



CITY OF EDMONDS

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WASTEWATER TREATMENT PLANT

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MIKE NELSON
MAYOR

March 15, 2021

The City of Edmonds (Edmonds) respectfully submits the following comments on the Department of Ecology, Preliminary Draft Puget Sound Nutrient General Permit (NGP). The comments have been developed by Edmonds staff working in collaboration with our engineering consultant, Jacobs.

If you have any questions regarding these comments, please do not hesitate to contact Pamela Randolph, Wastewater Treatment Plant Manager, at 425.771.0237, or by e-mail at pamela.randolph@edmondswa.gov.

- 1. TIN cap, general approach.** The Puget Sound nutrient and dissolved oxygen situation is a watershed-scale problem. It demands a watershed-based, watershed-scale approach with establishment of load allocations and tiered actions for all total inorganic nitrogen (TIN) inputs including non-point sources, as well as upstream treatment plants that discharge to rivers tributary to the Sound. Non-point sources, quantified by Ecology as river inputs, merit particular attention, as they often contribute TIN on the scale of a medium to large wastewater treatment plant, based on Ecology's data.
- 2. Missing data in TIN load cap calculation.** The data set that Ecology used to estimate Edmonds' annual load is missing a flow value and associated TIN load for 10/1/2019. The City checked Ecology's PARIS database for this date, and daily flow of 3.57 MGD is present and entered. The total inorganic nitrogen (TIN) load should be calculated for this date using the 3.57 MGD flow value.
- 3. Outlier in PARIS data set.** Ecology's calculated TIN concentration for 8/15/2019 is 15.5 mg/L, approximately half of the long-term mean or median TIN concentration of 30 mg/L and the lowest dry season value by a significant margin. This TIN value appears to be an outlier and should be removed from the data set. Please advise how the City can revise the associated PARIS data entry without triggering a late reporting violation.

It is unclear whether the root cause resides in a sampling anomaly or a laboratory error. In further support, please consider the following data assessment. The City's NPDES Permit requires quarterly sampling and analysis for TIN components, including total Kjeldahl Nitrogen (TKN), the sum of organic and ammonia nitrogen. The 483.5 lb/d TIN on 8/15/2019 is based on the measured 13.8 mg/L effluent ammonia and 1.7 mg/L nitrite/nitrate. The 13.8 mg/L effluent ammonia is the minimum ammonia concentration measured in the 6/1/2014 to 3/1/2020 data set, which averaged at 27.8 mg/L with a standard deviation of 7.7 mg/L, excluding interpolated data. The 13.8 mg/L value is 1.8 times the standard deviation *lower* than the average. The low ammonia measurement is an apparent outlier, especially compared with the 40.6 mg/L effluent TKN measured for the same sample. Effluent TKN consists of mostly ammonia, plus a small fraction of organically bound nitrogen. By subtraction, the organic nitrogen would be 26.8 mg/L, an implausibly high value for a secondary effluent. Effluent organic nitrogen is usually in a

single digit mg/L range, as supported by Edmonds' historical data. Please remove this unrepresentative data outlier and update AL₀ calculation accordingly.

4. Sampling frequency. The draft NGP classifies facilities with a maximum month daily flow of greater than 10.0 MGD as large plants and requires TIN analysis at a 4 times per week frequency. Edmonds has a long-term average flow of approximately 4.6 MGD, based on the data used in the TIN load cap calculations, less than 50 percent of the large plant flow value. However, with a maximum month daily design flow of 11.8 MGD, Edmonds would be required to sample and analyze for TIN at a 4 times per week frequency. This would cause a large, unbudgeted burden on the City as discussed in the following comment. Given that Edmonds discharges at a flow of less than 50 percent of the large plant cutoff value, the City proposes that the TIN sampling and analysis frequency be maintained at the medium plant value of 1 time per week until the plant reaches 85 percent of 10 MGD large plant value, at which time it would increase. Monitoring TIN at the medium plant frequency of 1 time per week will provide an accurate characterization of Edmonds's wastewater and will provide adequate time for planning of any required plant modifications, while decreasing the financial burden on the City and rate payers.

5. Evaluation of financial impact of Nutrient General Permit increased monitoring. Table 5 of the General Permit Draft details the parameters and sampling frequency for large plants. For the City of Edmonds, the additional workload is estimated to require an additional .5 FTE or \$57,412 per year if the work is performed in-house. In addition to the labor that is required, supplies and accreditation fees would increase by \$23,836 and the laboratory would have to be retrofitted to accommodate increased equipment required to run tests that were not envisioned during the plant laboratory's design. The cost of a laboratory upgrade, especially given our limited space, is not known at this time.

The City could determine that contracting all additional labor, supplies and testing is the lower cost options. Our evaluation includes a cost per test, sample prep, sample review, and courier service. The estimated increase for Edmonds annual laboratory contracted expense would be \$32,885 per year. This does not include any increased charges for expediting of results which would be required to ensure the DMR is submitted timely. However, the ultimate decision, to contract services or to perform these services in house is not simply a financial one. The City of Edmonds labor contracts clearly define that work that can be completed in house should be completed in house. In 2020, based on a joint agreement with DOE, Edmonds took on additional testing for a nutrient trial. Staff developed procedures and have proven their proficiency for many of the required tests. Therefore, based on the City taking on the initiative to conduct the Nutrient Removal trial, it has been established that the work should be performed in house by Edmonds labor.

In the end our evaluation has determined that the cost to Edmonds based on Table 5 would be:

- Hire one (1) 0.5 FTE at \$57,412 per year,
- Increase laboratory supplies and annual accreditations by \$12,656 per year
- Utilize contracted services for TKN and TOC for \$5,773 per year.

The total estimated impact of implementing the Table 5 Monitoring Schedule for Edmonds is at least an increase of \$75,841. This increase has not been reflected in our 2021 budget and rate models.

Given the substantial, unbudgeted impacts, dischargers should be given a period of 12 months before additional monitoring requirements take effect, so that additional budget monies and staff can be put in-place.

6. Nutrient action level calculations. Edmonds has the following comments on the proposed AL₀ TIN cap. Some comments may apply to other facilities as well, especially small to medium plants that monitor effluent TIN at a frequency similar to Edmonds.

- Section III.C., 1st bullet on page 9 states that “Monthly and quarterly samples are representative of the month or quarter sampled”. This may not be always the case. Sampling outliers due to sampling or analysis artifacts skewer the AL₀ determinations, especially for the small to medium plants that monitor effluent TIN less frequently and have a small dataset to work with. Allowing facilities to screen out obvious outliers would ensure representativeness of the dataset and thus a more appropriate AL₀ level.
- The sample per month setting is the most sensitive parameter in the Bootstrap method for calculating the AL₀. According to email correspondences with Ecology, 16 Samples per month was used in the Bootstrap method for determining AL₀ because it is considered appropriate for future sampling. This sampling frequency may be appropriate for large facilities that monitor effluent TIN more frequently but would make the distribution of Bootstrap estimate arbitrarily tighter than the original dataset and thus a lower than actual AL₀. This evidenced in a significantly tighter cumulative distribution of the Bootstrap estimates than that of the original dataset, as shown in the Summary page of the Bootstrap results for Edmonds.
 - We did a sensitivity analysis and found that AL₀ would increase from 409,000 lb/yr to 478,000 lb/yr, with the sampling frequency being reduced from 16 per months to 1 per month to better reflect the historical sampling frequency. Edmonds performed monthly effluent TIN sampling in 2014 and have reduced to quarterly sampling since 2015, but 1 sample per month is the minimum allowed for selection by Ecology’s tool.
 - Therefore, it is critical to set the sampling frequency properly to arrive at a AL₀ level that truly represent the historical TIN load at a 99% confidence interval. The principle of the Bootstrap method is to estimate the distribution of the original dataset by empirical distributions of repeated bootstrap random samples. To correctly represent the distribution of the original dataset, the bootstrap sample size is set at the same as the original dataset, as described in book “A Modern Introduction to Probability and Statistics” (Springer, 2005) and emphasized in the online resources by a number of organizations, such as:
 - https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/readings/MIT18_05S14_Reading24.pdf

- <http://www2.stat.duke.edu/courses/Fall12/sta101.002/Sec3-34.pdf>
- <https://stats.stackexchange.com/questions/263710/why-should-bootstrap-sample-size-equal-the-original-sample-size/275746>
- Assuming the compliance with the annual TIN cap is determined on a yearly basis, it seems reasonable to set the samples per month year such that the number of samples per year (i.e. Bootstrap sample size) matches the original data set. In the case for Edmonds, there are 70 data points (including interpolation) in the dataset used by Ecology, which corresponds to at most 6 samples per months and at least a 424,000 lb/yr AL₀. The resulting distribution of the Bootstrap estimate is still noticeably tighter than the original dataset, suggesting that the sampling frequency should be further lowered to better represent the original dataset.
- To better match the historical sampling frequency, reducing the sampling frequency to 1 sample per month, the minimum allowed by Ecology's tool, would result 478,000 lb/yr AL₀. This value seems to be a more appropriate AL₀ that better represents the original dataset's distribution, resulting in a distribution of the Bootstrap estimate closer to but still tighter than the original dataset. Please clarify the basis for selection of samples per month, which should be determined by the size of the available dataset per Bootstrap method principle and would be lower for small to medium plants with small datasets.
- Section III.C., 4th bullet on page 9 states that "When less than monthly data was available, Ecology calculated loads for intervening months using the representative concentration and flow from the intervening month. Since the sample per month setting should be proportional to the size of the original data set as commented above, interpolating data may hide the variability of the historical loads and artificially increase the original dataset size, thus allowing greater samples per month that would result in a lower AL₀ than what is warranted by the actual dataset. Is there sensitivity analysis done to support the interpolation approach, especially for small to medium plants with small datasets? For example, there are only 26 data points left for Edmonds after the interpolations are removed.

7. NGP data reporting. For efficiency in reporting, data submission required under the NGP should be performed as part of Edmonds eDMR reporting under our individual NPDES Permit.

8. Plant capacity ownership challenges and utilization of Edmonds permitted 11.8 MGD capacity. In addition to serving the City of Edmonds, the Edmonds plant provides wastewater treatment for local service providers including the City of Mountlake Terrace, Ronald Sewer District, and Olympic View Water and Sewer District. These local service providers have purchased and effectively own shares of the Edmonds plant hydraulic capacity. In addition, Edmonds also receives significant and variable flow from King County's Richmond Beach service area. The TIN cap may ultimately prevent Edmonds and local service providers from utilizing plant capacity that they have purchased, which will constitute a large, difficult to reconcile burden on local municipalities. Given these challenges, when a cap exceedance is identified, Edmonds should be granted a full

NPDES Permit cycle for evaluation of identification of potential remedies, prior to implementation. Further supporting information is presented below.

Edmonds has sold our Ecology-approved capacity to our wastewater treatment plant partners. The City of Mountlake Terrace owns 23.174 percent of plant capacity, Ronald Wastewater District owns 9.488% of plant capacity, and Olympic View Water and Sewer District owns 16.551 percent of plant capacity which leaves the City of Edmonds with 50.787 percent of plant capacity. While each participant is responsible for their utilization of plant capacity and capital projects are shared based on the ownership of plant capacity, it would be difficult to impossible to determine which partner is responsible for exceeding the nutrient cap. The plant partnership agreement was based on flows and typical loading but did not envision a nutrient load cap.

Edmonds cannot limit a partner's growth. One area (City or District) could expand faster than another driving up the cost of treatment and exceedance of the cap. In essence, growth in one area is financed by another. Currently one participant utilizes 52% of their capacity (based on flow) while another utilizes 35% of their capacity. It is conceivable that one partner could achieve 100% utilization of their capacity while another participant would be capped and not able to grow in an outer year and still forced to pay their fair share of the capital cost.

9. **Tier 3 implementation.** Tier 3 implementation activities will have significant impacts on many Puget Sound dischargers, the majority of which are short sludge age plants like Edmonds that were not configured to accommodate nitrogen removal. The Edmonds plant, similar to many other facilities, sits on a highly constrained site that is not amenable to expansion. An appropriate schedule must be allowed for alternatives evaluation, property acquisition for site expansion, funding, and implementation of plant improvements. The NGP should identify how such timelines will be developed.
10. **Tier 1, 2 and 3 compliance and credit for proactive actions.** Edmonds has voluntarily implemented many of the Tier 1 and 2 improvements identified in the Draft NGP. In addition, the City is undertaking a comprehensive pilot study to assess how a mobile fixed-film media process could improve the plant's nutrient removal efficiency, a step that aligns to a Tier 3 action. Edmonds should be given credit for these proactive activities and investments, and the NGP should address how such consideration will be incorporated into the Tier 1, 2 and 3 regulatory processes.

Edmonds has been implementing process optimization for years that aligns with the intent of the NGP, summarized as follows:

- In 2013 Aeration Basin #1 was reconfigured from complete mix to plug flow and retrofitted the tank with high efficiency diffusers. This project was implemented to improve the process control.
- In 2014 Edmonds applied for their NPDES renewal. During this time nutrient removal was being discussed in the wastewater community as being a far out on the horizon – potentially beginning the study phase 2 – 3 permit cycles out. Based on this information the City embarked on a rigorous plan to upgrade existing equipment to more efficient alternative that would greatly improve process control.

Since the issuing of the 2014 NPDES Permit, the following process optimization and energy improvements have been made:

- Retrofitted Aeration Basin #2 from complete mix to plug flow and retro fitted the tank with high efficiency diffusers,
- Replaced all centrifugal blowers with Aerzen hybrid blowers – reducing total HP and while providing better control and process options.
- Developed and implemented a blower energy strategy to ensure the process demand was always met in the most energy efficient manner utilizing a combination of 65, 125 and 150 HP blowers.
- Replace existing belt presses and solids conveyor with new screw presses and an enclosed shaft-less screw conveyor. This improved capture rate, allowed for 24 hr. processing of solids and reduced recycle rate.
- Increased the existing dewatered sludge hopper to allow for a 24-hour operation of the dewatering system.
- In 2019 Edmonds embarked on a mobile organic biofilm (Nuvoda) nutrient removal trial (O&M budget 2020 – 2021 to date \$193,300 dollars spent and/or under contract).

Under the NGP, these efforts are considered optimization projects and engineering studies. The projects were implemented as such and were developed in good faith to reduce our carbon footprint, reduce energy, and improve the environment. Since 2014 Edmonds has spent over \$21,000,000 completing capital projects designed to improve plant performance while reducing our impact on the environment. The City has substantially reduced our use of electrical energy and has reduced our carbon dioxide emissions by 1,146 metric tons/year.

The City is currently is under contract with a project to replace our Sanitary Sewage Sludge Incinerator with a uplift gasification process further reducing our impact on the environment by creating a clean biochar from biosolids. This project alone is estimated to cost over \$26,000,000 and will be completed by the end of 2022.

The City of Edmonds is a responsible custodian of our environment and our resources. We believe that imposing TIN load limits on the City at this time would not reflect or credit the optimization efforts that have been made to date.