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Reference: 017138.106

February 9, 2021

Leslie Marshall, General Manager
Scotia Community Services District
P.O. Box 104
Scotia, CA 95565

Subject: Scotia Wastewater Treatment Facility Local Limits Update

Dear Leslie Marshall:

SHN has prepared this letter at your request for additional investigation into local industrial wastewater discharge limits for the Scotia Community Services District (SCSD) wastewater treatment facility (WWTF). SHN completed the Scotia Wastewater Treatment Facility Local Limits Study in February 2020 (SHN, 2020; sampling for the 2020 local limits study was conducted between August 23-29, 2019). The 2020 local limits study assessed the capacity of the SCSD WWTF as a whole; considering factors, including influent and effluent quality, WWTF capacity, and waste load source characterization. The scope of the 2020 local limits study did not include an evaluation of individual treatment unit capacity.

Upon review of the estimated capacity of the trickling filter, it is likely that the organic loading rate to the trickling filter currently exceeds recommended loading rates for this type of treatment unit. Following the trickling filter is a secondary clarifier, chlorine gas disinfection, and aerated treatment ponds. It is likely that the processes that follow the trickling filter are currently removing the excess organic load that the trickling filter is unable to remove.

Biochemical Oxygen Demand (BOD)

SHN completed a detailed engineering analysis (DEA) in March 2016 for the SCSD wastewater treatment facility (WWTF) that estimated the capacity of the trickling filter to be between 107-130 pounds per day (lb/d) of biochemical oxygen demand (BOD). A primary clarifier upstream of the trickling filter at the SCSD WWTF removes a portion of the influent BOD prior to reaching the tricking filter. Typical BOD removal rates for a primary clarifier may range from 25%-40% (Metcalf & Eddy, 2014). Working backward from the trickling filter loading capacity to the influent suggests that a maximum allowable headworks loading (MAHL) of approximately 143-217 lb/d of BOD will prevent overloading of the trickling filter.

Average influent BOD loading to the SCSD WWTF during the local limits study (August 2019) was 307 lb/d, indicating that trickling filter loading was approximately 184-230 lb/d BOD. This exceeds the estimated trickling filter capacity (107-130 lb/d) described above. This indicates that the trickling filter is already overloaded on average with respect to organic loading. The excess organic loading that passes through the trickling filter will partially get oxidized by the chlorine disinfection process. Chlorination of organic matter can result in toxic disinfection byproducts. The purpose of the chlorination process is to kill pathogens such as bacteria and viruses, not to oxidize organic matter. More organic matter increases the chlorine demand

necessary to obtain the appropriate pathogen deactivation, resulting in higher operating cost and potential disinfection byproduct formation.

Based on the estimated loading capacity of the trickling filter of 130 lb/d, and an estimated primary clarifier removal rate of 40%, the resulting MAHL for BOD is 217 lb/d. The maximum allowable industrial loading is calculated from the MAHL by subtracting a safety/expansion factor, 20% in this case, and subtracting the domestic/commercial loading. This results in a MAIL of 98 lb/d. Based on an estimated average industrial flow rate of 33,000 gpd, the resulting local limit for industrial users is 352 milligrams per liter (mg/L).

Ammonia-Nitrogen

Ammonia-nitrogen (ammonia) creates an oxygen demand similar to BOD as it is oxidized to nitrate-nitrogen through bacterial processes in the trickling filter and the aerated treatment ponds. As described above, the trickling filter is already overloaded with respect to BOD, so high ammonia limits would impose an even greater load to the trickling filter and downstream processes such as chlorination and aeration in the treatment ponds.

Typical sanitary wastewater contains ammonia-nitrogen concentrations of 14-41 mg/L (Metcalf & Eddy, 2014). Influent ammonia concentrations measured during the local limits study (August 23 through August 29, 2019) ranged from 9.5 mg/L to 25.0 mg/L with an average of 17.5 mg/L. Industrial user samples collected during the local limits study had ammonia concentrations ranging from less than 1 mg/L up to 83 mg/L with six out of seven samples below approximately 5 mg/L.

Based on a maximum concentration of 41 mg/L, characteristic of typical high-strength sanitary wastewater, an average industrial user flow of approximately 33,000 gallons per day (gpd), an average combined domestic and commercial flow of approximately 45,000 gpd, and a 20% safety factor, the resulting MAHL for ammonia-nitrogen is 33.6 lb/d.

Total Suspended Solids (TSS)

Total suspended solids (TSS) in sanitary wastewater typically include organic matter, which contributes to BOD, called particulate BOD. As the small organic particles break down through the treatment processes, the organic matter is consumed by bacteria using oxygen in the process. Industrial wastewater may contain TSS that do not contribute to BOD such as inorganic matter and sediment; however, industrial users (such as, a brewery, butcher shop, lumber mill, automotive garage, biomass power plant, and fisheries exhibit) likely contain TSS that will contribute significantly to BOD.

Based on a maximum concentration of 250 mg/L, characteristic of typical medium-strength sanitary wastewater, an average industrial user flow of approximately 33,000 gpd, an average combined domestic and commercial flow of approximately 45,000 gpd, and a 20% safety factor, the resulting MAHL for TSS is 179 lb/d.

Zinc

Zinc is a common metal contained in many substances and products (ranging from dietary supplements to galvanization of steel products) that can be introduced into wastewater. Zinc has antimicrobial and antibiotic properties that can inhibit biological treatment processes. Literature values for trickling filter bacteria

inhibition by zinc could not be located; however, Anthony and Briemburst (1981) indicate that zinc concentrations above 0.3-5 mg/L may inhibit biological processes in conventional active sludge (CAS). The bacteria responsible for treatment in trickling filters and CAS systems are similar and likely have a similar sensitivity to zinc. Bacteria in trickling filters are known as fixed film because they grow attached to a medium (redwood slats in this case), whereas bacteria in CAS systems are suspended in a sludge. The fixed film trickling filter bacteria are less sensitive to inhibition by some pollutants because they grow in layers, providing shielding and protection from short-term exposure to high levels of pollutants. Suspended growth CAS bacteria do not develop the same level of protection and shielding from toxic substances and may be more sensitive than trickling filter bacteria populations.

Due to the likelihood that trickling filter bacteria are less sensitive to zinc toxicity and inhibition, the upper limit inhibition concentration for CAS bacteria of 5 mg/L should provide a protective limit for the SCSD trickling filter. For reference, note that the existing SCSD local limit for zinc is 0.135 mg/L, and the City of Eureka local limit for zinc is 0.678 mg/L.

Based on a maximum concentration of 5 mg/L, an average industrial user flow of approximately 33,000 gallons per day (gpd), an average combined domestic and commercial flow of approximately 45,000 gpd, and a 20% safety factor, the resulting MAHL for zinc is 1.74 lb/d.

Revised MAHL, MAIL, and Local Limits

Table 1 below includes revised MAHLs, MAILs, and local limits for ammonia, BOD, TSS, and zinc as described previously.

Table 1. Proposed Revised MAHL, MAIL, and Local Limits
Scotia Wastewater Treatment Facility, Scotia, California

Constituent	MAHL[a] (lb/d)[b]	MAIL[c] (lb/d)	Local Limits (mg/L)[d]	Limiting Criteria
Ammonia	33.6	11.4	41.0	Trickling Filter Organic Loading Capacity
BOD[e]	217	98	352	Trickling Filter Organic Loading Capacity
TSS[f]	179	70	250	Trickling Filter Organic Loading Capacity
Zinc	1.74	1.39	5.00	Trickling Filter Inhibition

[a] MAHL: maximum allowable headworks loading
[b] lb/d: pounds per day
[c] MAIL: maximum allowable industrial loading
[d] mg/L: milligrams per liter
[e] BOD: biochemical oxygen demand
[f] TSS: total suspended solids

BOD Load Distribution

As described above, the current organic (BOD) loading to the trickling filter exceeds the recommended typical organic loading for this type of trickling filter. It is likely that other treatment processes are currently making up for the excess loading, including chlorination and treatment pond aeration. It may be infeasible for SCSD to reduce organic loading to the WWTF without strictly limiting industrial and commercial users or

undergoing significant treatment upgrades. Figure 1 below is provided as a reference for the distribution of organic loading into the WWTF (in terms of BOD) between domestic/commercial users, safety factor/reserve capacity (20% of the MAHL), and the various significant industrial users evaluated during the local limits study.

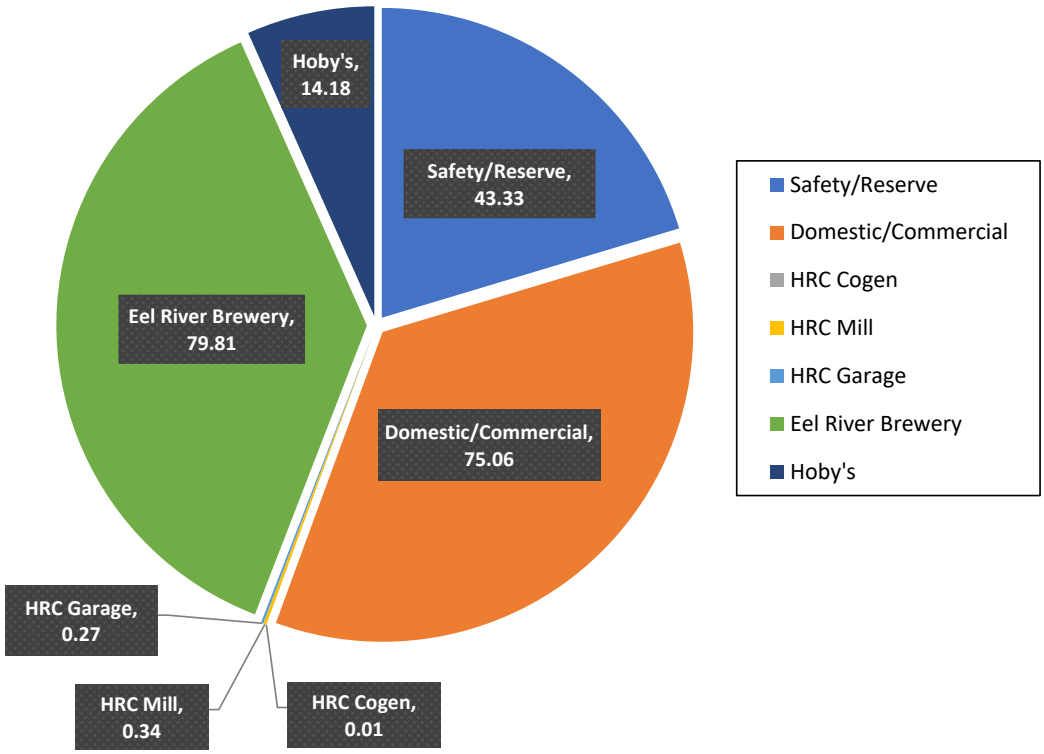

Figure 1. Estimated biochemical oxygen demand (BOD) loading (in pounds per day) to the Scotia Community Services District (data from the 2020 SCSD WWTF Local Limits Study by SHN).

Note that the estimated BOD loading to the WWTF is 213 lb/d based on an estimated domestic/ commercial user BOD concentration of 200 mg/L, and industrial user samples collected during the 2020 local limits study. Composite influent sampling conducted during the 2020 Local Limits Study indicated that BOD loading to the WWTF was 307 lb/d (seven-day average). Seven consecutive daily influent samples were collected during the study with BOD concentrations ranging from 130-1,300 mg/L, suggesting that industrial user loading may be highly variable and greater than concentrations observed through direct sampling of industrial users. Industrial user samples collected during the study were grab samples and not composite samples.

If you have any questions regarding the revised limits presented in this letter, please call me at (707) 441-8855. If you approve of the limits presented above in Table 1, SHN will revise and re-submit the SCSD WWTF local limits study to include the limits presented herein.

Sincerely,

SHN

Mike Foget
Senior Civil Engineer

Chuck Swanson
Project Manager

MKF/CRS:lam

References

Anthony, R. M., and L. H. Briemburst. 1981. *Determining Maximum Influent Concentrations of Priority Pollutants for Treatment Plants*. Journal Water Pollution Control Federation 53(10):1457-1468.

Metcalf & Eddy. 2014. *Wastewater Engineering: Treatment and Resource Recovery*. 5th edition McGraw-Hill. New York, USA.

SHN. 2020. *Scotia Wastewater Treatment Facility Local Limits Study*. Eureka, CA:SHN.