

**BEFORE THE ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.**

In re:	)
	)
South Essex Sewerage District	)
	)
Permit No. MA0100501	)
	)

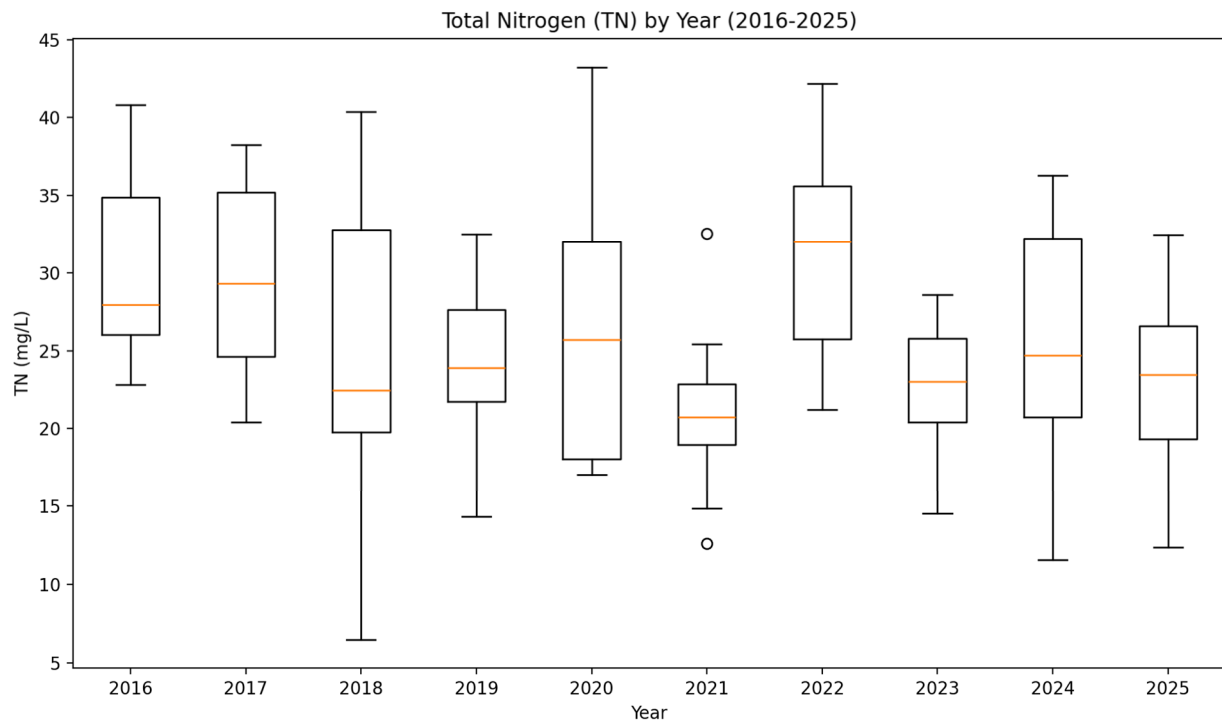
DECLARATION OF DINGFANG LIU, PhD.

I, Dingfang Liu, depose and state as follows:

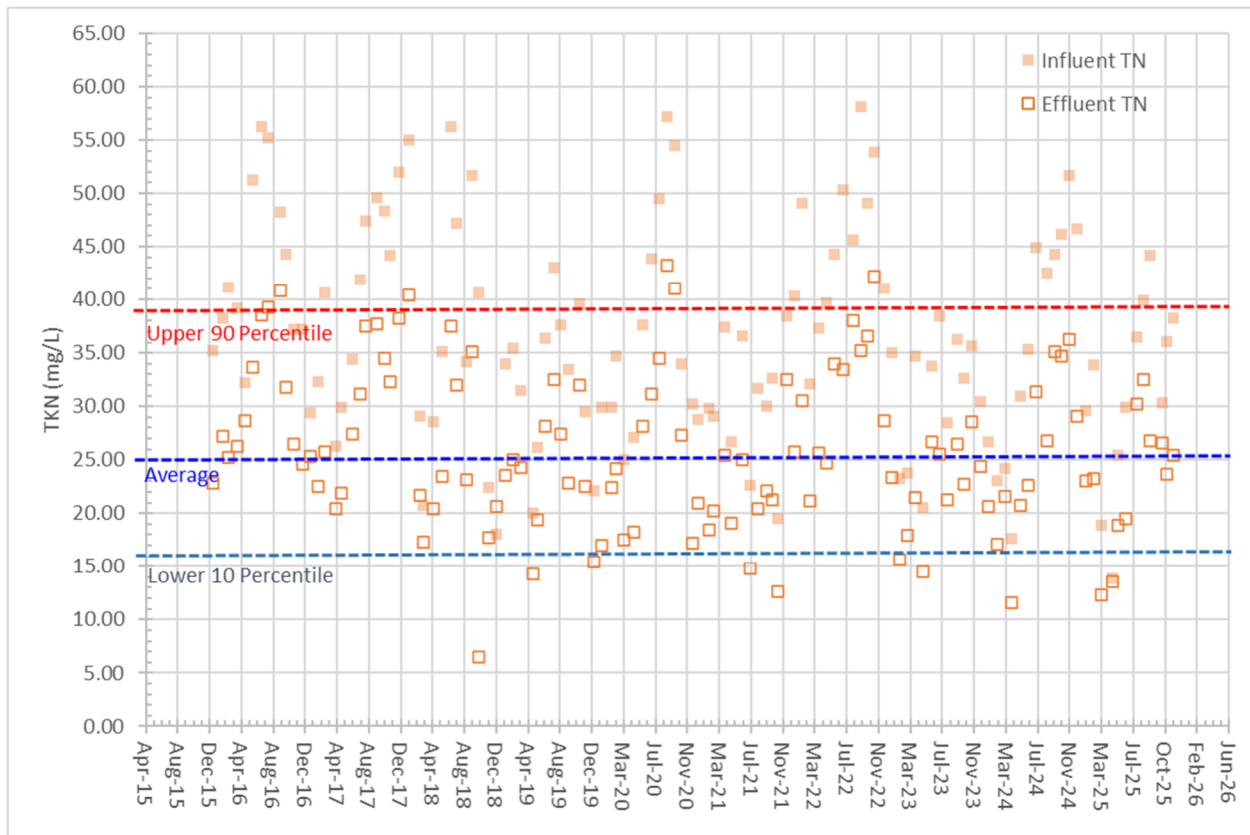
1. I am the General Manager of Kleinfelder Water Technologies, located at 1 Beacon Street, Suite 8100, Boston, MA 02108.
2. I have a PhD in Civil Engineering from Louisiana State University and an M.Sc. in Environmental Science from the Chinese Academy of Science.
3. I am also a board certified environmental engineer from the Academy of Environmental Engineers and Scientists.
4. I have been engaged by the South Essex Sewerage District (“District”) to provide a technical review and analysis in connection with its draft NPDES permit and this petition for review.
5. Exhibit A is a true and accurate summary of the total nitrogen testing results for the District’s facility’s effluent for the periods covering January 2016 through December 2025. This summary is derived from the District’s discharge monitoring reports submitted to the Environmental Protection Agency.
6. I performed a statistical analysis of the variances (ANOVA) in this data. ANOVA is typically used to determine whether there are significant differences between the means of three or more independent groups. In this case, I grouped the data by year and tested

the variation significance between groups at 95% confidence level. The results of that analysis are attached as Exhibit B.

7. When looking at data over the decade, statistically there are no significant changes statistically at the 95% confidence level. This is true when looking at data year-round or in the growing season (April – October) over the decade.
8. The box plot below illustrates the statistic parameters of yearly data over the decade:



9. The plot chart below shows effluent total nitrogen concentration over the years with mean, upper and lower percentiles.



10. The data is scattered over the period analyzed, there is no significant trend visually, and there is no regression observed (with R value < 0.05 for linear or nonlinear regression).
11. Based on these results, I have concluded that the total nitrogen discharges over the years have not changed and the data collected over the years at a monthly frequency (the same frequency as in the District's 2016 NPDES permit) adequately represents the District's total nitrogen loading into the receiving water, Salem Sound.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: January 21, 2026.

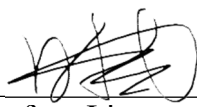

Dingfang Liu

Exhibit A

TOTAL NITROGEN TESTING RESULTS

Date	Total Nitrogen (mg/L)		Date	Total Nitrogen (mg/L)
2016-01-04	22.81		2019-01-08	23.56
2016-02-08	27.2		2019-02-06	25.01
2016-03-02	25.2		2019-03-07	24.27
2016-04-05	26.31		2019-04-23	14.33
2016-05-04	28.68		2019-05-09	19.37
2016-06-01	33.66		2019-06-10	28.18
2016-07-07	38.59		2019-07-11	32.51
2016-08-01	39.29		2019-08-06	27.42
2016-09-13	40.82		2019-09-04	22.82
2016-10-03	31.8		2019-10-16	31.96
2016-11-01	26.47		2019-11-04	22.52
2016-12-05	24.57		2019-12-10	15.47
2017-01-03	25.36		2020-01-07	17.05
2017-02-01	22.47		2020-02-12	22.44
2017-03-01	25.7		2020-03-03	24.14
2017-04-12	20.43		2020-04-01	17.56
2017-05-03	21.9		2020-05-06	18.22
2017-06-12	27.42		2020-06-10	28.1
2017-07-11	31.21		2020-07-14	31.18
2017-08-01	37.47		2020-08-13	34.49
2017-09-12	37.72		2020-09-09	43.24
2017-10-10	34.47		2020-10-07	41.1
2017-11-01	32.34		2020-11-03	27.27
2017-12-04	38.27		2020-12-14	17.26
2018-01-09	40.38		2021-01-05	21
2018-02-21	21.73		2021-02-17	18.47
2018-03-08	17.34		2021-03-03	20.28
2018-04-11	20.44		2021-04-13	25.41
2018-05-15	23.49		2021-05-11	19.12
2018-06-18	37.5		2021-06-22	25.06
2018-07-10	32.04		2021-07-20	14.86
2018-08-15	23.19		2021-08-16	20.49
2018-09-05	35.14		2021-09-21	22.1
2018-10-02	6.48		2021-10-13	21.25
2018-11-06	17.7		2021-11-02	12.6
2018-12-06	20.68		2021-12-06	32.55

(Continued on following page)

Date	Total Nitrogen (mg/L)		Date	Total Nitrogen (mg/L)
2022-01-04	25.75		2024-01-02	20.61
2022-02-01	30.5		2024-02-06	17.1
2022-03-01	21.22		2024-03-06	21.6
2022-04-05	25.68		2024-04-01	11.57
2022-05-02	24.68		2024-05-01	20.8
2022-06-01	34		2024-06-03	22.6
2022-07-06	33.5		2024-07-01	31.4
2022-08-11	38		2024-08-13	26.8
2022-09-12	35.27		2024-09-10	35.08
2022-10-04	36.53		2024-10-03	34.7
2022-11-01	42.17		2024-11-04	36.3
2022-12-05	28.66		2024-12-03	29.13
2023-01-03	23.31		2025-01-06	23.04
2023-02-01	15.65		2025-02-03	23.22
2023-03-04	17.94		2025-03-03	12.37
2023-04-03	21.47		2025-04-15	13.6
2023-05-03	14.53		2025-05-05	18.89
2023-06-04	26.7		2025-06-02	19.46
2023-07-05	25.56		2025-07-16	30.27
2023-08-02	21.23		2025-08-11	32.49
2023-09-06	26.5		2025-09-02	26.74
2023-10-03	22.7		2025-10-20	26.54
2023-11-01	28.6		2025-11-03	23.66
2023-12-03	24.38		2025-12-01	25.39

7767855.2

Exhibit B

(See attached)

Yearly Statistics Summary

Year	count	mean	std	min	max
2016	12	30.45	6.261358	22.81	40.82
2017	12	29.56333	6.529628	20.43	38.27
2018	12	24.67583	9.791349	6.48	40.38
2019	12	23.95167	5.700866	14.33	32.51
2020	12	26.8375	9.175716	17.05	43.24
2021	12	21.09917	5.129789	12.6	32.55
2022	12	31.33	6.279166	21.22	42.17
2023	12	22.38083	4.453645	14.53	28.6
2024	12	25.64083	7.843482	11.57	36.3
2025	12	22.9725	6.078288	12.37	32.49

Year	Mean_TN
2016	30.45
2017	29.56
2018	24.68
2019	23.95
2020	26.84
2021	21.1
2022	31.33
2023	22.38
2024	25.64
2025	22.97

Normality (Shapiro)

Year	n	Shapiro_W	Shapiro_p
2016	12	0.890846778	0.120840051
2017	12	0.915543289	0.251111731
2018	12	0.940897208	0.509782367
2019	12	0.957887153	0.753296611
2020	12	0.90267868	0.171757267
2021	12	0.946722176	0.589667551
2022	12	0.972791519	0.937734235
2023	12	0.945163733	0.56769669
2024	12	0.948096869	0.609349608
2025	12	0.960266632	0.78763

Summary of ANOVA & Test

Metric	Value
ANOVA F	3.172754319
ANOVA p	0.001914613
Method	scipy.stats.f_oneway
Levene W	1.474270849
Levene p	0.166313401
Kruskal H	25.24022039
Kruskal p	0.00271663

group1	group2	meandiff	p_adj	lower	upper	reject
-						
2016	2017	-0.8867	1	10.0066	8.2333	FALSE
-						
2016	2018	-5.7742	0.5698	14.8941	3.3458	FALSE
-						
2016	2019	-6.4983	0.3967	15.6183	2.6216	FALSE
-						
2016	2020	-3.6125	0.9563	12.7325	5.5075	FALSE
-						
2016	2021	-9.3508	0.0397	18.4708	-0.2309	TRUE
2016	2022	0.88	1	-8.24	10	FALSE
-						
2016	2023	-8.0692	0.1307	17.1891	1.0508	FALSE
-						
2016	2024	-4.8092	0.7914	13.9291	4.3108	FALSE
-						
2016	2025	-7.4775	0.2086	16.5975	1.6425	FALSE
-						
2017	2018	-4.8875	0.7756	14.0075	4.2325	FALSE
-						
2017	2019	-5.6117	0.6097	14.7316	3.5083	FALSE
-						
2017	2020	-2.7258	0.9936	11.8458	6.3941	FALSE
-						
2017	2021	-8.4642	0.0928	17.5841	0.6558	FALSE
2017	2022	1.7667	0.9998	-7.3533	10.8866	FALSE
-						
2017	2023	-7.1825	0.2577	16.3025	1.9375	FALSE
-						
2017	2024	-3.9225	0.9281	13.0425	5.1975	FALSE
-						
2017	2025	-6.5908	0.3761	15.7108	2.5291	FALSE
2018	2019	-0.7242	1	-9.8441	8.3958	FALSE
2018	2020	2.1617	0.9989	-6.9583	11.2816	FALSE
-						
2018	2021	-3.5767	0.9589	12.6966	5.5433	FALSE
2018	2022	6.6542	0.3623	-2.4658	15.7741	FALSE
2018	2023	-2.295	0.9983	-11.415	6.825	FALSE
2018	2024	0.965	1	-8.155	10.085	FALSE
-						
2018	2025	-1.7033	0.9998	10.8233	7.4166	FALSE
2019	2020	2.8858	0.9903	-6.2341	12.0058	FALSE
-						
2019	2021	-2.8525	0.9911	11.9725	6.2675	FALSE
2019	2022	7.3783	0.2244	-1.7416	16.4983	FALSE

				-		
2019	2023	-1.5708	0.9999	10.6908	7.5491	FALSE
2019	2024	1.6892	0.9999	-7.4308	10.8091	FALSE
				-		
2019	2025	-0.9792	1	10.0991	8.1408	FALSE
				-		
2020	2021	-5.7383	0.5787	14.8583	3.3816	FALSE
2020	2022	4.4925	0.8498	-4.6275	13.6125	FALSE
				-		
2020	2023	-4.4567	0.8557	13.5766	4.6633	FALSE
				-		
2020	2024	-1.1967	1	10.3166	7.9233	FALSE
2020	2025	-3.865	0.9341	-12.985	5.255	FALSE
2021	2022	10.2308	0.0154	1.1109	19.3508	TRUE
2021	2023	1.2817	1	-7.8383	10.4016	FALSE
2021	2024	4.5417	0.8414	-4.5783	13.6616	FALSE
2021	2025	1.8733	0.9997	-7.2466	10.9933	FALSE
				-		
2022	2023	-8.9492	0.0591	18.0691	0.1708	FALSE
				-		
2022	2024	-5.6892	0.5907	14.8091	3.4308	FALSE
				-		
2022	2025	-8.3575	0.1021	17.4775	0.7625	FALSE
2023	2024	3.26	0.9775	-5.86	12.38	FALSE
2023	2025	0.5917	1	-8.5283	9.7116	FALSE
				-		
2024	2025	-2.6683	0.9945	11.7883	6.4516	FALSE