



Water System Service Capacity in Equivalent Residential Units (ERUs)

Public water systems—especially small systems—mainly serve single-family residences. On average, each of these single-family residential customers uses a similar amount of water over a day. Customers from nonresidential and multifamily units (apartments and condominiums) can have significantly different demands.

When designing or evaluating a water system, we compare non-residential and multifamily water demands to the typical amount of water a single-family residential unit uses. We use the term “equivalent residential unit” (ERU) as a basis for this comparison.

Single-family residential demand as the basis for an ERU

Because single-family homes are the most common type of service, and they have relatively uniform water use patterns, it makes sense to base “equivalent per unit” water demands on them. Demands for other types of service, such as multifamily, industrial, and commercial connections, often vary more widely.



Water use for a typical single-family residence is the same as one ERU.

Using data for single-family residential demand allows for a more statistically consistent and valid approach for determining the amount of water for a “typical” ERU. The ERU quantity is determined as either the mean, median, or mode of the demand for the single-family residential customer group.

After you establish a system’s ERU quantity, you can use it to determine the number of ERUs for other types of service connections. The ERUs would be equivalent to what would be used by typical single-family residences, if they were using the water. The result is an estimate of total system service capability expressed as the number of ERUs the water system serves, or could serve.

With the exception of water systems serving only single-family residences, the number of service connections would not usually be the same as the number of ERUs.



HELPING TO ENSURE SAFE AND RELIABLE DRINKING WATER

The quantity of water an ERU represents

The quantity of water an ERU represents depends on the time (annual or peak day) under consideration. You can express the ERU quantity of a single-family home two ways:

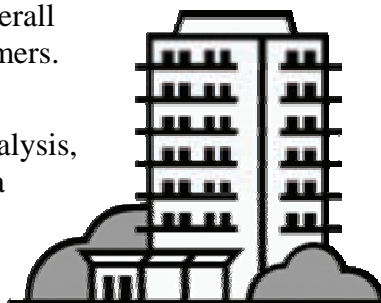
- **Average Day Demand**—gallons per average day per ERU—is used to determine compliance with annual water rights limitations and to estimate annual distribution system losses.
- **Maximum Day Demand**—gallons per peak day per ERU—is the basis for facility design. It applies to determinations of a water system’s overall service capacity.

Physical features affect peak day service capacity

State drinking water rules require water systems to have enough overall **source capacity** to meet the maximum day demands of their customers.

Factors that limit sources are:

- **Aquifer capacity:** Based on pump tests or hydrographic analysis, this is the amount of water a system can reliably take from a groundwater source.
- **Pumping capacity:** Based on designed or installed pump capacity, this sets the physical limit for peak-day water service.
- **Water rights limitations:** Based on state-approved water withdrawal, this is either the daily maximum rate or the annual allocation.



For multifamily residents, like this apartment complex, the number of service connections is usually not the same as the number of ERUs.

Distribution storage. Only two portions of total storage apply directly to determinations of a system’s service capacity (ERUs):

Equalizing storage volume is used to meet peak hourly demands on days when the source-pumping rate alone can’t provide sufficient service. Equalizing storage volume depends on the number of system users (ERUs).

Standby storage volume is for emergencies, such as power outages, flooding, or failed source pumps. Standby storage volume is based on consumer concerns or expectations (days of continued operation at some level during water outages). Depending on consumer expectations, standby storage could restrict system capacity (ERUs).

Transmission or distribution mains are sized to deliver water in sufficient quantity and pressure to meet state requirements and consumer expectations. As a system develops, the ability of the water mains to carry the increasing flows is stressed. A hydraulic analysis under peak hourly flow conditions can show areas of the water system that might have inadequate system pressures because of increased development (increased ERUs).

There are several important aspects of a water system that do not relate to ERU physical service capacity assessments, such as:

- **Emergency supply sources** are used only when needed.
- **Fire flow storage.** Local fire protection authorities establish fire flow requirements to meet specific needs for key industrial, commercial, or residential locations. Engineers may design the distribution system and storage facilities to meet fire considerations, but fire flow is independent of the system’s maximum day service needs.
- **Operating storage** relates solely to pump protection.
- **Dead storage** is the part of overall storage used to maintain adequate pressure in the system’s distribution network. It maintains the minimum hydraulic gradient to satisfy state or utility requirements.

The overall peak day source capacity dictates the overall service capacity (in ERUs). However, consumers do not use all the water going into the distribution system. Some is lost through distribution system leakage, some is system-authorized metered or unmetered uses, and some is unauthorized use.

True service capacity determinations must account for these other uses and losses. Service capacity is the difference between total production and the volume unavailable to serve consumers. Systems cannot apply water unavailable for direct consumer service (such as authorized utility uses and leakage) to increases in ERU service capacity unless they manage it differently or better control it in the future.

For procedures on determining the service capacity of a water system in ERUs, see Chapter 6 of the *Water System Design Manual* (DOH 331-123).

For more information:

Call your Office of Drinking Water regional office:

Eastern Region—Spokane Valley (509) 329-2100

Northwest Region—Kent (253) 395-6750

Southwest Region—Tumwater (360) 236-3030



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