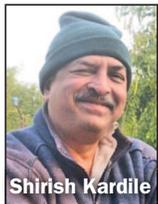


From the Board

Weirs and Notches Are Honest Friends



Shirish Kardile

Traditionally, weirs and notches have been used to ensure various functions in water and wastewater treatment plants. These devices, placed in open channels

to obstruct water flow, are simple to construct and install.

WEIR TYPES IN TREATMENT PLANTS

A weir measures the flow rate by measuring the depth of the water flowing through a precisely sized and shaped notch in the weir. However, there's more to a weir than meets the eye.

Flow Measurement. For large flows, rectangular weirs and notches (mostly sharp-crested) are used in a plant's receiving chamber (or channel) for raw water measurement. For relatively small flows (less than 5 mld), 90-degree V notches are preferred. Normally a weir's measurement accuracy is 95–98 percent.

Plant managers and operators should ensure there's no turbulence when water approaches a weir. Moreover, they should allow for at least a 0.10–0.15-m “freefall” downstream of a weir to apply simplified formulae for nonsubmerged weirs and notches. A simple scale, known as a float-and-board-level indicator, as well as electronic or ultrasonic devices, can be used in the upstream section of a weir

to calibrate head over weir against the flow rate. A weir's small notches are also an integral part of filter-outlet chambers for flow measurement. The crest elevation of these notches is often designed to ensure filter media always stay submerged.

Rapid-Mix Weirs. A 400–500-mm freefall on the downstream side of a weir/notch ensures a velocity gradient (G , m/sec/m) of 800–1,000. If this turbulence is confined in a detention basin of 2–5 sec, the arrangement works as an effective nonmechanical rapid- or flash-mix unit. The coagulant is normally delivered by a perforated diffuser pipe, located 500 mm above the crest of the weir and 100–200 mm on the downstream side to penetrate the nappe before the freefalling water hits the bottom of channel and ensures turbulence.

A slight disadvantage in this arrangement is that the G value varies according to the flow rate. However, the great advantage of discarding a mechanical agitator, along with its associated power and maintenance, offsets this disadvantage.

Splitting Flow. In large plants, where normally two or more “streams” are designed for plant sizing and reliability, rectangular weirs/notches play a crucial role. Equal-length weirs, which have their crest at the same elevation, split the flow accurately. A small head is sacrificed to ensure nonsubmerged flow. Plants can

also achieve proportionate flow-splitting by varying the weir lengths. The isolation gates on the crest of the weirs ensure flexibility and system redundancy.

Adjustable Weirs for Flow Control. A classic example of a clarifier weir is a telescopic drain arrangement. A circular telescopic tube with a bell mouth can be adjusted by rotating the extended spindle to create head difference between a clarifier's top water level and the sludge drain disposal pipe. A small amount of overflow over the bell mouth allows operators to visually inspect sludge quality to determine when to open the main drain valve.

Uniform Water Collection. Normally, clarifier launders fall into this class. A peripheral launder is required to collect the clarified water uniformly to ensure equal surface and weir loading. It's difficult to ensure an equal weir level in concrete over the unit's entire periphery. In such cases, V-notch weir plates (metallic or plastic) are fixed over the entire weir crest. It's easy to install and ensure a desired water level.

Overflow Safety. Rectangular weirs or bell-mouth pipes prevent water storage structures from overflowing or flooding because of a mismatched inflow and outflow. Despite automated tools that help prevent such events, such weirs and pipes are crucial fail-safe devices.

MULTIFACTED SYSTEMS

Weirs at water and wastewater plants are often designed to perform several duties. Even if a facility manager or operator can't remember the discharge formula, a weir or notch can be easily calibrated by the traditional time-vs.-volume method, using a downstream unit where some amount of water storage volume is available. Weirs and notches can be welcome “friends” indeed.

—Shirish Kardile,
AWWA India Strategic Board Chair



A weir can provide an effective rapid- or flash-mix unit (above) and notches for uniform water collection (right).

