

Wastewater Treatment Plants & Bacteria: Strategies for Compliance

Wastewater Collection Systems

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Collection System Impact to WWTP

The influent to a wastewater treatment plant is constantly changing in both flow rate and strength (quality).

WWTP design is based on an assumed range of flow rates and wastewater strength.

Anything that causes the influent to exceed the design range may upset the treatment process and reduce bacteria removal effectiveness.

Wastewater Treatment Plant Influent

The influent is affected by the types of customers: residential, office, food service, and industrial.

The influent is affected by wet weather and the degree of infiltration and inflow (I/I).

Wastewater Treatment Plant Influent

The influent flow rate is affected by lift station pump design and the pump control settings.

Multiple lift stations in a collection system, particularly if more than one lift station discharges directly to the WWTP headworks, can create significant impacts.

Customer Impacts

The design organic and ammonia nitrogen loadings of Domestic WWTPs are designed assuming that the influent sewage will be typical of a single family residential sewage.

Multi-family, office and commercial customers tend to produce higher strength wastewater than single family residential.

Customer Impacts

Restaurant & other food service customers can produce very high strength wastes including oil and grease. Grease traps are typically required to reduce the loading to the WWTP.

Car washes and other customers may required both a grit trap and a grease trap to pre-treat their discharges.

Customer Impacts

Industrial customers may produce high strength wastes or even toxic wastes. These may require more complex pre-treatment, or exclusion from the domestic collection (pump and haul to offsite disposal).

Even non-industrial customers can discharge wastes that are toxic to the biological process and cause a process upset. Examples: detergents, floor wax strippers, etc.

Compliance Strategy Tips:

1. Regularly Sample WWTP Influent to determine how the actual sewage strength compares to design assumptions.
2. Regularly Inspect and Sample Grease Traps to make sure they are operating properly and being cleaned.
3. Regularly Inspect and Sample Industrial Pre-Treatment facilities to make sure that they are operating properly.

Compliance Strategy Tips:

4. Require the installation of expansion of grease or grit traps if needed.
5. Water and Sewer Rate Schedules should include both:
 - fees for operator inspections and lab sampling, and
 - surcharges or fines for exceeding the allowable range of “domestic” sewage strength.

Lift Station Design: Peak Flows

Lift Stations are designed to pump the peak hourly flow with the largest pump out of service (standby pump).

Peak Flow is assumed to be 4 times Average Daily Flow (4Q) in current City of Houston and TCEQ Design Criteria

So a two pump lift station will by design always pump the peak hourly flow.

Lift Station Design: Peak Flows

Due to other design criteria and differences in pump manufacturers, the actual installed pump may produce in excess of design peak hour flow.

The clarifier and chlorine contact basin are also designed for peak hourly flow, meaning $4Q$.

Remember the standby pump: Lift station controls are typically set for it to start at “high wet well level.” If all pumps start: look out!

Infiltration & Inflow into Collection Systems

Collection Systems are designed to carry peak hourly flow, which includes an allowance for Infiltration & Inflow (I/I) caused by various leaks of rainwater or groundwater into the sewer system.

As collection systems age, I/I usually increases due to poorly made taps,, displaced pipe joints, broken manholes, tree root intrusions, etc.

Infiltration & Inflow into Collection Systems

Other sources of I&I include broken house lines and illegal taps made by customers to drain stormwater from yards and roof drains.

This added Infiltration & Inflow can result in peak hourly flows many times higher than $4Q$.

Compliance Strategy Tips:

1. Check actual lift station pump flow rates to see if they exceed the design peak hourly flow rate.
2. Modify pump impeller, or consider installing a Variable Frequency Drive to reduce pump flow rate.
3. Adjust pump start settings to reduce impact on WWTP, and check to make sure standby pump only comes on if other pump fails or at the highest wet well setting.

Compliance Strategy Tips:

4. Analyze influent flow records and determine dry weather flow and wet weather flow patterns for collection system.
 - Is I&I excessive ($>$ design flow)?
 - Are flows/connection increasing over time?
5. If I&I excessive, then perform sewer system investigation to locate sources. This is usually not easy nor inexpensive, but the choice is between reducing I&I or expanding the WWTP.

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Thank you, next we will hear from Ray Young

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