Measuring Water Use & Flow Meter Requirements

Flow Meter Requirements

Minnesota Statutes § 103G.281, Subdivision 2, requires all installations for appropriating water to be equipped with a flow meter to measure the quantity of water appropriated within the degree of accuracy required by rule (10%). The commissioner may approve alternate methods of measurement based on the quantity of water used, the method of appropriating or using water and any other information supplied by an applicant.

Why require Flow Meters ?

The law is aimed at improving the accuracy of water use reporting and has many benefits. Careful monitoring of water withdrawals can be used to: provide valuable information for management of the resource, detect well and pump problems, improve irrigation efficiency, and determine pumping plant efficiency. As a management tool, accurate flow monitoring can help to conserve both energy and water resources. Accurate data is necessary to evaluate the capability of the resource to sustain water withdrawals and is also important for investigation of well interference complaints.

Does everyone need a flow meter ?

All new permitted installations will be required to have flow meters unless **prior** DNR approval has been given for an alternate method. Existing systems may be allowed to use an approved alternate method. Depending upon the type of system, water use and quantity of water used, the commissioner may approve alternate methods for measuring water use. Requests for approval of alternate methods must be submitted in writing to the DNR. Proper record keeping is required for all approved methods of determining water use.

When is a flow meter required ?

Flow meters are required when alternate methods cannot provide an accurate measurement of water use. Flow meters will be required where the following circumstances exist:

1. Systems with widely fluctuating discharge rates or when variable speed pumps are used.
2. Systems with alternating zone coverage, such as golf course irrigation systems.
3. Instances where the permit holder has a history of providing inaccurate pumping reports or has failed to submit water use fees and reports.
4. Situations where the adequacy of the resource is a concern or there is a history of well interference problems.

What methods are approved ?

The following methods are approved for measuring water use:

1. Flow meters with a totalizer.
2. Flow rate meters used with timing devices.† ‡
3. Timing devices (hour meters and electric meters). † ‡
4. Vehicle gallon capacities (i.e. water trucks).†

† Daily records of water use and time pumped **must** be kept for these methods.
‡ Methods 2 and 3 **are required** to have a **constant** pumping rate.

What if I am using a gravity flow system ?

Special instructions regarding gravity flow operations are available by calling the DNR and requesting the "Measuring Appropriations from Gravity Flow Installations" information sheet.

Which methods are not approved ?

The following methods are not approved for measuring water use:

1. Rain gauges or other methods using application rates, such as irrigation systems that are set to apply a certain amount of water per acre or pass.
2. Buckets used to measure discharge rates.
3. Fuel consumption by gasoline or diesel engines.
4. Estimates using a set volume of water per person or animal.

How do I get my method approved ?

Each year permittees are required to sign an affidavit of compliance on the water use report indicating compliance with the law requiring a flow meter or an approved measuring device. The affidavit of compliance and the annual report of water use are due by February 15 of each year.

Permittees using a method of measurement that has not been approved must submit a written request for approval of an alternate method. Requests should include a detailed description of the proposed method (i.e. diagrams, calculations). Requests for approval of an alternate method should be sent to your local DNR Ecological and Water Resources Office. Only methods that measure water use within 10 percent accuracy will be considered for approval. Records of water use must be kept for all methods of water use.

Failure to have an approved method is a violation of Minnesota Statutes and permit conditions and is punishable as a misdemeanor with fines up to $700 and/or 90 days in jail.

General

To obtain information about the purchase and/or installation of a flow meter, contact a licensed well driller, irrigation equipment dealer or plumbing supply company.

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DEPARTMENT OF NATURAL RESOURCES

651-296-6157

This information is available in an alternative format upon request.

Updated: July 2018

Calculating Monthly Water Use

To calculate monthly water use from:

A. **Flow Meter:** Subtract the reading at the beginning of the month from the reading at the end of the month. If the meter is in cubic feet, multiply the monthly use by 7.48 to convert the usage into gallons.

B. **Timing Device:** Multiply the hours pumped for the month by the pump rate (in gallons per minute, gpm) times 60 (minutes). [Example; 150 hrs x 800 gpm x 60 min/hr = 7,200,00 gallons].

Hourly timing device options:

1. An hourly time clock connected directly to irrigation pumping plant system.
2. Kilowatt Hours: Monthly hours of pumping determined by dividing monthly electric usage by electric meter's monthly power demand rate (Kw). [Example: 3000 Kwh of electricity was used in the month of June and the electric meter recorded a peak demand for the month of 25 Kw, then the total hours pumped is found by dividing 3000 Kwh by 25 Kw, which yields 120 hours pumped for the month. To find water use take 120 hrs x 300 gpm x 60 min/ hr = 2,160,000 gallons].

* Approved Alternatives for Estimating Water Pumping Rate from Agricultural Irrigation Systems

The following alternate methods are approved by the DNR for agricultural irrigation systems:

- Pumping flow rate test.
- Center pivot/linear system's manufacturers nozzling chart.
  - for a center pivot with a corner swing unit, refer to the following section.
- Traveling gun nozzling chart.
- Lateral line irrigation systems nozzling chart.
- _____ gph per 100' of trickle tube* _____ feet/100 = _____ gpm
- Open discharge pump's manufacture curve.

ESTIMATING DISCHARGE OF A CENTER PIVOT WITH CORNER UNIT

A good average discharge flow rate estimate for a center pivot with a corner arm can be determined by taking the average of the discharge rate when the corner arm is fully extended and fully retracted. The water discharge from a center pivot with a corner swing arm varies depending on the postion of the swing arm, usage of flow control/regulators, and the slope of the pump performance curve.

STEPS TO ESTIMATE GPM FOR A TRAVELING GUN

1. Determine nozzle size to nearest 1/100th of an inch and nozzle type (bore or ring): [ex: 1-1/4" = 1.25 inches taper & bore nozzle].
2. Determine average operating pressure at the base of the sprinkler. If pressure varies between first and last travel runs, take the average between the first and last runs: [ex: 1st run = 95 psi, last run = 85 psi, average = (95 + 85)/2 = 90 psi].
3. Select the appropriate discharge table (bore or ring nozzle) listed below and find the estimated gpm for your nozzle size and average operating pressure or use gun manufacturer's published discharge table.
   If your nozzle size or operating pressure values follow between the table numbers, make an interpolation between the smaller and larger numbers to get a more accurate estimate of flow: [ex: have 1.25" bore nozzle @ 90 psi; table gives at 90 psi 405 gpm @ 1.2" and 545 @ 1.4"; then to estimate the gpm for 1.25" nozzle calculate as follows:

   gpm = 405 gpm + [(1.25" - 1.2")/(1.4" - 1.2")] X (545 gpm - 405 gpm)
   = 405 + (0.05/0.20) X 140
   = 405 + 0.25 X 140
   = 405 + 35 = 440 gpm

Typical Discharges for Single Large Nozzle Sprinkler Guns

Sprinkler Pressure (psi)	Straight or taper bore nozzle sizes (inches)				
	0.8	1.0	1.2	1.4	1.6
	Sprinkler discharge in gpm				
60	145	225	330	445	585
70	155	245	355	480	630
80	165	260	380	515	675
90	175	275	405	545	715
100	185	290	425	575	755
110	195	305	445	605	790
120	205	320	465	630	825

	Ring Nozzle Sizes (inches)				
	0.9	1.1	1.3	1.5	1.7
(psi)	Sprinkler discharge in gpm				
60	110	185	275	385	510
70	120	200	295	410	550
80	130	215	310	435	585
90	135	225	325	460	620
100	140	240	340	485	655
110	150	250	350	510	690
120	155	260	360	530	720

Table Sources: Nelson Irrigation Corp. - sprinkler charts. Rain Bird, Agri Products Division - sprinkler charts. SCS National Sprinkler Irrigation Book - Chapter 15.

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For additional information or questions, contact:

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