TETRA TECH

Memorandum

City of Stevenson

Stevenson WWTP, High Strength Dischargers

Brewery Wastewater Guidance Document

April 28, 2016

This memorandum describes best practices, goal setting and other general guidance information for breweries and distilleries in the Stevenson, Washington area of impact. This guidance document is based on the *Brewers Association Water and Wastewater: Treatment/Volume Reduction Manual.*

WATER SURVEY AND METERING

Prepare a Water Survey:

1. Map the brewery's water distribution network and mark the routes of major pipes and drains on the site plan.
2. Identify the major points at which water is used.
3. Identify the major points of wastewater discharge.
4. Identify the content of the effluent (yeast, trub, etc) if possible. Identify locations where high strength waste is generated.
5. Estimate the amount of water used and discharged at each major point. Water meters or submeters could be installed at key locations to help identify water use and to assist with water use tracking and conservation.
6. Identify the water quality and availability at each major point.
7. Include designations for hot, cold and drainage systems.
8. Check water use in different areas of the brewery when production has ceased. If liquid is flowing through pipes or drains, either there is a leak or equipment has been left 'On'.
9. Label pipes, valves and manholes for easy identification.

Suggestion: Team with an intern, possibly and engineering student, from an area university to prepare the water survey.

Use Water Meters to Identify Opportunities for Brewery Operations Optimization

A single water meter is not capable of providing enough information on water usage in different process steps. Installing sub-meters at key process locations is recommended. These locations must be identified by the brewer. Water meter data collection and analysis can provide the following opportunities:

- Reduce hot water liquor waste

15350 SW Sequoia Parkway, Suite 220, Portland OR 97224
Tel 503.598.2532 tetratech.com

- Other process optimization and reduction in product waste
- Water conservation

WASTEWATER DISCHARGED TO THE CITY SEWER

The Stevenson Wastewater Treatment Plant (WWTP) cultivates aerobic microorganisms in their oxidation ditch treatment process, which stabilize wastewater and create effluent water of equal or higher quality than the river it is discharged to. These microorganisms flourish under consistent conditions.

Spikes of high strength wastewater discharged to the City sewer disrupt the treatment process and can create conditions where undesirable microorganisms "take over". This may create difficult conditions at the wastewater treatment plant and thus can result in significant costs to the brewery.

Each brewery or distillery will have different wastewater concentrations. Table 1 provides typical ranges of brewery effluent.

Table 1 - Typical Ranges of Brewery Untreated Wastewater Effluent

Parameter	Typical Range
Water to beer ratio	4-10 liter/liter
Wastewater to beer ratio	1.3-2 liter/liter lower than water to beer ratio
Biochemical Oxygen Demand (BOD)	600-15,000 mg/L
Chemical Oxygen Demand (COD)	1,800-5,500 mg/L
Nitrogen	30-100 mg/L
Phosphorus	30-100 mg/L
pH	3-12
Total Suspended Solids (TSS)	200-1,500 mg/L

BOD, or biochemical oxygen demand, is a measure of how much oxygen it takes for microorganisms to break down organic waste in the wastewater. The high BOD concentration in brewery wastewater, if discharged to the Stevenson WWTP, means that the oxidation ditch process would need to be significantly larger in order to treat this high strength waste. It is frequently more cost-effective to treat the high strength wastewater separately, in a pre-treatment process, prior to discharging it to the WWTP.

Pre-treated brewery wastewater effluent has parameters similar to residential and most commercial effluent, as described in Table 2. Brewery effluent with these characteristics, when discharged to the WWTP, maintain stable conditions for the beneficial microorganisms at the WWTP.

Table 2 - Typical Ranges of Brewery Pre-treated Wastewater Effluent

Parameter	Typical Range
Biochemical Oxygen Demand (BOD)	100-400 mg/L
pH	6-9
Total Suspended Solids (TSS)	50-500 mg/L

Please note that *Stevenson City Ordinance 613 5(C), 1972, 13.08.230, Prohibited discharges to public sewer*, states, "Except as hereinafter provided, no person shall discharge or cause to be discharged any of the following waters or wastes to any public sewer: E. Any waters or wastes having a pH lower than 6.0 or higher than 9.0 or having any corrosive property capable of causing damage to structures, equipment and personnel of the sewage works."

REDUCING HIGH STRENGTH LOADS IN WASTEWATER

Table 3 shows typical brewery processes which generate high strength wastewater.

Table 3 – Main Areas of High Strength Wastewater Generation

Source	Operation	Characteristics
Mash Tun	Rinsing	Cellulose, sugars, amino acids, ~3,000 mg/L BOD.
Lauter Tun	Rinsing	Cellulose, sugars, spent grain. SS ~3,000 mg/L, BOD ~ 10,000 mg/L
Spent Grain	Last running and washing	Cellulose, nitrogenous material. Very high in SS (~30,000 mg/L). Up to 100,000 mg/L BOD.
Boil Kettle	Dewatering	Nitrogenous residue. BOD ~2,000 mg/L
Whirlpool	Rinsing spent hops and hot trub	Proteins, sludge and wort. High in SS (~35,000 mg/L). BOD ~85,000 mg/L.
Fermenters	Rinsing	Yeast SS ~6,000 mg/L. BOD up to 100,000 mg/L.
Storage Tanks	Rinsing	Beer, yeast, protein. High SS (~4,000 mg/L). BOD ~80,000 mg/L.
Filtration	Cleaning, start up, end of filtration, leaks during filtration	Excessive SS (up to 60,000 mg/L). Beer, yeast, proteins. BOD up to135,000 mg/L.
Beer Spills	Waste, flushing, etc.	1,000 mg/L BOD
Bottle Washer	Discharges from bottle washer operation	High pH due to chemical used. Also high SS and BOD, especially through load of paper pulp.
Keg Washer	Discharges from keg washing operations	Low in SS (~400 mg/L). Higher BOD.
Miscellaneous	Discharged cleaning and sanitation materials. Floor washing, flushing water, boiler blow-down, etc.	Relatively low on SS and BOD. Problem is pH due to chemicals being used.

Brewery processes should be reviewed to identify which processes produce high strength wastewater. Then best practices can be implemented, goals set and approaches for meeting the goals can be implemented.

Best Practices and Goal Setting

Descriptions and discussion of best practices specific to brewers are included in the Brewers Association document *Water and Wastewater: Treatment/Volume Reduction Manual, Section Three*. A focus on best practices to reduce generation of high BOD and high/low pH waste streams is recommended. An example of best practices to reduce BOD and high/low pH waste streams would include (but not be limited to):

- Separate sanitary waste from brewery wastewater
- Yeast disposal – avoid disposing to the sewer. Separate and give to local farmers for land application or animal feed.
- Reuse cleaning water
- Don't overfill tanks (reduce spills and chemical use)
- Optimize chemical dose needed

Goal Setting

Review brewery processes and identify processes with the highest potential for waste generation with high BOD and high/low pH

- Prioritize these processes from highest to lowest potential for high strength waste generation
- Set goals for the highest strength waste generation processes
    - List approaches to achieve these goals
    - Implement these approaches

- Reassess waste generation from these processes monthly and track waste reduction

The following questions may assist in developing approaches/strategies to meet these goals:

- Is there an opportunity to avoid, recycle/reuse high strength waste streams?
- Is there an opportunity to avoid, recycle/reuse high or low pH streams?
- Can less chemical be used in the process (particularly for cleaning)?
- Can washwater (with cleaning chemicals) be reused?
- Can lower quality water be used (or reused)?
- Can water be recovered elsewhere?
- Is the discharge authorized and legal (particularly regarding high or low pH effluent)?

Potential Strategies to Meet Goals

Recommendations from simple to more complex are as follows:

- Implement best practices and housekeeping measures
- Install an aerated holding tank
- Reuse or recycle water
- Install Clean-in-Place (CIP) system, which reuses cleaning water
- Install a pretreatment process, as described below

Aerated Holding Tank

There are three significant benefits which would result from using an aerated holding tank. These are: 1) pH neutralization, 2) BOD reduction, and 3) discharge consistent flow and load to the sewer system.

This tank would function as an aerated equalization tank. It is recommended that effluent be stored in an aerated holding tank (AHT) prior to discharge to the sewer. The AHT would capture both high and low pH waste streams, and would allow for some degree of pH neutralization. Prior to discharge from this tank, pH adjustment would be made to ensure that discharge to the sewer is in compliance with Stevenson's ordinance on pH.

Aeration would keep the waste from going septic, and so would reduce odor generation. BOD would be reduced through aeration, given sufficient residence time in the tank. It is recommended that flow from the AHT be discharged to the sewer at a consistent flowrate 24-hours per day. This will ensure that the beneficial microorganisms at the Stevenson WWTP will not receive shock loads that will disrupt the treatment process.

Onsite Pretreatment

Onsite pretreatment should be considered, particularly if there are several dischargers located near each other or on a common interceptor pipeline. Scalability for microbreweries may need to be researched. Types of pretreatment technologies which could be considered include:

- UASB (Upflow anaerobic sludge blanket reactor)
- MBR (Membrane bioreactor)
- External Circulating Sludge Bed

References

Brewers Association, Water and Wastewater: Treatment/Volume Reduction Manual

https://www.brewersassociation.org/attachments/0001/1517/Sustainability_-_Water_Wastewater.pdf