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Open-Channel Wastewater Flow Monitoring for Data Centers

Application Note: W-AN28



Industry

Data Centers

Application

Managing Waste Water in a Growing Industry

Data Center Types and Water Infrastructure

Data centers share a need for reliable computing infrastructure, but their ownership, scale, and water demands vary. Enterprise data centers serve a single organization. Colocation data centers provide space, power, cooling, and connectivity to multiple customers. Hyperscale data centers support very large cloud and digital-service workloads, while AI data centers are designed for high-density computing that can place significant demands on cooling and supporting utilities.

Regardless of type, a data center can generate several wastewater streams. Understanding these sources—and how they combine before leaving the site—is the first step in selecting an appropriate flow-measurement technology.

Sources of Wastewater Discharge

Data-center wastewater is not limited to cooling systems. Typical sources may include:

- Cooling-tower blowdown: Water discharged to control dissolved solids and maintain cooling-system performance.
- Water-treatment waste: Reverse-osmosis reject, filter backwash, softener regeneration water, and other treatment residuals.
- Equipment and facility drainage: Drainage from maintenance, cleaning, condensate management, and mechanical areas, subject to site design and local requirements.
- Normal sanitary wastewater: Discharge from restrooms, hand-washing, showers, and other employee facilities.
- Cafeteria and kitchen wastewater: Flow from sinks, dishwashing, food preparation, and cleaning, often routed through required pretreatment such as grease interceptors.
- Combined site discharge: Multiple approved streams may join a common building sewer or campus gravity sewer before entering the municipal collection system.

Inside the facility, many cooling and process-water lines operate as full, pressurized pipes and require closed-pipe instruments. Open Channel flowmeter are intended for the downstream location where an approved wastewater stream flows through a partially filled gravity pipe, channel, or sewer.

Measurement Challenge

Data-center operators need reliable discharge data for utility billing and allocation, permit reporting, capacity planning, water-balance studies, leak investigations, and sustainability programs. Measurement can be challenging because gravity-flow depth and velocity fluctuate with cooling cycles, occupancy, maintenance, and other facility demands. A successful installation requires suitable hydraulics, known conduit geometry, safe access, adequate flow depth, and a visible water surface. The application review should also verify lawful sewer routing and applicable pretreatment requirements.

The measurement point may be accessible only through a manhole, and combined lines can range from low sanitary flows to much higher cooling or process discharges. Installing primary devices such as flumes or weirs may require costly civil work, channel modifications, flow diversion, and downtime. These devices also require regular inspection, cleaning, and maintenance to manage sediment, debris, and hydraulic effects. A metering manhole with an integrated primary device and open-channel flowmeter can simplify installation.



An area-velocity (AV) flowmeter offers an alternative that eliminates the need for a primary device and its associated installation and maintenance. It measures velocity and water level, uses the level and conduit geometry to determine the wetted cross-sectional area, and calculates flow as Q = wetted area × velocity.

Open-channel flowmeters use either contact sensors placed in the flow or non-contact sensors mounted above it. Contact sensors are exposed to grease, debris, sediment, biological growth, and changes in water quality, which can increase fouling and maintenance needs.



Two examples of flow meter installations. DuraTracker and LaserFlow installation (Left) and a Signature meter (right).

The LaserFlow® Solution

Teledyne ISCO LaserFlow is a non-contact open-channel flow sensor designed to measure velocity below the liquid surface using Laser Doppler Velocity technology while measuring level ultrasonically. With the sensor mounted above the stream, the primary measurement equipment remains out of the wastewater. Unlike non-contact radar sensors, which measure surface velocity, LaserFlow measures velocity below the surface to avoid false readings from surface turbulence and signal loss when the surface is still. An optional surcharge AV sensor enables flow measurement even when the LaserFlow sensor is fully submerged.

For a data center, a suitable measurement point may be a gravity discharge pipe, manhole, or channel downstream of selected wastewater sources and upstream of the municipal sewer connection. The measured level, velocity, and programmed channel geometry are used to determine flow. LaserFlow can support monitoring of an individual stream—such as cooling-tower blowdown—or a combined site discharge that also includes sanitary and cafeteria wastewater.

Rated IP68, the LaserFlow and intrinsic safe LaserFlow Ex sensors can be installed inside a manhole. It can be paired with an IP68-rated Teledyne ISCO DuraTracker or DuraTracker Ex installed in the manhole or an IP66-rated Teledyne ISCO Signature flowmeter located outside it. The final configuration depends on site power, communications, data-management and reporting requirements, access, and hydraulic conditions.

Customer Benefits

- Reduced cleaning and maintenance: Above-stream sensing minimizes the primary sensor's exposure to grease, debris, sediment, and changing wastewater conditions.
- Reduced confined-space entry: Once the mounting bracket is installed, LaserFlow can be deployed and removed from street level, reducing the risk and cost of confined-space entry.
- Wide measurement range: With velocity measurements from 0 to 15 ft/s and level measurements from 0 to 10 ft, LaserFlow can accurately capture flows ranging from low nighttime flow from kitchen and restroom discharge to high-flow cooling-tower blowdown.
- Continuous data during submerged conditions: When the sensor is submerged, the optional continuous-wave Doppler ultrasonic area-velocity technology maintains uninterrupted flow measurement.
- Useful discharge visibility: Flow information helps operators understand how cooling, treatment, sanitary, cafeteria, and other approved streams contribute to total site discharge.
- Support for billing and cost allocation: High accuracy flow data can provide an objective basis for sewer-charge review, tenant allocation, or internal water accounting.
- Operational insight: Trends and unexpected changes can support investigations of abnormal discharge, leaks, excessive blowdown, or changing facility demand.
- Planning and compliance support: Historical data can inform sewer-capacity discussions, water-balance studies, permit reporting, and expansion planning.
- Flexible deployment: The system can be configured for permanent infrastructure or remote monitoring locations, depending on the selected flow-meter platform.

Application Summary

Data centers generate wastewater from more than cooling operations. Sanitary facilities, cafeterias, water treatment, maintenance, and mechanical systems can all contribute to site discharge. When these flows enter a partially filled gravity conduit, open-channel monitoring becomes appropriate. At a hydraulically suitable location, Teledyne ISCO LaserFlow offers a non-contact method for measuring level and subsurface velocity, helping data-center operators turn wastewater discharge into actionable flow information.

LaserFlow® Non-Contact Velocity Sensor

The TIENet 360 LaserFlow sensor is a non-contact, area-velocity flow and water-level measurement device that remotely senses flows in open channels using non-contact Laser Doppler Velocity Sensing and non-contact Ultrasonic Level Sensing technologies. The sensor uses advanced technology to measure velocity with a laser beam directed at single or multiple points below the surface of the water stream. Therefore, unlike radar technology, it does not require the creation of ripples on the surface of the stream.



DuraTracker® Flow Meter

The DuraTracker is the most efficient and reliable flow measurement solution on the market today for open channel flow measurement. It supports flow measurement technologies including non-contact laser area velocity, submerged Doppler area velocity, and ultrasonic. The intrinsically safe DuraTracker Ex provides the same benefits for use in hazardous areas classified as Class I, Div 1, Zone 0, ATEX Category 1G.



Signature® Flow Meter

The Signature flow meter from Teledyne ISCO, designed for open channel flow metering, supports flow measurement methods including bubbler, non-contact laser area velocity, ultrasonic, and submerged Doppler ultrasonic area velocity. Up to nine sensors can be connected to the Signature, providing a broad range of I/O and communications options.

The Signature flow meter is rugged (IP 66) even if the cover of the lid is open. It performs data logging with variable rate data storage and data integrity verification and has the ability to connect a USB drive for data/report retrieval and programming.



Teledyne ISCO is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.