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WATER CONNECTION CHARGES: A TOOL FOR ENCOURAGING WATER-EFFICIENT GROWTH

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This report is a collaborative effort between Western Resource Advocates (WRA), the Environmental Finance Center (UNC) at University of North Carolina and Ceres. Amelia Nuding (WRA) and Jeff Hughes (UNC) were the lead authors. Sharlene Leurig (Ceres) provided significant contributions. Essential research support was provided by intern Josh Boissevain (WRA). Production was facilitated by Sharlene Leurig, Peyton Fleming (Ceres), Joan Clayburgh (WRA), with copy editing by Mary Headley and design by Patricia Robinson.

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Executive Summary

One of the greatest challenges facing many U.S. communities today is supporting a growing population with limited water resources. Conservation is widely acknowledged as a critical part of the solution, but often utility conservation efforts are heavily focused on existing customers and ignore new customers at the crux of the challenge. This first-of-its-kind report focuses on the extent to which water connection charges are encouraging water-saving design in new construction and landscaping before ground is broken.

Water connection charges — also called tap fees, impact fees, system development charges, or plant investment fees — are one-time charges assessed to new developments to help pay for the direct costs of connecting to a utility's water system, and for the infrastructure and water resources capacity needed to support these new developments. These one-time charges provide utilities with much-needed revenue to pay for water system infrastructure; importantly, they can also be designed to influence water demand in new developments.

Although extensive research has been done on how to price the volume of water sold month by month in order to encourage water efficiency in residential and business customers, far less attention has been focused on structuring connection charges in ways that will encourage developers to incorporate water-saving features into project designs.

For this report, we surveyed 800 water connection charge structures used by communities in Georgia, North Carolina, Arizona, Colorado, and Utah. These states are five of the fastest-growing states in the U.S. and have all experienced some degree of water scarcity and resource vulnerability. They are, therefore, more likely to have connection charges designed to influence future water demand.

Our research of single-family home connection charges revealed the following trends:

- ***Most communities assess uniform connection charges for all single-family units.***

More than 90% (689 of 740 connection charges) of the Southeastern communities researched, and more than 60% (37 of 60 charges) of the Western communities researched, use a uniform water connection charge for single-family homes. A uniform structure means that no matter the size, location, or outdoor landscaping of the home, every single-family residential unit pays the same amount to be connected to the water system if they use a standard-sized residential meter. This provides no incentive for builders to construct more water-efficient developments.

- ***Meter size — the basis for most uniform charges — fails to correlate strongly with water use.***

Meter size alone is an imprecise predictor of the long-term actual water use patterns of residential customers. Numerous studies, a few of which are highlighted in this report, have demonstrated how different homes can have very different water demands, both seasonally and annually. Customers with larger demands contribute to larger water system capacity

needs (infrastructure and water acquisition), and vice versa. Thus, water connection charges relying solely on water meter size not only fail to allocate costs fairly among customers, but they also provide little to no water saving incentives.

A few communities used a variety of factors to more accurately scale the connection charge in proportion with the predicted water demand of single-family units.

A minority of the communities researched used a variety of factors to determine water connection charges for single-family residential homes, sometimes in combination with meter size. These multi-factor connection charges aimed to correlate the charge with predicted water usage. Many of these types of charges were found in Colorado, but examples were found in all states researched except Georgia. Factors often included were:

- **Size of lots/irrigated areas.** The larger the lot or irrigated area, the more water is likely to be used and the higher the charge, thereby encouraging smaller irrigated areas.
- **Water demands of different types of landscape.** Some utilities charge less if the landscape has low-water-using plants or no-water-using plants, and charge more for turf grass.
- **Efficiency of water fixtures.** Some utilities charge less if indoor water appliances are efficient, such as low-flow showerheads and low-flow toilets.
- **Home size** (measured in square footage, number of bedrooms, or number of bathrooms). The larger the house, the higher the water use is likely to be.

Case studies highlight the potential for these charges to change development patterns and more fairly allocate costs among customers.

In a handful of communities, especially in water-parched Colorado, connection charges have been used successfully to reduce the water footprint of new residential and commercial developments, and to more fairly allocate costs among customers. These communities also found it more cost-effective to avoid new infrastructure expenditures by encouraging efficiency at the outset, rather than implement conservation programs after new developments were established. While these examples show enormous promise that other water systems may want to consider, they are largely the exception rather than the rule among the 800 utilities we evaluated.

Aurora, Colorado, the state's third-largest municipality, developed an incentive to encourage the use of native plants that require no irrigation water (after the initial establishment period) in large landscaped areas in new developments. Since its adoption in mid-2014, five of six new developments have elected this "z-zone" option, in which the developer receives a 100% refund on connection charges for zero-water-use landscapes. This will result in an estimated water savings of 21 acre-feet per year — enough for 42 families of four for almost a year.

In **Fountain, Colorado**, connection charges for new residential homes are determined in part by the type of landscaping — water-conserving landscapes pay significantly less than turf-only landscapes. Since mid-2014, about 75% of proposed new residential homes feature water-conserving landscapes.

After discovering that the residential sector had effectively been subsidizing commercial sector fees, the City of **Westminster, Colorado**, developed a system in 1998 to more fairly allocate charges among its customers. Connection charges for commercial businesses are based on the type of establishment (such as restaurant, office, or hotel) and the typical water usage of that type of establishment, rather than just the water meter size. As a result, all new customers now pay for their proportionate share of the water system costs, and there is greater equity between customer classes.

In 1997, the **Orange Water and Sewer Authority (OWASA)** in North Carolina developed a connection charge system for single-family units that is based on square footage. OWASA also requires the payment of additional connection charges for new properties with residential irrigation systems. This has resulted in a system that better links connection charges to actual costs; this system more fairly allocates costs within the residential sector, lessens the financial impact on low-income residents, and provides alignment with the Authority's water conservation objectives.

This report recommends:

- ***Utilities should consider refined, multi-factor connection charges to encourage water efficiency of new developments and capture the true costs of new development.*** While no factor is foolproof in forecasting capacity demands, the fairness of refined, demand-based factors, such as lot size and outdoor irrigation design, should be weighed against uniform connection charges relying only on meter size.
- ***Utilities should consider putting in place mechanisms to ensure longevity of water savings.*** To ensure the longevity of customer water savings, utilities can implement mechanisms and policies to address changes made by customers that lead to future unexpected increases in their water use (such as replacing xeriscaping with a lawn or adding another bathroom). This may include the use of metering and data-collection technologies to monitor use, and setting triggers that lead to collection of supplemental connection charges, either through rates or through an incremental capacity charge. The use of tiered water rates linked to water budgets can also be used to assure that customers that make changes that influence their long-term water demand pay more in the future.
- ***Utilities should invite customers and developers into the connection charge design process.*** Working with key stakeholders can help gain support for the new program and increase adoption of more water-efficient development proposals early on in the program.
- ***Local policymakers and planners should recognize the importance of connection fees in shaping future water demand and development patterns, and in managing costs of this fundamental service.*** Quite simply, connection charges can help ensure sustainable economic growth amid increasing water scarcity. Growing as water-efficiently as possible is one way to stretch new and existing water infrastructure, and to delay or avoid the need for costly new capacity-expansion projects.

Chapter 1: Overview of Water Connection Charges

Many communities use water connection charges to pay for the direct costs of making a connection and/or past and future water system capacity investments, with the view that "growth should pay for growth." *Water connection charges* — a broad term that is used differently across the country — may include one or more charges with names such as tap fees, capacity charges, system development fees, impact fees, or plant investment fees. This family of fees are one-time charges applied to new development to help pay for the direct costs of making a connection (such as extending transmission lines and purchasing meters) as well as the infrastructure and water resources that have been created to support new development. These kinds of charges are not unique to water systems; they are also commonly charged to new developments to help pay for essential infrastructure and services, such as roads, parks, fire departments, and sewer systems. Water connection charges provide utilities with much-needed revenue to pay for expanding water system services and can be tailored to influence the water footprint of new developments.

Many regions of the United States face compounding challenges of population growth, water scarcity, and resource vulnerability. Connection charges provide an opportunity to manage future water demand and shape new development patterns by more clearly linking the connection charge to the likely water use of the home or business being connected to the water system. Connection charges can take into consideration several factors that shape water use: the size of a lot or its irrigated area, the water demands of different types of landscape, the efficiency of interior water fixtures and plumbing design, and/or the number of bathrooms or water-using fixtures.

These kinds of ***multi-factor connection charges*** can better cover the true costs that different types of development impose on water utilities. A large home and a small home may require the same water meter size, but may use dramatically different water volumes, imposing very different costs on their utilities. Thus, multi-factor connection charges may also be able to more fairly allocate costs among new customers. Yet despite the importance of these factors in predicting customer demand and usage, many utilities base connection charges solely on meter size.

Multi-factor connection charges can better cover the true costs that different types of development impose on water utilities.

Connection charges can also be structured to provide a financial incentive to encourage water-efficient development. For example, if a lower cost per square foot is charged to developments with low-water-using plants compared with high-water-using turf grass, it can incentivize developers to design large landscaped areas with low-water-using plants. The same can be done to incentivize building interiors with highly water-efficient fixtures and plumbing.

Utility Costs Depend Largely on the Capacity Costs of Their System

Water utilities provide customers two interrelated but fundamentally distinct services — units of water for use today and reserved capacity in treatment, storage, and distribution infrastructure for tomorrow. The first service is what most customers think they purchase from their water utilities. In the vast majority of cases, most of the money that customers pay to their utility each month is a function of the volume of water they used, despite the fact that for most utilities, their monthly costs have little do with how much water they sell. Most utilities' costs are driven by the "capacity" of their water assets — storage, treatment, and delivery infrastructure — fixed costs that occupy, on average, about 80% of utilities' total costs no matter how much water their customers use. Utilities size their facilities to meet future capacity needs of their customers. The size of the facility determines the initial cost and debt payments, along with the number of people needed to run the facility — factors that do not change if people use less water.

To understand how a customer's water use shapes a utility's capacity costs, let's look at two customers. Customer A uses 5,000 gallons every month except for each June, when this retired couple's outdoor water use peaks at 20,000 gallons. Next door, Customer B has no lawn and dislikes gardening, but this four-person household uses 8,000 gallons every month. In total, Customer A uses 75,000 gallons a year and Customer B uses 96,000 gallons a year.

Intuitively, it would seem that Customer B would pose the higher cost to the water utility. But in reality, Customer A likely places a higher cost burden on the utility, even though this household uses less water in total. The reason is that most utilities plan their capacity and invest in storage, treatment, and distribution infrastructure based on peak use. This means that the water utility must build its infrastructure to deliver 20,000 gallons to Customer A year-round, even though use only spikes to this level one month a year. The pronounced cost of marginal capacity is the reason that many utilities attach a cost to customers' capacity as well as gallons of water sold.

Upfront Charges to New Development

The concept that water connection should carry a cost is straightforward. How to allocate the cost, however, is a complex task on which there is no universal agreement. While there are a handful of established guides and practices that address pricing of connection charges,[1] utilities across the country employ a dizzying array of approaches, charges, and terms for this basic concept.

Much has been written on how to price the volume of water sold in a given month in order to incentivize efficiency.[2] Far less has been written on how to determine stand-alone connection charges in order to influence development behavior.

1 A) American Water Works Association. 2012. *M1 Principles of Water Rates, Fees and Charges*, 6th Edition. Available from http://www.awwa.org/store/productdetail.aspx?productid=28731. B) Water Environment Federation. 2004. *Financing and Charges for Wastewater Systems*. New York: McGraw-Hill. Available from http://www.wef.org/publications/page_wet.aspx?id=5613&page=ca&section=Water%20Volumes.

2 Tiger, Mary, Jeff Hughes, and Shadi Eskaf. 2014. *Designing Water Rate Structures for Conservation & Revenue Stability*. (A collaborative effort within the Environmental Finance Center at the University of North Carolina, Chapel Hill, and with the Sierra Club, Lone Star Chapter.) http://texaslivingwaters.org/wp-content/uploads/2014/03/Texas-Rate-Report-2014-Final-1.pdf.

DEFINITION

Tap Fee

A tap fee typically covers the purchase of the meter, labor, and equipment necessary to make the physical connection, as well as administrative time.

Capacity Charge

A capacity charge covers a portion of the costs associated with the capacity that the utility has developed to serve the customer, for example the treatment plant(s), the distribution network, and water rights acquisition.

Water Connection Charge

We consider water connection charges to include both the tap fee and capacity charge.

It is common for customers and developers requesting water service for the first time to pay one or more charges prior to getting service. Here are some of the common charges a new customer may expect to pay:

- Most utilities will assess a charge to cover the cost of connecting the new development to the main water system. This ***tap fee*** typically covers the purchase of the meter, labor, and equipment necessary to make the physical connection, as well as administrative time to add the customer to the utility's list of customers in various databases. These charges are direct costs and should be treated as utility operating revenue.
- A ***capacity charge*** is often added prior to a connection to cover a portion of costs associated with the capacity that the utility has developed to serve the customer. Some utilities recover their capital and capacity investments from their customers over time through monthly bills. However, as capacity costs in many areas have become more expensive, a growing number of utilities are recovering a significant part of their capacity costs from new customers at the time of connection.

Unfortunately for researchers studying these charges, there is no standard terminology for either of these components, making research on water connection charges more complex. Some utilities present customers and developers with a menu of discrete charges, while others lump them into a single charge. A utility may blend these distinct charges together or use the term "tap fee" for very different types of services rendered, blurring the distinction between a direct connection cost and a capacity charge. Many states have their own terminology based on historical use or state law. Capacity charges may be labeled system development charges, impact fees, facility fees, or otherwise.

In this report, we will refer to this family of one-time fees paid by customers or developers as ***water connection charges***. Thus, we consider water connection charges to include both the tap fee and capacity charge.

Principles of Water Connection Charges

The philosophy that growth should pay for growth has begun to dominate the policy dialogue in many communities, particularly high-growth communities where the costs of meeting growth have spiraled. A community experiencing population downturns and excess water infrastructure capacity may need growth to support the cost of services to existing customers and, therefore, may hold down capacity charges to attract new customers, instead recovering the cost of capacity through monthly payments. On the other hand, in areas with severe capacity restraints due to precipitous growth, connection charges have become an essential way to allow communities to implement policy directives to require growth to pay for itself.

The location and ownership structure of a utility can have a major impact on connection charge options. Some states have very prescriptive terminology and rules for how utilities can design connection charges, while other states have no overall legal framework, let alone rules about what these fees should be called. In most states, investor-owned utilities that are regulated by a utility commission or a public service commission must follow different rules for creating and modifying fees than those that are publicly owned and operated.

Water utilities facing severe water capacity restraints are much more likely to rely on connection charges that include capacity charges to pay for system expansion. For these communities, considering factors in addition to meter size can allow connection charges to become a powerful tool for promoting water-efficient development that limits the capital cost of system expansion and the long-term cost of water delivery. For example, a utility with highly constrained water supplies

may not be able to service many more 20,000-gallon-a-month irrigators and may want to structure a connection charge to dampen the potential of adding more high-use customers.

The design of connection charges poses two fundamental decisions for a utility:

- What types of costs should be recouped from new customers?
- How much of those costs should an individual customer or customer class bear?

As far as what costs to recoup from customers, the first decision is whether to recover only some or all of the direct costs associated with making the tap or whether to also recover a portion of the costs associated with providing water supply, distribution system, and facility capacity to the new customer.

The approaches for calculating the capacity charge component of connection charges (often referred to as system development charges) are more complicated, but, in simplistic terms, can be presented as considering the costs of existing unused capacity or the costs of future unbuilt capacity. Utilities can calculate these costs and allocate either one, or a blend of the two, to new customers. Industry guides, such as the American Water Works Association's M1 Principles of Water Rates, Fees and Charges and the Water Environment Federation's Financing and Charges for Wastewater Systems, present different cost accounting and allocation methods that utilities can use.

Allocating Costs to Customers

The next critical step is determining how much of these existing and future costs an individual customer should be charged. There are many ways to calculate this allocation.

There is relatively little water-saving incentive on the residential side if connection charges are based solely on meter size.

For residential customers, the most prevalent allocation method is to assume that all customers using a specific meter size place the same tap and capacity demands on their utility. The meter size — which is defined by the size of the pipe connecting the customer's plumbing to the main water system — largely determines the direct costs (meter and meter vault, boring, etc.) of making the tap and also dictates the maximum amount of water that a customer could theoretically use in any given moment. However, the meter size alone is an imprecise predictor of the true capacity impact across the single-family customer class. To use the example from earlier, a customer using 20,000 gallons in summer months and a neighbor using 8,000 gallons in summer months are both likely to be served by meters of the same size. As a result, there is relatively little water-saving incentive on the residential side if connection charges are based solely on meter size.

Nonresidential customers may have a slightly more pronounced incentive in their connection charges, since meter sizes vary more significantly between different businesses. For this sector as well, however, meter size alone is a weak proxy for capacity. As one example, a car wash and an office building may both require a two-inch meter, but a car wash uses significantly more water than does an office.

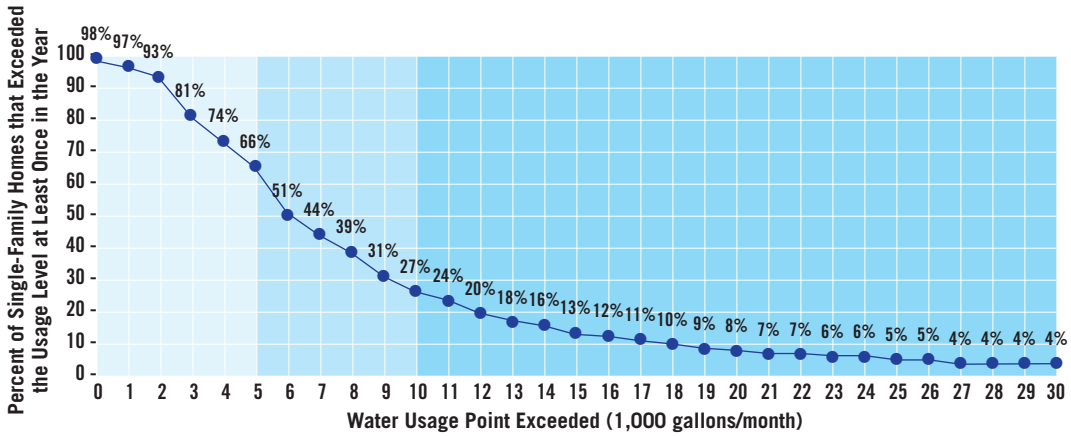
Customer-level analyses in both dry[3] and water-rich[4] climates have highlighted the variation in usage and demand patterns among customer classes, demonstrating that water demand and meter size are not well correlated. Figure 1 shows the distribution of water use across

3 Brand, Cortney C., and Douglas Frost. 2015. "Understanding Declining Water Demand: New Approaches to Research and Projections." Paper presented at the 2013 Utility Management Conference, Glendale, Ariz., March 10–13. http://www.brownandcaldwell.com/technicalPapersAbstract.asp?TPID=6501.

4 Boyle, Christine E., Shadi Eskaf, Mary Tiger, Hughes Wyatt, and Jeffrey A. Hughes. 2011. "Mining Water Billing Data to Inform Policy and Communication Strategies." *Journal – American Water Works Association* 103(11): 45–58. http://www.awwa.org/publications/journal-awwa/abstract/articleid/29082.aspx.

the single-family customer class for a Southeastern utility.[5] At one end of the usage spectrum, 10% of the customer base uses more than 18,000 gallons per month at least once during the year. For the same utility, approximately 25% of its customers never even exceed 4,000 gallons per month during the year. Clearly these groups of customers require different capacity commitments from their utility.

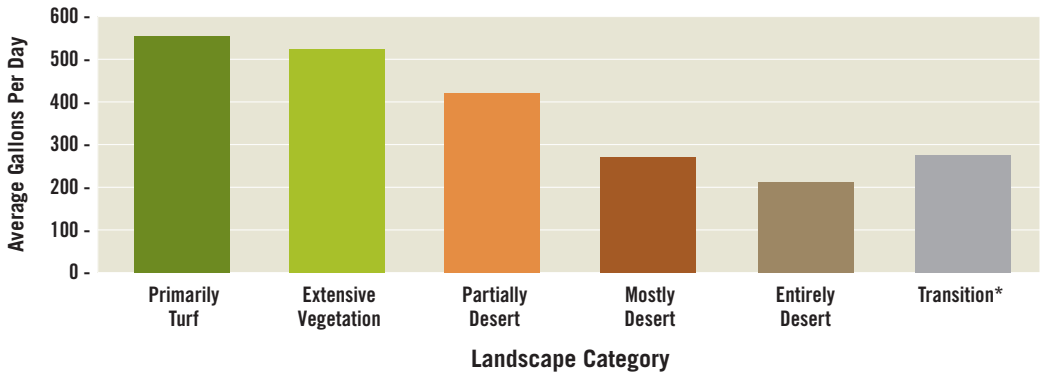
Figure 1. Single-Family Customers' Water Use Varies Widely.



The monthly water use of residential customers for this Southeastern utility demonstrates the potential for customers with the same meter size to use widely different amounts of water. This chart shows the percentage of customers that used more than a given amount of water use in at least one month per year. For example, at this utility, 26% of customers never used more than 4,000 gallons/month, while 10% of customers used more than 18,000 gallons in at least one month.

The same variation in usage among single-family units exists in the Western region, as demonstrated by Figure 2, which shows the variation in average use based on landscaping.[6]

Figure 2. Phoenix Single Family Water Use Varies by Landscape Category (2010-2012).



Single-family water use in Phoenix is affected by landscape type. Water use increases with turf and extensive vegetation, and decreases with desert-related landscapes.

*Transition turf means dying, dead, dormant, or difficult to define.

5 Source: Boyle, Christine E., Shadi Eskaf, Mary Tiger, Hughes Wyatt, and Jeffrey A. Hughes. 2011. "Mining Water Billing Data to Inform Policy and Communication Strategies." *Journal – American Water Works Association* 103(11): 45–58. http://www.awwa.org/publications/journal-awwa/abstract/articleid/29082.aspx.

6 Doug Frost, Principal Planner, City of Phoenix Water Services Department, personal correspondence, 5/2015

Chapter 2: Water Connection Charges in Five High-Growth, Water-Stressed States

Methodology

To understand how connection charges reflect variation in water usage and to find communities using connection charges to encourage water conservation, we surveyed public information on connection charges in five high-growth, water-stressed states. These five states — Georgia, North Carolina, Arizona, Colorado, and Utah — are among the fastest-growing states in the country. They have all experienced some degree of water scarcity and resource vulnerability; they are, therefore, more likely to have connection charges designed to influence future demand.

Data from two Southeastern states — Georgia and North Carolina — were collected as part of a statewide financial and pricing benchmarking survey done by the University of North Carolina's Environmental Finance Center.[7] The North Carolina survey includes 450 separate published rate structures from 2014; the Georgia survey includes 290 connection charge schedules from 2013. Both datasets include information from the vast majority of utilities operating in those states. While some systems provide information on the details of what their connection charges include and specify whether the charges include tap fees and/or capacity charge components, many systems simply present one ambiguously named connection charge.

In the West, no similarly comprehensive survey has been done on water connection charges. To gain some insight, we collected information from 60 communities — 20 each in Arizona, Colorado, and Utah — about their current connection charges in 2014 and 2015. The community selection criteria included a diversity of population sizes, population growth rates, geographic locations, and water sources. These communities cannot provide complete representation of statewide practices, but they do provide insight on the range of approaches and general trends in each state. More information about the communities surveyed is contained within Appendix A.

7 A) Berahzer, Stacey Isaac, and David Tucker. 2013. "Table and List of Tap Fees and Impact Fees for Residential Water and Wastewater Connections in GA as of August 2013." http://www.efc.sog.unc.edu/project/residential-water-and-wastewater-tap-fees-and-impact-fees-ga-2013. B) Hughes, Jeff, David Tucker, Alex Clegg, Shadi Eskaf, and Chris Nida. 2015. *How Much Does it Cost to Connect to a Water and Wastewater Utility in North Carolina? Residential Water and Wastewater Connection Fees as of January 2015.* (A collaborative effort within the Environmental Finance Center at the University of North Carolina, Chapel Hill, and with the North Carolina League of Municipalities.) http://www.efc.sog.unc.edu/sites/www.efc.sog.unc.edu/files/Memo%20on%20Tap%20Fees%20and%20System%20Development%20Charges%202015_0.pdf.

Connection Charges Show Significant Variation Across Five States

We collected water connection charge data for single-family homes because of the consistency of meter sizes across that customer class compared to multi-family, commercial, and industrial classes, where meter size may vary substantially. In the communities that use more than just meter size to determine the water connection charge, we used attributes of new homes that are typical of Southeastern and Western regions, such as lot size, square footage of the house, and the number of bathrooms, to achieve comparable estimates of the "average" connection charge for a typical single-family unit.

Average water connection charges for single-family homes in each of the five states show quite a bit of variety, as shown in Tables 1 and 2. The Western states' charges are higher than those of the Southeastern states. Colorado's connection charges are by far the highest of the five states.

There are several factors that affect the size of connection charges, such as infrastructure investment costs, the cost of water resources (water rights acquisition), and local planning objectives. Other factors, such as the legal restrictions on funding water-related investments with other revenue streams such as taxes, could drive up connection charges. While the focus of this research was not to determine why charges are as high or low as they are, the authors believe some combination of these factors contribute to Colorado's substantially higher charges.

Table 1. Southeastern Water Connection Charges for New Single-Family Homes Are Slightly Higher in North Carolina than in Georgia.

	Georgia (2013) (n=290)	North Carolina (2014) (n=450)
Maximum	$4,800	$15,900
Minimum	$15	$50
Median	$800	$1,000
Mean	$900	$1,500

The connection charges shown include both tap fees and capacity charges, when applicable. All numbers have been rounded to the nearest hundred.

Table 2. Median Connection Charges for New Single-Family Homes in Western States Researched Are Significantly Higher than in the Southeastern States.

	Arizona (2014/2015) (n=20)	Colorado (2014/2015) (n=20)	Utah (2014/2015) (n=20)
Maximum	$9,600	$25,400	$8,200
Minimum	$1,700	$1,000	$900
Median	$4,800	$11,900	$2,400
Average	$5,200	$12,400	$2,900

Water connection charges for new single-family homes in the Western communities researched show significantly higher charges than those in the Southeastern states, particularly in Colorado. The connection charges shown include both tap fees and capacity charges, when applicable. All numbers have been rounded to the nearest hundred.

Wastewater connection charges, while not the focus of this report, show some interesting trends that are worth noting briefly. In the Southeastern communities, the wastewater charges tended to be higher than potable water charges. In the Western communities, the reverse is true. This is likely a reflection of the fact that water quality concerns drive infrastructure investment in many parts of the Southeast, whereas water availability is more of a priority issue in the West.

Like potable water services, wastewater costs depend on customers' capacity demands on the system, which can vary considerably for customers with the same water meter size. When indoor water demands are reduced, the wastewater produced is smaller. Thus, there is a direct relationship between indoor water demand and the impact a new development will have on the wastewater system. While water and wastewater services may be managed separately, there may be good reason for these two utilities to work together when developing their connection charges. In our research, we found a small number of utilities in North Carolina and the West that employ such factors as the number of bedrooms, house square footage, or type of commercial business to determine wastewater charges.

Figure 3. Median Wastewater Connection Charges Are Lower than Water Connection Charges in New Single-Family Homes in the Communities Surveyed in the West.

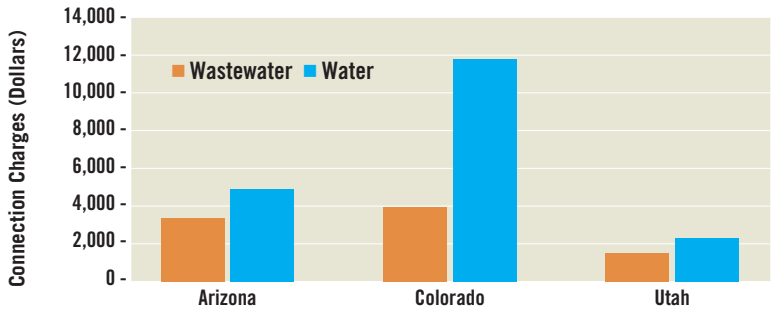
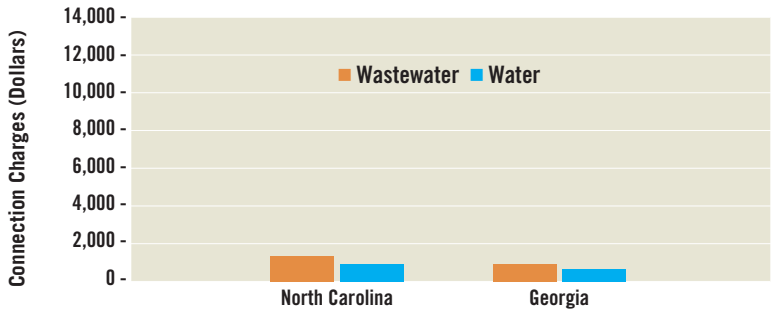


Figure 4. Median Wastewater Connection Charges Are Higher than Water Connection Charges in New Single-Family Homes in the Communities Surveyed in the Southeast.



Water Meter Size and Connection Charges

In our research, we also recorded the variety of factors that are used in determining water connection charges. The focus was on single-family homes because they are the easiest customer class to compare across many communities. We highlight a few interesting trends in the industrial, commercial, and institutional sectors in our case studies.

In the vast majority of the North Carolina communities and all of the Georgia communities we researched, the size of the water meter supplying a new single-family home with water was the predominant factor in determining the connection charge. In some cases, small utilities that do include capacity charges in their connection charges and that have very few new connections each year will charge the actual cost of making each tap on a case-by-case basis. Single-family residential water meters are usually either 5/8 inch or ¾ inch. Frequently, only one of these meter sizes is offered by a utility, or the same connection charge is applied to both. The end result is that the connection charge for a new single-family home is uniform across the entire single-family customer class. This is similar to what occurs in communities that have a single uniform connection charge for new homes, without mention of water meter size. The Western communities surveyed follow similar trends.

Figure 5 and 6 show that in the communities we researched, 93% (689 of 740) in the Southeast, and 62% (37 of 60) in the West, used a process that essentially resulted in a uniform water connection charge for single-family residential homes. These communities either assign a fixed charge to all single-family homes or rely exclusively on meter size to set charges.

Figure 5: In the Southeastern Communities, Uniform Water Connection Charges to Single-Family Residential Homes Are Far More Common than Variable Connection Charges.

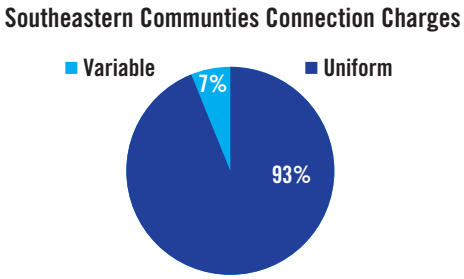
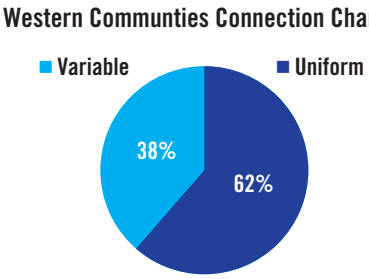


Figure 6: In the Western Communities, Uniform Water Connection Charges to Single-Family Residential Homes Are Far More Common than Variable Connection Charges.



The approach based only on meter size is so often used because it is easy to administer. Ignoring other factors besides meter size may also be technically justified for utilities that do not include any type of capacity charge in their connection charges.

Most connection charges do not reflect differences in water demand — and therefore capacity costs — of developments with very different water use profiles.

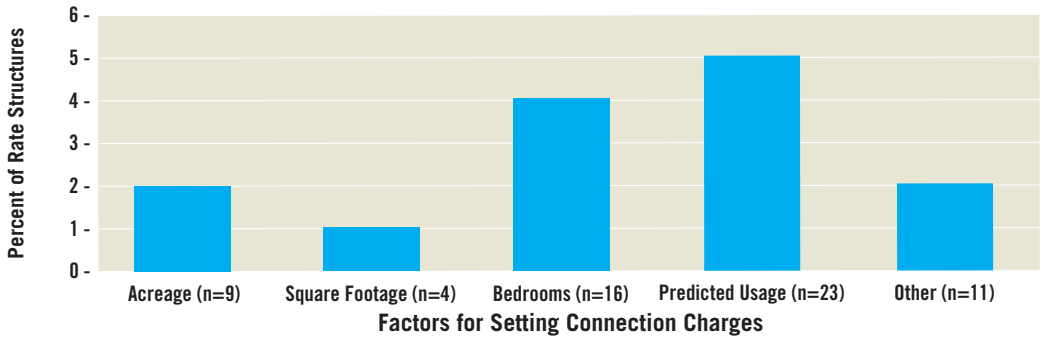
As a widely accepted industry practice, meter-based connection charges are premised on the idea that meter size is a proxy for water demand, because meter size controls the maximum amount of water that can flow in an instant to a customer. However, as illustrated in Figures 1 and 2, single family residential water use can vary significantly, and is therefore not well correlated to a single meter size. Yet it is clear that when it comes to connection charges, meter size is the most popular factor used by most utilities for determining the size of the charge. As a result, most connection charges do not reflect differences in water demand — and therefore capacity costs — of developments with very different water use profiles.

Water Demand Factors and Water Connection Charges

Some of the communities surveyed used several factors other than water meter size to determine their water connection charges (some used these factors in combination with meter size). These factors, for the most part, were used to account for variation in water use by homes with the same meter size. They include outdoor water demand factors (irrigation area, plant selection, lot size) and indoor water demand factors (house area, number of bathrooms, fixture count). Each of these variables is described in the sidebar box on page 17.

In the Southeastern communities surveyed, relatively few utilities reported using anything other than meter or service line size to determine single-family residential connection charges. In Georgia, where the connection charges that include capacity charges are defined statutorily as impact fees and must follow strict rules, none of the 290 Georgia utilities surveyed indicated using anything other than line size or meter size to calculate their fees. There was slightly more variation in the North Carolina communities, with 4% (16 of 450 connection charges) reporting using number of bedrooms, 2% (9 of 450) using lot area (acreage), and 1% (4 of 450) using house square footage. Another 5% (23 of 450) reported using demand predictors based on housing stock or home design that generated an estimated water use that was converted to a connection charge (see Figure 7). Location within a utility's service area was only used by city utilities to assess higher charges to properties outside their incorporated areas.

Figure 7. Relatively Few Factors Other Than Meter Size Were Used to Calculate Connection Charges in North Carolina (n=450).



In the Western communities surveyed, there was more variation in the factors used to determine water connection charges in single-family homes than in the Southeast.

Western utilities surveyed used a total of seven factors other than meter size to set connection charges, six of which can be considered water demand factors; these are categorized as outdoor or indoor in Figure 8.

FACTORS USED TO DETERMINE WATER CONNECTION CHARGES

Uniform Charge — A "one size fits all" charge for single-family homes is easy to administer and treats all customers in this class identically. Having a single charge for all new commercial and industrial properties is unusual because of the wide variability in water demand.

Meter Size — Most connection charge schedules based on meter size address all customer classes (residential, commercial, and industrial) in one schedule, with residential customers using the smallest size meter ($^5/_8$ inch or ¾ inch), and other customers (e.g., multi-family, commercial, industrial) using the larger sizes (often up to 4 inches or more). Meter size correlates poorly to actual water use behavior, particularly for residential customers. Nonresidential customers may have a slightly more pronounced incentive in their connection charges, since meter sizes vary more significantly between different types of businesses. However, in that sector as well, meter size alone is a relatively weak proxy for water use behavior.

Geographic Region — Charges related to geographic location are fairly common because of the additional infrastructure (e.g., pipes and pumps) required to reach areas that are beyond the original boundaries of the town or utility service area. Some utilities use elevation zones in their calculations to account for the greater pumping costs.

Lot Size — Lot size can be used as a proxy for both outdoor and indoor water use, as larger lots tend to have both larger landscapes and homes. In some cases, utilities may use it as a proxy for outdoor area only. This data is relatively easy to find in most cases because lot size is often listed on permit papers and available through the county assessor's office.

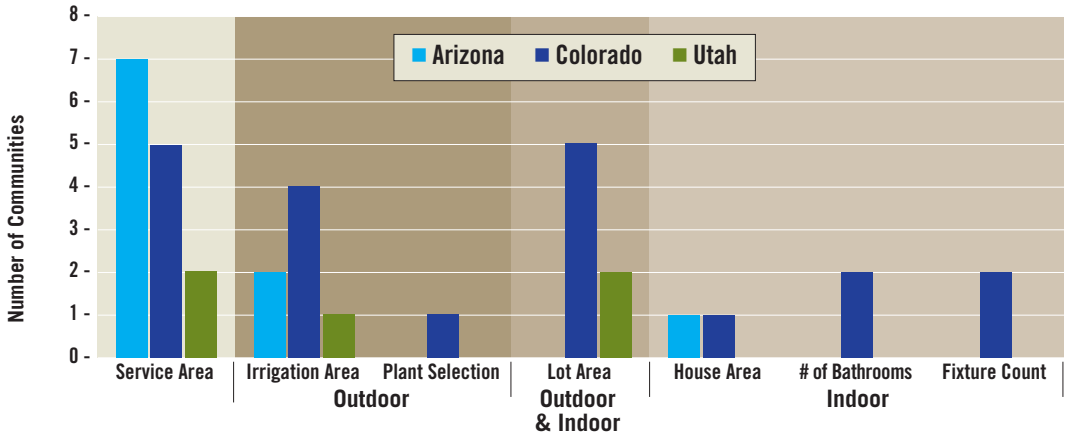
Irrigation Area — Outdoor irrigation area is a more specific metric than lot size for determining outdoor water demands. It is typically harder to obtain, since it may require reviewing site plan drawings and then calculating irrigable area by subtracting the house footprint and any non-landscaped surfaces (such as driveways and walkways) from total lot size. Some utilities have used aerial imagery to calculate irrigated area, and impervious area figures may also be available from the storm water utility.

Plant Selection — Plant selection (for example, turf grass or low-water-use plantings) is a highly specific approach for determining projected water demands and connection charges. It was used explicitly as a conservation incentive for single-family homes charges in Aurora, Colo., and has been used in a few other communities for the industrial, commercial, and institutional customers.

House Area, Number of Bathrooms, and Fixture Count — Each of these metrics helps to approximate indoor water demand. House area is often readily obtained from development plans. The number of bathrooms may be included in development plans or the MLS (multiple listing service for real estate listings), and distinctions between half and full baths can be made. Fixture count is a tally of the number and types of water-using fixtures, commonly used in determining water meter size needs.

Predicted Usage Charts — Buildings can be categorized by their intended use, and occasionally utilities will produce predicted peak usage charts that list intended use classification factors and establish formulas for estimating peak usage — for example, peak gallons per customer seat for a restaurant or peak gallons per bed for a hotel. For residential properties, a utility may use an estimated usage chart that includes number of bathrooms, fixtures, and/or type of residential zoning in order to calculate property-specific usage estimates. The final connection charge is calculated by multiplying the total projected usage by a charge per gallon amount.

Figure 8. Several Factors Other than Meter Size Were Used in Determining Water Connection Charges in the West. Indoor & Outdoor Water-Demand Factors Were Used Most Frequently in Colorado.



It has already been established that meter size was the most commonly used factor, but, in the West, it was often used in combination with the other factors shown above.

Service area is typically used when water utilities provide service to areas outside a boundary, such as outside the city limits or above a given elevation. Transporting water greater distances or up elevations takes more energy and infrastructure and, therefore, comes at a greater cost. Geographic service area was used by 23% (14 of 60) of studied communities in the three states.

The other six factors allow for a more precise estimation of water demand than meter size, but these factors were found in only 18% (11 of 60) of studied communities. Lot area is a factor that may capture both indoor and outdoor water uses, and thus is listed as a combination of the two. Larger lots tend to have both larger homes and larger irrigated areas. Anecdotally, some communities use lot area as a proxy for irrigated area since lot area data is easier to obtain.

It is interesting to note that 13% (8 of 60) of communities used outdoor water-use factors, whereas only 7% (4 of 60) of communities used one or more indoor factors. This attention to outdoor water use is likely a recognition that outdoor water use is a more important indicator of water demand variability than indoor water use.

Of the communities surveyed in the West, Colorado communities relied the most on outdoor and indoor water-demand factors, and also used the greatest variety of factors in determining their connection charges. This may be related to the relatively high water acquisition and infrastructure costs, which makes conserving water an economically attractive option.

We found no examples of connection charges that differentiate between "once-through" water systems in homes or businesses versus those that use greywater or onsite water reuse. As these technologies become more widely accepted, scaled water connection charges may be effective tools for encouraging recycled water adoption.

Connection charges are not only about water conservation, but are more broadly about allocating capital costs fairly among users, such that all new customers truly pay for the actual demand they place on the water system.

The data might seem to indicate that the potential for using water connection charges as part of a conservation strategy is strongest in states and utilities with the highest connection charges. However, connection charges are not only about water conservation, but are more broadly about allocating capital costs fairly among users, such that all new customers truly pay for the actual demand they place on the water system. That, coupled with water resource challenges and climate change, indicate that communities across the United States could benefit from multi-factor water connection charges that fairly allocate costs among customer classes and result in reduced future water infrastructure capacity needs.

Chapter 3: Case Studies of Communities Using Multi-Factor Connection Charges

Most of the communities surveyed use a meter-based water connection charge structure for customer classes, despite evidence that the water demand profiles within each customer class — and associated costs to the utility — can differ dramatically.

However, a handful of communities have begun using multi-factor connection charges for residential and commercial customers. These connection charges can better reflect the true variability of water demands and system costs within a customer class, and can allow developers to offer lower water demand profiles in exchange for reduced water connection charges. Multi-factor connection charges also have the potential to fundamentally change development patterns, as evidenced in the following case studies, particularly in Aurora and Fountain, Colorado.

Multi-factor connection charges are a relatively new concept in water management for most utilities, but a few communities are leading the way and serve as excellent examples. We present here four case studies profiling communities that have crafted multi-factor connection charges across a variety of customer classes:

- **Aurora, Colorado**
- **Fountain, Colorado**
- **Westminster, Colorado**
- **Orange Water and Sewer Authority, North Carolina**

Aurora, Colorado

Aurora is the third-largest city in Colorado, with a population of more than 345,000 people.[1] About one-third of the land within its boundaries has been developed,[2] with more growth projected, and new water supplies are increasingly difficult and expensive to obtain. In 2014 the city adopted a new connection charge schedule that directly correlates water fees with the expected water demand (indoor and out) for each customer class. The schedule also incentivizes low-water-using landscaping through lower fees, including one particularly innovative program called the "z-zone" in which no fee is charged if the landscape requires no water after plant establishment.

CONNECTION CHARGE

Communities use a wide variety of terms to describe these charges. In this case study, we us the term "connection charge," although the local term may differ.

New Connection Charges Designed to Cover Costs and Reduce Water Demands

The charges assessed under the previous schedule were not adequately covering the City's costs for infrastructure and water. Changes in water demand and growth patterns had shifted the balance of water use between customer classes, such that residential fees were effectively subsidizing larger water users' (e.g., irrigation, commercial) fees. In addition, there were requests from the building community to lower the fees. New leadership at the utility initiated a process to develop a connection charge structure that would better align the fees with water utility costs and provide an incentive to builders to construct more water-efficient developments.

Connection Charges Are Based on Robust Analysis

Aurora's connection charges help to pay for past and future capital investments in the water system, in five categories:[3]

1) Water resources (the market cost of water in the region)
2) Source of supply (the existing and projected assets required to move and store water)
3) Treatment and distribution (the existing and projected assets)
4) Carrying costs (the financial costs incurred to obtain water)
5) Water losses in the system

The cost of a gallon of water per day was calculated for each of these categories and then summed, totaling $57.45 per gallon per day. This cost is then multiplied by the projected average daily demand of each new development type (residential, multi-family, commercial), to determine the connection fee. Six years' worth of billing data were analyzed to determine projected average daily demands.

1 U.S. Census Bureau. 2013. "QuickFacts." Available at http://quickfacts.census.gov/qfd.

2 City of Aurora, Colorado. 2010. City of Aurora Comprehensive Plan. Available at https://www.auroragov.org/DoingBusiness/CityPlanning/PlansandStudies/ComprehensivePlan. See Chapter IV, Section A, page 1.

3 Van Ry, P., Aurora Water. 2013. Water Service Connection Fees presentation.

Residential Connection Charges for Indoor and Outdoor Use, and Xeric Landscaping Credit

New detached single-family residential homes are charged a two-part water service connection charge: one for indoor use and one for outdoor use.[4] The indoor use charge is either $5,509, $8,901, or $15,425, depending on the number of bathrooms in a home (1-2, 3-4, 5+, respectively). The number of bathrooms was found to be a reasonable proxy for the volume of indoor water use, based on billing data analysis.

A-Table 1. 2015 Connection Charges for Single-Family Residential (Detached).

Indoor Use Charge		Outdoor Use Charge
Number of Bathrooms	**Fee**	
1-2	$5,509	$0.941 / sq. ft. of lot size -$1,000 for 100% front yard xeriscaping
3-4	$8,901	
5+	$15,425	

The outdoor water use charge is $0.941/sq. ft. and is applied to the total area of the lot. In addition, if 100% of the front yard is xeric landscaping, then a $1,000 credit is given. Xeric landscapes are designed to be drought-tolerant, using low-water plants and specific techniques, such as soil amendment, mulch, and grouping of plants with similar water needs, to maximize water efficiency. The City provides a list of xeric plant species that are suited to the semi-arid environment, using no more than 15" of water per year and as little as no water after the initial plant establishment period. Establishment of landscape requires higher amounts of water during the first few months or years, until the plant is established in the soil. Once established, less water is required to maintain optimal health.

A-Table 2. 2015 Sample Connection Charges for Single-Family Residential (Detached).

House Type	Indoor Use Charge	Outdoor Use Charge	Total Charges
3 bedroom, 2 bathroom, 8,000 sq. ft. lot	$5,509	($0.941 x 8,000) = $7,528	$13,037
5 bedroom, 3 bathroom, 8,000 sq. ft. lot with front yard xeriscaped	$8,901	($0.941 x 8,000) -$1,000 = $6,528	$15,429

Irrigation Connection Charges Are Tiered for Different Landscape Types

Irrigation meters are used for irrigation water in commercial or residential common areas. They are assessed in three tiers: $2.75/sq. ft. for non-water-conserving landscape (e.g., bluegrass), $1.47/sq. ft. for water-conserving landscape,[5] and $0/sq.ft for "z-zone" landscapes that use zero water after establishment. More than 50 plants currently meet the z-zone requirement in Aurora.

If a z-zone is elected, the developer is required to put down a $20,000 deposit on the temporary irrigation meter, pay an administrative fee, and agree to a "water budget" for the landscaped area during the plant establishment period. A water budget has two parts: a calculated volume of water that the entire landscape should use if watered properly (the budget limit), and a tiered pricing structure that charges a lower rate ($/gallon) for water used up to that budget limit, with a higher rate(s) if that limit is surpassed. After the plants are established, the water utility will remove the irrigation meter and fully refund the deposit.

4 City of Aurora, Colorado. 2015. "Development and Connection Fee Schedule." https://www.auroragov.org/cs/groups/public/documents/document/021682.pdf.

5 Water-conserving landscape means any turf or plant using less than 15 inches per year through automatic irrigation, in normal weather conditions. See City of Aurora, Colorado, Planning Department, 2014. Landscape Reference Manual. https://www.auroragov.org/cs/groups/public/documents/document/005465.pdf.

A-Table 3. 2015 Connection Charges for Irrigation Meters

Landscape Type	Cost Per Sq. Ft. of Landscaped Area	Cost for 10,000 Sq. Ft. of Landscaped Area
Non-Water-Conserving	$2.75	$27,500
Water-Conserving	$1.47	$14,700
z-zone	$0 [$20,000 deposit, 100% refundable after establishment period]	$0 after refund

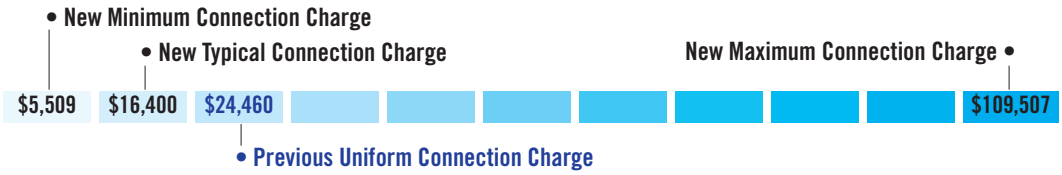
The cost of a water-conserving landscape is almost half the price per square foot as a non-water-conserving landscape. Fees for z-zones cost the least.

Uniform Charges Replaced by Multi-Factor Charges

The fee schedules prior to 2014 had uniform charges for each residential type (single-family attached, single-family detached, and multi-family). For example, a detached single-family home had a flat fee of $24,460, regardless of home or lot size. But under the 2014 schedule, that cost can range from as little as $5,509 (1-2 baths with no lot) to as much as $109,507 (5+ baths and 100,000 sq. ft. lot), as shown in Figure 1. However, those low and high figures are very rare, as the average lot size is about 8,200 sq. ft., and more than 97% of lot sizes are less than 14,000 sq. ft.[6] Thus, a home in 2014 with an 8,000 sq. ft. lot and 3-4 baths would result in a charge of about $16,400 as compared with a $24,460 charge in 2013.

Commercial and multi-family connection charges were also changed to account for projected average daily demand. Irrigation fees were significantly less expensive prior to 2014: $0.71/sq. ft. for non-water-conserving landscape and $0.36/sq. ft. for water-conserving landscape. The 2014 fees are almost four times higher, but also feature tremendous cost saving opportunities through the z-zone program.

A-Figure 1. Single-Family Residential Charges Under Aurora's New & Old Connection Charge Structures



The "typical" charge shown represents a home with an 8,000 sq. ft. lot. The minimum charge shown represents a 0 sq. ft lot, and the maximum charge shown represents a 100,000 sq. ft lot. The previous, uniform connection charge did not vary with lot size.

Stakeholder Engagement Helped Create Innovative New Program

The new connection charge schedule was developed a little over a year before it was adopted. Several private and public meetings were held with the Homebuilders Association, the Citizens Water Advisory Committee, the City/Development Community Joint Task Force (comprised of developers, landscape professionals, planners, and water utility staff), and the City's Infrastructure and Operations Committee. There was a high degree of transparency through

6 Van Ry, P., Aurora Water. 2013. Water Service Connection Fees presentation.

this process, especially with respect to how and why the new charges were to be calculated. Transparency throughout the process helped gain the support of various stakeholders — which helped lead to its adoption by City Council.

Once the new schedule was adopted, developers expressed concerns about the new charges for irrigated areas, since those costs increased significantly. The water utility met with the Joint Task Force over the course of several months to try to address this; as a result, the z-zone concept was born. It was a solution that satisfied both parties by reducing costs to developers and reducing water demands on the system.

Water Utility Is Now More Involved with the Development Approval Process

The way in which developers and city planners work together has changed a bit as a result of this new schedule. Usually the entire plan would go through the City's land use planning department, but if any area is intended to be a z-zone, the water utility now also reviews the plan. In addition, developers may choose to have a pre-development meeting with Aurora Water to go over the draft landscape plan. This provides Aurora Water the opportunity to tell them more about how the z-zone works and the other water-efficient landscaping incentives that are built into the fee schedule. There are also ongoing efforts by the utility to educate developers about xeriscape and to promote the $1,000 residential fee credit.

Multi-Factor Connection Charges Benefit the Utility, Builders, and Home Owners

The City and Aurora Water benefit from this new connection charge schedule because the charges to new customers are now in line with the costs to the utility incurred by all new customers. The connection charge structure for detached single-family homes also incentivizes the development of smaller lots — which tend to have lower water demands — which in turn reduces the burden on the City to develop additional infrastructure and acquire new water supplies.

The z-zone is a benefit to both developers and the City. A typical irrigation meter for a large landscaped area can cost $200,000 to $300,000, so the z-zone provides developers with a voluntary option to eliminate that large charge entirely. The City benefits because those landscaped areas do not create a permanent water demand; therefore, there is no need for new permanent infrastructure or water supply.

Importantly, the water utility also has a couple of financial safeguards through this program. First, if the landscaped area continues to require water on a permanent basis, then the developer must pay the normal irrigation charge. Second, the developer must agree to a water budget pricing system for the landscaped areas. Thus, in the event that the z-zone plants continue to be watered after the establishment period and after the developer's deposit is refunded, the City will recover its monthly costs through the water budget pricing structure.

Majority of New Plans Are Using the Z-Zone Option

Within the first few months of the z-zone program being adopted, the City of Aurora saw 5 of 6 plans using the z-zone option. Together, these five plans include more than 730,000 square feet dedicated to z-zone plant material, resulting in a potential water savings of 21 acre-feet per year — enough for 42 families of four people for almost a year. The utility will continue to promote this program, as well as the $1,000 xeriscape rebate program, which has not yet created as much interest as the z-zone, in the coming years.[7]

7 Lyle Whitney, Water Conservation Supervisor, Aurora Water, personal communication with author, February 4, 2015.

Fountain, Colorado

Fountain is a small community in the middle of Colorado's Front Range, with a population of about 27,000 people. It is a suburban community near Colorado Springs and adjacent to a military base. In June 2014, the City of Fountain adopted an ordinance to encourage water conservation in new residential developments. Water acquisition fees are reduced by 50% for lots with 50% or less turf area, and by about 70% for lots with 30% or less turf area. In addition, smaller residential lots are assessed smaller charges.

New Connection Charge Structure Designed to Reduce Water Demands

The majority of Fountain's existing water supplies come from a transbasin water diversion (the Fryingpan-Arkansas Project), and the rest is from groundwater.[1] New water supplies are increasingly difficult and expensive to obtain, so a new connection charge structure was developed to rein in new water demands. Residential landscapes became the focus; because of Fountain's proximity to a military base, new residents are often from more water-rich regions and are not aware of the high water needs and costs associated with watering the lawn of their new home.

Residential Connection Charges Linked to Turf Percentage

The City's connection charge has two parts: an infrastructure fee and a water acquisition fee.[2] The infrastructure fee takes into account the costs of the existing and planned water delivery infrastructure (fire flow requirements, storage, treatment, and distribution). The water acquisition fee is based on the current market price for water (usually priced as $/AF)[3] and is applied to the assumed volume of water used (e.g., 1/3 AF for one household). Both fees for new commercial and multi-family buildings are based on meter size, but the residential water acquisition fee features a conservation incentive.

The residential water acquisition fee varies by lot size and landscaping type. Lot sizes are divided into three classes, and the water acquisition fees get progressively higher with larger lot sizes (see Table 1). Smaller fees are charged for smaller lots because their irrigation needs are commensurately smaller.

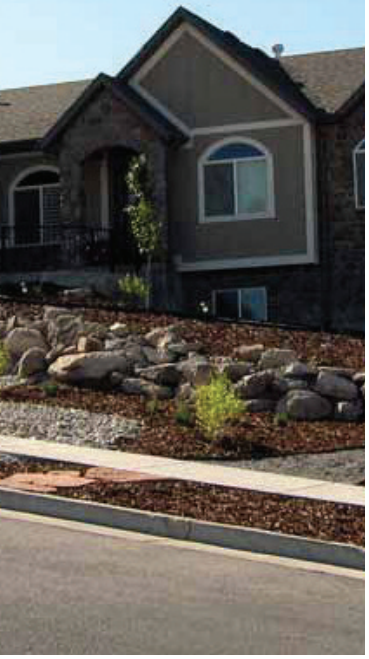
Within each lot size class, a water conservation incentive is given for reduced turf areas. Residential lots with turf on 50% or less of the total "landscapable" area are charged half of the full fee. The landscapable area is not the same as the lot size; it excludes the footprint of the house and driveway. A lot with turf on 30% or less of the total landscapable area pays about 30% of the full fee.[4] Non-turf areas do not have to meet specific requirements, but generally must have low-water-using plants or hardscape. These fee incentives were designed to be financially appealing to builders so that they would go through the extra work to design water-efficient landscaping.

1 City of Fountain, Colorado. 2015. "Water Supply and Facilities." Accessed January 28, 2015. http://www.fountaincolorado.org/department/division.php?structureid=179.

2 City of Fountain, Colorado. 2015. "Tap Fees & Water Rates." Accessed January 28, 2015. http://www.fountaincolorado.org/department/division.php?structureid=175.

3 An acre-foot (AF) of water is equal to approximately 325,851 gallons.

4 With one exception: The smallest lot size with 30% or less irrigated area pays about 20% of the normal fee. This is an additional incentive.



F-Table 1. 2015 Water Acquisition Fees for New Single-Family Residential Lots (Fountain, Colo.)

Lot Size	Water Acquisition Fee	Water Acquisition Fee With Conservation Incentive: 50% or Less Irrigated Area	Water Acquisition Fee With Conservation Incentive: 30% or Less Irrigated Area
Less than 9,000 sq. ft.	$4,875	$2,438	$1,024
9,001 to 13,000 sq. ft.	$5,688	$2,844	$1,706
Greater than 13,000 sq. ft.	$6,500	$3,250	$1,950

Fees are smaller for smaller turf areas, and for smaller lots.

F-Table 2. 2015 Connection Charge Structure for All New Commercial and Multi-Family Taps (Fountain, Colo.)

Tap Size	Infrastructure Fee	Water Acquisition	Total Connection Charge
¾"	$10,824	$6,500	$17,324
1"	$19,279	$11,577	$30,856
1½"	$42,530	$25,539	$68,070
2"	$47,433	$28,483	$75,916
3"	$110,819	$66,545	$177,364
4"	$193,740	$116,341	$310,081
¾" each unit multi-family	$6,173	$3,640	$9,813
For larger than 4" water rates are set via a contract between user and City of Fountain.			

The fees increase with tap size.

Simple Connection Charge Structure Gained Support of City and Builders

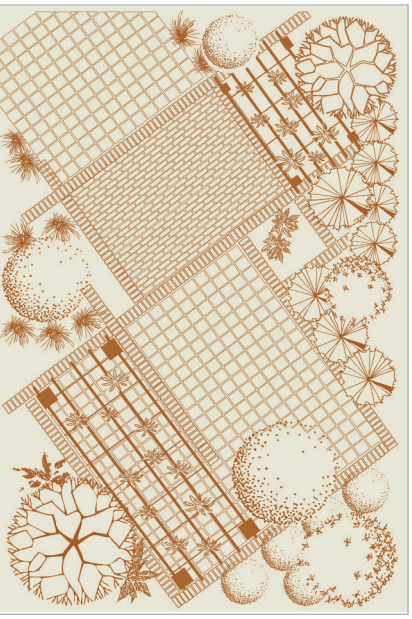
The director of the water utility initiated discussions about a revised fee structure in 2009, several years prior to its adoption. However, because the new housing market significantly declined in 2009, the effort was stalled.

A few years later, the effort was revived, and individual meetings with city council members and home builders were held to talk through the rationale, the economics, and the logistics. An initial concern in City Council was the financial implications of this change, and concerns which reduced fees while water rates were increasing. Ultimately, the high cost of new water supplies was significant enough to justify an effort to reduce new water demands through a voluntary fee incentive.

The Home Builders Association (HBA) initially had concerns about the complexity, public (homebuyer) acceptance, program enforcement, and the application process. Once those concerns were addressed, the HBA ultimately supported this new connection charge structure because it created substantial savings for their home builder members. The City adopted the simple connection charge structure, believing that a simple concept for saving water, paired with a simple fee structure, had a better chance of being understood and accepted by the community.

Landscape Templates Help Increase Adoption of Conservation Incentive

After the new connection charge schedule was adopted by City Council, the water utility developed template landscape plans to help the builders and landscape contractors meet the requirements of the conservation incentive. The landscape templates demonstrate where areas of turf can be placed, which types of low-water-using plants can be used, and how they might be arranged, all while meeting the varying turf percentage requirements. The utility reviews the builder's final landscape plan before it is installed; once installed, the landscapes are inspected before a Certificate of Occupancy is issued to ensure that the landscape is consistent with the plan and requirements. In addition, the water utility is developing brochures and informational material to promote this incentive and explain the new process to home owners and home builders.



Multi-Factor Connection Charges Benefit Utility, Builders, and Home Owners

According to the utilities director, this new connection charge structure is a win for the water utility because it can prolong its existing water supply, a win for home builders because they have an option to pay lower fees, and a win for home buyers because their water bills will be lower.[5]

In addition, the voluntary approach makes this an appealing water conservation program to all parties. The City of Fountain — residents and government alike — would not likely be supportive of a water conservation mandate, and the water utility has limited capacity to enforce those kinds of restrictions anyway.

Lastly, whereas several other Western communities have implemented turf buy-back programs to replace existing lawns with low-water-using landscapes, this program reduces turf area at the outset.

One potential challenge the utility faces is that there is no mechanism to prevent homeowners from changing their low-water landscaping to one with more turf. The utility does, however, have an inclining block rate structure with steep rate increases, which is a deterrent against installing water-thirsty landscapes.

Majority of New Residential Developments Are Using Conservation Incentive

This connection charge schedule has been in place since June 2014; as of November 2014, approximately 75% of the proposed new residential developments were making use of the incentive.[6] The water utility plans to develop a database of new homes that were designed to meet the conservation requirements, as well as to perform spot checking periodically in the future to monitor any changes and determine how successful the program is over the longer term.[7]

5 Curtis Mitchell, Utilities Director, City of Fountain, personal communication with author, November 18, 2014.
6 Ibid.
7 Ibid.

Westminster, Colorado

Westminster, a suburb of Denver with over 100,000 residents, is the seventh-largest city in Colorado. In the late 1990s, the water utility began to re-examine the water demands of its customers and adjust its connection charges accordingly. Since 2001, Westminster's connection charges for industrial, commercial, and institutional customers have been carefully designed to be proportionate with each customer's projected water use. In addition, the connection charge schedule includes incentives for low-water-use landscapes installed in large irrigated areas.

Good Data Improved Cost Recovery and Connection Charge Equitability

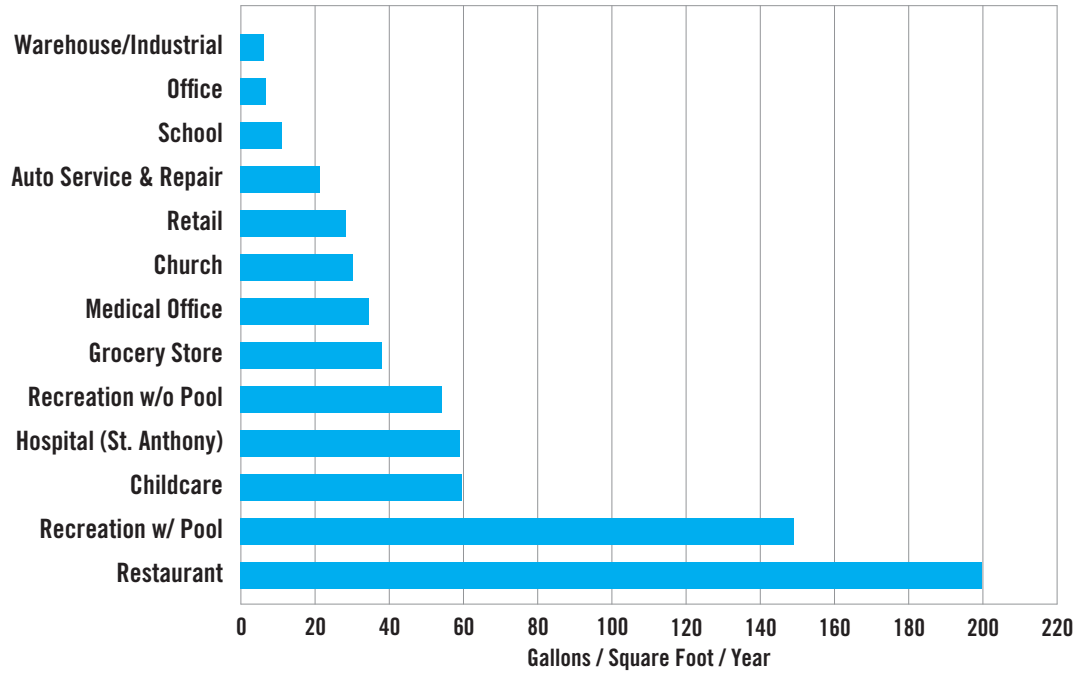
In 1998, Westminster reviewed its connection charge structure and discovered that the fees paid by the industrial, commercial, and institutional (ICI) sector were not fully or equitably covering their true financial impacts to the system, in contrast with the fees paid by the residential sector. The ICI connection charges were based on meter size, which is determined by instantaneous peak demand. However, customers with the same meter size often had very different water demand profiles over the course of a year. Effectively, this resulted in customers with lower annual water use subsidizing the higher water users' fees. Thus, the City developed a fine-tuned system to assign costs more proportionately.

The City developed a connection charge structure for the ICI sector that is comprised of two main parts: the infrastructure fee and the water resources fee. The infrastructure fee is based on the size of the meter, which is determined by the number of "fixture units." The fixture-unit count tallies the number and types of fixtures to be installed and accounts for peak demand of the customer. When City staff members review the new development's design plans, they have the opportunity to recommend water efficiency measures that could result in a reduced fee. The infrastructure fee increases with increasing meter size; a $^{5}/_{8}$-inch by ¾-inch meter is about $10,000, and a 2-inch meter is a little over $80,000.[1]

The water resources fee is proportionate to the customer's projected annual water use. Average annual water for each type of ICI customer — e.g., restaurants, hotels, schools, and warehouses — was determined by analyzing Westminster customer data and researching national data sources. The utility developed a table of water use for each type of ICI customer, expressed as a function of the size of the establishment. For example, the average water use of a restaurant was found to be 200 gallons per square foot per year, and the average water use of a hotel was found to be 23,500 gallons per hotel room per year. Figure 1 shows the range of water uses in gallons per square foot per year for a variety of ICI customers. The water resource fee, therefore, depends on the type of business establishment and its size. While water resource fees vary widely, they typically range from $10,000 to $100,000.

1 2014 data. Stu Feinglas, Water Resources Analyst, City of Westminster, personal communications with author, November 2014.

W-Figure 1. The Water Use For Various Industrial, Commercial, & Institutional Facilities is Measured in Gallons Per Square Foot Per Year.



This data was determined by City of Westminster staff using customer data and nationally available resources.

As properties redevelop or change uses, these changes are evaluated against the original Official Development Plan, and additional tap fees may be charged if water use is projected to increase or if a larger tap is required. Customers who consistently use more water than was projected are re-evaluated; if water use is not reduced to the levels purchased, they are charged an additional water resources fee.

Water-Efficient Landscapes Are More Prevalent Now Due to Fee Incentives

Westminster requires separate irrigation meters on all non-single-family projects. Since 1998, Westminster has incentivized water efficiency in large landscaped areas, such as commercial landscapes and common areas, or whenever an irrigation water meter is required. Irrigation connection charges are based on the area of landscaping and the projected annual water demand, as determined by the water requirements of the plants — the cost per square foot is highest for turf areas and lowest for low-water-use landscapes. The three types of landscapes are defined in the City's Landscape Regulations, as reflected in the table below. In addition, the cost to use reclaimed water is about 80% the cost of potable water because no additional water acquisition is necessary.

W-Table 1. Westminster Incentivizes Water Efficient Landscape Types Through Lower Connection Charges for Low Water Use Landscapes.

	Fee ($/sq ft)		
	Turf	Medium Water Use	Low Water Use
Potable Irrigation Tap Fee	$2.05	$1.02	$0.51
Reclaimed Water Fee	$1.68	$0.84	$0.41
Water Use and Irrigation Profile	More than 10 gallons per sq. ft. Irrigation methods will typically be spray or rotor heads. Bluegrass turf is a typical grass in this zone.	No more than 10 gallons per sq. ft. Irrigation methods will typically be spray heads. Turf-type tall fescue is a typical grass in this zone.	No more than 3 gallons per sq. ft. Irrigation methods will typically be micro-spray or drip. Buffalo grass is a typical grass in this hydrozone.

Before this tiered irrigation fee schedule was in place, the typical irrigation tap was using three times as much water as was projected by the City.[2] With the new system that is based on water use by landscape type, it is only 25% more than projected.

As a result of this tiered landscape connection charge, more low-water-use and medium-water-use landscaping has been installed. In 2004, the City developed a Landscape Plan establishing new water quality and water efficiency standards for landscape installations. Most new landscapes are now coming in below the City's Landscape Plan limits for turf and with more water-efficient irrigation technologies, such as drip and subsurface irrigation. As a side benefit, developers are not incentivized to undersize irrigation taps, since the tap fee is based on the irrigated area, ensuring proper operations.

The City issues up to a certain number of water service commitments per year in a competitive process. One service commitment is equal to the typical use of a single-family home; a small hotel might be equivalent to 5–10 service commitments. Thus, projects with lower water use are given preference in light of the competition for service commitments. Many other attributes of the development are considered as well in the selection of which proposed projects will ultimately be approved by the City.

Like buildings, landscapes can change over time as well, often because of new ownership or management. What may have started as low-water-use landscape could be converted to something with a higher water demand after the connection charge has been paid. In Westminster, this issue is addressed by requiring the Official Development Plan to be adhered to; if any changes occur, they must be approved and additional water connection charges will be charged commensurately if water demands increase. The fees are not refunded if water demands decrease over time because the City has already purchased water and infrastructure to meet the originally projected demand.

2 Stu Feinglas, Water Resources Analyst, City of Westminster, personal communications with author, April 15, 2015.

OWASA, North Carolina

The Orange Water and Sewer Authority (OWASA) is a public, nonprofit utility that provides water, sewer, and reclaimed water services to the Carrboro-Chapel Hill community, including the University of North Carolina at Chapel Hill (UNC). The service area population is about 83,000, with university students making up more than 25 percent of the population. OWASA follows a strict cost-of-service rate-making approach that assigns revenue requirements to new and existing customers to fully and equitably recover the costs they place on the system. OWASA has determined that meter size alone is an insufficient indicator of the cost impacts of residential customers and has developed a tiered connection charge system for residential customers that also takes into consideration home size.[1] OWASA also requires a separate meter and payment of additional connection charges for residential irrigation systems. The resulting connection charge structure provides a significant financial incentive for the construction of smaller homes with limited irrigation needs.

Charges Focus on Adhering to Cost-of-Service Principles

Connection charges in North Carolina are relatively modest compared to areas such as Colorado that are experiencing water supply challenges linked to growth. Many utilities in North Carolina do not even recover the full cost of making a water or sewer tap, let alone recover costs linked to capital facilities required to serve new development. Conversely, OWASA adheres to a rigorous connection charge framework that requires that all of the costs associated with new customers, including tapping costs and capacity costs, are fully covered by connection charges. OWASA follows this approach for several reasons, including a community value that "growth should pay for growth" and the high cost of capital needed to serve new customers. Possibly most importantly, the OWASA system was created with a transfer of water and sewer system assets from a system previously owned and operated by the towns of Carrboro and Chapel Hill, and by UNC; under the transfers agreements, OWASA must require new customers to pay the costs associated with providing new service.

Building Size Determines Residential Water and Sewer Connection Charges

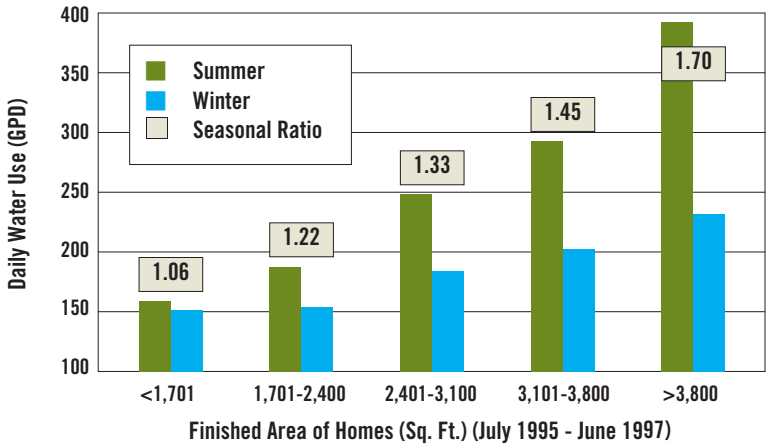
Prior to connecting to OWASA's system, new residential customers pay a variety of charges, including service installation charges, tapping fees, and water and sewer availability fees. Individually metered residential customers comprise more than 80% of OWASA's customer base. There are significant variations in housing design among this class, ranging from large 3,200-finished-square-foot homes with extensive irrigation needs to modest 1,600-square-foot homes within affordable housing or "eco-developments" that are situated on small lots and/or have little to no irrigated areas. Almost all of OWASA's residential customers — regardless of house size — are served by a $^{5}/_{8}$-inch or ¾-inch meter.

In 1997, OWASA carried out a detailed study to analyze the customer attributes that are correlated to water use patterns and the customer capital cost impacts on its system. As a result of the study, OWASA determined that the finished square footage of a home had a significant impact on water demands and the eventual capital impact on its system. Thus, OWASA implemented

1 Pat Davis, Sustainability Manager, OWASA, personal correspondence with author, May 20, 2015.

a tiered residential water and sewer availability fee system that takes into account finished square footage in addition to meter size. OWASA currently has a seven-tiered availability fee system for single-family homes that incorporates finished building size and meter size.

O-Figure 1. Indoor & Outdoor Water Use Increases with Size of Finished Area of Homes[2]



O-Figure 2. OWASA Sewer Connection Charges for Single Family Units Vary by Size of Home[3]

5/8-Inch Meter or 3/4-Inch Meter Combination Fire and Domestic Service, Single-Family Residential	Connection Charge
<1,300 square feet	$2,938
1,301-1,700 square feet	$3,549
1,701-2400 square feet	$3,611
2,401-3,100 square feet	$4,425
3,101-3,800 square feet	$4,781
>3,800 square feet	$5,431
1-Inch Meter, Single-Family Residential (all square footages)	$12,301

O-Figure 3. OWASA Water Availability Charges for Single Family Homes also Vary by Size of Home[4]

5/8-Inch Meter or 3/4-Inch Meter Combination Fire and Domestic Service, Single-Family Residential	Connection Charge
<1,300 square feet	$1,265
1,301-1,700 square feet	$1,545
1,701-2400 square feet	$1,956
2,401-3,100 square feet	$3,344
3,101-3,800 square feet	$4,546
>3,800 square feet	$7,631
1-Inch Meter, Single-Family Residential (all square footages)	$9,260

2 Holland, Edward A., and W. Ed Kerwin. 2000. "Making Your Infrastructure Program Affordable: Service Availability Fees Based on Finished Area of New Homes." Paper presented at an American Water Works Association conference. Available from: http://www.industrycodes.com/products/776ddf/awwa-inf52168-making-infrastructure-program.

3 Orange Water and Sewer Authority Schedule of Rates, Fees, and Charges, Effective October 1, 2014.

4 Orange Water and Sewer Authority Schedule of Rates, Fees, and Charges, Effective October 1, 2014.

Irrigation Requires Separate Meter and Separate Payment of Connection Charge

Utilities in North Carolina employ a range of approaches for assessing connection charges for irrigation services. Since 2009, pursuant to North Carolina law, any new home with a residential underground irrigation system in the State is required to install a separate irrigation meter; however, utilities employ different methods for calculating the connection charges linked to those irrigation meters. Some utilities charge fees based on the direct costs of the meter and installation, but do not charge additional capital connection charges beyond those paid for the (non-irrigation) domestic meter. Others treat the irrigation meter as an independent new service and assess installation costs as well as capacity charges. Recognizing the impacts that irrigation systems can have on water supply requirements, OWASA charges a separate set of connection of charges for residential irrigation meters, creating a further incentive for new homebuilders to consider water use and efficiency in their property designs.

Demand-Based Connection Charges Incentivize Water-Efficient New Developments

Taken together, OWASA's irrigation meter policy and tiered residential availability fee approach provides a significant financial incentive for less water-intensive residential development. Compare the water and sewer connection charge cost for the two types of properties mentioned above: a 1,600-finished–square-foot home with little or no irrigation versus a 3,200-finished-square-foot home with an underground irrigation system. The total cost of connecting the smaller home under OWASA's policies is $8,614, while costs for the larger home are significantly more at $19,716. Table 1 summarizes these costs.

O-Table 1. Smaller Homes With No Outdoor Irrigation Incur Smaller Connection Charges in OWASA's Service Territory.[5]

Connection Charge Component	1,600-Square-Foot Home, No Irrigation	3,200-Square-Foot Home, Underground Irrigation / Separate Meter
Water Availability Fee	$1,545	$4,546
Water Installation Charge	$3,165	$3,165
Sewer Availability Fee	$3,549	$4,781
Sewer Tap Charge	$355	$355
Irrigation Meter Availability Fee	NA	$3,704
Irrigation Meter Installation Charge	NA	$3,165
Total Connection Charges	**$8,614**	**$19,716**

Fee Structure Indirectly Supports Low-Impact Design and Affordable Housing

OWASA's tiered system has resulted in much greater and more refined variation in what home builders pay than if the utility relied only on the size of the meter. The resulting structure links those fees to actual costs, while also indirectly complementing local affordable housing efforts and providing builders an incentive to build smaller properties.

5 Orange Water And Sewer Authority Schedule Of Rates, Fees, And Charges, Effective October 1, 2014.

Chapter 4: Effectively Implementing Multi-Factor Connection Charges

Multi-factor connection charges need to balance several criteria to achieve their intended purpose of fairly allocating the costs of expanding water services for new development. First, the charges need to be consistent with state and local laws. Secondly, allocation methods need to be fair and defensible, based on good data, and make use of accepted industry-standard practices. Any incentives provided to builders and developers through water connection charges need to be strong enough to attract participation in water-efficient development options, while also securing sufficient revenues from all connection charges to meet utility needs. Lastly, utilities need to do outreach and education so that stakeholders understand and accept any newly proposed connection charge schedule. These considerations, among several others, are described more fully below.

CALCULATING MULTI-FACTOR CONNECTION CHARGES

There is a wide body of guidance outlining industry-accepted methods for calculating different components (tap fees, capacity charges) of connection charges.[8] These methods may also be the basis for the legal framework in some states. State law typically requires all connection charges to be "reasonable and proportionate" to the impact that a new development will have on a water system.

Reimbursement and Improvement Method Calculations

Industry standards for calculating the capacity component of connection charges provide utilities with multiple approaches based on their circumstances and objectives. One of the key choices regarding cost recovery relates to whether the utility chooses a method that is based on historic investments (buy-in method or reimbursement method) or one that is more forward looking and takes into consideration planned expenditures (improvement method). These different approaches are viable and legal, yet have very different impacts on water connection charge calculations.

Since in water-stressed areas the historic cost of water supply is often much lower than the future supply, using the reimbursement method alone often results in a lower calculated connection charge that may not be high enough to incentivize significant behavior change. Using the improvement method or a combination of the improvement and reimbursement

8 American Water Works Association's *M1 Principles of Water Rates, Fees and Charges* and the Water Environment Federation's *Financing and Charges for Wastewater Systems.*

methods works well as a conservation-oriented strategy when utility capacity costs are sizable and can be avoided or mitigated by a concerted effort. For example, a Colorado utility that needs to buy incremental water rights to serve customers has the financial ability to allocate those costs to new customers as opposed to existing customers. This approach allows the utility to present a very clear nexus to its customers between efforts made to reduce capacity needs and incentives offered through connection charge reductions.

Allocating Costs to Customers

Regardless of whether a community uses the reimbursement method, the improvement method, or a combination of the two to calculate its water connection charges, it also needs to choose a method for allocating costs to different customers. The most common approach is to group customers based on their meter size and charge all customers with the same meter size the same connection charges. Another similar approach uses an *equivalent residential unit*, which first establishes the water demand of a single-family home and then scales others' demands based on this. Both approaches assume a fixed volume of water for single-family residential homes.

A third common method uses the number of fixture units to determine a connection charge; this entails a count of the water-using fixtures, like showers and sinks, along with each fixture's associated demand. This is a more detailed and, potentially, precise way of capturing indoor water demands. Lastly, *estimated usage techniques* attempt to quantify future water demand of a new development based on historical demands of similar customers. This approach is most often used for larger water customers (for example, those with meters larger than 2 inches), but it can also be used for smaller commercial customers, as is being done in Westminster, Colo., and in single-family homes, as is being done by the Orange Water and Sewer Authority in North Carolina.

Good Data Are Essential in Crafting Multi-Factor Water Connection Charges

Understanding the different water demands within a customer class requires having reliable information on the characteristics of properties that shape water use and the related cost pressure they place on utilities.

Utilities all over the country have used alternative calculation methods successfully for years, establishing accepted methods of scaling water connection charges. Utilities can study their customers' usage, determine what factors influence demand, and then design a water connection charge to incentivize water conservation. Understanding the different water demands within a customer class requires having reliable information on the characteristics of properties that shape water use and the related cost pressure they place on utilities. In areas where outside irrigation drives customer demand and utility capacity requirements, using the size of irrigated area is likely to be more accurate than meter size in predicting capacity needs. Urban utilities that see their demands influenced more by indoor use might be better off relying on indicators such as number of bedrooms, house size, and types of appliances and fixtures.

Utilities are increasingly realizing that the market intelligence analysis used by other industries to understand their customers is essential for the utility sector as well. Increased use of customer surveys, smarter metering technology, and more sophisticated data mining and analysis techniques can provide utilities with a more refined understanding of their customers' capacity needs and the costs associated with serving them. Without data to support decisions, utilities open themselves up to customer relations problems or legal challenges.

Utilities should also consider the availability of data on new developments in their decisions. One reason that most utilities use meter size as the only indicator of capacity is that it is information that is easily available to the utility. Yet utilities now have access to integrated governmental data systems that did not exist 10 or 15 years ago, when existing water connection charge methods were first established. Governmental databases that contain detailed property characteristics can now be used to refine pricing. To make the process easier, integrating the

permitting process for new development with the connection charge setting process could help utilities more easily gain access to basic information — like lot size, square footage of the building, or the number of bathrooms and bedrooms — to set multi-factor connection charges. This was exemplified by the case study on Aurora, Colo.

Any incentive offered to encourage water efficiency in new developments needs to send an adequate price signal to developers.

Lastly, any incentive offered to encourage water efficiency in new developments needs to send an adequate price signal to developers. The price point will vary community by community, but is typically related to the cost of new construction in the area, any additional costs associated with water-efficient features (like landscaping design), and the magnitude of the connection charge itself. Determining this price point may be most effectively done by working with the development community, as described in the following section.

DESIGNING MULTI-FACTOR CONNECTION CHARGES

Inviting Customers and Developers Into the Connection Charge Design Process

A utility that decides to incorporate multiple factors into its connection charge calculations should work with relevant stakeholders to design these charges. Utilities should promote the program to all stakeholders involved in new property construction and sales, including realtors, buyers, and developers. This information gives more parties a chance to benefit from the program by taking actions that lead to expanded uptake of water-efficient development practices. Especially in areas where the cost of satisfying high peak water use has driven connection charges upward, multi-factor connection charges can lower the average cost paid by new development. Reduced charges ultimately means lower home prices for new developments, which can appeal to homebuyers as well as developers, who can market their product more price competitively. If an incentive is offered, the appropriate incentive level will depend on new development costs and familiarity with proposed water conservation measures (indoor and outdoor). The water utility in Fountain, Colo., ultimately developed landscape templates to help developers and landscape architects meet the water-efficient landscape requirements, which helped lead to greater adoption of the incentive.

Ensuring the Longevity of Water Efficiency Measures

One challenge in implementing water conservation measures in new developments — particularly landscaping measures — is that there is no guarantee the landscape will produce the promised result or remain unaltered through the life of the property. In other words, there is no way to prevent a family that buys a home with a xeriscaped yard from replacing it with water-intensive landscape five years after the payment of a lower water connection charge.

This is a valid concern that can be addressed in a few ways. A utility policy, such as tiered water rates or water budgets that charge higher prices per gallon when usage exceeds a certain threshold, can be an effective deterrent from increased water use. Contracts and terms that allow utilities to retroactively correct connection charges to reflect actual usage are other tools to ensure the longevity of water efficiency measures and the revenue sufficiency of water utilities. The city of Westminster, Colo., addresses this issue by requiring the official development plan to be adhered to for as long as the property exists. City staff members perform site checks throughout the year to check for compliance; while they cannot examine every property, this practice does provide a mechanism to prevent backsliding. Another alternative is for an agreement between the property owner and utility to be signed to ensure the persistence of low-water-using landscapes.

Improvements in metering and data technology have made ongoing monitoring more practical. Utilities across the country are investing millions of dollars in smart meter and data management technology. With those investments comes the ability to track water use and implement smarter pricing systems, similar to systems that have been part of telecommunications and electricity pricing for years. There is no longer an insurmountable technological or customer relations barrier for most utilities to convey to customers that they will have limits on their usage based on the capacity they purchased. If usage changes, customers can be assessed a supplemental capacity charge, either through rates or an incremental capacity charge. This approach also reinforces the concept that utilities sell capacity and services through their infrastructure, treatment, and delivery, in addition to gallons of water — a marketing message that many utilities are actively promoting.

Leveraging Other Development Incentives

Utilities that want to maximize water efficiency incentives for new development have other tools to magnify the financial rewards of low-impact construction. Providing density bonuses to developers that allow them to market more units on their property can have the impact of reducing lot size, thereby qualifying the properties for a reduced water connection charge. Other tools include reduced plan review fees for "green" developments. Some local governments will have the authority to implement practices that are driven by policy rather than pure financial requirements. In these cases, local governments may be able to waive fees altogether for some types of construction or development that meet other local objectives relating to community or economic development.

FINANCIAL CONSIDERATIONS

Comparing Costs of Conservation With Capacity Investments

One of the first steps for any cost-of-service study — whether for determining rates or water connection charges — is to develop a robust inventory of costs associated with both existing and future capacity. Utilities that are serious about conservation and promoting efficiency should use this opportunity to evaluate the costs of permanently reducing the water demands of current and future customers as a capacity investment. In other words, a cost analysis will reveal how the value of conservation programs compare with projects that add to system capacity. An interesting study in Westminster, Colo., was done showing that 30 years of conservation efforts had significantly decreased capital costs, avoiding what otherwise would have been a 91% increase in water and wastewater rates and an 80% increase in water and wastewater connection charges.[9]

Balancing Water Connection Charges With Water Rates

Water connection charges are only one of the tools available for sending financial signals to encourage water conservation and should be considered in the context of an overall strategy. While connection charges are a unique opportunity to affect water demands of new customers, water and sewer rates are the dominant method of sending pricing signals to existing water customers. Many rate structures are designed to reward conservation behaviors while recovering needed revenues. A utility's revenue requirements are the basis for calculating both rates and water connection charges, and the two financial tools should be developed in tandem to assure that customers are not being "double-billed" for some costs. Utilities can choose how to

9 Feinglas, Stuart, Christine Gray, and Peter Mayer. 2013. *Conservation Limits Rate Increases for a Colorado Utility*. Chicago: Alliance for Water Efficiency.

allocate capacity costs between water connection charges, flat recurring fees (base charges), and volumetric charges (price per gallon). The decision about how to allocate these costs should be thoughtful and take into consideration local conditions and the utility's overall goals.

Utilities that want to maximize the economic signal linked to development decisions may want to place as many of their capacity costs as possible into water connection charges as opposed to their monthly water and sewer bills. Utilities that rely on water connection charges should understand that they place their revenue stream more at risk, since water connection charge revenue is historically very cyclic, with bust and boom years based on growth. Utilities under financial distress may find it safer to focus their attention on water and sewer monthly fees. There are many guides that describe how recurring fees can be designed with conservation in mind.[10] For utilities without considerable growth, focusing on water and wastewater rates that provide short-term incentives for existing customers to use water wisely may make more sense than trying to rely on water connection charges.

Utilities that want to maximize the economic signal linked to development decisions may want to place as many of their capacity costs as possible into water connection charges as opposed to their monthly water and sewer bills.

Considering Local Conditions

While water connection charges may be an effective tool for some utilities, they have limitations — and not all utilities will find it the right tool for their situation. Local conditions and the legal limitations on which costs may be covered by water connection charges will influence their effectiveness as an incentive tool.

Utilities with ample unused capacity installed at relatively low historic costs legally may only be able to assess relatively low charges. When overall water connection charges are low, multi-factor connection charges designed to more fairly allocate costs or to reduce water connection charge for low-water-demand customers is not likely to have a substantial impact on construction decisions. For example, utilities that determine the cost to serve an average single-family unit is $1,500 could scale the water connection charge such that properties with higher impact (e.g., large lots) pay $1,700 and homes with minor impact pay $1,300. Yet that differential alone ($400) in most markets will not revolutionize housing and landscaping design. However, this financial incentive could be paired with other incentives — such as expedited permitting or technical assistance for landscaping specifications — to attract participation. On the other hand, utilities facing very expensive incremental capacity costs (such as is seen in many parts of Colorado, which have water connection charges as high as $20,000 to $30,000) may have no trouble soliciting participation with multi-factor connection charges that offer significant savings opportunities.

10 A) Alliance for Water Efficiency. 2014. *Building Better Water Rates for an Uncertain World: Balancing Revenue Management, Resource Efficiency, and Fiscal Sustainability.* (Developed in partnership with the California Urban Water Conservation Council.) Chicago: Alliance for Water Efficiency. Available at http://www.financingsustainablewater.org/tools/building-better-water-rates-uncertain-world. B) Tiger, Mary, Shadi Eskaf, and Jeff Hughes. 2014. *Designing Water Rate Structures for Conservation and Revenue Stability.* Chapel Hill, N.C.: University of North Carolina, Environmental Finance Center. Available at http://www.efc.sog.unc.edu/reslib/item/designing-water-rate-structures-conservation-and-revenue-stability. C) Eskaf, Shadi, and Jeff Hughes. 2009. *Designing Rate Structures that Support Your Objectives: Guidelines for NC Water Systems.* Chapel Hill, N.C.: University of North Carolina, Environmental Finance Center. Available at http://www.efc.sog.unc.edu/reslib/item/designing-rate-structures-support-your-objectives-guidelines-nc-water-systems.

Chapter 5: Recommendations

Water connection charges are an important financial tool for utilities to generate the money needed to cover the infrastructure and capacity costs associated with supplying water services to new developments. As water supply challenges become more serious, these charges have the potential to become an important tool to drive water efficiency. The most common historical approach for allocating these costs among new residential customers is by assigning connection charges in proportion with meter size only. With more sophisticated customer data analytics at our disposal, we now know that the variety of customers who use the same meter size do not necessarily have similar water demand profiles over the course of a year. This can lead to some new developments paying more or less than their fair share.

Multi-factor connection charges are now being used by some communities to more fairly allocate the true costs associated with water demand and even to encourage water-efficiency in new developments. Additional demand-prediction factors, such as lot size, fixture counts, and number of bathrooms, have been used as the basis for more refined connection charges in single-family homes. In the commercial sector, water use by a variety of customers, such as restaurants, offices, and hotels, have been developed on the basis of typical water usage per square foot or number of rooms, as appropriate. These refined, multi-factor connection charges have not only helped utilities to achieve better cost recovery, but have also been used to incentivize water efficiency in new developments, by charging lower charges in connection with lower water usage. Utilities, local policymakers, and land use planners should consider these kinds of multi-factor connection charges as a tool for achieving local objectives, shaping future water use patterns, and managing costs of water service.

Utilities should consider refined, multi-factor connection charges to encourage water efficiency of new developments and capture the true costs of new development.

While no factor is foolproof in forecasting capacity demands, the fairness of multi-factor charges that rely on lot size and outdoor irrigation design should be weighed against uniform connection charges relying only on meter size. Utilities, developers, and customers should ask if it is fair to charge a fixed amount to all single-family homes with a $^{5}/_{8}$-inch meter based upon the flawed premise that all development imposes equal costs on the water system. Incorporating property-specific characteristics that better capture actual water use behavior leads to a fairer, more efficient allocation of costs.

Utilities should consider putting in place mechanisms to ensure longevity of water savings.

If a utility decides to adopt a multi-factor connection charge that provides significant incentives for low use, it is important to put a mechanism in place to address what happens if customers unexpectedly increase their water use, for example by replacing xeriscaping with a lawn or adding another bathroom. Tiered water rates or water budgets that charge higher prices per gallon when usage exceeds a certain threshold are one tool for holding customers' water use in check. Utilities can also perform site checks to ensure the longevity of outdoor conservation measures. They can also use today's improved metering and data-collection technologies for such monitoring. There is no longer an insurmountable technological or customer relations barrier for most utilities to convey to customers that they will have limits on their usage based on the capacity they purchased. If usage changes, customers could be assessed a supplemental connection charge, either through rates or through an incremental capacity charge. This approach also reinforces the concept that utilities sell capacity as much as they sell gallons of water — a marketing message that many utilities are actively promoting.

Utilities should invite customers and developers into the connection charge design process.

Utilities that incorporate connection charges into their water management program should work with key stakeholders to determine what an effective incentive level would be. This can help gain support for the new program and increases adoption of more water-efficient development proposals early on in the program. In addition, promoting the program to all stakeholders involved in new property construction and sales — including realtors, buyers, and developers — gives more parties a chance to benefit from the program by taking water-saving actions.

Especially in areas where the cost of satisfying high peak water use has pushed connection charges upward, connection charges that incentivize water efficiency can lower the average cost of a connection charge. Reduced connection charges ultimately means lower home prices, which can appeal to homebuyers and developers, who can potentially market their product more price competitively.

Local policymakers and planners should recognize the importance of connection fees in shaping future water demand and development patterns, and in managing costs of this fundamental service.

Quite simply, connection charges can help ensure sustainable economic growth amid increasing water scarcity. Growing as water efficiently as possible is one way to stretch new and existing water infrastructure, and to delay or avoid the need for costly new capacity-expansion projects.

Appendix A

Links and References to Southeastern Communities Surveyed

Utilities participating in annual rates and charges survey:
http://www.efc.sog.unc.edu/project/residential-water-and-wastewater-tap-fees-and-impact-fees-ga-2013

Data from each Georgia community:

http://www.efc.sog.unc.edu/sites/www.efc.sog.unc.edu/files/GA_Tap_and_Impact_Fees_Table_August_2013_v2_0.pdf

Utilities participating in annual North Carolina rates and charges survey:
http://www.efc.sog.unc.edu/reslib/item/how-much-does-it-cost-connect-water-and-wastewater-utility-north-carolina-residential

Data from each North Carolina community:

http://www.efc.sog.unc.edu/sites/www.efc.sog.unc.edu/files/NC_W%26WW_One-Time_Connection_Fees_Tables_2015.pdf

Western Communities Researched

Connection charge data for single-family residential units in the Western communities surveyed is shown below. Because communities use a wide variety of terms to describe these fees and there is no standardized terminology, we chose to define the various charges in the following ways:

Tap Fee — The cost to physically connect a new development to the main water/wastewater line. This often includes the cost of materials and labor.

Capacity Charge — The cost of "buying into" the water/wastewater system. This often includes a portion of past/future capacity investments, such as treatment plants, distribution systems, and water rights acquisition (for water charges only).

Total Connection Charge — The sum of the Tap Fee and the Capacity Charge, for water and wastewater.

Notes about the data: In addition to terminology varying across communities, the way in which fees are categorized or charged varied quite a bit as well. That is, some communities may not differentiate a "tap fee" from a "capacity charge" in water or wastewater, and simply group them as one fee. We made efforts to understand what the charges represented; in several cases, we made contact with the utility/building department, but in a few cases that was not possible. In virtually all cases, we used publicly available data, with the understanding that not all information is fully represented in those documents. A notation of "$0" indicates that no fee is charged in that category, and a notation of "NA" indicates that data was not available. While in our data collection process we strove to be as accurate as possible, we acknowledge that some imperfections may exist.

In addition, some charges depend on attributes of the single-family home, such as the square footage of the house, the size of the lot, or other variable factors. The following is what we used to calculate those communities' charges, based on a "typical" new single-family home in the West. We relied on the U.S. Census Bureau's new construction data (2013) for lot size, square feet, and number of bedrooms that are typical in the West.[11] Specifically, we assumed new homes had the following: a $^5/_8$-inch or ¾-inch water meter, a 2,400-square-foot house, 3 bedrooms, 2 bathrooms, a 7,000-square-foot lot, and 4,300 square feet of landscaped area.

11 U.S. Census Bureau. 2013. "Characteristics of New Housing." Accessed 11/2014. Available at https://www.census.gov/construction/chars.

ARIZONA — Single-Family Unit Water and Wastewater Connection Charges							
Community	Water Tap Fee ($)	Water Capacity Charge ($)	Total Water Connection Charge	Wastewater Tap Fee ($)	Wastewater Capacity Charge ($)	Total Wastewater Connection Charge	Total Water & Wastewater Connection Charges
Buckeye	$600	$6,475	$7,075	$600	$6,128	$6,728	$13,803
Casa Grande	$600	$5,458	$6,058	$0	$4,500	$4,500	$10,558
Chandler	$1,819	$5,680	$7,499	$0	$6,642	$6,642	$14,141
Clarkdale	$500	$2,322	$2,822	$500	$5,027	$5,527	$8,349
Flagstaff	$210	$5,891	$6,101	$275	$3,126	$3,401	$9,502
Gilbert	$0	$5,091	$5,091	$0	$3,596	$3,596	$8,687
Glendale	$120	$2,761	$2,881	$0	$1,944	$1,944	$4,825
Goodyear	$503	$6,835	$7,338	$0	$3,320	$3,320	$10,658
Lake Havasu City	$1,725	$0	$1,725	$0	$2,000	$2,000	$3,725
Mesa	$0	$2,220	$2,220	$0	$2,659	$2,659	$4,879
Oro Valley	$320	$9,295	$9,615	$0	$4,066	$4,066	$13,681
Payson	$950	$6,592	$7,542	$250	$5,825	$6,075	$13,617
Peoria	$317	$4,068	$4,385	$0	$1,659	$1,659	$6,044
Phoenix	$3,066	$5,481	$8,547	$245	$1,696	$1,941	$10,488
Prescott	$440	$5,121	$5,561	$200	$3,896	$4,096	$9,657
Scottsdale	$940	$3,365	$4,305	$0	$2,042	$2,042	$6,347
Sierra Vista	$1,945	$2,400	$4,345	$0	$2,400	$2,400	$6,745
Surprise	$275	$2,260	$2,535	$149	$3,313	$3,462	$5,997
Tempe	$634	$2,496	$3,130	$0	$2,001	$2,001	$5,131
Tucson	$2,326	$2,267	$4,593	$0	$4,066	$4,066	$8,659

11 U.S. Census Bureau. 2013. "Characteristics of New Housing." Accessed 11/2014. Available at https://www.census.gov/construction/chars.

COLORADO — Single-Family Unit Water and Wastewater Connection Charges							
Community	Water Tap Fee ($)	Water Capacity Charge ($)	Total Water Connection Charge	Wastewater Tap Fee ($)	Wastewater Capacity Charge ($)	Total Wastewater Connection Charge	Total Water & Wastewater Connection Charges
Aspen	$600	$24,753	$25,353	$125	$7,700	$7,825	$33,178
Aurora	$0	$12,096	$12,096	$0	$9,924	$9,924	$22,020
Boulder	$819	$13,316	$14,135	$137	$4,652	$4,789	$18,924
Broomfield	$356	$22,454	$22,810	$50	$12,559	$12,609	$35,419
Castle Rock	$388	$16,718	$17,106	NA	$3,056	$3,056	$20,162
Colorado Springs	NA	$11,615	$11,615	NA	$2,335	$2,335	$13,950
Denver	NA	$7,930	$7,930	NA	$4,370	$4,370	$12,300
Durango	$334	$5,773	$6,107	$0	$2,023	$2,023	$8,130
Fort Collins	$309	$7,602	$7,911	NA	$3,090	$3,090	$11,001
Fort Morgan	NA	$22,500	$22,500	NA	$4,000	$4,000	$26,500
Fountain	$0	$15,699	$15,699	NA	$4,087	$4,087	$19,786
Glenwood Springs	$200	$6,965	$7,165	$0	$4,179	$4,179	$11,344
Grand Junction	$700	$300	$1,000	$0	$4,244	$4,244	$5,244
La Junta	$500	$1,500	$2,000	$150	$400	$550	$2,550
Lakewood	NA	$16,400	$16,400	NA	$5,300	$5,300	$21,700
Pueblo	$746	$4,483	$5,229	$940	$800	$1,740	$6,969
Steamboat Springs	$197	$7,500	$7,697	$197	$3,953	$4,150	$11,847
Sterling	$890	$1,980	$2,870	$313	$2,350	$2,663	$5,533
Thornton	$181	$20,515	$20,696	NA	$5,809	$5,809	$26,505
Westminster	$321	$20,836	$21,157	$0	$5,554	$5,554	$26,711

UTAH — Single-Family Unit Water and Wastewater Connection Charges							
Community	Water Tap Fee ($)	Water Capacity Charge ($)	Total Water Connection Charge	Wastewater Tap Fee ($)	Wastewater Capacity Charge ($)	Total Wastewater Connection Charge	Total Water & Wastewater Connection Charges
Blanding	$500	$600	$1,100	$250	$250	$500	$1,600
Delta	$470	$2,400	$2,870	$800	$0	$800	$3,670
Green River	$600	$1,000	$1,600	NA	$1,000	$1,000	$2,600
Lehi	$833	$2,268	$3,101	$0	$3,023	$3,023	$6,124
Logan	NA	$1,738	$1,738	NA	$884	$884	$2,622
Moab	$868	$478	$1,346	$705	$2,819	$3,524	$4,870
Orem	$549	$3,699	$4,248	$600	$0	$600	$4,848
Provo	$150	$1,139	$1,289	$0	$1,230	$1,230	$2,519
Richmond	NA	$3,791	$3,791	NA	$3,983	$3,983	$7,774
Salt Lake	NA	$2,473	$2,473	$545	$0	$545	$3,018
Sandy	$265	$2,265	$2,530	$0	$2,412	$2,412	$4,942
South Jordan	$333	$3,194	$3,527	$0	$3,677	$3,677	$7,204
South Ogden	$375	$529	$904	$100	$1,500	$1,600	$2,504
South Salt Lake	$3,000	$733	$3,733	$570	$0	$570	$4,303
Spanish Fork	$250	$1,816	$2,066	$0	$1,452	$1,452	$3,518
St George	$223	$7,939	$8,162	$0	$1,070	$1,070	$9,232
Vernal	$1,000	$1,000	$2,000	NA	$1,500	$1,500	$3,500
Washington County	NA	$6,728	$6,728	Not Applicable	Not Applicable	Not Applicable	Not Applicable
West Jordan	NA	$1,922	$1,922	$0	$1,333	$1,333	$3,255
West Valley City — Granger-Hunter Improvement District	$75	$2,343	$2,418	$100	$2,324	$2,424	$4,842

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