Agricultural Pumping Efficiency Program

Development and management of the Agricultural Pumping Efficiency Program by:
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Flow Meters
Helping California Agriculture...

Put More Power Through the Pump!
Flow Meters

The Agricultural Pumping Efficiency Program is providing this information regarding the importance of measuring water flow and the different methods available to do this. Knowing your pump’s flow rate and the total amount of water pumped is essential for good irrigation efficiency and energy conservation. Please call the Program at one of the numbers listed if you have any questions.

What is the Program?

The Agricultural Pumping Efficiency Program (“Program”) is a statewide educational and incentive program designed to improve water pumping efficiency and promote energy conservation in agriculture. The Program includes these key components:

• Subsidized Pump Efficiency Tests
• Incentive Rebates for pump retrofit or repair
• Education

Where Can I Get More Information?

Log on to www.pumpefficiency.org or call the Program using the following toll-free numbers:

• Main Office - (800) 845-6038
• San Joaquin Valley - (800) 352-0434
• Northern California - (866) 333-8938
• Southern California - (866) 333-8939
• Central Coast - (866) 473-0847

Please feel free to contact us if you have any questions.
Each measurement is important for managing an irrigation system. Flow rate is the type of information often used to help verify that pressurized irrigation systems (e.g., sprinkler or micro-irrigation systems) are operating correctly. Flow rate is also important in judging pumping plant efficiency.

Total volume readings are used in irrigation scheduling methods that use a water balance approach. They are a check on how much water was actually pumped to a field versus what you thought you needed. They are also used by water supply or drainage agencies to measure total water volume onto or off farms.

**What Does a Flow Meter Measure?**

*Water flow meters* (flow meters or meters) can measure the flow rate of water or the total water that has passed by the measuring point. Many meters will do both.

*Instantaneous reading* is used for meters that measure flow rate.

*Totalizer* is used for meters that measure the total volume of water.

*Flow rate* is the volume of water per unit of time moving past the measuring point. Typically, flow rates are measured in either gallons per minute (GPM) or cubic feet per second (CFS).

Total volume readings may be in either gallons or acre-feet of water (one acre-foot of water equals 325,900 gallons).

**Measure Flow Rate or Total Volume of Water?**

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You need to measure water to manage water. Efficient and effective irrigations deliver the right amount of water at the right time, spread evenly across the field. Thus, it is important to know how much water is required for each irrigation. However, if you do not know how much water is actually applied during an irrigation you will not know how efficient you were or whether or not you need to improve.

If you are using a pressurized system such as a sprinkler or drip system, there is a design flow rate for that system. A flow meter can tell you if the right amount of water is moving through the system. A meter with a totalizer will indicate how much water was applied per irrigation and can help you judge how closely your irrigations met water management objectives.

Why is Flow Important to Energy Savings?

It requires energy to power a water pump and energy is costly. A flow meter can help identify pump, well, and irrigation system problems before a failure occurs. In drip and micro-irrigation systems, catastrophic problems due to plugging or pipeline/hose breaks can be detected and corrected before crop loss or flooding occurs. Keeping records of flow meter readings can indicate when a pumping system is deteriorating. Thus, meters can help you maintain highly efficient hardware in the field.

However, energy-efficient hardware is of little help in reducing energy costs if it is run longer than needed. Flow measurement will also help you judge how long you need to run the pump.

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A pump test does measure flow rate but only gives a snapshot of pump flow at one point in time. A flow meter will provide a measurement at any given point of time. Periodic measurements should be recorded to track your pump performance history. This is especially important with water wells where wear from sand or declining water tables can substantially impact pump performance over time.

Flow meters range in cost from $150 each for simple models to highly-sophisticated electronic meters of several thousand dollars each. Typical propeller saddle meters range in cost from $600 to $1,000. However, the cost of flow meter installations may be increased significantly if major modifications have to be made to allow for accurate measurements.

IMPORTANT!
Although sometimes a substantial investment, the cost of a flow meter should be compared to the total cost of the pumping system and the annual cost of operating that system. Accurate flow measurements can pay for themselves many times over with decreased water and energy costs and potentially higher yields due to improved irrigation management.
There are many different ways that water flow in pipelines can be measured. The most commonly used flow meter in agriculture is the propeller type (Figures 1 and 2), mounted as a saddle on a pipeline or inserted as a section of the pipe.

Other common types of meters used in pipelines are the Venturi type (Figure 3) and the paddle wheel type (Figure 4). Pump efficiency testers will often use a manometer (Figure 5).

Each of these methods has its advantages and disadvantages. Consult with knowledgeable people in your area for the best device for your situation. You may want to talk to your local pump dealer, irrigation system designer/installer, or UC Cooperative Extension agent.
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What is Used to Measure Flow Rate?

Figure 1 - Propeller-type flow meter inserted in-line
Figure 2 - Meter in pipe section mounted in a sprinkler system show portability
Figure 3 - Venturi type
Figure 4 - Paddle wheel
Figure 5 - Manometer setup

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Yes. Most people think of flow meters in terms of the common propeller type installed in pipelines. However, measuring water flow in ditches and canals is quite common. It is even possible to measure flow in a single furrow. Some common ways of measuring water are the overflow weir (Figure 6), the meter gate (Figure 7), orifice plates or various types of flumes.

Can I Measure Water in Ditches?

Yes. Many types of flow meters can be made portable, for both pipelines and canals and ditches. This allows the use of one flow meter on different pumping systems, thus, saving money. You should maintain written records of meter readings for each system that you use a portable meter on.

IMPORTANT!
Whenever using a portable water meter, make sure that it is calibrated to the particular installation. For example, do not use a saddle-mounted flow meter calibrated for a 6" pipeline in an 8" pipeline.

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How Much Does a Flow Meter Cost?

Correct Installation in Pipelines

Traditionally it is recommended there be at least 8-10 diameters of straight pipe upstream of a meter and 4 diameters downstream of any obstruction in a pipe (elbow, valve, pump discharge head, etc.). Obstructions create turbulent water conditions which make measurement difficult or impossible. For example, a 6” discharge pipe would require 6 times 8 which equals 48” or 4’ of straight pipe before the measurement point.

Sometimes straightening vanes can be added that will allow reasonably accurate measurement within less than 8-10 pipe diameters of an obstruction. Always check the manufacturer’s recommended specifications for an accurate installation.

Correct Installation in Canals and Ditches

Flow measurement in open channels requires a certain amount of head loss (reduction in the overall elevation of the water flow). Thus, there must be enough freeboard (distance from the top of the flowing water to the top of the channel banks) to accommodate this loss. Care must be taken in choosing the method and designing the installation of a flow measuring device in an open channel. However, some types of flumes, especially the trapezoidal flume, require very little head loss. Also, as with pipelines, water flow into the measurement section should be straight and smooth.

IMPORTANT!

Whenever installing a flow meter, either in pipelines or an open channel, consult with a qualified pumping specialist or engineer to ensure that the installation will result in accurate measurements.
As with other mechanical devices, flow meters require routine maintenance and inspection. When your flow meter is installed, always ask about normal maintenance and inspection procedures and make sure to get a copy of any owner’s manual that is available for your particular meter. Follow the manufacturer’s recommended maintenance routine to make sure your flow meter is operating at its optimum level of performance.

Some things to watch for:

• Most flow meters operate very quietly. Noise is often the first sign that a failure may be near - listen for any sounds that would indicate binding or worn gears.

• Visual clues of poor flow meter operation include an unsteady flow rate indicator (indicating binding or worn gears or possibly a pipe that is not running full) or fogging of the lens (leak in the bearing assembly or external seal).

• Open channel flow measuring devices should also be properly maintained. Weirs and flumes should be level, permanent measuring staffs should be set at the correct levels and trash should not be allowed to collect upstream of an overflow weir.
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In Summary

Water flow measurement is essential to water and energy management. A flow measurement can indicate whether a pumping system or an irrigation system is operating correctly. Thus, they help you to maintain highly efficient equipment in the field. They also help you manage that equipment to minimize energy and water use. Contact the program for more information on flow measurement.
The Agricultural Pumping Efficiency Program is providing this information regarding the importance of measuring water flow and the different methods available to do this. Knowing your pump’s flow rate and the total amount of water pumped is essential for good irrigation efficiency and energy conservation. Please call the Program at one of the numbers listed if you have any questions.

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The Program may be terminated or modified without notice. The Program has a limited budget. Applications for retrofit/repair rebates or pump tests are accepted on a first-come, first-served basis until available funds are allocated or the ending date of the program, whichever comes first (visit www.pumpefficiency.org or call 800.845.6038 for more information).

California consumers are not obligated to purchase any full fee service or other service not funded by this program. This program is funded by California utility ratepayers under the auspices of the California Public Utilities Commission. Los consumidores en California no estan obligados a comprar servicios completos o adicionales que no esten cubiertos bajo este programa. Este programa esta financiado por los usuarios de servicios públicos en California bajo la jurisdiccion de la Comisión de servicios Públicos de California.

The Center for Irrigation Technology developed and manages the statewide Agricultural Pumping Efficiency Program. CIT is dedicated to advancing water/energy management practices and efficient irrigation technology. Located on the campus of California State University, Fresno, CIT functions as an independent testing laboratory, applied research facility and educational resource to both the public and private sectors. For more information, check the CIT link at www.pumpefficiency.org or call (800) 845-6038.
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