4 | WATER DEMANDS

INTRODUCTION

A detailed analysis of system demands is crucial to the planning efforts of a water supplier. A demand analysis first identifies current demands to determine if the existing system can effectively provide an adequate quantity of water to its customers under the most crucial conditions, in accordance with federal and state laws. A future demand analysis identifies projected demands to determine how much water will be needed to satisfy the water system's future growth and continue to meet federal and state laws.

The magnitude of water demands typically is based on three main factors: 1) population; 2) weather; and 3) water use classification. Population and weather have the two largest impacts on water system demands. Population growth tends to increase the annual demand, whereas high temperatures tend to increase the demand over a short period of time. Population does not solely determine demand because different user types use varying amounts of water. The use varies based on the number of users in each customer class, land use density, and irrigation practices. Water use efficiency efforts also impact demands and can be used to accommodate a portion of the system's growth without increasing a system's supply capacity.

Demands on the water system determine the size of storage reservoirs, supply facilities, water mains, and treatment facilities. Several different types of demands were analyzed and are addressed in this chapter, including average day demand, maximum day demand, peak hour demand, fire flow demand, future demands, and a demand reduction forecast based on the Water Use Efficiency program.

Certificate of Water Availability

In accordance with the requirements of the Growth Management Act (GMA), the City of Woodland (City) must identify that water is available prior to issuing a building permit. Per Woodland Municipal Code (WMC) 19.02.080, an application for a project permit shall include information regarding evidence of adequate water supply as required by Revised Code of Washington (RCW) 19.27.097. The requirement for providing evidence of an adequate water supply was codified in 1990 under RCW 19.27.097 in the Building Code section.

Per the Municipal Water Law and RCW 43.20.260, the City:

> …has a duty to provide retail water service within its retail service area if: 1) Its service can be available in a timely and reasonable manner; 2) the municipal water supplier has sufficient water rights to provide the service; 3) the municipal water supplier has sufficient capacity to serve the water in a safe and reliable manner as determined by the [Washington State] department of health [DOH]; and 4) it is consistent with the requirements of any comprehensive plans, development regulations…

or any other applicable plan or regulation.

CURRENT POPULATION AND SERVICE CONNECTIONS

Water Use Classifications

The City has divided all water customers into seven different classes for billing purposes. For planning purposes, the same seven groups were used with the addition of one group: 1) single-family residential; 2) multi-family residential; 3) motel; 4) mobile or RV; 5) commercial; 6) City; 7) churches and schools; and 8) other. The "other" group includes metered fire hydrant usage, miscellaneous meters not included in the previous billing groups, and other unauthorized recorded use. The demand analysis that follows will report on the water use patterns of these eight user groups.

Residential Population Served

The population within the City limits was 6,205 in 2018 based on estimates from the Washington State Office of Financial Management (OFM). Since the City provides water service to some customers outside of the City limits and does not provide water service to some customers within the City limits, the actual population served by the City's water system differs from the population within the City limits. The 2018 residential population served by the City's water system is estimated to be approximately 6,308. The computation of the population served is discussed in **Chapter 3**, along with a more detailed discussion of the City's population and household trends.

As shown in **Table 4-1,** the City provided water service to an average of 2,169 connections inside the City's Retail Water Service Area in 2018. Approximately 1,757 connections (81 percent) were single-family residential customers, 62 connections (2.9 percent) were multi-family residential customers, 8 connections (0.4 percent) were motel customers, 6 connections (0.3 percent) were mobile or RV customers, 269 connections (12.4 percent) were commercial customers, 22 connections (1 percent) were City connections, 26 connections (1.2 percent) were churches and schools customers, and 19 connections (0.9 percent) were all "other" customers.

EXISTING WATER DEMANDS

Water Consumption

Water consumption is the amount of water used by all customers of the system as measured by the customer's meters. **Table 4-1** shows the number of connections, annual consumption, and average daily consumption per connection of each customer class served by the City from 2013 through 2018. Two sets of data were provided by the City for this summary report: the first being monthly recordings of Water Treatment Plant use, utility billing, including adjustments due to meter reading errors, and other authorized consumption; the second being annual consumption by meter address, split out into the customer classes mentioned at the beginning of this section. However, the second set of data did not include the adjustments to utility billing seen in the monthly data. Therefore, the consumption by customer class was scaled to match

the annual totals presented in the first set of data to reflect the unknown adjustments made to utility billing, as shown in **Table 4-1**.

Table 4-1

Average Annual Metered Consumption and Service Connections

	Customer Class								
Year	Single-Family Residential	Multi-Family Residential	Motel	Mobile or RV	Commercial	City	Churches and Schools	Other	Totals
				Average Number of Connections					
2013	1,579	66	8	6	255	17	25	--	1,956
2014	1,583	61	8	7	237	21	25	--	1,942
2015	1,565	63	14	6	247	22	30	23	1,970
2016	1,622	61	8	7	249	21	26	20	2,014
2017	1,710	62	9	7	265	21	27	20	2,121
2018	1,757	62	8	6	269	22	26	19	2,169
				Average Annual Consumption (gallons) [1]					
2013	106,869,221	28,375,325	3,645,841	6,447,918	89,764,101	1,193,837	9,273,183	--	245,569,426
2014	96,116,533	30,797,770	4,322,370	9,369,717	99,091,688	5,073,267	5,386,664	--	250,158,009
2015	94,188,209	35,925,635	3,784,004	10,809,813	96,837,163	5,775,865	9,562,906	410,919	257,294,514
2016	96,072,178	25,868,355	4,509,593	11,115,162	103,732,776	5,467,217	10,961,817	2,716,570	260,443,668
2017	110,334,349	24,630,532	4,428,512	18,120,954	106,240,525	3,634,230	12,213,255	2,603,711	282,206,068
2018	118,297,672	30,548,647	4,547,523	9,505,946	98,652,611	5,044,079	11,230,834	3,283,878	281,111,190
				Average Daily Consumption Per Connection (gpd/conn)					
2013	185	1,178	1,249	2,944	964	192	1,016	--	344
2014	166	1,383	1,480	3,667	1,146	662	590	--	353
2015	165	1,562	741	4,936	1,074	719	873	49	358
2016	162	1,159	1,540	4,338	1,138	711	1,152	372	353
2017	177	1,088	1,348	7,092	1,098	474	1,239	357	365
2018	184	1,350	1,557	4,341	1,005	628	1,183	474	355
Average	**173**	**1,287**	**1,319**	**4,553**	**1,071**	**565**	**1,009**	**313**	**355**

1 = Average Annual Consumption was scaled to the totals given by the City, which included adjustments to utility billing due to meter reading errors.

As shown in **Chart 4-1**, the single-family residential class represents approximately 81 percent of all connections, but only 42.1 percent of the total system consumption, as shown in **Chart 4-2**. This is due to the lower consumption per connection of single-family residential customers as compared to other customer types. As shown in **Table 4-1**, single-family residential customers use an average of approximately 173 gallons per day (gpd) per connection, compared to multi-family customers that use an average of approximately 1,287 gpd per connection. Multiple units are typically served by one multi-family residential connection, resulting in additional consumption per connection compared to single-family residential connections. As shown in **Table 4-2**, the number of multi-family units associated with the 62 multi-family connections in 2018 is approximately 523 units. This results in approximately 160 gpd per multi-family unit, which is expected since multi-family units will typically use less water than single-family connections as they generally do not have the same irrigation needs. The mobile or RV customer class has the highest average daily consumption per connection, 4,553 gpd. This is due to this customer class containing an irrigation account as well as an entire gated community, Woodland East Community, on 369 Gun Club Road. The higher consumption per connection of motel, mobile or RV, commercial, and churches and schools customers compared to single-family and multi-family residential customers is expected since these customers include the system's highest individual water users. One such example, as shown in **Table 4-3** includes Columbia River Carbonates located on 288 North Pekin Road who is included in the commercial customer class.

Chart 4-1
2018 Water Connections by Customer Class

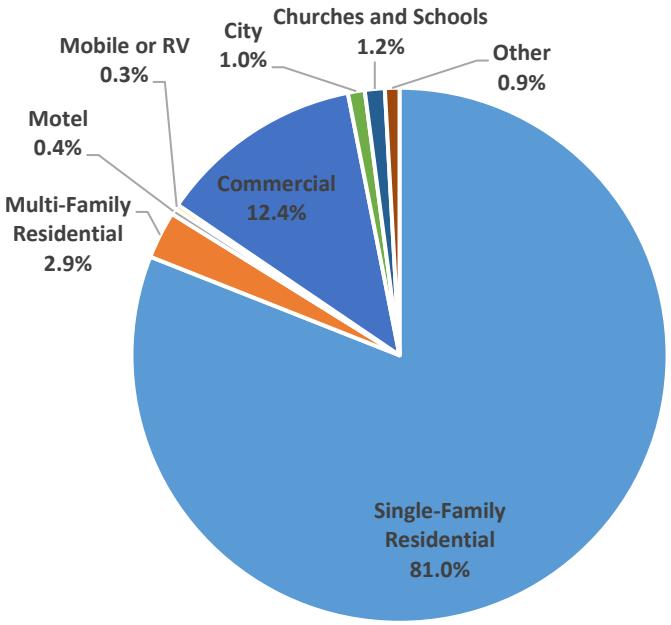


Chart 4-2
2018 Water Consumption by Customer Class

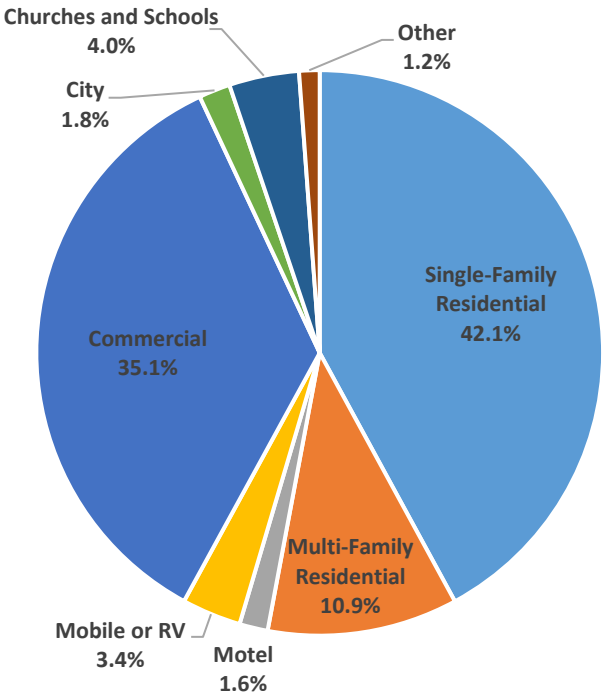


Table 4-2

Multi-Family Units

Year	Approximate Total Multi-Family Units	Approximate Average Daily Consumption Per Unit (gpd/unit)
2018	523	160

Table 4-3 shows the 20 largest water users of the system in 2018, and their total amount of metered consumption for the year. The total water consumption of these 20 water accounts represented approximately 35.2 percent of the system's total metered consumption in 2018.

Table 4-3

2018 Largest Water Users

Address	Customer Class	Total Annual Consumption (gals)
288 N Pekin Road	Commercial	23,581,448
1967 Meadowood Loop	Single-Family Residential	7,553,304
1915 Rhododendron Drive	Single-Family Residential	7,494,960
1500 Dike Access Road, Irrigation	Churches and Schools	6,832,980
803 Hoffman Street	Multi-Family Residential	6,179,976
1635 Down River Drive	Commercial	5,857,588
295 N Pekin Road	Commercial	5,804,480
369 Gun Club Road	Mobile or RV	5,115,168
350 N Pekin Road, Irrigation 56596459	Commercial	4,315,212
1635 Down River Drive	Commercial	4,292,024
1625 Down River Drive	Commercial	3,357,024
125-151 S Pekin Road	Multi-Family Residential	3,064,556
1625 Heritage Street	Commercial	2,226,048
310 4th Street	Commercial	2,155,736
1725 Pacific Avenue	Commercial	2,077,196
350 N Pekin Road, 98191719	Commercial	1,985,192
1010 Atlantic Avenue	Commercial	1,932,832
1451 N Goerig Street	Multi-Family Residential	1,765,280
1380 Atlantic Avenue	Motel	1,681,504
1350-1370 Woodside Street, Tulip Valley	Multi-Family Residential	1,565,564
Largest Water Users Total Consumption		**98,838,072**
Water System Total Metered Consumption		**281,111,190**
Percent of Total		**35.2%**

Water Supply

Water supply, or production, is the total amount of water supplied to the system, as measured by the meters at source of supply facilities. Water supply is different than water consumption in that water supply is the recorded amount of water put into the system, and water consumption

is the recorded amount of water taken out of the system. The measured amount of water supply of any system is typically larger than the measured amount of water consumption due to non-metered water use and water loss (i.e., distribution system leakage), which will be described more in the **Distribution System Leakage** section.

Table 4-4 and **Chart 4-3** show the annual water supply from 2013 to 2018. **Table 4-4** also presents the average day demand in gallons per minute (gpm) and gallons per day (gpd) for 2013 through 2018. The water demands generally have remained steady between the years 2015 to 2018.

Table 4-4

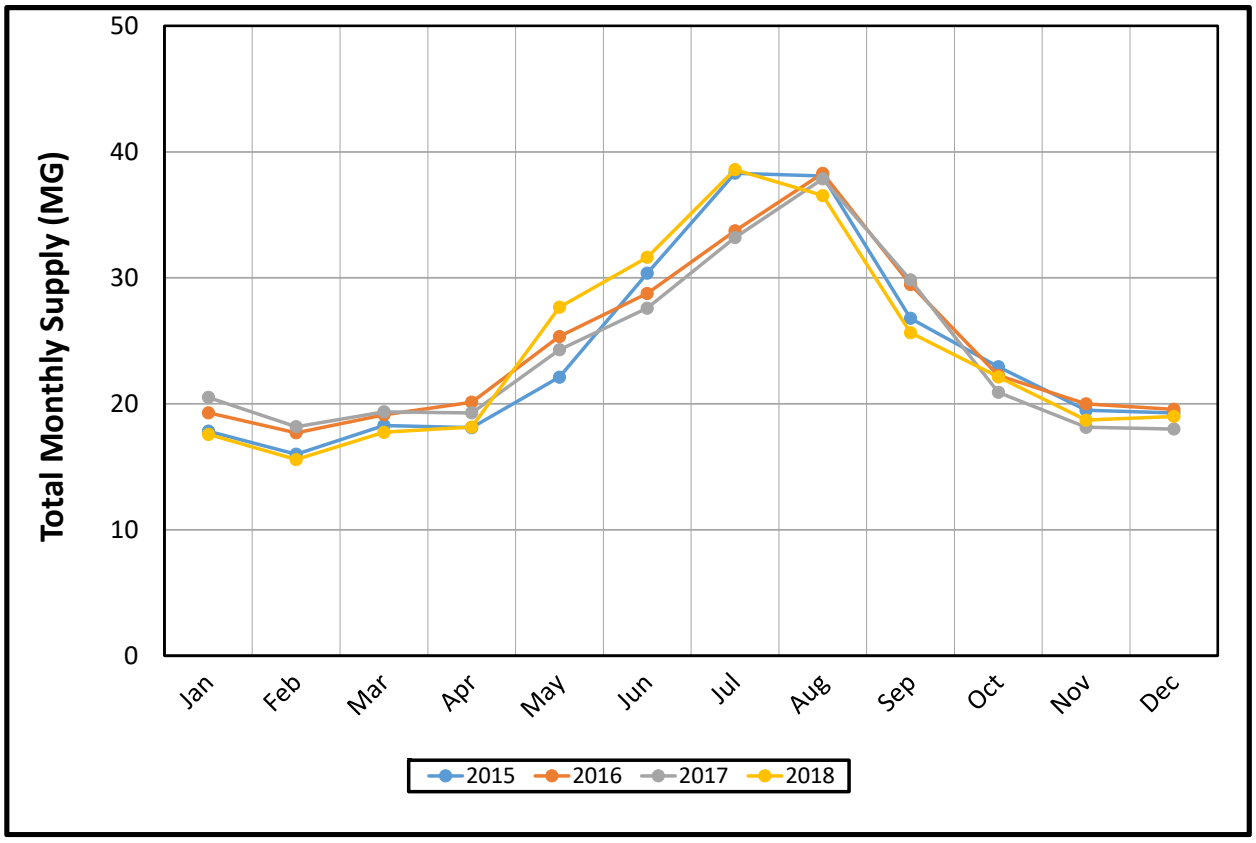
Historical Water Supply

Year	Annual Supply (gallons)	Average Day Demand (gpm)	Average Day Demand (gpd)
2013	265,716,000	506	727,989
2014	264,055,000	502	723,438
2015	287,612,000	547	787,978
2016	293,724,000	557	802,525
2017	287,195,000	546	786,836
2018	289,003,000	550	791,789

Like most other water systems, the City's water use varies seasonally. **Chart 4-3** shows the historical amount of water supplied to the City's system for each month from 2015 through 2018. Monthly water supply data was unavailable for the years prior to 2015; therefore, it is not presented in **Chart 4-3**.

Chart 4-3

Historical Monthly Water Supply



As shown in **Chart 4-3**, water supply increases significantly during summer months, primarily due to increases in irrigation and residential usage. The City's highest water use typically occurs in July and August. On average, the amount of water supplied during these 2 months is approximately 25 percent of the total supply for the entire year.

Distribution System Leakage

The difference between the amount of water supply and the amount of authorized water consumption is the amount of distribution system leakage (DSL). There are many sources of DSL in a typical water system, including water system leaks, inaccurate supply metering, inaccurate customer metering, illegal water system connections or water use, fire hydrant usage, water main flushing, and malfunctioning telemetry and control equipment resulting in reservoir overflows. Several of these types of usages, such as water main flushing and fire hydrant usage, may be considered authorized use if they are tracked and estimated. Although real losses from the distribution system, such as reservoir overflows and leaking water mains, should be tracked for accounting purposes, these losses must be considered leakage. The Water Use Efficiency (WUE) Rule establishes a DSL standard of 10 percent or less based on a rolling 3-year average.

The amount of DSL in the City's system has been under 10 percent since 2017, with 2015 and 2016 exceeding 10 percent, as shown in **Table 4-5**. The rolling 3-year average DSL has been less than 10 percent since 2015. The City will continue to record authorized water usage and

improve the reporting of additional authorized water uses. The City also will implement the WUE Program contained in **Appendix F**.

Table 4-5

Distribution System Leakage

Description	2013 [1]	2014 [1]	2015	2016	2017	2018
Authorized Consumption (AC)						
Total Authorized Consumption (MG)	245.6	250.2	257.3	260.4	282.2	281.1
Total Production (TP)						
Total Production/Supply (MG)	265.7	264.1	287.6	293.7	287.2	289.0
Distribution System Leakage (TP - AC)						
Total Distribution System Leakage (MG)	20.1	13.9	30.3	33.3	5.0	7.9
Total Distribution System Leakage (%)	7.6%	5.3%	10.5%	11.3%	1.7%	2.7%
Rolling 3-Year Average DSL (%)	---	---	7.8%	9.0%	7.9%	5.3%

Per Capita Demands

Table 4-6 presents the computation of the existing residential population per capita demand based on 2018 data.

Table 4-6

Existing Residential Population Per Capita Demand

2018 Residential Population Served	
Calculated 2018 Residential Population Served	6,308
2018 Total Annual Supply (gal)	
2018 Total Annual Supply (gal)	289,003,000
Existing Per Capita Demand (gpd/capita)	**126**

Because the density and type of existing water users generally is consistent with expectations for the future development of the water system, no adjustments are necessary to the per capita demand figures for future customers. Often, future per capita demands are adjusted to account for large industrial customers that are not considered representative of future users. However, for the City, the existing 126 gpd per capita demand was assumed to be representative of the City's future water system. The 126 gpd per capita figure is used later in this chapter to forecast water demands in future years based on future population estimates.

Peak Demands

Average Day Demand

Average day demand (ADD) is the total amount of water delivered to the system in a year divided by the number of days in the year. ADD is determined from the historical water use patterns of the system and can be used to project future demands within the system. Water

production records from the City's Water Treatment Plant were reviewed to determine the system's ADD. The system's average day demand from 2013 through 2018 is shown in **Table 4-3**.

Maximum Day Demand

Maximum day demand (MDD) is the maximum amount of water used throughout the system during a 24-hour time period of a given year. MDD typically occurs on a hot summer day when irrigation is occurring throughout much of the system. In accordance with Washington Administrative Code (WAC) 246-290-230, the distribution system shall provide fire flow at a minimum pressure of 20 pounds per square inch (psi) during MDD (i.e., peak day demand) conditions. Supply facilities (e.g., wells, springs, pump stations, interties) typically are designed to supply water at a rate that is equal to or greater than the system's MDD.

MDD typically is determined from the combined flow of water into the system from all supply sources and reservoirs on the maximum day. The only records available for flow into the system are monthly reports of water produced at the Water Treatment Plant. DOH recommends that systems serving 1,000 to 100,000 people multiply the maximum month ADD (MMADD) by 1.35 to determine the MDD. The City's MMADD for years 2015 through 2018, which occurred in July 2018, was 864 gpm as shown in **Table 4-7**. Multiplying the MMADD by 1.35 resulted in an estimated MDD of 1,167 gpm as shown in **Table 4-7**.

Table 4-7

Demands and Peaking Factors

Peak Demand Data			
Demand Type	**Date**	**Demand (gpm)**	**Demand (gpd)**
Average Day Demand (ADD)	2018	550	791,789
Maximum Month Average Day Demand (MMADD)	July, 2018	864	1,244,774
Maximum Day Demand (MDD)	Daily supply data unavailable Assumed MDD/MMADD = 1.35	1,167	1,680,445
Peak Hour Demand (PHD)	Hourly data unavailable Equation 3-1 from WSDM [1]	1,946	2,802,719
Peaking Factors			
Maximum Day Demand/Average Day Demand (MDD/ADD)		2.12	
Peak Hour Demand/Maximum Day Demand (PHD/MDD)		1.67	
Peak Hour Demand/Average Day Demand (PHD/ADD)		3.54	

1 = Calculated number of Total System ERUs for the year 2018 from **Table 4-8B** was used in Equation 3-1 to determine PHD.

Peak Hour Demand

Peak hour demand (PHD) is the maximum amount of water used throughout the system, excluding fire flow, during a 1-hour time period of a given year. In accordance with WAC 246-290-230, new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 pounds per square inch (psi) during PHD conditions.

The PHD, like the MDD, typically is determined from the combined flow of water into the system from all supply sources and reservoirs. Hourly water production records and chart recordings of reservoir levels were not available for the City's storage facilities or

the Ranney Well. Therefore, the system's PHD could not be computed based on actual system data. Instead, Equation 3-1 from DOH's *Water System Design Manual* was used to compute the system's PHD. This resulted in an estimated PHD of 1,946 gpm.

DOH Equation 3-1

$$\mathbf{PHD = (ERU_{MDD}/1440)[(C)(N) + F] + 18}$$

Where:

PHD = Peak hourly demand in gpm

C = Coefficient associated with ranges of equivalent residential units (ERUs)

N = Number of ERUs based on MDD

F = Factor associated with ranges of ERUs

ERU_{MDD} = Maximum day demand per ERU (gpd).

Table 4-7 shows the peaking factors of the water system based on the average day, maximum day, and peak hour demand data. The MDD/ADD ratio of 2.12 is within the typical range of 1.2 to 2.5 for most systems. The estimated PHD/MDD ratio of 1.67 also is within the typical range of 1.3 to 2.0 for most systems. These peaking factors will be used later in this chapter, in conjunction with projected average day demands, to estimate the system's future maximum day and peak hour demands.

Existing Equivalent Residential Units

The consumption of each customer class can be expressed in terms of ERUs for demand forecasting and planning purposes. One average day of consumption per ERU (ERU_{ADD}) is equivalent to the amount of water consumed by a single-family residence on an average day, not including DSL. One maximum day of consumption per ERU (ERU_{MDD}) is equivalent to the amount of water consumed by a single-family residence on the day that the water system experiences the highest demand of the year, not including DSL. The number of ERUs represented by the consumption of the other customer classes is determined from the total consumption of the customer class and the unit demand per ERU from the single-family residential demand data. The number of ERUs consumed by DSL also is calculated in this fashion.

Tables 4-8A and **4-8B** present the computed number of ERUs for each customer class on a consumption basis from 2013 through 2018, as well as the number of ERUs consumed by DSL. The consumption shown is based on the totals of each customer class shown in **Table 4-1**. The average ERU_{ADD} of single-family residential customers between the years 2013 and 2018 (6-year average) was 173 gpd per ERU. The average ERU_{MDD} of single-family residential customers between the years 2013 and 2018, calculated by multiplying the ERU_{ADD} by the MDD/ADD peaking factor presented in **Table 4-7**, was 368 gpd per ERU. The average ERU_{ADD} and ERU_{MDD}, as shown in **Table 4-8B**, will be used later in this chapter to forecast ERUs in future years based on estimated future demands. This demand per ERU value also will be used to determine the capacity (in terms of ERUs) of the existing system in **Chapter 7**. The 2018 ERU_{ADD} and ERU_{MDD} values were chosen to estimate future demands and ERUs, as the most detailed information was available for 2018, allowing for the most accurate projections possible.

Table 4-8A
Equivalent Residential Units

Year	Average Number of Connections	Average Annual Consumption (gallons)	Consumption per ERU_{ADD} (gpd/ERU_{ADD})	Consumption per ERU_{MDD} (gpd/ERU_{MDD})[1]	Total ERUs
Single-Family Residential					
2013	1,579	106,869,221	185	394	1,579
2014	1,583	96,116,533	166	353	1,583
2015	1,565	94,188,209	165	350	1,565
2016	1,622	96,072,178	162	343	1,622
2017	1,710	110,334,349	177	375	1,710
2018	1,757	118,297,672	184	391	1,757
Multi-Family Residential					
2013	66	28,375,325	185	394	418
2014	61	30,797,770	166	353	506
2015	63	35,925,635	165	350	595
2016	61	25,868,355	162	343	437
2017	62	24,630,532	177	375	381
2018	62	30,548,647	184	391	452
Motel					
2013	8	3,645,841	185	394	54
2014	8	4,322,370	166	353	71
2015	14	3,784,004	165	350	63
2016	8	4,509,593	162	343	76
2017	9	4,428,512	177	375	68
2018	8	4,547,523	184	391	67
Mobile or RV					
2013	6	6,447,918	185	394	95
2014	7	9,369,717	166	353	154
2015	6	10,809,813	165	350	179
2016	7	11,115,162	162	343	188
2017	7	18,120,954	177	375	280
2018	6	9,505,946	184	391	141
Commercial					
2013	255	89,764,101	185	394	1,323
2014	237	99,091,688	166	353	1,628
2015	247	96,837,163	165	350	1,605
2016	249	103,732,776	162	343	1,751
2017	265	106,240,525	177	375	1,642
2018	269	98,652,611	184	391	1,461

(1) = Estimated based on MDD/ADD peaking factor from **Table 4-7**.

Table 4-8B
Equivalent Residential Units

Year	Average Number of Connections	Average Annual Consumption (gallons)	Consumption per ERU_{ADD} (gpd/ERU_{ADD})	Consumption per ERU_{MDD} (gpd/ERU_{MDD})[1]	Total ERUs
City					
2013	17	1,193,837	185	394	18
2014	21	5,073,267	166	353	83
2015	22	5,775,865	165	350	96
2016	21	5,467,217	162	343	92
2017	21	3,634,230	177	375	56
2018	22	5,044,079	184	391	75
Churches and Schools					
2013	25	9,273,183	185	394	137
2014	25	5,386,664	166	353	88
2015	30	9,562,906	165	350	158
2016	26	10,961,817	162	343	185
2017	27	12,213,255	177	375	189
2018	26	11,230,834	184	391	166
Other [2]					
2013	--	--	185	394	--
2014	--	--	166	353	--
2015	23	410,919	165	350	7
2016	20	2,716,570	162	343	46
2017	20	2,603,711	177	375	40
2018	19	3,283,878	184	391	49
Distribution System Leakage					
2013	--	20,146,574	185	394	298
2014	--	13,896,991	166	353	229
2015	--	30,317,486	165	350	504
2016	--	33,280,332	162	343	562
2017	--	4,988,932	177	375	77
2018	--	7,891,810	184	391	117
Total System					
2013	1,956	265,716,000	185	394	3,926
2014	1,942	264,055,000	166	353	4,349
2015	1,970	287,612,000	165	350	4,779
2016	2,014	293,724,000	162	343	4,959
2017	2,121	287,195,000	177	375	4,451
2018	2,169	289,003,000	184	391	4,292
Average 2013 to 2018			**173**	**368**	

(1) = Estimated based on MDD/ADD peaking factor from **Table 4-7**.

(2) = Consumption and connection values for the "Other" customer class for 2013 and 2014 were unavailble for this Water System Plan.

Fire Flow Demand

Fire flow demand is the amount of water required during firefighting as defined by applicable codes. Fire flow requirements are established for individual buildings and expressed in terms of flow rate (gpm) and flow duration (hours). Fighting fires imposes the greatest demand on the water system because a large volume of water must be supplied over a short period of time, requiring each component of the system to be properly sized and configured to operate at its optimal condition. Adequate storage and supply are useless if the transmission or distribution system cannot deliver water at the required rate and pressure necessary to extinguish a fire.

General planning-level fire flow requirements were established for the City's different land use categories to provide a target level of service for planning and sizing future water facilities in areas that are not fully developed. The general planning-level fire flow requirement for each land use category or specific building type is shown in **Table 4-9**. The water system analyses presented in **Chapter 7** are based on an evaluation of the water system for providing sufficient fire flow in accordance with these general planning-level fire flow requirements. The fire flow requirements shown in **Table 4-9** do not necessarily equate to actual existing or future fire flow requirements for all buildings, since this is typically based on building size, construction type, and fire suppression system provided. Improvements to increase the available fire flow to meet the actual fire flow requirements greater than those shown in **Table 4-9** shall be the responsibility of the developer.

Table 4-9

General Planning-Level Fire Flow Requirements

Land Use Category	Fire Flow Requirement (gpm)	Flow Duration (hours)
Low Density Residential [1]	1,000	1
High Density Residential [2]	1,500	2
Commercial [3]	1,500	2
Industrial [4]	2,000	2

1 = Includes Low Density Residential, Medium Density Residential, Floodway Use District, and Public Quasi Public Institutional land use groups.
2 = Includes only High Density Residential land use group.
3 = Includes Central Business District, Highway Commercial, and Neighborhood Commercial land use groups.
4 = Includes Light Industrial and Heavy Industrial land use groups.

FUTURE WATER DEMANDS

Basis for Projecting Demands

Future demands were calculated from the results of the future residential per capita demand computations shown in **Table 4-5** and the projected population data from **Chapter 3**. Future demand projections were computed with and without water savings expected from implementing WUE measures contained in the City's WUE Program in **Appendix F**.

Demand Forecasts and Water Use Efficiency

Table 4-10 presents the projected water demand forecast for the City's water system. The actual demand data from 2018 also is shown for comparison purposes. Future ADDs were projected based on population estimates for the given years from **Chapter 3** and the estimated demand per capita values. It is anticipated that by 2021, the City will be providing wholesale water supply via an intertie to the Bridge Road Water System due to elevated levels of arsenic in the Bridge Road Water System. As shown in **Appendix P**, the maximum allowable flow rate through the Bridge Road Intertie is 50 gpm. This demand was added to all projected years from 2021 through 2040, assuming that an automatic renewal of the interlocal agreement between the City and Clark Public Utilities may take place in 10 years for an additional 10 years, as stated in **Appendix P**.

Table 4-10

Future Water Demand Projections

Description	Actual	Projected												
	2018	2019	2020	2021 [1]	2022	2023	2024	2025	2026	2027	2028	2029	2030 (+10 years)	2040 (+20 years)
Population Data														
Water Service Area Population	6,308	6,453	6,601	6,753	6,909	7,068	7,230	7,396	7,567	7,741	7,919	8,101	8,287	10,403
Increase from Base Year 2018		145	294	445	601	760	922	1,088	1,259	1,433	1,611	1,793	1,979	4,095
Demand Basis Data (gpd/capita)														
ADD without WUE	126	126	126	126	126	126	126	126	126	126	126	126	126	126
Average Day Demand (gpm)														
Demand without WUE	550	547	560	624	637	651	665	680	694	710	725	741	757	942
Demand with WUE		547	560	622	633	645	657	670	682	695	708	722	735	887
Maximum Day Demand (gpm)														
Demand without WUE	1,167	1,162	1,189	1,267	1,296	1,326	1,356	1,386	1,418	1,450	1,483	1,517	1,551	1,943
Demand with WUE		1,162	1,189	1,264	1,289	1,314	1,341	1,367	1,394	1,422	1,450	1,479	1,508	1,833
Peak Hour Demand (gpm)														
Demand without WUE	1,946	1,938	1,984	2,080	2,128	2,177	2,228	2,279	2,331	2,385	2,440	2,496	2,554	3,206
Demand with WUE		1,938	1,984	2,075	2,116	2,159	2,202	2,247	2,292	2,338	2,385	2,433	2,481	3,024

1 = 50 gpm was added to demands in 2021 and all projected years to account for the water demands of the Bridge Road Water System.

Future MDDs and PHDs shown in **Table 4-10** were computed from the projected ADDs and the maximum existing system peaking factors shown in **Table 4-7**. The future MDD and PHD projections are shown with and without estimated reductions in water use from achieving the City's WUE goal of reducing the ERU_{ADD} by 10 gpd over the course of the planning period (2020 to 2040).

The analysis and evaluation of the existing water system with proposed improvements, as presented in **Chapters 7** and **9**, is based on the 2040 projected demand data without WUE reductions. This ensures that the future system will be sized properly to meet all requirements, whether or not additional water use reductions are achieved. However, the City will continue to pursue reductions in water use by implementing the WUE Program contained in **Appendix F**.

Table 4-11 presents the existing and projected ERUs of the system. The ERU forecasts are based on the projected water demands from **Table 4-10** and the average ERU_{ADD}. The projected maximum day water demand and ERU data from **Tables 4-10** and **4-11** are shown graphically in

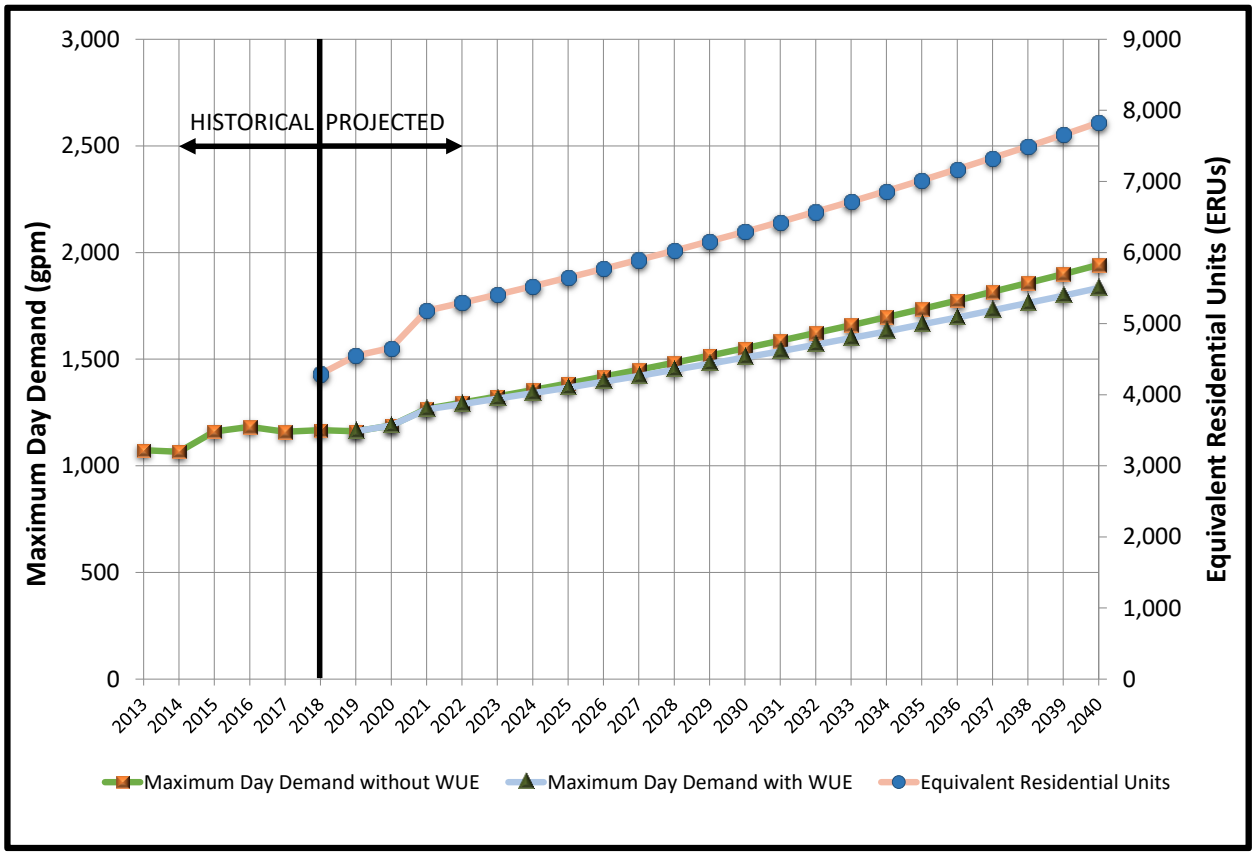
Chart 4-4. **Chart 4-4** will be used in **Chapter 7** to compare demand projections with source of supply availability.

Table 4-11
Future ERU Projections

Description	Actual	Projected													
	2018	2019	2020	2021 [1]	2022	2023	2024	2025	2026	2027	2028	2029	2030	2030 (+10 years)	2040 (+20 years)
Demand Data (gpm)															
ADD	550	547	560	560	624	637	651	665	680	694	710	725	741	757	942
MDD without WUE	1,167	1,162	1,189	1,189	1,267	1,296	1,326	1,356	1,386	1,418	1,450	1,483	1,517	1,551	1,943
MDD with WUE		1,162	1,189	1,189	1,264	1,289	1,314	1,341	1,367	1,394	1,422	1,450	1,479	1,508	1,833
Demand per ERU															
ERU_{ADD} (gpd/ERU_{ADD})	184	173	173	173	173	173	173	173	173	173	173	173	173	173	173
ERU_{MDD} without WUE (gpd/ERU_{MDD})	391	368	368	368	368	368	368	368	368	368	368	368	368	368	368
ERU_{MDD} with WUE (gpd/ERU_{MDD})		368	368	367	366	365	364	362	361	360	359	358	357	357	347
ERUs															
Total System ERUs	4,292	4,549	4,657	5,182	5,295	5,410	5,527	5,648	5,771	5,897	6,026	6,158	6,293	6,293	7,826

1 = 50 gpm was added to demands in 2021 and all projected years to account for the water demands of the Bridge Road Water System.

Chart 4-4
Maximum Day Demand and ERU Projections



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