366.00	365.00	365.00	365.00	366.00	1826.00	2192.00
Confidence Level (95.0%)	3217.16	2940.26	1787.06	3424.39	2955.87	3189.65	1863.72	1808.16

Table of wastewater quality data summary statistics for 2015–2020

Statistic	Temp.	pH	Conduc-tivity	TSS	VSS	TDS	COD	BOD	Grease & Oil	N-NH ₄	N-org	N-NO ₃	N-NO ₂	P-total	PO ₄ -total	alkalinity (CaCO ₃)	Cl ⁻	SO ₄	Sulfides-total (H ₂ S)	TKN	Settleable solids	Total Coliform
Unit	[°C]	[-]	[µs/cm]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[ml/l]	[CFU/100ml]
Mean	28.70	6.92	1423.17	188.35	156.86	821.19	436.01	202.56	40.70	29.63	8.67	0.41	0.02	5.54	16.92	192.24	260.40	130.16	4.25	38.13	2.25	4763467153285.12
Stan-dard Error	0.07	0.00	8.01	1.51	1.23	4.80	2.22	1.15	0.35	0.08	0.06	0.01	0.00	0.03	0.10	0.49	2.45	0.64	0.09	0.08	0.03	38354226225.53
Median	29.10	6.90	1344.50	178.00	150.00	780.00	426.00	199.00	39.00	29.20	8.60	0.30	0.01	5.20	15.90	192.00	238.00	127.50	3.10	38.00	2.10	4800000000000.00
Mode	30.10	6.90	1260.00	156.00	152.00	740.00	432.00	191.00	41.00	28.30	8.50	0.20	0.01	5.00	15.00	195.00	246.00	111.00	1.60	39.00	2.10	4900000000000.00
Stan-dard Devia-tion	3.36	0.15	374.87	70.70	57.40	224.66	104.12	53.69	16.17	3.76	2.68	0.38	0.17	1.56	4.69	22.71	114.73	30.17	4.12	3.78	1.51	1795698833110.84
Sample Vari-ance	11.28	0.02	140530.52	4998.85	3294.40	50471.10	10840.01	2882.78	261.43	14.12	7.19	0.14	0.03	2.43	21.97	515.95	13162.84	910.29	17.00	14.30	2.28	3224534299235650000000000.00
Kur-tosis	0.03	1.32	8.58	12.02	12.39	7.31	21.09	6.90	158.98	1.46	0.79	201.51	1204.14	27.71	27.98	1.56	9.68	0.07	10.77	1.33	27.75	42.85
Skew-ness	-0.61	0.26	2.30	2.36	2.34	2.07	2.32	1.27	7.22	0.48	0.29	8.86	32.37	4.09	4.03	0.08	2.43	0.31	2.44	0.04	3.12	3.18
Range	23.70	1.60	3868.00	840.00	738.00	2270.00	1779.00	673.00	426.00	35.79	22.40	10.00	7.00	21.40	65.50	244.00	1169.00	215.00	42.46	43.46	22.40	3199999999520.00
Mini-mum	13.30	6.30	502.00	40.00	26.00	295.00	141.00	74.00	7.00	11.31	1.20	0.00	0.00	1.50	4.50	51.00	25.00	38.00	0.04	14.13	0.00	480.00
Maxi-mum	37.00	7.90	4370.00	880.00	764.00	2565.00	1920.00	747.00	433.00	47.10	23.60	10.00	7.00	22.90	70.00	295.00	1194.00	253.00	42.50	57.59	22.40	3200000000000.00
Sum	62919.50	15179.27	3119595.00	412872.00	343828.00	1800056.00	955727.00	444012.00	89211.60	64945.48	19000.43	904.42	42.10	12143.65	37095.32	421393.00	570798.00	285302.00	9312.84	83581.80	492.530	10441520000001000.00
Count	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00	2192.00
Con-fidence Level (95.0%)	0.14	0.01	15.70	2.96	2.40	9.41	4.36	2.25	0.68	0.16	0.11	0.02	0.01	0.07	0.20	0.95	4.81	1.26	0.17	0.16	0.06	75214452060.00

Table of annual averages for wastewater quality data 2015–2020

Statistic	Temp. [°C]	pH [-]	Con-duc-tivity [µs/cm]	TSS [mg/l]	VSS [mg/l]	TDS [mg/l]	COD [mg/l]	BOD [mg/l]	Oil& Grease [mg/l]	N-NH ₄ [mg/l]	N-org [mg/l]	N-NO ₃ [mg/l]	N-NO ₂ [mg/l]	P-total [mg/l]	PO ₄ ⁻ total [mg/l]	Alkalinity (CaCO ₃) [mg/l]	Cl- [mg/l]	SO ₄ [mg/l]	Sulfides-total (H ₂ S) [mg/l]	TKN [mg/l]	Settleable solids [ml/l]	Total Coliform [CFU/100ml]	
Unit																							
2015	28.8	6.9	1851.0	190.9	156.5	1086.4	427.1	218.6	35.2	27.9	9.7	0.8	0.04	5.4	16.6	177.1	397.8	154.5	2.7	37.6	1.6	5332766550185.9	
2016	27.6	6.9	1236.2	188.1	159.3	685.5	419.1	231.4	35.3	28.5	9.7	0.4	0.02	5.5	16.7	178.3	208.9	140.4	2.6	38.1	2.0	5803170108624.1	
2017	28.8	7.0	1337.7	204.0	171.8	736.2	452.7	200.1	43.9	28.8	8.7	0.2	0.03	5.9	18.0	199.0	240.6	116.1	4.8	37.5	2.7	4919355741239.8	
2018	28.9	7.0	1415.9	191.1	156.6	831.6	453.9	208.1	42.4	30.4	7.9	0.4	0.01	5.4	16.5	196.4	254.2	120.8	4.7	38.2	2.4	4604235989187.1	
2019	29.6	6.9	1324.9	184.2	153.9	779.1	445.9	176.2	42.1	29.7	7.8	0.5	0.01	5.3	15.9	195.0	226.2	122.1	5.8	37.5	2.4	3852236132836.5	
2020	28.5	7.0	1373.0	174.3	144.5	807.7	419.7	181.7	45.5	32.4	8.2	0.2	0.01	5.9	17.9	207.6	234.8	126.8	4.8	39.8	2.3	4063569756724.2	
6-yr	28.8	6.9	1424.0	191.7	159.7	818.2	440.2	206.3	39.9	29.1	8.7	0.5	0.02	5.5	16.7	189.6	262.6	130.1	4.2	37.8	2.3	4881019690053.2	
5-yr	29.2	6.9	1363.7	189.4	157.9	783.4	445.9	194.0	42.8	29.5	8.1	0.4	0.02	5.4	16.6	195.9	241.7	120.2	4.9	37.6	2.5	4506457567800.6	
3-yr	28.7	6.9	1414.9	188.6	157.0	816.4	436.6	201.9	40.9	29.7	8.6	0.4	0.02	5.5	16.9	192.8	257.6	129.5	4.3	38.2	2.3	4734818664085.2	

Table of Kruskal-Wallis post hoc comparisons

Parameter	All years	2020,15–19,15–20	2020/15–20	2020/15–19	15–19/15–20
Temp.	0.814	0.905	0.755	.713	0.932
pH	000	0.197	0.198	0.114	0.514
Conductivity	000	0.683	0.590	0.378	0.932
TSS	0.414	0.228	0.178	0.128	0.887
VSS	0.228	0.118	0.114	0.068	0.590
TDS	000	0.933	0.799	0.755	0.932
COD	0.455	0.513	0.443	0.291	0.755
BOD	0.000	0	0	0	0.242
Grease & Oil	0	0.084	0.101	0.045	0.514
N-NH ₄	0	0.012	0.045	0.008	0.114
N-org	0	0.704	0.590	0.443	0.843
N-NO ₃	0	0	0	0	0.028
N-NO ₂	0.003	0.004	0.005	0.003	0.713
P-total	0.129	0.295	0.291	0.178	0.478
PO ₄ -total	0.089	0.366	0.347	0.242	0.443
Alkalinity (CaCO ₃)	0	0.006	0.010	0.007	0.128
Cl ⁻	0	0.257	0.242	0.128	0.755
SO ₄	0	0.617	0.443	0.410	0.887
Sulfides-total (H ₂ S)	0.025	0.908	0.887	0.799	0.671
TKN	0.105	0.060	0.101	0.028	0.410
Settleable solids	0.004	0.881	0.671	0.713	1.000
Total Coliform	0	0.095	0.114	0.050	0.478