A. Thermal Mass Flowmeter

Thermal flowmeters can be divided into two types. The first type measures the current required to maintain a fixed temperature across a heated element. The greater the flow, the more current required to maintain a constant temperature. The current required is proportional to the mass flow rate.

The second type of thermal flowmeter is the “hot wire”. The hot wire method measures the temperature at two points on an element or “hot wire”. As the fluid or gas flows over the element, heat is dissipated. The upstream side of the hot wire will be hotter than the downstream side. The change in temperature is proportional to the mass flow.

1.1.1 Open Channel Flow

The "open channel" refers to any conduit in which liquid flows with a free surface. Included are tunnels, non-pressurized sewers, partially filled pipes, canals, streams, and rivers. Of the many techniques available for monitoring open-channel flows, depth-related methods are the most common. These techniques presume that the instantaneous flow rate may be determined from a measurement of the water depth, or head. Weirs and flumes are the oldest and most widely used primary devices for measuring open-channel flows.

A. Weirs

Weirs and flumes are distinguished as “rate meters” in that they are used in open pipe or channels that do not flow full. They fall into the general category of “head-area” meters and are used extensively in the measurement of irrigation water as well as the primary device for municipal and industrial wastewater applications.

Weirs are dam-like structures placed across the flowing stream. A notch of predetermined size and shape, cut out of the upper edge, creates a path for the flow. The sheet of liquid falling over the weir through the notch is called the nappe. When air has free access beneath the nappe, the flow is considered free; otherwise, it is considered submerged. The degree of submergence can significantly reduce the flow over the weir. Most weirs are sharp crested. Common weir profiles are V-Notch (triangular), Rectangular, or trapezoidal (Cipolletti).

The V-Notch Weir is especially recommended for metering flows less than 1 ft^3/s (cfs) equivalent to 0.65 million gal/day (mgd) and is suitable for measuring slowly changing flows up to 10 cfs. Extensive experiments have been made to determine the calibration data for v-notch weirs with 60 and 90 degree angles. Accuracy is limited to about 3%.