Legislative Report

Recommendations for Efficient Metering of Water Use by Local Governments and Large Community Water Systems

As Required by North Carolina House Bill 2499 /S.L. 2008-143
Section 18

Prepared by the N.C. Department of Environment and Natural Resources
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Executive Summary

Historically, North Carolina has been considered a state with abundant water resources. However, water resources have become a major concern as population growth coupled with cyclical drought conditions have caused many public water supply systems to experience limited raw water availability. The population is expected to grow from 8.5 million in 2004 to 12 million in 2030. Water consumption is expected to increase from 241 billion gallons per year for all households to 335 billion gallons if consumption continues on its current path. With this trend expected to continue, it is apparent that we must efficiently and accurately measure water use in all applications to sustain water resources.

S.L. 2008-143, Section 18, mandated the N.C. Department of Environment and Natural Resources to develop recommendations for the efficient metering of water use by local governments and large community water systems.

This document contains best management practices and recommendations for the efficient and effective metering of water use by local governments and large community water systems.

DENR recommends the following:

- Systems should meter all water sources and water uses that are practical;
- Systems should only install meters that are of the appropriate size and type for each application; and
- Meters should be calibrated on an established schedule and replaced as needed.

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I. Introduction

Metering of water supplies and uses is an essential element of efficiency and conservation management, and is necessary in order to conduct a system water audit. An effective metering program allows comparison of measured flows in the system with metered deliveries to customers. This comparison can be used to identify losses in the system due to both leaks and unaccounted for uses. In order to be effective, metering must be installed on all important water production processes and delivery locations in the water system.

Water meters not only help utilities collect the revenue they are due, but they also help pinpoint leaks, locate pressure problems along their distribution system, and identify and evaluate periods of peak and non-peak use among both residential and business consumers. However meters can only perform these tasks effectively if they accurately measure the flow.

Unfortunately like all mechanical devices, water meters can lose their sensitivity over time and fail to accurately monitor how much water is being produced as well as how much water businesses and residences are consuming. Inaccuracy in measured water totals also results when the meters are improperly installed, are outdated or are in poor repair. This is a serious problem and needs to be promptly addressed. Inaccurate water meters result in lost income for often cash-strapped utilities and prevent utilities from realizing the potential for greater savings.

Accurate assessment of water usage is vital in keeping utility bills equitable and conserving water in drought conditions. In order to assure water is being accounted for accurately, meters need to be selected, installed, operated and maintained using generally accepted industry standards.

Meters should be regularly calibrated and tested in accordance with the manufacturer's recommendations or the guidelines recommended by the American Water Works Association (AWWA), Manual for Water Meters-Selection, Installation, Testing, and Maintenance (AWWA M6).

AWWA M6 contains a comprehensive review of water meters. It provides utility managers and operators with the results of many years of utility system experience to assist them in making informed decisions.

II. Philosophy of Metering

Water usage can not be efficiently managed if it is not effectively measured.

Accurate water measurement is the means by which water utilities produce revenue to cover expenses, charge each customer equitably, prevent waste of water, and minimize the load on wastewater facilities.[1]

III. Recommendations

Metering Locations

Local governments and large community water systems should meter all water sources and water uses that are practical. This should include both direct connections to the system as well as bulk users. This should also include all uses by the system owner, including water used in the water treatment facility and uses in system owned/publicly owned buildings.

> For the purpose of this recommendation, practical is defined as: Capable of being used or put into effect; useful. It is further defined by 143-355.4(b)(4), where it states that it is impractical to meter water uses including but not limited to water used for firefighting and to flush waterlines. However, if the system currently meters these uses or estimates and records these uses based on established criteria, they should continue to monitor these uses and maintain these records since they are beneficial in tracking total water use in the system. Likewise, if a system determines it practical to implement monitoring or criteria to estimate these uses based on established criteria, they are strongly encouraged to do so. Forms for this purpose can be obtained from the American Water Works Association as well as other sources. An example form can be found in Attachment 1.

Beneficial and practical locations of water meters include the following:

1. Each surface water intake source
2. Each water production well
3. Each source of purchased finished or raw water
4. Filter backwash and all other uses of water at the water plant that are not returned to the finished water system.

5. Finished water to distribution system
6. All purchasers of bulk finished water
7. All governmental, industrial, commercial, institutional, and residential water users as well as water uses for special events.

Meter Selection and Installation

Once a metering location is identified, the system must next determine the appropriate size and type of meter to be installed. Recommendation for meter sizes and types can be obtain from the meter suppliers as well as from AWWA publications. A listing of meter types and their recommended uses can be found in Attachment 2.

Systems should review their practices on meter selection, sizing, and installation to see whether present practices permit accurate operation.[2] These practices should not only cover the installation of meters on new sources but also the installation of replacement meters if the water uses changes from a high water user to a low water user as well as from a low water user to a high water user.

Meter Calibration and Replacement Programs

Since meters will lose accuracy over time, they must be calibrated on a scheduled basis and replaced as needed.

All meters greater than 2 inches in diameter, along with a random sampling of smaller meters, should be inspected and tested on an annual basis.[2] These scheduled efforts will assist the system in determining what meters should be calibrated and those that need to be replaced. See Attachment 3 for recommended calibration frequencies.

While these calibrations and replacements may be costly, they are critical to insuring that the operational costs of the system are equitably distributed to all the users of the system. It is also critical in the system's efforts to identify water losses. The pay back time for these expenses can be easily calculated and will be helpful in the system's efforts to prioritize these calibrations and replacements.

Many systems have also found it to be cost effective to replace old manually read residential meters with remote radio-read meters. This decision should be made on a

case by case basis after an evaluation of the number, age and condition of the system's existing meters and the ability of the system to fund this upgrade.

1. AWWA Manual M6: Water Meters-Selection, Installation, Testing, and Maintenance

2. AWWA Manual M36: Water Audits and Leak Detection

Attachment 1

WATER USED FOR FIRE FIGHTING AND TRAINING

Fire Department Name: _____

Town, City or System Name: _____

Month and Year: _____ Person Completing Form _____

Volumes in Gallons

1. _____ 17. _____
2. _____ 18. _____
3. _____ 19. _____
4. _____ 20. _____
5. _____ 21. _____
6. _____ 22. _____
7. _____ 23. _____
8. _____ 24. _____
9. _____ 25. _____
10. _____ 26. _____
11. _____ 27. _____
12. _____ 28. _____
13. _____ 29. _____
14. _____ 30. _____
15. _____ 31. _____
16. _____

Monthly Total: _____

Attachment 2

Common Types of Water Meters

Multi-jet Meters: Multi jet water meters use multiple ports surrounding an internal chamber, to create a jet of water against an impeller. The impeller rotation speed is in relation to the velocity of water flow. Multi jet water meters are accurate in small sizes and widely used in 1/2" (15mm) to 2" (50mm) sizes for residential and smaller commercial uses, but are not used in larger sizes, since they don't have the straight-through flow path needed for the high flow rates used in large pipe diameters.

Single-jet Meters: Single jet water meters use single input port to create a jet of water against an impeller. The impeller rotation speed is in relation to the velocity of water flow. Single jet water meters are accurate in small sizes and widely used in 1/2" (15mm) to 2" (50mm) sizes for residential and smaller commercial uses.

Positive Displacement Meters: This type of water meter is most often used in residential and small commercial applications. Two common methods of positive displacement (PD) measuring are Oscillating Piston meters and Nutating Disk meters. Either method relies on the water to physically displace the moving measuring element in direct relation to the amount of water that passes through the meter. The piston or disk moves a magnet that drives the register. PD meters are generally very accurate at low to moderate flow rates typical of residential and small commercial users, and are common in sizes from 5/8" to 2". Because displacement meters rely on all water flowing through the meter to "push" the measuring element, they generally are not practical in large commercial applications requiring high flow rates or low pressure loss.

Turbine Meters: Turbine meters are less accurate than displacement and jet meters at low flow rates, but the measuring element does not occupy or severely restrict the entire path of flow. The flow direction is generally straight through the meter, allowing for higher flow rates and less pressure loss than displacement-type meters. They are the meter of choice for large commercial users, fire protection, and as master meters for the water distribution system. Turbine meters are generally available for 1-1/2" to 12" or higher pipe sizes.

Fire Meters: Fire meters are a specialized type of turbine meter with approvals for the high flow rates required in fire protection. They are often approved by Underwriters Laboratories (UL) or Factory Manual (FM) for use in fire protection.

Fire Hydrant Meters: Fire hydrant meters are a specialized type of portable turbine meter that are attached to a fire hydrant to measure water out of the hydrant. The meters are normally made of aluminum to be light weight, and are usually 3" capacity. Utilities often require them for measurement of water used in construction, pool filling, or where a permanent meter is not yet installed.

Compound Meters: A compound meter is used where high flow rates are necessary, but at times there are smaller rates of flow that still need to be accurately measured. Compound meters have two measuring elements and a check valve to regulate flow between them. At high flow rates, water is normally diverted primarily or completely to the turbine part of the meter. When flow rates drop to where the turbine meter cannot measure accurately, a check valve closes to divert water to a smaller meter that can measure the lower flow rates accurately. The low flow meter is typically a multi-jet or PD meter. By adding the combination of the high and low meter registers, the utility has the total consumption through the meter.

Magnetic Flow Meters: Magnetic Flow Meters, commonly referred to as "mag meters", are technically a velocity-type water meter, except that they use electromagnetic properties to determine the water flow velocity, rather than mechanical means which jet and turbine meters use. Since mag meters have no mechanical measuring element, they normally have the advantage of being able to measure flow in either direction, and use electronics for measuring and totalizing the flow. Mag meters can also be useful for measuring untreated water, raw (untreated/unfiltered) water, and wastewater, since there is no mechanical measuring element to get clogged or damaged by debris flowing through the meter.

Attachment 3

Recommended Calibration Frequencies

Size of Meter in inches	Maximum Interval Between Test in Years
5/8	10
3/4	8
1	6
1 ½	4
2	1
3	1
4	1
6 or larger	1