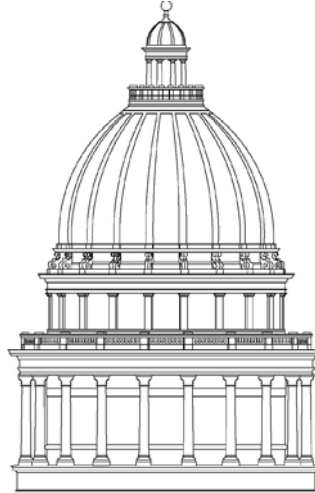


REPORT TO THE
UTAH LEGISLATURE

Number 2014-13



**A Review of the Division of Drinking Water's
Minimum Source Sizing Requirements**

December 2014

Office of the
LEGISLATIVE AUDITOR GENERAL
State of Utah



STATE OF UTAH

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AUDITOR GENERAL

December 2014

TO: THE UTAH STATE LEGISLATURE

Transmitted herewith is our report, **A Performance Review of the Division of Drinking Water's Minimum Source Sizing Requirements** (Report No. 2014-13). A digest is found on the blue pages located at the front of the report. The objectives and scope of the audit are explained in the introduction.

We will be happy to meet with appropriate legislative committees, individual legislators, and other state officials to discuss any item contained in the report in order to facilitate the implementation of the recommendations.

Sincerely,

John M. Schaff, CIA
Auditor General

JMS/lm

Digest of A Review of the Division of Drinking Water's Minimum Source Sizing Requirements

Water is one of the state's most valuable resources and as such should be carefully tracked and accurately reported. Good information is essential to ensure that policymakers are well equipped to make critical decision about the future of this valuable resource. The audit subcommittee directed our office to evaluate the accuracy of the data that state agencies rely on to regulate water systems and plan for future water needs. This review is the first of two audits that promote enhanced management of Utah's water. This audit focuses on the Division of Drinking Water's minimum source sizing requirements. The second audit, soon to be released, examines the data and forecasting models used to predict Utah's future water needs.

The Division of Drinking Water (DDW) within the Department of Environmental Quality is responsible for ensuring that public drinking water systems are safe and reliable. To do this, the DDW has adopted a set of minimum sizing requirements for source capacity, storage volume, and pipelines used by engineers when designing or expanding water systems. Several individuals from the residential development community have criticized the source sizing requirements because they believe the average household uses less water than the requirements impose. Consequently, they report that they are paying too much in water-related costs such as impact fees and water rights purchases. This audit investigates the validity of these claims by interviewing water system experts, reviewing division documentation, and examining water use data. This report describes the results of these efforts.

Chapter II Indoor Source Sizing Requirements Appear Excessive

Indoor Source Sizing Requirements Appear Outdated and Lack Supporting Data. Research shows that residential water use has declined during the past 30 years. Despite this decline, the state indoor source sizing requirements have not been updated in 35 years. While the division has periodically reviewed local water use data, DDW staff were unable to provide documentation supporting the current standards. Consequently, the division has not updated the state indoor requirements to reflect reductions in indoor water use.

Average Day Indoor Standard Appears Excessive. Although reliable data is difficult to obtain, we have identified three sources of data indicating that the state average day indoor requirement of 400 gallons per day (gpd) per connection appears excessive. First,

the average Utah resident uses less water than the state requirement. Second, data from Salt Lake City also shows residential water use is below the state requirement. Third, engineers who design municipal water systems report that average water use in their client cities is below the state requirement. These three sources indicate average indoor water use is 40 to 50 percent less than the 400 gpd average day requirement. While this data represents cities with large urban water systems and may not be representative of smaller water systems, we believe the data warrants a formal review and reduction to the state indoor average day requirement.

Peak Day Indoor Standard Appears Excessive. The peak day indoor requirement of 800 gpd per connection also appears excessive for the following reasons. First, water use data gathered from three cities that supply culinary water for indoor use indicate that peak day indoor demand is between 31 and 57 percent less than the 800 gpd peak day requirement. Second, engineers report that the peak requirement is excessive but also report that obtaining reliable peak day data is difficult.

Lower Source Sizing Requirements Could Reduce Some Water System Costs. Some cities rely on the division's average day source sizing requirement to determine the amount of water rights that will be required for a new housing development. Additionally, some cities use the peak day standard for establishing water system impact fees. It is possible that a reduction to one or both of these requirements could result in lower municipal water system costs. However, reducing the requirements does not guarantee that there will be savings. A variety of factors, including local level of service standards, will affect the size and cost of a community water system.

Chapter III Outdoor Source Sizing Requirements Appear Too Low

Data Suggests Actual Outdoor Water Demand Is Higher than State Standards. Data obtained for Salt Lake City, Sandy, and Provo indicate that these cities use more outdoor irrigation water than the state outdoor standards require. The division also acknowledged that the outdoor standards are too low and has begun collecting and evaluating water use data in order to determine a new set of outdoor requirements.

Inaccurate Assumptions Underlie State Requirements for Outdoor Water Use. The reason the state outdoor standards are lower than actual water use is that the standards are based on inaccurate assumptions and outdated research. Specifically, the standards assume home watering systems are perfectly efficient in their application of water to lawns and gardens. However, the amount of water applied by Salt Lake City homeowners exceeded the amount of water required to grow lawns and gardens by 140 percent,

according to a Utah State University study. Additionally, the standards are based on a 1970s-era study on orchard grass, which is not what homeowners grow. Updated studies may provide a more appropriate basis for establishing a new set of outdoor standards.

The Effects of Low Outdoor Standards Are Unclear. The effects of having low outdoor standards are unclear and difficult to document. If outdoor water use exceeds the state requirements, we would expect to see more water systems running out of water. However, we were only able to document one water system that had been undersized. Because most culinary water systems serve both indoor and outdoor needs, the effect of the low outdoor source sizing standards may be partially offset by indoor source sizing standards that are too high.

Chapter IV

State Requirements Are Needed; Regulatory Process Can Be Improved

State Requirements Are Needed to Protect Public Drinking Water Systems. It is widely recognized that there is a need for the state to regulate the size of the supply for public water systems. In fact, all the engineers and water managers we interviewed told us the standards were necessary to provide a basic level of safety and reliability. In addition, five of six western states we contacted have minimum sizing standards.

The Process for Receiving a Reduction Is Difficult but Is Improving. State rule allows the division to grant a reduction from the minimum source sizing requirements when certain criteria are met. Engineers and other water experts have complained that obtaining a reduction from the state requirements is unlikely and the requirements are unclear. Without a meaningful process for receiving a reduction, some water systems may be supplying more water than needed at an added cost to the water system. The division has recently granted its first reduction to a larger city water system and has also provided additional guidance for water systems interested in a reduction.

Engineers Express Uncertainty Regarding How to Apply the Requirements. Specifically, engineers raised several concerns that need additional rule clarity. They are unclear whether they can use water system data or must use the state minimum sizing requirements when designing or augmenting water systems. Additionally, some engineers have requested clarity in the requirements, specifically regarding water loss, safety factors, and the need for redundancies.

REPORT TO THE UTAH LEGISLATURE

Report No. 2014-13

A Review of the Division of Drinking Water's Minimum Source Sizing Requirements

December 2014

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Chapter I

Introduction

Several individuals from the residential development community have raised concerns about the Division of Drinking Water's (DDW) minimum source sizing requirements. They believe the average household uses less water than the requirements impose. Consequently, they claim that they are paying too much in water-related costs such as impact fees and water rights purchases. These individuals, as well as several city officials, are also concerned that the division's process for receiving a reduction to the requirements is too difficult. State legislators have asked our office to review these concerns and evaluate whether the source sizing requirements need to be changed.

Division of Drinking Water Regulates Utah's Culinary Water Systems

The Division of Drinking Water (DDW) within the Department of Environmental Quality is responsible for ensuring that public water systems are safe and reliable. To this end, the division has adopted three regulations related to the sizing of water systems. They include:

- R309-510-7. Source Sizing
- R309-510-8. Storage Sizing
- R309-510-9. Distribution System Sizing

While the sizing of the source, storage, and distribution systems are all interrelated, the regulations governing source sizing have been the greatest concern. For this reason, this report focuses only on the source sizing requirement, which is the amount of water required from a water source (lake, river, reservoir, water well, spring, or aquifer) to meet the demand placed on a water system. It is important to note that DDW rule requires water systems to provide adequate storage and pipelines sized for fire suppression. As a result, the size of a water system's infrastructure is typically dictated by these fire suppression requirements. However, fire suppression requirements typically do not affect the source sizing. The following sections describe the DDW's source sizing requirements as well as the process for requesting a reduction to these requirements.

The Division of Drinking Water is responsible for ensuring that public water systems are safe and reliable.

R309-510-7 Establishes Minimum Standards For a Water System’s Source of Supply

The source sizing standards address two different demands placed on a water system: the peak day demand and the average day demand.

For indoor water demand, the source supply standards address two different demands placed on a water system: the peak day demand and the average yearly demand for water.¹ There is a separate set of source sizing regulations for outdoor irrigation. These requirements also specify a peak day and average yearly demand requirement for outdoor use. For those systems that provide indoor and outdoor water through the same culinary water system, the regulations instruct water system designers to add the indoor and outdoor components of the source sizing regulation together to determine the anticipated demand placed on a water system.

The Indoor Source Sizing Standards Include Requirements for Peak Day Demand and Average Yearly Demand. In order to provide a reliable supply of water, a culinary water system needs to have sufficient capacity to handle the peak day demand. Peak day demands are driven by short-term events such as dry, hot weather or seasonal events such as holidays, which temporarily increase population or use. Water systems must also have sufficient water to meet average yearly demand. Figure 1.1 below shows a table from R309-510-7 that summarizes the indoor standards for peak day and average yearly demand.

Figure 1.1 Source Demand for Indoor Use. To address a water system’s peak demand, the standards require 800 gallons per day (gpd) per connection or equivalent residential connection (ERC). To address average yearly demand, the requirement is 146,000 gallons per year per connection, which equals 400 gpd per connection.

Each culinary water system must have sufficient water to cover the peak day demand or the day of highest water use.

Table 510-1 Source Demand for Indoor Use		
Type of Connection	Peak Day Demand	Average Yearly Demand
Year-Round Use		
Residential	800 gpd/conn	146,000 gal./conn
ERC	800 gpd/ERC	146,000 gal./ERC

Figure 1.1 shows that the division requires water systems to have twice the average day demand, or 800 gpd, to cover the demand on the day of highest water use. Each culinary water system must also

¹ See Appendix A for the full text of the regulation.

have sufficient water to deliver 146,000 gallons of water a year per connection. This is equal to 400 gpd.

Figure 1.1 only addresses the indoor portion of the requirement. For cities with separate outdoor water systems that do not use their culinary systems for irrigation purposes, the above indoor standards are the only requirements that apply. However, a majority of cities in Utah rely on their culinary systems to meet both indoor and outdoor water use. For those cities, the division imposes an outdoor watering requirement as well.

The Outdoor Source Sizing Standards Differ According to Climate Zone. To meet outdoor water demand, different standards apply depending on the residential lot size, percent of lot that is irrigated, and climate zone in which a water system is located. See Appendix A for the climate map. As with the indoor requirement, the outdoor requirement includes separate standards for peak day demand and average annual demand. See Figure 1.2.

Figure 1.2 Source Demand for Outdoor Use. The standards governing the supply for outdoor use vary from region to region. There are also separate standards for peak day demand and average yearly demand.

Table 510-3 Source Demand for Irrigation (Outdoor Use)		
Map Zone	Peak Day Demand (gpm/irrigated acre)	Average Yearly Demand (AF/irrigated acre)
1	2.26	1.17
2	2.8	1.23
3	3.39	1.66
4	3.96	1.87
5	4.52	2.69
6	4.9	3.26

Figure 1.2 shows that, in order to meet peak day demand for outdoor irrigation, a water system in Zone 4 (which includes Salt Lake County) must supply 3.96 gallons per minute per irrigated acre. To meet average annual demand for outdoor irrigation, water systems in Zone 4 must supply 1.87 acre-feet per irrigated acre per year.

A majority of cities in Utah rely on their culinary systems to meet both indoor and outdoor water use.

The outdoor source sizing standards differ depending on the residential lot size, percent of lot that is irrigated, and climate zone.

After Combining Indoor and Outdoor Standards, a Typical Salt Lake County Home Would Require 1,630 Gallons per Day.

The following example demonstrates how the division’s source capacity regulations are applied. To meet the peak demand requirement for a typical residence in Salt Lake County, a water system would need to supply 800 gallons per day for indoor use. Added to that amount is the outdoor requirement of 3.96 gallons per minute for every irrigated acre. In Salt Lake City, with a typical lot size of 0.26 acres and 56 percent of the lot irrigated, the outdoor requirement would be 830 gpd per connection. In mathematical form this is:

$$3.96 \text{ gallons per minute} \times 0.26 \text{ acres} \times .56 \text{ percent irrigated} \times 24 \text{ hours} \times 60 \text{ minutes} = 830 \text{ gallons per day per connection}$$

By adding the indoor requirement of 800 gpd to the outdoor requirement of 830 gpd, the total system requirement to meet peak day demand would be 1,630 gpd per connection. Results will vary from community to community, based on the average lot size, average percent of lot irrigated, and differences in climate zones. The above example is for peak day demand. To calculate the supply needed to meet average yearly demand a similar set of calculations would be made using the average yearly demand requirements in Figure 1.1 and 1.2 above. Salt Lake City’s average yearly indoor and outdoor demand requirement is 643 gpd per connection.

R309-510-5 Allows for Reduction Of Source Sizing Requirements

For those water systems that use less water than state requirements, the regulations allow for a reduction of the requirements. To do this, the requester would need to provide the DDW with actual water use data. The DDW would then review this data to determine if it was sufficient to warrant a reduction of the requirements. If the DDW accepts the data based on the criteria stated in R309-510-5, they will issue a letter stating the reduced sizing requirement. The regulation allows the division to reduce the requirements to as low as 90 percent of the actual use. For example, Woods Cross received a reduction of the peak day indoor demand requirement of 800 gpd to 400 gpd, which includes a safety factor of 16 percent above the city’s actual use of 345 gpd plus excess storage capacity. In order for the DDW to consider a reduction of the peak day requirement, cities must provide data demonstrating actual

Adding the peak day indoor and outdoor requirements together provides the total system requirement for peak day demand. For Salt Lake City, this is 1,630 gallons per day per connection.

For those water systems that use less water than state requirements, the regulations allow for a reduction of the requirements.

average daily use, peak day use, and the capacity set aside for other safety factors.

There has been confusion surrounding the type of data required to receive a reduction. In particular, certain critics of the standards have suggested that the requirements be reduced to reflect average household use. Water systems designed for average household use, however, risk running out of water, causing potential health hazards. The DDW's director articulates this risk in the following response to one of these critics:

It would be inappropriate for the Division of Drinking Water to use averages to determine minimum sizing requirements. By definition, half of all the water systems of the State would have insufficient water supply if average use data was implemented.

Therefore, water systems wishing to receive a reduction in the requirements would need to provide data for peak day demand in addition to average yearly demand. Additionally, for those systems that combine culinary and irrigation water in a single system, an indoor reduction request would be contingent upon the applicant's ability to supply both indoor and outdoor actual water use data.

Audit Scope and Objectives

Critics of the division's source sizing requirements believe the standards are too high and the exemption process is too difficult. To address these concerns, legislators asked for this audit. In response, we reviewed the history of the regulations, examined actual water system data, and compared Utah's regulations with those of other states. We also conducted numerous interviews with city engineers, water managers, critics of the regulation, and division staff. Based on our preliminary work, we developed an audit plan that focused on following objectives:

- Identify if actual indoor water use patterns are consistent with the current state indoor requirements – Chapter II.
- Identify if actual outdoor water use patterns are consistent with the current state outdoor requirements – Chapter III.

Water systems designed for average use risk running out of water, causing potential health hazards.

Critics of the division's source sizing requirements believe the standards are too high and the exemption process is too difficult.

- Identify if state source sizing requirements are needed and if the process for receiving a reduction to the requirements is working – Chapter IV.

Chapter II

Indoor Source Sizing Requirements Appear Excessive

We found several reasons to question the Division of Drinking Water's (DDW) source sizing regulations for indoor water use. First, the division was unable to document support for the current requirements, which have not substantively changed since 1979. The rules have remained unchanged despite well-established evidence that indoor water use has been in decline for over 30 years. Second, evidence from a variety of cities suggests that the source sizing standard of 400 gallons per day (gpd) per connection for average day demand is higher than most water systems need today. Third, peak day demand also appears to be below the division's requirement of 800 gpd per connection, although this data is more difficult to obtain. Because the source sizing requirements for indoor use appear excessive, we recommend that the division carry out a formal review of the minimum sizing requirements for indoor use.

The division needs to carry out a formal review of the minimum sizing requirements for indoor use.

Indoor Source Sizing Requirements Appear Outdated and Lack Supporting Data

Over the past 35 years, state indoor source sizing requirements have remained unchanged, despite the fact that the amount of water used in a typical home has declined. The division has periodically reviewed local water use data to verify if its source sizing requirements are still valid. Based on this ongoing review, the division concluded that there was insufficient data to support a change in the requirements. Consequently, the current indoor requirements need to be updated to reflect reductions in indoor water use.

The state indoor source sizing requirements have remained unchanged since 1979, despite the fact that the amount of water used in a typical home has declined.

Declining Indoor Water Use Is Not Reflected in Present State Average Day Requirement

While water use studies widely acknowledge a decline in indoor water use, the source sizing requirements have not changed in decades. According to the division director, the requirements have not substantively changed since 1979. In Utah, indoor water use declined by 14 percent between 2001 and 2009, based on the Division of Water Resources' 2010 study on residential home use. This decline is

Residential water use declined by 13 percent in 30 states and Canada during the past 30 years.

Division staff concluded that the requirements should remain the same because there was insufficient data to justify any changes to the requirements.

We believe that, with improvements in indoor watering efficiencies and new methods for collecting water use data, it is time to update the requirements.

consistent with national trends. According to a 2010 study on water use trends by the Water Research Foundation, “residential water usage per customer has decreased more than 380 gallons annually over the last three decades....Compounded over 30 years, the decline amounts to 13.2 percent.”² American Water, a large utility service company that has studied historic water use trends in North America, reports that residential water use has declined by 13 percent in 30 states and Canada during the past 30 years.³

The main causes for this decline in indoor water use appear to be (1) high-efficiency plumbing fixtures and appliances; (2) reductions in the number of persons per household; and (3) water efficiency programs, which incentivize reductions in household water use. Because residential indoor water use has gone down over the last several decades, the state requirements for indoor water use also need a reduction.

Indoor Requirements Lack Supporting Data

Division staff, who performed a review of the state requirements, concluded that the current standards governing peak use and average daily demand should remain the same because there was insufficient data to justify any changes to the requirements. This review was based on water use data for 35 water systems. Because most of the examined water use data combined indoor and outdoor use, the division was unable to separately evaluate the indoor and outdoor requirements.

In addition to having limited water use data, division staff did not know when the requirements had last been updated or the origin of the requirements. In any event, DDW staff could not demonstrate how the agency justifies a peak day requirement of 800 gpd per connection. Regardless of the origin, we believe that, with improvements in indoor watering efficiencies and new methods for collecting water use data, it is time for the requirements to be updated. The following sections demonstrate that Utah water systems are actually using less indoor water than the current source sizing standards require.

² Coomes et al. *North American Water Usage Trends Since 1992*, Water Research Foundation, 2010.

³ Rockaway et al. “Residential Water Use Trends in North America,” *Journal AWWA*, February 2011.

Average Day Indoor Standard Appears Excessive

The average day indoor requirement of at least 400 gpd per connection appears excessive for three reasons. First, research suggests the average Utah resident uses less water than the state requirement. Second, water use data from Salt Lake City also shows residential use is less than the state requirement. Third, engineers who design municipal water systems provided us with data suggesting the state requirement is excessive. Collectively, these points appear to warrant a formal review of and reduction to the state average day indoor requirement.

Utah's Residential Indoor Demand Is Below the State Requirement

According to data from the Division of Water Resources as well as our own analysis of Salt Lake City's residential water use data, the average indoor water demand is below the 400 gpd per connection requirement. To estimate indoor use, water use during the winter months is used. This is a common way to approximate indoor use because it represents those months with little-to-no outdoor watering. Since indoor use often peaks during the summer months, winter demand data may underestimate indoor water use. Thus, a broader study of indoor use is needed.

Indoor Water Use in Utah Averages 60 GPD per Person. A November 2010 Division of Water Resources study reported that the average residence used 60 gpd per person.⁴ This study, which analyzed water use data from 17 communities across the state, showed that the average indoor household water demand was about 223 gpd. Indoor use was estimated by taking the lowest billed month for water as indoor only use. Multiplying the 60 gpd per person number by 3.10 (2010 U.S. Census average household size for Utah) produced an average yearly indoor use of 186 gpd. Since water use numbers do not account for unaccounted water due to inaccurate meters, leaks, and unmetered uses, water systems need to account for this in their data. According to an engineer who designs municipal water systems, a typical water system needs to produce 20 percent more water than is used to account for such losses. Assuming this 20 percent loss rate, the

Indoor water demand is below the 400 gpd per connection average day state requirement.

⁴ Adams et al. *2009 Residential Water Use*, Utah Division of Water Resources, 2010.

Residential data from Salt Lake City indicates average indoor water demand is about 196 gpd per connection.

average household uses 223 gpd indoors. This amount is well below the state indoor standard of 400 gpd.

Salt Lake City Residential Indoor Water Use Is 73 GPD per Person. At 2.44 people per household in Salt Lake City, this use equates to an indoor demand of 196 gpd per household, assuming a known loss rate of 10 percent. While this is 27 gpd less than the 223 gpd number calculated from the 2010 Division of Water Resources study, it is still below the state indoor requirements of 400 gpd per connection.

Using metered water use data for about 70,000 Salt Lake City residents (provided by Salt Lake City's Department of Public Utilities), we estimated indoor water demand by calculating the average use per day per residential connection for the months of January, February, and December – months with little if any outdoor water use. Based on the data from these winter months, we estimate the average indoor use is 178 gpd. Salt Lake City reports a water loss rate of 10 percent, which results in an average indoor water demand of 196 gpd per connection. This use is 204 gallons less than the state average supply requirement of 400 gpd.

While residential water use is only a portion of the total indoor demand placed on water systems, it is the largest portion. We acknowledge that other users, such as commercial and industrial users, contribute to indoor water demand, which was not included in our estimates of residential indoor use. The next section, which included these users, also shows that average indoor demand is below the state requirement as reported by Utah water engineers.

Engineers Report Indoor Demand Is Below the Average Day Requirement

Several water engineers provided us with data suggesting that their client cities are using far less water than the supply level the state requires. We contacted several engineers licensed in Utah to discuss their experience with the DDW's minimum source sizing regulations. These engineers all work for private consulting firms and are responsible for designing water system plans and other water-related engineering services for municipalities. Because this data comes from private firms, we were unable to validate the accuracy of the data. We provided cities with the opportunity to review the indoor demand numbers reported for their city. Layton City was the only city to

Several water engineers supplied data suggesting that cities use less water than the state indoor average day requirement.

request a change due to updated information. The following table shows average indoor demand estimates provided to us by these engineers.

Figure 2.1. Average Daily Indoor Water Demand. As reported by engineers, average day indoor water demand is consistently below the state minimum source sizing requirement.

Average Indoor Water Demand in gpd/ERC	
State Requirement	400
Blanding City	207
Draper City	216
Granger-Hunter Improvement District	273
Layton City	224
Midvale City	236
Provo City	320
Salt Lake City	185
Sandy City	269
South Jordan City	202
South Salt Lake City	225
Spanish Fork City	259
Timpanogos Special Service District	249
Average	239

For every city and district sampled, the indoor water demand was less than the state source sizing requirement.

Figure 2.1 shows that for every city and district sampled, the indoor water demand is less than the state source sizing requirement. On average, the numbers reported by engineers are 40 percent below the state requirement of 400 gpd.⁵ Because these reported numbers reflect relatively large, urban water systems, the numbers may not be representative of smaller and more rural water systems.

Since indoor water use includes activities that occur throughout the year, such as the use of showers, toilets, and faucets, indoor water use is relatively stable. Hence, large seasonal peaks in demand are mostly attributable to outdoor use. Nonetheless, water systems, even indoor only systems, need to accommodate peak days or those days with the greatest demand. Activities such as filling up swimming pools and washing cars, which uses culinary water, increases the demand

⁵ Differences in reported average day demand estimates may partially reflect differences in how equivalent residential connections (ERCs) are reported. For example, Provo City's water manager stated that since there are multiple dwelling units that share a single connection, it is difficult to identify the number of ERCs.

placed on indoor water systems. Therefore, a decline in average day indoor water consumption does not mean there will be a decline in peak day water consumption. Peak day demands typically drive infrastructure costs as well as operational costs such as treatment and pumping. The next section focuses on the peak day indoor requirement, which is double the average day requirement.

Peak Day Indoor Standard Appears Excessive

The peak day indoor requirement of 800 gpd per connection also appears excessive for the following reasons. First, we gathered water demand data from three cities whose culinary water systems supply water for indoor use only. The peak day demand of these cities is well below 800 gpd. Second, engineers also report that the peak requirement is excessive but reliable peak day data is difficult to obtain.

Culinary Water Systems that Supply Only Indoor Use Have Relatively Low Peak Day Demand

We obtained water use data from three cities whose culinary water systems only supply indoor use. The peak day use for these cities is between 31 and 57 percent less than the 800 gpd source sizing required by the Division of Drinking Water.

Peak Indoor Demand Is Difficult to Identify Because Most Culinary Water Systems Supply Both Indoor and Outdoor Watering Needs. However, we reviewed data from three cities, Woods Cross, Spanish Fork, and Centerville, whose water systems supply only indoor demand. Assuming these cities typify indoor water demand patterns across the state, water use data from these cities suggest the division's indoor peak day supply requirement of 800 gpd is higher than actual peak day demand.

Woods Cross' Highest Peak Day Demand Was 345 GPD. The DDW granted Woods Cross a reduction from the state indoor water supply standard of 800 gpd to a reduced standard of 400 gpd. This reduction was granted because the city was able to provide several years of peak day demand data from their Supervisory Control and Data Acquisition (SCADA) system. To receive a reduction, Woods Cross identified their peak days, or those days with the highest

The peak day indoor requirement of 800 gpd per connection also appears excessive.

Water use data from three cities with indoor only systems indicate the peak day requirement is excessive.

demand for each year in a three-year period. According to the data submitted, Woods Cross demonstrated an indoor peak demand of 345 gpd,⁶ 57 percent less than the state standard of 800 gpd.

Spanish Fork’s Highest Peak Day Demand Was 437 GPD.

Spanish Fork provided data spanning from 2010 to 2013 that we analyzed to determine peak day use. In 2010, Spanish Fork reported a peak day indoor demand of 437 gpd. Spanish Fork’s peak is 45 percent below the state peak supply standard of 800 gpd. Despite using less water than is required, Spanish Fork has not sought a reduction of the source sizing requirement, although they could potentially be eligible for a reduction.

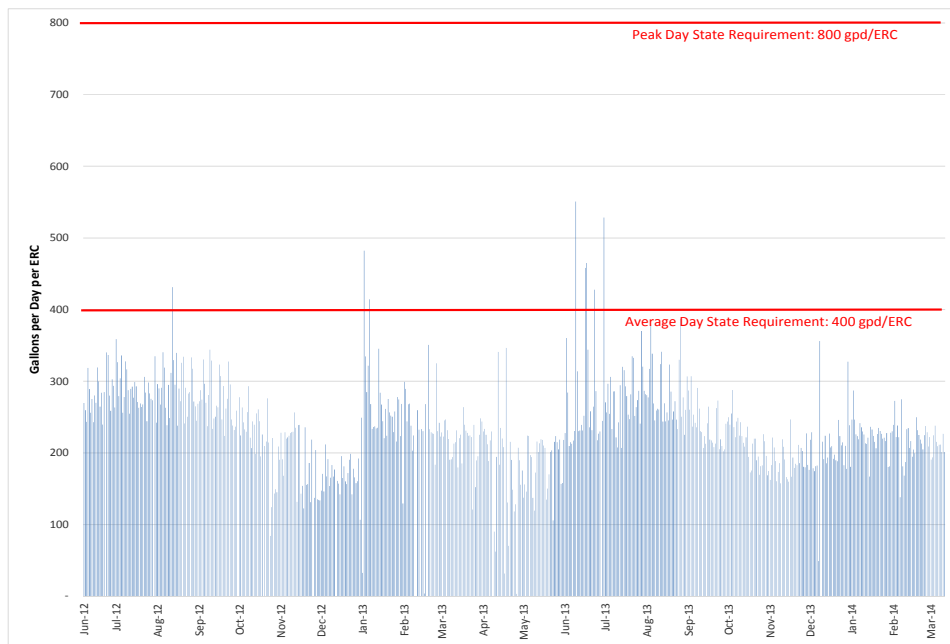
Spanish Fork’s peak is 45 percent below the state standard.

Centerville City’s Highest Peak Day Demand Was 551 GPD.

Centerville is another city with a secondary irrigation system. Based on our analysis of the data provided by the city, Centerville’s highest indoor demand over the last three years was 551 gpd. This reported peak is 31 percent below the state supply standard. Using daily use data provided by Centerville, Figure 2.2 illustrates how the city’s water demand was less than state water supply requirements.

Centerville City’s peak is 31 percent below the state standard.

Figure 2.2. Centerville City’s Water Demand Between June 2012 and March 2014. Centerville City’s average day demand and peak day demand were below the state requirements.



⁶ This number reflects the peak instantaneous demand.

Figure 2.2 shows Centerville’s average daily demand per connection was between 200 and 300 gallons. This is well below the 400 gallons the division requires for average day demand. Centerville’s peak day demand is also well below the division’s peak day demand requirement of 800 gallons per connection. The figure shows that, on a couple of occasions, the water demand peaked at just over 500 gallons per day. Since 1.5 percent of Centerville’s residents do not have a secondary system, some of this peak day demand may be driven by outdoor demand.

Woods Cross’, Spanish Fork’s, and Centerville City’s daily indoor water use data indicates that the peak day standards for indoor use may be excessive. These examples, while limited, highlight the possibility that there may be additional cities that have built water systems with capacity that is in excess of demand. While we expect indoor use to be relatively consistent across households, other users, such as commercial users, can create additional demand for indoor water. Because this is a limited sample of indoor water systems and the range in peak day demand between systems is wide, we recommend that the division reevaluate the indoor requirements. It will be necessary for the DDW to collect additional data on separated systems to verify that these sampled systems are representative of indoor use.

Water System Design Engineers Report Limited Peak Indoor Water Demand Data

Engineers who design water systems report that the state’s peak day indoor requirement is excessive but also report that this type of data is limited. Because actual peak day flow data is not commonly available, engineers told us that they often default to the state indoor requirement of 800 gpd.

A lack of reliable data for identifying peak use is a consistent concern reported by engineers as well as DDW staff. This data shortage exists because there are only two known sources of peak use data:

- Daily sales data for cities with advanced metering infrastructure (AMI). Most cities read meters monthly; consequently, metered use records do not capture peak days. Several cities have moved to AMI, which reports hourly water use data for every meter to a central database.

We recommend that the DDW collect additional data on separated systems to reevaluate the state indoor requirements.

A lack of reliable data for identifying peak use is a consistent concern reported by engineers as well as DDW staff.

- Daily production data. This is daily production (or source) data from SCADA systems, which is used to remotely measure water production levels. Changes in storage reservoirs can make this approach difficult to apply.

We also had trouble obtaining peak use data from some municipalities because they lack the technology or the expertise to supply such data. As an increasing number of cities adopt AMI and SCADA systems, the technology may soon be available for the DDW to evaluate the state's peak day requirement against water system data. While the evidence we have presented appears to suggest a reduction of the indoor requirements, additional data will help the DDW ensure that the requirements are supported with actual water use data.

Lower Source Sizing Requirements Could Reduce Some Water System Costs

Some cities rely on the division's average day source sizing requirement to determine the amount of water rights that will be required for a new housing development. Additionally, some cities use the peak day standard for establishing water system impact fees. While it is possible that a reduction to one or both of these requirements could result in lower municipal water system costs, reducing the requirements does not guarantee that there will be a savings. A variety of factors, including local level of service standards, will affect the size and cost of a community water system.

A Reduction of the Average Day Requirement May Cut Costs for Water Rights

For expanding water systems, a reduction of the state indoor requirements could cut costs for water rights. This is because the DDW's average day requirement of 400 gpd (or 0.45 acre-feet) is used as the metric by which water rights are purchased. If fewer water rights are required, it is possible that the overall cost of the water system could be reduced, resulting in a reduced impact fee.

Some Cities Use the State's Metric as the Standard for Establishing Water System Impact Fees. Our review of impact fees indicates that, in some instances, the minimum sizing standard of 800 gpd is used for determining impact fees. Eagle Mountain and Herriman are examples of cities that based their impact fees on the

Reducing the indoor requirements could potentially lower some costs for municipal water system.

A reduction of the state indoor requirements could cut costs for water rights.

cost of implementing the state’s minimum peak day demand standard. In each case, the impact fee study assumed that construction of any additional system capacity would need to meet the source sizing required by DDW regulations. The impact fee study was then used to establish a fee schedule for impact fees now charged to those seeking a building permit.

Division management told us that the intent of the minimum sizing requirements is to ensure water systems have sufficient physical capacity to meet the system’s water demand. Hence, the requirements were never intended to be used for calculating impact fees. They also point out that state law requires that impact fee studies be based on actual water system costs and capacity needs, which may be higher or lower than the amount required by the state drinking water standards. Centerville City’s impact fees, for example, are assessed below the state peak day requirement because they chose to base their fees on actual demand, not the state source requirements.

A Reduction of the Peak Day Requirement Could Benefit Some Water Systems, Particularly Those with Separated Systems.

For example, Woods Cross’ public works director reported that the benefit of requesting a reduction was that it reduced water supply and infrastructure costs. Woods Cross’ impact fees will not be reduced. According to the public works director, their impact fees currently reflect only the infrastructure costs of building water systems and do not include the costs of the source supply. This example suggests that some cities may not be affected by a reduction in the state’s source sizing requirements because their source supply is already established.

Reduced Standards Could Reduce the Number of Water Rights Cities Require for a New Development. Some cities and water districts purchase sufficient water rights to accommodate growth. They then recover that cost through water bills or property taxes. Often, however, cities require developers to cover the cost of supplying the water needed to support a new subdivision. Developers may be required to transfer to the city any water rights already attached to the property or they may be required to purchase new water rights and transfer them to the city.

Sometimes cities add the cost of providing additional water to a developer’s impact fees. For example, in St. George City, all new developments are required to pay an impact fee for water to the

A reduction of the peak day requirement for Woods Cross resulted in reduced water supply and infrastructure costs.

Some cities require developers to purchase water rights for new housing developments.

Washington County Water Conservancy District, which includes the costs associated with acquiring water rights.

In 2014, the minimum residential culinary water impact fee in St. George was \$6,408 per connection. The city charged an additional \$1,211 to distribute and store this water, resulting in a total impact fee of \$7,619.⁷ If the state average day indoor requirement was reduced, a portion of these fees might also be reduced.

Reduced Source Sizing Standards Do Not Guarantee Reduction in Water System Costs

A reduced water supply requirement does not guarantee that cities will reduce the amount of water rights they require developers to bring or purchase. The state's minimum requirements provide guidance for estimating average water demand, but cities are not restricted from building more capacity than is minimally required. Each water system is unique and may encounter different factors affecting the size of its source of supply. These factors include:

- Size and complexity of water system
- Need to provide redundancies
- Reliability of water sources
- Future growth and extent water system is built out
- Number of connections served by a secondary irrigation system

Due to the variety of factors that affect the sizing of water systems, it is difficult for us to predict the degree to which a reduction in the standards would reduce costs. When designing water systems, design engineers and city officials must take into account local factors affecting the size of their water systems in addition to the state requirements. Some cities may choose to supply more water than the minimum standard require as an insurance policy against unforeseen events.

Recommendation

1. We recommend that DDW reevaluate its indoor source sizing regulations and issue a set of revised standards that are based on actual indoor use data provided by Utah water systems.

⁷ Updated January 2015.

If the state average day indoor requirement was reduced, a portion of the impact fees might also be reduced.

A reduced water supply requirement does not guarantee that cities will reduce the amount of water rights they require developers to bring or purchase.

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Chapter III Outdoor Source Sizing Requirements Appear Too Low

Although the indoor source sizing standards appear to be too high, the outdoor source sizing standards appear to be too low. While our work showed that a typical homeowner uses less indoor water than the state regulations require, it appears a typical homeowner uses far more outdoor water than the amount required by Division of Drinking Water's (DDW) standards. The reason for this discrepancy is that the outdoor standards assume a perfectly efficient application of outdoor water. However, research suggests that homeowners apply far more water to their yards than is necessary. We recommend the division reexamine its outdoor source sizing standards and issue new standards that better reflect actual outdoor watering practices.

The effects of having low outdoor source sizing standards are unclear. Because most culinary water systems serve both indoor and outdoor needs, the effect of the low outdoor source sizing standards may be partially offset by indoor source sizing standards that are too high. It is also possible that water systems that do not have sufficient source supply are not reporting this concern. We encountered one water system that had insufficient source supply because they sized their water system according to the state outdoor requirements.

Data Suggests Actual Outdoor Water Demand Is Higher than State Standards

As noted, the typical homeowner's outdoor water demand appears to exceed the division's source sizing standards. Based on outdoor water demand data obtained for Salt Lake City, Sandy, and Provo, we found that the actual outdoor water demand was higher than the amount required to be available by DDW regulations. Furthermore, the division director acknowledged that the outdoor source sizing requirements are too low. He stated that the division would soon undergo a process of collecting and evaluating outdoor irrigation information to determine a more appropriate set of outdoor requirements.

A typical homeowner appears to use far more outdoor water than required by the state standards.

Outdoor Water Demand Appears to Exceed State Source Sizing Requirements

We were able to obtain outdoor water use data for Salt Lake City, Sandy City, and Provo City. Although limited to just three urban cities, the data suggests that actual use was consistently above the division’s source sizing standards for outdoor annual and peak day demand. Figure 3.1 shows the state source sizing requirements (in red) for both the average and peak day outdoor water use. These requirements, which are reported in gallons per day (gpd) per equivalent residential connection (ERC), are compared against actual use (in blue) for the three cities.

Although limited to just three urban cities, the data suggests that actual use was consistently above the division’s source sizing standards.

3.1. More Outdoor Water Is Used than Is Required by the State Source Sizing Requirements. Both average day and peak day outdoor demand indicate that the state source sizing requirement is too low when compared with data from Salt Lake City, Sandy City, and Provo City.

	Average Day gpd/ERC			Peak Day gpd/ERC		
	State Standard	Actual Demand	Difference	State Standard	Actual Demand	Difference
Salt Lake City ¹	243	260	7%	830	955	15%
Sandy City ²	242	509	110%	827	1501	82%
Provo City ³	194	381	96%	640	1248	95%

¹ Source: Salt Lake City. Based on .26 average lot size, .56 percent irrigated, and 142,790 ERCs.

² Source: Sandy City. Based on .25 average lot size, .58 percent irrigated, and 32,758 ERCs.

³ Source: Provo City. Based on .23 average lot size, .57 percent irrigated, and 29,043 ERCs.

It is important to note that the state standards will differ from city to city because of differences in a city’s climate zone, average lot size, and irrigated acreage. To calculate actual use for comparison against the state standards, each city’s equivalent residential connections (ERCs) were determined. We did this by converting the commercial and institutional connections into ERCs from annual water use data. For example, if a commercial water customer uses ten times the water as an average residence, then one commercial connection is worth ten residential connections or ten ERCs. R309-110 requires all public water system managers to “review annual metered drinking water volumes delivered to non-residential connections and estimate the equivalent number of residential connections.” We found that this review is not done and inaccuracies are a concern. We asked each city to validate the ERC data in order to improve the accuracy of our analysis.

Outdoor water demand for Salt Lake City, Sandy, and Provo were found to be higher than state standards.

Salt Lake City’s Average Daily Outdoor Demand Is 7 Percent Higher than State Supply Standards. Salt Lake City’s average day outdoor demand is 260 gallons per day (gpd) per connection. This exceeds the state standard by 17 gpd per connection. Salt Lake City’s peak day outdoor demand at 830 gpd per connection is also higher than the state standard by 125 gpd per connection.

Sandy City Residents Use More than Twice the Amount of Water Required by the Average Day State Standard. Sandy City’s average day demand for outdoor water is 509 gpd per connection. Sandy’s peak day demand of 1,501 gpd per connection also exceeds the state standard, by 82 percent.

Provo City’s Average Daily Outdoor Demand Nearly Doubles the State Average Day Standards. Provo City’s demand is 381 gpd per connection, nearly double the average day state standard. Their peak day demand of 1,248 gpd per connection is also nearly double the state standard of 640 gpd. While Provo’s peak water use is less than Sandy’s, Provo is located in a different irrigation zone than Sandy and thus has a lower state standard. This difference highlights the possibility that the irrigation zone map and corresponding table may be inaccurate, as discussed later in this chapter.

Outdoor Peak Day Demand Is Not Easily Identifiable. First, most cities do not track daily water use, which is required to estimate peak day demand. In addition, culinary water systems often serve both indoor and outdoor use. Because a typical home operates with a single connection and one meter, it is difficult to separate indoor from outdoor use. We therefore identified peak use during the winter months, when we assume no outdoor watering occurred, and subtracted that amount from the peak day use during the summer to estimate peak outdoor use. Salt Lake City, Sandy City, and Provo City were the only cities that could provide sufficient daily water demand data to estimate peak outdoor use using this method. Because these cities have among the largest and best-run water systems, they are not necessarily representative of all water systems. To provide additional validation that the peak day requirements are too low, the division will need to obtain water use data from a representative sample of water systems across the state.

Because it is so difficult to identify the peak day demand for indoor and outdoor water use, we question whether the division has the

Sandy City’s average day demand was nearly double the state standard.

Salt Lake City, Sandy City, and Provo City were the only cities that could provide sufficient daily water demand data to estimate outdoor water use based on winter months.

ability to enforce state requirements. It also leads us to question whether cities know if they comply with the standards.

Division of Drinking Water Acknowledges Its Outdoor Requirements Are Too Low

The division acknowledges that outdoor water use typically exceeds the state supply requirements. In 2014, the DDW director said the following in response to a report calling for a reduction to the state's outdoor water requirements:

We have received feedback from consultants, who have done recent studies, modeling actual water irrigation usage for drinking water systems. They indicate that the Division of Drinking Water requirements are measurably lower than what is actually being seen.... At this time it would not be prudent to lower the requirements for irrigation demands.

The director's observation is consistent with the actual water use data above. Both the DDW's observation and actual use data support the conclusion that outdoor water use exceeds the state supply requirements. In response, the director has stated the division is willing to collect the data and do the analysis to update the state requirements but that it will take time. The next section discusses the reasons why actual use exceeds the state requirements.

Inaccurate Assumptions Underlie State Requirements for Outdoor Water Use

The reason the state standards are lower than actual outdoor water use is that the standards are based on inaccurate assumptions and outdated research. Specifically, the standards are based on 1970s era research into the watering needs of orchard grass. The concern with this research is that it assumes a perfect application of water. Instead, homeowners tend to apply much more water than their yards need. In addition, recent research into outdoor watering practices in Utah may provide a more current basis for establishing the standards than the 1970s era research on orchard grass provides. The following material describes our concerns with these standards.

The division acknowledges that outdoor water use typically exceeds the state supply requirements.

The state outdoor standards are based on inaccurate assumptions and outdated research.

Standards Assume Homeowners Use Perfectly Efficient Outdoor Watering Practices

One assumption of the outdoor requirements is that homeowners will apply exactly the right amount of water to their lawns and gardens. Because homeowners do not water their lawns and gardens efficiently, the actual amount of outdoor water used is far greater than the amount of water required by the source sizing standards. Figure 3.2 illustrates the difference between consumptive use, which assumes complete watering efficiency, and actual use for Salt Lake City.

Figures 3.2. Salt Lake City's Outdoor Consumptive Use Compared Against Actual Use in 2002 to 2011. There is a significant difference between the amount of water required under efficient watering practices and the amount of water actually used under less efficient watering conditions.

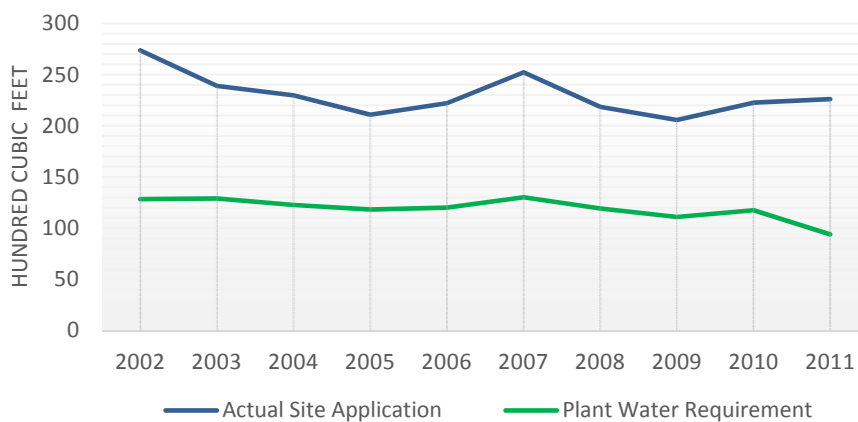


Figure 3.2 is based on data (collected by Utah State University's (USU) Plant, Soils, and Climate Department) that compared the amount of water required by typical landscape vegetation against the amount of outdoor water actually used by homeowners. Salt Lake City's actual site application, or the total cubic feet of water used outdoors during the irrigation season (between April and October), exceeded the watering requirement, which is the amount of water actually required to keep plants healthy. In 2011, the actual amount of water used exceeded the amount of water required by 140 percent, indicating that watering practices are inefficient. The USU data explains why (as shown in Figure 3.1, page 19) Salt Lake City, Sandy City, and Provo City report actual peak day use and average daily demand that is greater than the state water supply requirement standards.

The state outdoor standards assume homeowners are watering their lawns and gardens efficiently.

The amount of water applied by homeowners exceeds the amount of water required for lawns and gardens by 140 percent.

We are also concerned that the regulatory standard for outdoor watering continues to be based on the consumptive use of orchard grass instead of lawns and gardens.

Standards Assume Orchard Grass Requires Similar Amounts of Water as Turf Grass

We are concerned that the regulatory standard for outdoor watering continues to be based on the consumptive use of orchard grass. Turf grass and gardens are the two most common landscape features found at Utah residences, accounting for half of all household outdoor water use. However, the drinking water regulations, including the irrigation zone map, are based on a 1978 Soil Conservation Study, which analyzed the amount of water required to grow various agricultural crops. As mentioned, in 1978 orchard grass was the crop most similar to turf grass. However, studies published in 1994 and 2011 by Utah State University contain updated information regarding the watering needs of gardens and turf grass. Using this updated information will help ensure that the water use table accurately reflects the type of land cover most likely to be found in residential areas.

Effects of Low Outdoor Standards Are Unclear

The effects of having low outdoor standards are unclear because such effects are difficult to document. If outdoor water use exceeds the state requirements, we would expect to see more water systems running out of water. However, we were unable to document any problems with water systems being undersized, except for one example. Saratoga Springs sized its secondary water system according to the outdoor source sizing requirements, which resulted in their system running short of water.

Effects of Low Outdoor Standards Are Difficult to Document

We could not document many negative effects of having a set of outdoor source sizing that are too low. There are several possible reasons for this. First, for combined systems, it is possible that having indoor standards that are too high helps to compensate for outdoor standards that are too low. Salt Lake City's combined total indoor and outdoor use is below the combined requirements. Sandy City's and Provo City's combined use, however, exceeds the state requirements. This leads us to the second possibility, which is that, since the requirements are minimums, water system engineers are sizing water

The effects of having low outdoor standards are unclear because such effects are difficult to document.

systems larger than required by the minimum standards to meet actual demand. Finally, it is possible that there are undersized water systems, but such systems are unlikely to announce their problem to DDW which provides regulatory oversight of these systems. DDW staff acknowledge that, while rare, they do encounter water systems with insufficient source supply. The division detects insufficient source supply when they receive requests to deepen a well or connect to neighboring water systems. The division also analyzes the overall capacity of water systems during on-site inspections of water systems conducted every three years.

Saratoga Springs Undersized Secondary Water System Based on Standards

Saratoga Springs offers one example of a city that had insufficient source supply for their secondary system. Even though secondary water systems are not subject to the standards, Saratoga Springs used the DDW source capacity requirements to size its secondary water system. As a result, Saratoga Springs' actual outdoor water use exceeded its secondary system's capacity, forcing the city to supplement its outdoor irrigation system with water from its culinary system. The city has responded by making a significant investment to improve their secondary system.

The Saratoga Springs example offers a natural experiment with which to test the division's outdoor source sizing requirements. It shows that a secondary (outdoor) system, designed using the state's requirements, will likely not have sufficient capacity. This example offers another indication that the division needs to review its outdoor requirements.

Recommendation

1. We recommend that DDW review its outdoor source sizing requirements and establish new requirements, based on current research, that are consistent with actual outdoor water use data.

DDW staff acknowledge that, while rare, they do encounter water systems with insufficient source supply.

Saratoga Springs' outdoor water use exceeded its secondary system's capacity, forcing the city to supplement its outdoor irrigation system with culinary water.

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Chapter IV

State Requirements Are Needed; Regulatory Process Can Be Improved

Although the Division of Drinking Water's (DDW) source sizing requirements need clarification, there is value in having minimum sizing requirements. Engineers and water managers we interviewed support having a state minimum standard because the regulations provide a minimum level of protection against water systems running out of water. In addition, most of the surrounding states have minimum sizing standards, suggesting that these requirements are useful.

While minimum water system supply requirements are important, the division can make it easier for water systems to comply with the regulations by (1) improving the process for obtaining a reduction of the source sizing requirement, and (2) clarifying the sections of rule that are confusing to engineers. Because each water system is unique, it is difficult to develop a single standard that applies to each. Therefore, we recommend the division develop a simplified process for obtaining a reduction of the requirements.

State Requirements Are Needed to Protect Public Drinking Water Systems

It is widely recognized that there is a need for the state to regulate the size of the supply for public water systems. In fact, all of the engineers and water managers we interviewed told us the standards were necessary to provide a basic level of safety and reliability. In addition, five of six western states we contacted have minimum sizing standards.

Engineers and Water Systems Managers Report Benefits of Minimum Requirements

Engineers and water system managers reported benefits of having minimum sizing requirements for source capacity. We interviewed dozens of water experts regarding their opinion of the requirements. These interviews included DDW staff engineers, engineers that design water systems, and water system managers. These individuals,

Engineers and water managers support the state requirements because they provide protection against water systems running out of water.

Engineers and water system managers reported benefits of having minimum sizing requirements for source capacity.

The requirements protect small water systems that may not have the ability to conduct sophisticated analyses.

including two that occasionally represent developer interests, reported that the state requirements are beneficial. The following lists the primary benefits mentioned by these experts.

- The requirements protect small water systems that may not have the ability to conduct sophisticated analyses.
- The requirements provide a starting place for designing new water systems.
- The requirements protect water systems from an unreliable source supply.
- The requirements protect water systems from being undersized due to external pressures a city may face to undersize a system.

As mentioned in Chapter I, the DDW's primary objective is to regulate water systems to ensure that the public is provided with an adequate supply of safe drinking water. To do this, DDW relies on the minimum sizing requirement set in rule. The division maintains that the requirements are most important for smaller water systems because their staff may not have the resources or expertise to design effective water systems. Larger cities' water systems are less of a concern because they generally have engineering staff or outside consultants with the required expertise to ensure that water systems are suitably designed.

Other States Have Minimum Standards

We reviewed rules adopted by Arizona, Colorado, Idaho, Nevada, Washington, and Wyoming and found that all these states, except Colorado, have minimum standards. Each state, including Colorado, reported that there is value in having state standards for the size of a water system's source of supply.

Because each state's requirements differ, it was not possible for us to compare our state requirements with those of other states. We found both similarities and differences. For example, Idaho's indoor peak day requirement of 800 gpd (gallons per day) per connection is identical to Utah's, although Idaho does not have a separate outdoor requirement. Nevada's requirements differ because they account for factors such as the presence of water meters. The following are some of the requirements found in other states:

Many surrounding western states have minimum standards.

- Arizona: 110 gallons per capita per day for residential units with a person per housing unit value of 2.7 for new residential units (297 gpd per connection). For peak water demand, a peaking factor is used unless there is more specific data available. The peak day demand factor is 1.8 times the average daily demand. There is not a separate requirement for indoor and outdoor use.
- Colorado: No specific requirements other than that a professional engineer must design all water systems. The plans are submitted to the Water Quality Division's section for approval.
- Idaho: Minimum peak day capacity of 800 gpd per residence for indoor use. Idaho does not have a set outdoor standard but requires that outdoor standards be established in the design of their systems.
- Nevada: Source requirements are based on the number of connections and the use of meters. A system of more than 500 connections requires at least 1 gallon per minute per connection for metered systems and 1.5 gallons per minute per connection for unmetered systems. This equals 1,440 gpd per connection metered and 2,160 gpd per connection unmetered.
- Washington: Engineers must design water systems based on actual use records, water use from an analogous water system, or the water source sizing criteria, which advises multiplying the average day demand by a peaking factor of 2.0 to get a peak day demand.
- Wyoming: The requirement includes 125 gpd per person (391 gpd per connection) for average use and 340 gpd per person (1,064 gpd per connection) for peak day use. This is a combined requirement of approximately 1,455 gpd per connection for indoor and outdoor use.

The above information shows that states use a variety of methods and metrics to regulate a water system source supply. Our review of other states suggests that having minimum standards is generally recognized as important for ensuring adequate supplies of drinking water and promoting public health. As Nevada's bureau chief of safe drinking explained, "Despite wanting to believe all engineers are

Nevada's source sizing requirements are based on the number of connections and the use of meters.

Having minimum standards is generally recognized as important for ensuring adequate supplies of drinking water and promoting public health.

ethical, there are many that work for their client and not the greater good for public health, so the standards protect against this.” The next section discusses the need for the DDW to improve the regulatory process for granting reductions to the requirements.

Process for Receiving a Reduction Is Difficult but Is Improving

State rule allows the division to grant a reduction from the minimum source sizing requirements when certain criteria are met. Engineers and other water experts have complained that obtaining a reduction from the state requirements is unlikely and the requirements are unclear. Because it is difficult for cities to supply the data required in rule for an exception to be considered, reductions are rarely granted. Without a meaningful process for receiving a reduction, some water systems may be supplying more water than needed, which adds to the cost of a water system. The division has recently granted its first reduction to a larger city water system and has also provided additional guidance for water systems interested in a reduction.

DDW Rarely Grants Reductions to Minimum Source Sizing Requirements

We documented four instances when the division granted reductions; of these, three involved relatively small developments with limited or seasonal water use. As the division director stated in a January 2014 letter, “Over a 30-year period there have been very few reductions granted and they have typically involved unusual circumstances.” This statement was written in the context of justifying the state minimum source capacity requirements. However, another way to interpret this statement is that few reductions have been granted because few water systems are confident they can complete the process. A number of water experts we interviewed reported that obtaining a reduction of the requirements is unlikely. For example, one engineer stated that the DDW has not been flexible about granting reductions. Another stated that few reductions have been granted because the requirements are too onerous. The following specific requirements are stated in *Administrative Rule 309-510-5*:

If acceptable data [emphasis added] are presented, certain number of days of peak day demand to establish minimum source capacity; certain number of years of annual demand

Without a meaningful process for receiving a reduction, some water systems may be supplying more water than is needed.

“Over a 30-year period there have been very few reductions granted and they have typically involved unusual circumstances.”

to establish minimum water right requirements; and certain number of readings of peak hourly demand to establish minimum peak instantaneous demand; showing that the requirements made herein are excessive for a given project, the requirements may be appropriately reduced to the 90th percentile of readings, on a case by case basis by the Director....

This ambivalent wording does not clarify what type of data is considered acceptable nor does it address how water systems that do not have sophisticated computer-based systems can report peak annual demand or peak instantaneous demand.

Several engineers told us that, in order to be considered for a reduction, the division requires data that is not normally collected by water systems. Since water systems often do not have sufficient data to calculate peak day demand, engineers will typically apply a peaking factor or multiplier to the average day demand. Although a couple other states accept this approach, Utah's Division of Drinking Water would not approve a reduction based on estimates of peak day or annual average use. Instead, the division requires a city to obtain peak use data.

For example, in a letter denying Herriman City's request for a reduction, the division states the following:

The Division typically requires water use data consisting of at least two peak seasons for evaluating reduction of peak day demand.... The water system will need to do daily [emphasis added] meter reading of all service connections to collect representative peak day water use data during the identified peak periods. If the data are acceptable, the Division will issue a letter allowing the water system to use the 90th percentile reading (among all the actual water use data) for the peak day demand.

As one engineer commented, it is too much to ask a city to read the water meters for all its water connections for the identified peak periods for two years. The division has clarified this statement and explained that they would accept data other than metered service connection data, as long as the data provided demonstrates peak day

In order to be considered for a reduction, the division requires data that is not normally collected by water systems.

use per connection. For example, two of the four reductions granted by the division relied on metered data from the source.

Another concern is whether the reduction process allows for reductions to low-water use developments prior to building. Because the current requirements maintain actual water use data must be used to identify peaks in water use, this precludes new developments from seeking a reduction. Therefore, the division should consider exploring whether it is possible to grant such a reduction without compromising water supply or safety standards as long as the city can assure the division that low water use will continue to be enforced. Such reductions could be based on a peaking factor or analogous low-water-use housing developments.

As discussed in the following section, without a meaningful process for receiving a reduction, some water systems may be supplying more water than needed at additional expense.

DDW Grants a Large Reduction And Clarifies Process

When concerns about the source sizing requirement reduction process were brought to the attention of DDW management, they stated that they were willing to work with individual water systems to help them provide appropriate data. DDW willingness has been shown in two ways. First, during this audit, the division granted a significant reduction to Woods Cross in August 2014. Second, the division provided us with a copy of a guidance document, which is designed to clarify the rule requirements and help water systems interested in applying for a reduction prepare the appropriate data.

DDW Granted Its First City Reduction to Woods Cross.

Woods Cross worked with the DDW to obtain a reduction of the requirements from an indoor peak of 800 gpd per connection to 400 gpd per connection. This reduction was granted because Woods Cross was able to demonstrate that its peak was 345 gpd per connection, less than half the state requirement. Additionally, Woods Cross was granted a reduction because the city has a city ordinance that requires all residential users to use secondary water for outdoor use. This reduction benefitted Woods Cross by lowering the source supply and associated infrastructure costs. Woods Cross' public works director reported that the division was helpful in the reduction process and provided specific guidance.

DDW says they are willing to work with individual water systems to help them provide appropriate data for a reduction.

DDW granted a reduction to Woods Cross, the first city to receive such a reduction.

DDW Has Clarified the Reduction Application Process.

During the course of this audit, the division worked to clarify the process for applying for and receiving a water source sizing reduction. Division staff revised and adopted additional guidance in the rules that would help clarify division expectations for granting a reduction of the requirements. Among the improvements is language that states:

It is recommended that prior to collecting or compiling the water use data for a reduction request, you meet with the Division of Drinking Water engineering staff to understand the information needed for the reduction request and to establish a data collection protocol.

There has also been additional clarification regarding the criteria that is reviewed by the division. We credit the division for proactively working toward clarifying the reduction requirements. The next section discusses areas requiring additional rule clarification.

Engineers Express Uncertainty Regarding How to Apply the Requirements

Engineers who design municipal water systems report that the minimum sizing regulations are “unclear and are subject to individual interpretation.” Specifically, engineers are unclear about whether they can use water system data or must use the state minimum sizing requirements when designing or augmenting water systems. Additionally, engineers would like the DDW to clarify how to assess unaccounted water when using metered data, safety factors, and the need for redundancies.

Engineers Are Unclear if They Can Base Their Designs on “Firm Water Use Data”

Due to ambiguous rule wording, engineers that design municipal water systems are unclear if the state requirements direct them to use their own data in designing a water system or if they should use the source sizing requirements. Specifically, R309-510-7(2) states the following, “In the absence of firm water use data, Table 510-3 shall be used to estimate the peak day demand and average yearly demand for indoor water use.” Likewise, R309-510-7(3) uses the same language for outdoor use. The plain language of the rule suggests that, if engineers have water use data for the systems they are designing, they

We credit the division for proactively working toward clarifying the reduction requirements.

The plain language of the rule suggests that engineers can use their local system data instead of the state standards.

If the division intends to have engineers size their water systems according to the requirements, then they need to clarify this in rule.

can use their data instead of the requirements. In contrast to this interpretation, division management stated that the expectation is that all water systems comply with the minimum sizing requirements or request a reduction.

Because the rule can be interpreted in multiple ways, water engineers are inconsistent in their practices. For example, one engineer stated that he interprets the rule literally and collects water use data to inform how he sizes his water systems. We were told that some engineers rely too heavily on the minimum sizing requirements and are not sizing their systems according to water use data. We believe the rule wording is ambiguous and needs to be better defined. If the division intends to have water systems engineers size their water systems according to the minimum sizing requirements and not their own water use data, then they need to clarify this in rule.

Other Areas of Minimum Sizing Rule Lack Clarity

Other areas in the minimum sizing rule need additional clarity, according to engineers. For example, while the requirement is at the source, engineers are not consistently interpreting the rule correctly. Some are using source or production data while others are using metered data. If metered data is used, then unaccounted water must be added back into the calculation to correctly identify the amount of source water needed. Unaccounted water includes leaks, inaccurate meter readings, and unmetered connections. Addressing unaccounted water when using metered data is not made clear in rule.

Redundancy or a “safety factor” is another concern. Engineers are unclear if redundancy is included in the peak day indoor requirement of 800 gpd per connection or if it should be added to the 800 gpd per connection requirement. Additionally, the rules do not acknowledge how differences in source reliability influence the amount of redundancy needed in a given system.

Water System Engineers Need Clear Guidance

We believe that the DDW's regulatory framework should provide minimum standards that are tied to actual use data and take into consideration the appropriate safety factors needed in promoting adequate and safe drinking water. To do this, water system design engineers need a clear and meaningful regulatory framework. The regulations should also allow engineers to size the water source capacity in a manner than reflects the unique conditions presented by that water system. This specificity concurs with the division director's statement that "the minimum sizing numbers should not be used for actual design without evaluating each water system's unique conditions or actual use data."

In conclusion, we recommend that the division revise its rules governing the reduction of the source sizing requirements. Engineers should be able to obtain a reduction of the requirements when warranted, without needing to undertake an onerous process of collecting water use data from every meter during multiple years of service. We also recommend the division clarify the rules to ensure consistent interpretation.

Recommendations

1. We recommend that DDW revise R309-510-5 Reduction of Requirements in a manner that clarifies the process of obtaining a reduction when one is justified.
2. We recommend that DDW establish a written protocol to provide guidance for those interested in pursuing a reduction to the source sizing requirements.
3. We recommend that DDW consider creating a process for receiving a reduction to the source sizing requirements prior to building low water use developments.
4. We recommend that the DDW work to clarify in rule the following:
 - a. The intent behind the language "in the absence of firm water use data"

Water system design engineers need a clear and meaningful regulatory framework.

- b. How the requirements address unaccounted water
- c. How the requirements address redundancy

Appendices

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Appendix A

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Appendix A

R309-510 Facility Design and Operation: Minimum Sizing Requirements.

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R309-510. Facility Design and Operation: Minimum Sizing Requirements.

R309-510-1. Purpose.

This rule specifies requirements for the sizing of public drinking water facilities such as sources (along with their associated treatment facilities), storage tanks, and pipelines. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

R309-510-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-510-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-510-4. General.

This rule provides estimates of quantities and flow rates which shall be used in the design of new systems, or if there is an absence of data collected by the public water system meeting the required confidence level for a reduction mentioned below, when evaluating water sources, storage facilities and pipelines. Within each of these three broad categories, the designer shall ascertain the contributions on demand from the indoor use of water, the outdoor use of water, and fire suppression activities (if required by local authorities). These components must be added together to determine the total demand on a given facility.

Guidance: Rules in this section are designed to assure that a water system never runs out of water. This is not only an inconvenience for the public, but a risk to public health and safety. When a distribution goes dry, the risk of system contamination from in-leakage and backflow increases. Furthermore, no fire protection would be available. Thus, the design engineer must give careful consideration to the daily and yearly variations of demand and verify that the system facilities are sufficient. Furthermore, the design engineer shall consider how the

system would behave during drought periods when demands may be higher than usual, and source yield (particularly the of springs) will likely be reduced.

R309-510-5. Reduction of Requirements.

If acceptable data are presented, certain number of days of peak day demand to establish minimum source capacity; certain number of years of annual demand to establish minimum water right requirements; and certain number of readings of peak hourly demand to establish minimum peak instantaneous demand; showing that the requirements made herein are excessive for a given project, the requirements may be appropriately reduced to the 90th percentile of readings, on a case by case basis by the Director. In the case of Recreational Home Developments, in order to qualify for a quantity reduction, not only must the actual water consumption be less than quantities required by rule but enforceable policy restrictions must have been approved which prevent the use of such dwellings as a permanent domicile and these restrictions shall have been consistently enforced. The Director may re-consider any reduced minimums if the nature and use of the system changes.

R309-510-6. Water Conservation.

This rule is based upon typical current water consumption patterns in the State of Utah. They may be excessive in certain settings where legally enforceable water conservation measures exist. In these cases the requirements made in this section may be reduced on a case-by-case basis by the Director.

Guidance: Drinking water systems are encouraged to use the water resources of the state wisely. Conservation measures such as low flow toilets and low water demand landscaping (xeriscaping) may significantly reduce the demands on water systems.

R309-510-7. Source Sizing.

(1) Peak Day Demand and Average Yearly Demand.

Sources shall legally and physically meet water demands under two separate conditions. First, they shall meet the anticipated water demand on the day of highest water consumption. This is referred to as the peak day demand. Second, they shall also be able to provide one year's supply of water, the average yearly demand.

Guidance: If the above two criteria are met, the source(s) can be relied upon to adequately serve the system under most, if not all, conditions. The term “legally”, above, refers to what is permitted by the owner’s water right. The design engineer shall fully investigate the available water rights for a system. Water rights vary in the way they are written. Some are written in “cfs”, others are written in terms of “AF”. Still

others are written in terms of allowable acreage or livestock. Furthermore, water rights may be restricted to certain times of the year, or certain uses (e.g. irrigation). Consult the Division for assistance in determining how many connections a specific water right may support.

(2) Estimated Indoor Use.

In the absence of firm water use data, Tables 510-1 and 510-2 shall be used to estimate the peak day demand and average yearly demand for indoor water use.

Table 510-1 Source Demand for Indoor Use		
Type of Connection	Peak Day Demand	Average Yearly Demand
Year-Round Use		
Residential	800 gpd/conn	146,000 gal./conn
ERC	800 gpd/ERC	146,000 gal./ERC
Seasonal / Non-Residential Use		
Modern Recreation Camp	60 gpd/person	(see note 1)
Semi-Developed Camp		
a. With pit privies	5 gpd/person	(See note 1)
b. With flush toilets	20 gpd/person	(See note 1)
Hotels, Motel & Resort	150 gpd/unit	(See note 1)
Labor Camp	50 gpd/person	(See note 1)
Recreational Vehicle Park	100 gpd/pad	(See note 1)
Roadway Rest Stop	7 gpd/vehicle	(See note 1)
Recreational Home Development	400 gpd/conn	(See note 1)

Note 1. Annual demand shall be based on the number of days the system will be open during the year times the peak day demand unless data acceptable to the Director, with a confidence level of 90% or greater showing a lesser annual consumption, can be presented.

TABLE 510-2 SOURCE DEMAND FOR INDIVIDUAL ESTABLISHMENTS ^(a) (Indoor Use)	
Type of Establishment	Peak Day Demand (gpd)
Airports	
a. per passenger	3
b. per employee	15
Boarding Houses	
a. for each resident boarder and employee	50
b. for each nonresident boarders	10
Bowling Alleys, per alley	
a. with snack bar	100
b. with no snack bar	85

Churches, per person	5
Country Clubs	
a. per resident member	100
b. per nonresident member	25
c. per employee	15
Dentist's Office	
a. per chair	200
b. per staff member	35
Doctor's Office	
a. per patient	10
b. per staff member	35
Fairgrounds, per person	1
Fire Stations, per person	
a. with full time employees and food prep	70
b. with no full time employees and no food prep	5
Gyms	
a. per participant	25
b. per spectator	4
Hairdresser	
a. per chair	50
b. per operator	35
Hospitals, per bed space	250
Industrial Buildings, per 8 hour shift, per employee (exclusive of industrial waste)	
a. with showers	35
b. with no showers	15
Launderette, per washer	580
Movie Theaters	
a. auditorium, per seat	5
b. drive-in, per car space	10
Nursing Homes, per bed space	280
Office Buildings & Business Establishments, per shift, per employee (sanitary wastes only)	
a. with cafeteria	25
b. with no cafeteria	15
Picnic Parks, per person (toilet wastes only)	5
Restaurants	
a. ordinary restaurants (not 24 hour service)	35 per seat
b. 24 hour service	50 per seat
c. single service customer utensils only	2 per customer
d. or, per customer served (includes toilet and kitchen wastes)	10
Rooming House, per person	40
Schools, per person	75
a. boarding	15

b. day, without cafeteria, gym or showers	20
c. day, with cafeteria, but no gym or showers	25
d. day, with cafeteria, gym and showers	
Service Stations (b), per vehicle served	10
Skating Rink, Dance Halls, etc., per person	
a. no kitchen wastes	10
b. additional for kitchen wastes	3
Ski Areas, per person (no kitchen waste)	10
Stores	
a. per public toilet room	500
b. per employee	11
Swimming Pools and Bathhouses(c), per person	10
Taverns, Bars, Cocktail Lounges, per seat	20
Visitors Centers, per visitor	5

NOTES FOR TABLE 510-2:

1. Source capacity must at least equal the peak day demand of the system. Estimate this by assuming the facility is used to its maximum.
2. Generally, storage volume must at least equal one average day's demand.
3. Peak instantaneous demands may be estimated by fixture unit analysis as per Appendix E of the 2006 International Plumbing Code.

(a) When more than one use will occur, the multiple use shall be considered in determining total demand. Small industrial plants maintaining a cafeteria and/or showers and club houses or motels maintaining swimming pools and/or laundries are typical examples of multiple uses. Uses other than those listed above shall be considered in relation to established demands from known or similar installations.

(b) or 250 gpd per pump,

(c) $20 \times \{ \text{Water Area (Ft}^2) / 30 \} + \text{Deck Area (Ft}^2)$

(3) Estimated Outdoor Use.

In the absence of firm water use data, Table 510-3 shall be used to estimate the peak day demand and average yearly demand for outdoor water use. The following procedure shall be used:

Guidance: The demand on drinking water sources is related to whether the system supplies water for outdoor use such as the irrigation of lawns and gardens. While the indoor use of water can be expected to remain relatively constant throughout the state,

the outdoor use component is highly variable through the year, and is related to the amount of land irrigated as well as local climatological conditions.

(a) Determine the location of the water system on the map entitled Irrigated Crop Consumptive Use Zones and Normal Annual Effective Precipitation, Utah as prepared by the Soil Conservation Service (available from the Division). Find the numbered zone, one through six, in which the water system is located (if located in an area described "non-arable" find nearest numbered zone).

Guidance: The irrigation zone map is provided below. If you are viewing a printed copy of this rule, the map may be in black and white. A more usable colored version of the map may be viewed or downloaded from:

http://drinkingwater.utah.gov/irrigation_map_intro.htm

Tip: If you are viewing an electronic version of this rule, to make the map more readable use any zoom-in feature which may be available.

(b) Determine the net number of acres which may be irrigated. This is generally done by starting with the gross acreage, then subtract out any area of roadway, driveway, sidewalk or patio pavements along with housing foundation footprints that can be reasonably expected for lots within a new subdivision or which is representative of existing lots. Before any other land area which may be considered "non-irrigated" (e.g. steep slopes, wooded areas, etc.) is subtracted from the gross area, the Director shall be consulted and agree that the land in question will not be irrigated.

Guidance: For instance, in the case of a heavily wooded mountain home subdivision, it may be claimed that large lawns will not be put in by the lot owners. The division must review and concur with this judgment.

(c) Refer to Table 510-3 to determine peak day demand and average yearly demand for outdoor use.

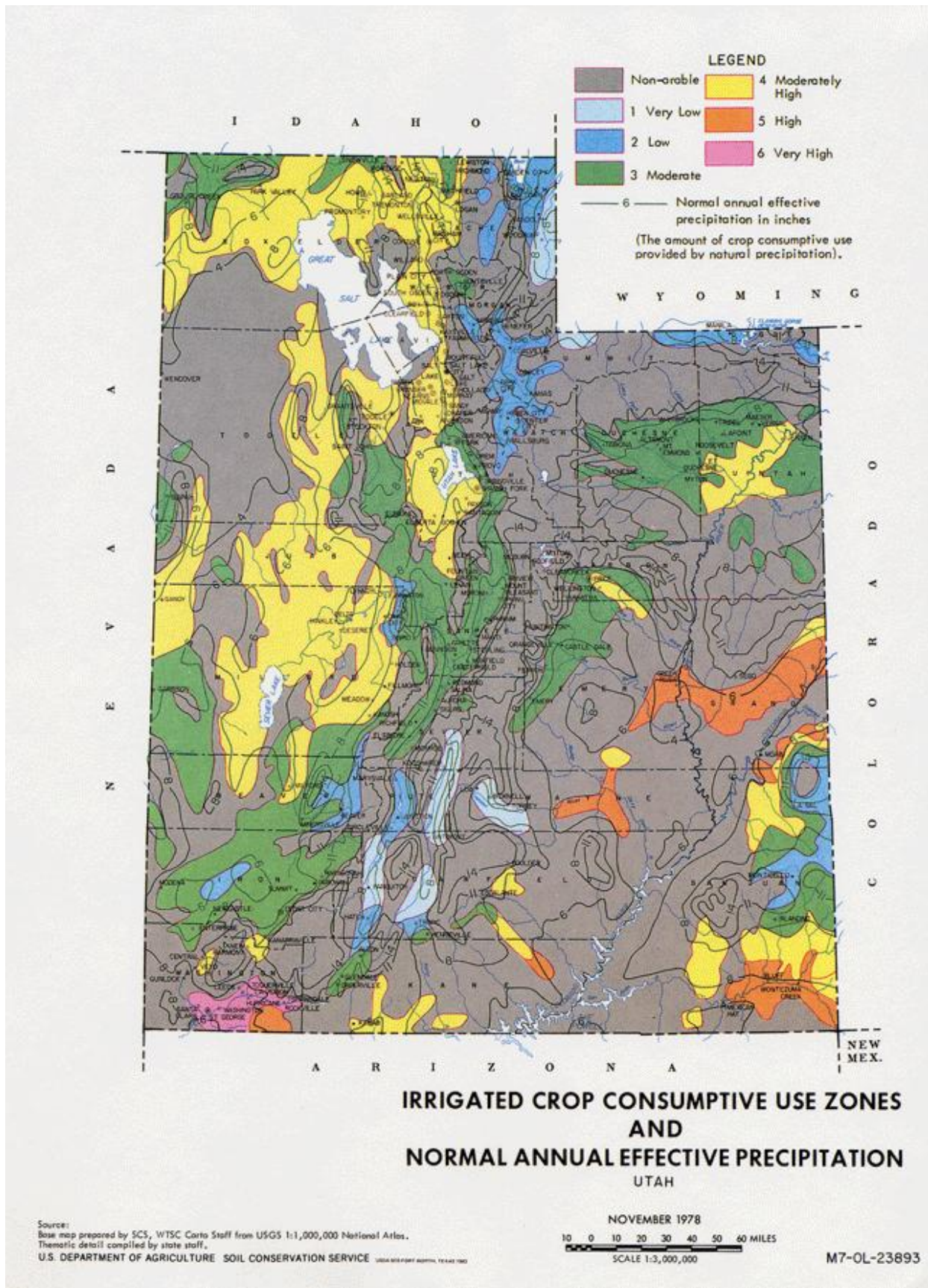
(d) The results of the indoor use and outdoor use tables shall be added together and source(s) shall be legally and physically capable of meeting this combined demand.

Table 510-3 Source Demand for Irrigation (Outdoor Use)		
Map Zone	Peak Day Demand(gpm/irrigated acre)	Average Yearly Demand(AF/ irrigated acre)
1	2.26	1.17
2	2.80	1.23
3	3.39	1.66
4	3.96	1.87
5	4.52	2.69
6	4.90	3.26

(4) Accounting for Variations in Source Yield.

The design engineer shall consider whether flow from the source(s) may vary. Where flow varies, as is the case for most springs, the minimum flow rate shall be used in determining the number of connections which may be supported by the source(s). Where historical records are sufficient, and where peak flows from the source(s) correspond with peak demand periods, the Director may grant an exception to this requirement.

Guidance: The design engineer is cautioned to thoroughly investigate spring behavior. During dry periods, springs (particularly those at higher elevations) may drastically decrease in flow. In assessing minimum flowrates of springs, watersheds shall be assumed to have received only 80% of normal precipitation.



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R309-510-8. Storage Sizing.

(1) General.

Each storage facility shall provide:

- (a) equalization storage volume, to satisfy average day demands for water for indoor use as well as outdoor use,
- (b) fire suppression storage volume, if the water system is equipped with fire hydrants and intended to provide fire suppression water, and
- (c) emergency storage, if deemed appropriate by the water supplier or the Director, to meet demands in the event of an unexpected emergency situation such as a line break or a treatment plant failures.

(2) Equalization Storage.

- (a) All public drinking water systems shall be provided with equalization storage. The amount of equalization storage which must be provided varies with the nature of the water system, the extent of outdoor use and the location of the system.
- (b) Required equalization storage for indoor use is provided in Table 510-4. Storage requirements for non-community systems not listed in this table shall be determined by calculating the average day demands from the information given in Table 510-2.

Table 510-4 Storage Volume for Indoor Use	
Type	Volume Required(gallons)
Community Systems	
Residential; per single resident service connection	400
Non-Residential; per Equivalent Residential Connection (ERC)	400
Non-Community Systems	
Modern Recreation Camp; per person	30
Semi-Developed Camp; per person	
a. with Pit Privies	2.5
b. with Flush Toilets	10
Hotel, Motel, & Resorts; per unit	75
Labor Camp; per unit	25
Recreational Vehicle Park; per pad	50
Roadway Rest Stop; per vehicle	3.5

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Recreational Home Development; per connection	400
---	-----

(c) Where the drinking water system provides water for outdoor use, such as the irrigation of lawns and gardens, the equalization storage volumes estimated in Table 510-5 shall be added to the indoor volumes estimated in Table 510-4. The procedure for determining the map zone and irrigated acreage for using Table 510-5 is outlined in Section R309-510-7(3).

Table 510-5 Storage Volume for Outdoor Use	
Map Zone	Volume Required (gallons/irrigated acre)
1	1,782
2	1,873
3	2,528
4	2,848
5	4,081
6	4,964

(3) Fire Suppression Storage.

Fire suppression storage shall be required if the water system is intended to provide fire fighting water as evidenced by fire hydrants connected to the piping. The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration. This information shall be provided to the Division. Where no local fire suppression authority exists, needed fire suppression storage shall be assumed to be 120,000 gallons (1000 gpm for 2 hours).

Guidance: The 1991 Uniform Fire Code has been adopted statewide in Utah. However, local authorities are authorized to deviate from this code if it can be justified. Normal fire storage volume is given in Table A-III-A-1 of the code. According to this table, flow duration must be 2 to 4 hours depending on the size and type of structure which must be protected. Fire flow storage for a one or two family dwelling of less than 3,600 square feet would be 120,000 gallons (1,000 gpm x 120 minutes). Larger volumes would be required for other structures.

(4) Emergency Storage.

Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system dependability. The Director may require emergency storage when it is warranted to protect public health and welfare.

Guidance: It is advisable to provide water storage for emergency situations, such as

pipeline failures, major trunk main failures, equipment failures, electrical power outages, water treatment facility failures, raw-water supply contamination, or natural disasters. Generally, the need for emergency storage shall be determined by the water supplier and design engineer.

R309-510-9. Distribution System Sizing.

(1) General Requirements.

The distribution system shall be designed to insure that minimum water pressures as required in R309-105-9 exist at all points within the system. If the distribution system is equipped with fire hydrants, the Division will require a letter from the local fire authority stating the fire flow and duration required of the area to insure the system shall be designed to provide minimum pressures as required in R309-105-9 to exist at all points within the system when needed fire flows are imposed upon the peak day demand flows of the system.

(2) Indoor Use, Estimated Peak Instantaneous Demand.

(a) For community water systems and large non-community systems, the peak instantaneous demand for each pipeline shall be assumed for indoor use as:

$$Q = 10.8 \times N^{0.64}$$

where N equals the total number of ERC's, and Q equals the total flow (gpm) delivered to the total connections served by that pipeline.

Guidance: The equation above shall only be used to estimate the flow required for N connections from a single pipeline and shall not be used to estimate node or junction demands utilized in hydraulic analyses.

For Recreational Vehicle Parks, the peak instantaneous flow for indoor use shall be based on the following:

Table 510-6 Peak Instantaneous Demand for Recreational Vehicle Parks	
Number of Connections	Formula
0 to 59	$Q=4N$
60 to 239	$Q= 80+ 20N^{0.5}$
240 or greater	$Q= 1.6N$

NOTES FOR TABLE 510-6:

R309-510 Facility Design and Operation: Minimum Sizing Requirements

Q is total peak instantaneous demand (gpm) and N is the maximum number of connections. However, if the only water use is via service buildings the peak instantaneous demand shall be calculated for the number of fixture units as presented in Appendix E of the 2006 International Plumbing Code.

(b) For small non-community water systems the peak instantaneous demand to be estimated for indoor use shall be calculated on a per-building basis for the number of fixture units as presented in Appendix E of the 2006 International Plumbing Code.

(3) Outdoor Use, Estimated Peak Instantaneous Demand.

Peak instantaneous demand to be estimated for outdoor use is given in Table 510-7. The procedure for determining the map zone and irrigated acreage for using Table 510-7 is outlined in Section R309-510-7(3).

Table 510-7 Peak Instantaneous Demand for Outdoor Use	
Map Zone	Peak Instantaneous Demand (gpm/irrigated acre)
1	4.52
2	5.60
3	6.78
4	7.92
5	9.04
6	9.80

(4) Fire Flows.

(a) Distribution systems shall be designed to deliver needed fire flows if fire hydrants are provided. The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration. This information shall be provided to the Division. Where no local fire suppression authority exists, needed fire flows shall be assumed to be 1000 gpm unless the local planning commission provides a letter indicating that the system will not be required to provide any fire flows, in which case fire hydrants will not be allowed to be installed on any mains.

Guidance: Generally, fire flows shall be as required by Appendix B of the 2003 International Fire Code. According to this appendix, minimum fire flow for a one or two family dwelling not exceeding 3,600 square feet is 1,000 gpm. Fire flows for other types of buildings are higher. The 2003 International Fire Code

has been adopted statewide in Utah. However, local authorities are authorized to deviate from this code if it can be justified.

(b) If a distribution system is equipped with fire hydrants, the system shall be designed to insure that minimum pressures required by R309-105-9 exist at all points within the system when fire flows are added to the peak day demand of the system. Refer to Section R309-510-7 for information on determining the peak day demand of the system.

KEY: drinking water, minimum sizing, water conservation
Date of Enactment or Last Substantive Amendment: August 28, 2013
Notice of Continuation: March 22, 2010
Authorizing, and Implemented or Interpreted Law: 19-4-104

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Agency Response

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State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF DRINKING WATER
Kenneth H. Bousfield, P.E.
Director

December 9, 2014

John M. Schaff, CIA Auditor General
West 315 Utah State Capital Complex
PO Box 145315
Salt Lake City, Utah 84114-5315

Dear Mr. Schaff,

The purpose of this letter is to respond to the Legislative Audit Report, prepared by your office, regarding the Division of Drinking Water's source capacity requirements. The division's and the Drinking Water Board's authority, as set forth in State statute (19-4 UCA) has two specific objects: 1) that drinking water systems within the State provide safe water to drink and 2) that drinking water systems provide sufficient water to satisfy water user's needs. Those needs can include water for: drinking, cooking, cleaning, personal hygiene, outside irrigation and fire protection. Hence the subject covered by the Audit is extremely important. As such the resultant requirements must be both justified by actual measured data and conservative.

First of all I'd like to thank your staff. We have had numerous meetings with your staff and found them to be very professional and thorough in their investigation. We also appreciate the findings and recommendations of the report. Specifically we appreciate that the report recommends a more detailed investigation be conducted to validate the indoor and outdoor use capacities needed to meet the demands placed on water systems.

Issues and Tasks Related to Implementing Recommendations of Chapters 2 and 3

1. Recommendation 1 of Chapter 2 found on page 18: "We recommend that DDW re-evaluate its indoor source sizing regulations and issue a set of revised standards that are based on actual indoor use data provided by Utah water systems"

The division intends to take a two pathway approach in addressing this issue. This involves allowing an engineer submitting plans to either: a) submit a design based on the researched and validated statewide standard, or b) provide justification for an alternate standard based on specific detailed information related to the system for which the design is being prepared. Taking this two pathway approach enables the division to also accommodate recommendations: 1 and 3 of Chapter 4 found on page 35.

Note that in order for the division to ensure that water systems are able to satisfy all of the water user's needs, water systems must be designed based on peak flows rather than average flows. To

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come up with a justifiable peak flow requirement, the Division will need to investigate a sufficient number of systems' peak day usage data in order to have the confidence that the statewide requirement is appropriate. There are two problems with coming up with accurate data.

First, the division would need to look at water systems that provide both indoor and outdoor uses and tease out the number for just indoor usage. A logical approach to this problem is to identify winter demand as the indoor component and the summer demand as a combination of both indoor and outdoor demand. However, if one looks at the graph presented on page 14 of the Audit Report, they will see that Centerville, which only provides indoor water to its residents, has seasonal fluctuations. This table shows that the summer demand is approximately 50% higher than the winter demand.

Second, the division needs to obtain data from systems that might not have the technology or infrastructure necessary to obtain peak use data without costly upgrades or employing labor intensive methods. This would include looking at water systems that serve unmetered connections. It is important to include these systems in a representative data set as water systems often find that, after installing meters, the overall water usage is significantly reduced. Water systems that have peak usage data available are usually large, well-managed systems that use less water than other systems. In establishing a statewide standard, it is imperative that we obtain representative data from the wide variety of systems found in Utah. In order to do this, it is likely that some of the smaller systems may need to install the equipment necessary to gather the data from their sources or service connections.

2. Recommendation 1 of Chapter 3 found on page 25 of the report: "We recommend that DDW review its outdoor source sizing requirements and establish new requirements based on current research that are consistent with actual outdoor water use data."

Determining the outdoor source sizing requirement will be particularly difficult to accomplish because we know of no water system in the state that measures the water used for outdoor uses separately from indoor use. We propose to research available studies and reports on irrigation use in Utah and seek input from Utah State University as we reevaluate the outdoor water use regulation. It is likely that we will use a similar methodology as currently outlined in the division's regulations, because of the lack of actual field data. Specifically this deals with: a) determining the area within the state where the water system is located, which determines the irrigation zone, b) determining the demand in gallons per minute per irrigated acres, and c) multiply the factor identified in "c" by and acreage identified in "a". We intend to add default factors addressing evaporation and leak losses based on the irrigation delivery methods and condition of the piping to the R309-510 rule. Such factors can be adjusted according to a water system's specific data.

3. Implementing the recommendations presented in the report will take time and resources to obtain verified revised statewide standards. The Division intends to pursue the following actions:
 - a. Send out a survey to community water systems and water system consultants in January 2015 to solicit their interest in participating in the water use study, specifically for peak day use, yearly average use, indoor and/or outdoor water uses. The survey will be done in collaboration with Brigham Young University Romney Institute as a continuation of the study that was initiated in September 2014.
 - b. Based on the survey results, identify possible candidates of a statewide water use study by June 2015. The selected water systems should represent an adequate number of water systems, various sizes of water systems (large versus small), rural versus urban areas,

various climate zones, metered versus unmetered service connections, indoor water use only versus combined or separated indoor/outdoor uses, etc.

- c. Compile a proposal for a statewide water use study in September 2015. This proposal will identify the participating water systems, any needs for monitoring equipment such as: installing meters and/or installing new or modified SCADA systems along with the associated costs. Further the compiled report would include available reports and information on irrigation use in the State of Utah. The compiled report would make a recommendation as to whether division staff and/or a contractor would proceed with: collecting the data and analyzing it. The proposal would also include an estimate of the time frames to complete the work.
- d. The completed proposal will be used to justify a funding request in October of 2015 for consideration in the Fiscal Year 2017 budget. The division may explore cooperation with other funding entities (such as our division's Water Security Account funds and/or the Divisions of Water Rights' and Water Resources' funds).
- e. If funding is approved, or partially secured from other funding entities, the proposed statewide water use study would proceed. The division plans to start the study as soon as possible and cover 3 peak operating seasons, to account for dry or wet years. The division will then be able to evaluate the indoor and outdoor minimum sizing requirements based on realistic and representative data gathered during the study and make appropriate revisions to the rules.

Issues and Tasks Related to Implementing Recommendations of Chapter 4

4. Recommendation 1 of Chapter 4 found on page 35 of the report: "We recommend that DDW revise R309-510-5, Reduction of Requirements, in a manner that clarifies the process of obtaining a reduction when one is justified."

Currently the division has a provision in its regulations that allows for a water system to seek and obtain a reduction of its source sizing requirements. The division strongly agrees that it has an obligation to be as clear as it can be for all of its regulations. Consequently the division plans to update and clarify that portion of our rules and supplement it with guidance documents. We also plan on developing case histories of past and unique future reductions to give engineering designers and water system managers and operators ideas on options to discuss with the division in anticipation of preparing an application. Also as noted in item # 1 of this letter discussing Recommendation 1 of Chapter 2; the suggested rule revision would encourage a reduction request discussion.

5. Recommendation 2 of Chapter 4 found on page 35 of the report: "We recommend that DDW establish a written protocol to provide guidance for those interested in pursuing reduction to the source sizing requirements."

The division will pursue this recommendation and will follow the direction and use similar language of the second pathway mentioned in Item #1 of this letter under Recommendation 1 of Chapter 2.

6. Recommendation 3 of Chapter 4 found on page 35 of the report: "We recommend that DDW consider creating a process for receiving a reduction to the source sizing requirements prior to building low water use developments."

The Division will pursue this recommendation as noted in Item #1 of this letter under Recommendation 1 of Chapter 2.

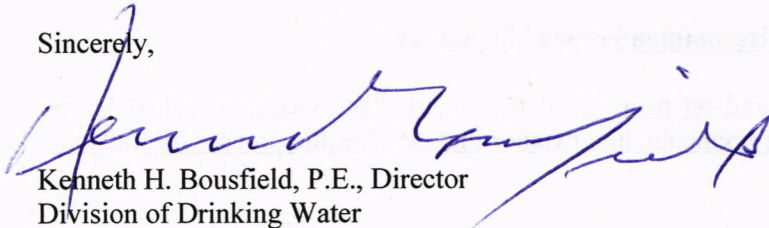
7. Recommendation 4 of Chapter 4 found on pages 35 and 36 of the report: "We recommend that DDW work to clarify in rule the following: a) the intent behind the language "in the absence of firm water use data," b) how the requirements address unaccounted water, and c) how the requirements address redundancy."

The division will incorporate these clarifying concepts into the revised rule.

8. The division intends to revise R309-510 in 2015 to provide clarifications per the four recommendations listed in Chapter 4 of the report. The revision of the indoor and outdoor minimum standards (recommended in the Chapters 2 and 3 of the audit report) will be the division's long term goal and will depend on the outcome and time frame of the statewide water use study mentioned above.

In implementing the above stated intentions, the division may see it desirable to consult with representatives of the Office of the Legislative Auditor General in establishing our indoor and outdoor requirements as well as our effort to make our rules as clear as possible. We hope you will be amenable to such contacts.

Sincerely,



Kenneth H. Bousfield, P.E., Director
Division of Drinking Water
Utah Department of Environmental Quality

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