TOWN OF FIRESTONE

2020—2050 Water Action Plan

March 10, 2020

CONNECTING WATER TO LIFE

TOWN OF FIRESTONE

2020—2050 Water Action Plan

Prepared for:
Town of Firestone

Date March 10, 2020

Project Number 1527TWF02-20

The technical material in this report was prepared by or under the supervision and direction of the undersigned, whose seal as a Professional Engineer is affixed below.

The following members of the LRE Water staff contributed to the preparation of this report.

Principal-in-Charge: Gregg S. Ten Eyck, P.E., Senior Project Engineer
Reviewer: Brett Gracely, P.E., D.WRE. Water Resources Planning and Management Practice Leader

Executive Summary: 2020—2050 Water Action Plan

The 2020—2050 Water Action Plan addresses how the Town of Firestone ("Town" or "Firestone") will meet raw water and treated water demands over the next 10 to 30 years.

Raw water supplies are needed to deliver water to:

1) Carter Lake for transfer to the Central Weld County Water District (Central Weld);

2) Firestone reservoirs or to the St. Vrain Creek as augmentation water to support delivery to the Town's non-potable irrigation system; and

3) Firestone reservoirs or to the St. Vrain Creek as augmentation water to support delivery to the St. Vrain Water Authority (SVWA).

Raw water that is owned by the Town will be delivered to: 1) Central Weld for treatment and delivery to the Town's distribution system; or 2) SVWA for treatment and delivery to the Town's distribution system.

Treated water demands addressed by this plan are for lands within the Town where the Town is the retail water provider. This area includes lands south of the St. Vrain Creek and east of I-25. This area is currently supplied water that has been treated by Central Weld and delivered to master meters in Firestone. Firestone owns and operates its own distribution system in the portion of Firestone where the Town is the retail provider of treated water. In this document we will refer to this area as the "Firestone service area."

Lands within the Town that lie west of I-25 is served treated water by the Left Hand Water District ("LHWD") under a retail service agreement. Lands with the Town that lie north of St. Vrain Creek are in the Barefoot Lakes development, which is served by a retail service agreement with Little Thompson Water District ("Little Thompson"). Providing water to current and proposed customers in those areas is not the responsibility of the Town, and this action plan does not address water needs for those areas.

Therefore, discussions in this action plan related to growth and water needs are only for the part of Firestone that is served water under the wholesale agreement that Firestone has with Central Weld—the Firestone service area. Colorado-Big Thompson ("C-BT") and Windy Gap project water sources that are owned by Firestone are treated by Central Weld at the Carter Lake Filter Plant. That treated water is delivered by Central Weld to the Firestone service area through various master meters owned by the Town.

The Town is a member of the St. Vrain Water Authority. The SVWA will accept raw water from the Town for treatment and subsequent delivery to the Firestone service area. The SVWA water treatment plant is in the design phase and is expected to be operational in 2022.

Discussions about water supplies below are for those supplies that the Town can acquire and transfer to Carter Lake for subsequent delivery to Central Weld, or that can be delivered to the SVWA for treatment. Each of those sources will deliver water to the Firestone service area.

The Town owns and operates its distribution system and all water service connections are metered and usage data is reported on a monthly basis. The data relied upon and referenced in this plan are from the Town's metered usage data.

Summary of Current Water Use and Water Dedication Requirement

Firestone currently delivers about 2,500 acre-feet of water each year to the Carter Lake Filter Plant. Prior to 2019 the supply was exclusively C-BT water; in 2020 the Town started delivery of Windy Gap water to the Carter Lake Filter Plant.

The Town's raw water dedication requirements are codified in the municipal code. For a single family residence on a lot of 10,000 square feet or less, the raw water dedication requirement is 0.60 acre-feet.

Summary of Projected New Water Demand

Section 3 projects water demand based on projected land use and projected population growth, at year 2030 and year 2050. About 2,000 acre-feet of new supply will need to be added between now and 2030, and about 2,600 acre-feet of new supply will need to be added between 2030 and 2050.

Summary of Total New Raw Water Demand
(Acre-feet per Year)

Time Period	Additional Supply Required
2016--2030	1,960
2031--2050	2,622
2016--2050	4,582

Summary of Projected Population Growth

Section 4 presents an estimate of the number of people expected to be added to the existing Firestone population by the year 2030 and the year 2050. The projections are for the population within the Firestone service area only.

Summary of Population Projections

YEAR	Population	Incremental Growth from 2016
2016	13,059	-
2030	21,481	8,422
2050	32,750	19,691

Summary of Estimated Costs and Cash and Financing Needs

Section 7 details the estimated cost of the individual elements of the 2020-2050 Water Action Plan. The table below is a summary of the costs, listed by project type.

Summary of Total Estimated Costs

PROJECT TYPE	ESTIMATED COST	CASH or OTHER	DEBT FINANCED
Other Source Water	$52,200,000	$10,000,000	$42,200,000
Alluvial Wells	$15,553,000	$4,100,000	$11,453,000
Augmentation Infrastructure and Water Sources	$49,090,000	$11,650,000	$37,440,000
Non-Potable Irrigation	$9,764,000	$1,500,000	$8,264,000
Water Treatment	$40,850,000	$0	$40,850,000
Pipelines and Tanks	$16,169,000	$0	$16,169,000
Total Costs 2020-2050	**$183,626,000**	**$27,250,000**	**$156,376,000**

Summary of Costs by Phase

Section 8 gives information on the projects required and the estimated cash and financing needs for the 2020—2024 (Phase 1a), 2025—2030 (Phase 1b), and 2031—2050 (Phase 2) time periods.

Summary of Estimated Costs, by Phase

PHASE	ESTIMATED COST	CASH or OTHER	DEBT FINANCED
Phase 1a: 2020--2022	$69,066,000	$27,250,000	$41,816,000
Phase 1a: 2023-2024	$54,659,000	$0	$54,659,000
Phase 1b: 2025--2030	$24,531,000	$0	$24,531,000
Phase 2: 2031--2050	$35,370,000	$0	$35,370,000
Total Costs: 2020--2050	**$183,626,000**	**$27,250,000**	**$156,376,000**

Summary of Single Family Equivalent Taps

Section 9 gives an estimate of the number of single family equivalent taps supported by the 1.5 MGD and 5 MGD water treatment plant and associated infrastructure. The equivalent of about 3,100 new taps can be supported between now and 2030, with an additional 4,150 new taps supported between 2030 and 2050.

Summary of Estimated Single Family Equivalent Taps

Time Period	Equivalent Single Family Taps
2016--2030	3,108
2031--2050	4,159

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

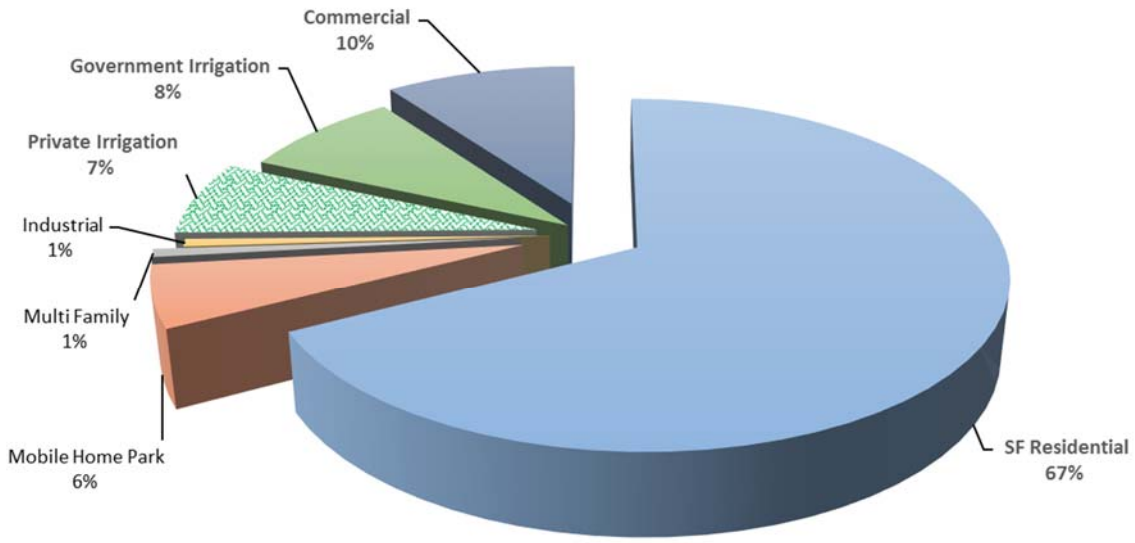
SECTION 1: WATER USE IN THE TOWN OF FIRESTONE

This section discusses current water use within the Town of Firestone.

1.1 METERED DATA EXPLANATION

About 92 percent of the Town's metered use is for four categories of use: commercial (10 percent of total use); irrigation of Town of Firestone (Government) parks and open space) (8 percent); private irrigation of parks and open space (7 percent); and single family residential (67 percent). Other categories of metered use are: mobile home park (6 percent); industrial (1 percent); and multi-family (1 percent). Discussion below is on water use by the first three categories, which in total represent about 92 percent of historical metered water use. Multi-family water use is expected to grow, and we expect to have more data available to project future demands (see page 4 of the 2018 Water Rate Study).

Figure 1
Average Annual Water Use, by Category



1.1.1 Distribution system losses

Based on a comparison of master meter data and data from individual meters in Firestone conducted by Colorado Civil Group ("CCG"), it is estimated that there is one to four percent loss of water between the master meters and the individual meters (page 7, March 2010 Potable Water Master Plan). A three percent distribution system loss is assumed in demand calculations below.

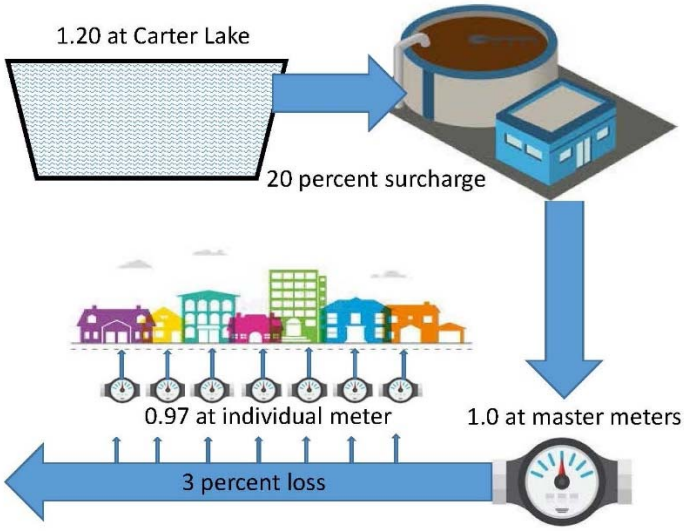
1.1.2 Central Weld Surcharge

The agreement with Central Weld requires that the Town of Firestone transfer 20 percent more C-BT and Windy Gap water than is delivered to the master meters.

The amount of water reported as delivered to the Carter Lake Filter Plant below is based on the total of the individual meter use, divided by 0.97 to account for three percent losses in Firestone, times 1.20 to account for the Central Weld surcharge.

The sketch below illustrates the above losses and surcharge:

Figure 2
Schematic of Surcharge and Losses



1.1.3 2012—2016 Total Water Use

The table below shows the total annual metered water use for the 2012—2016 time period. This period was selected because at that time the entire population of the Town was within the land area that will be served by the SVWA Treatment Plant. The table reflects the estimated three percent distribution system loss and the 20 percent surcharge for water delivered to the Carter Lake Filter Plant. The average annual use in this period was about 2,500 acre-feet.

Table 1
Total Annual Water Use, Acre-feet

	2012	2013	2014	2015	2016	Average 2012--2016
At the Individual Meter, AF	2,235	1,799	1,868	2,013	2,098	2,003
At the Master Meter, AF	2,304	1,854	1,926	2,075	2,163	2,064
At the Treatment Plant, AF	2,765	2,225	2,311	2,490	2,596	2,477

SECTION 2: WATER DEDICATION REQUIREMENTS AND WATER SUPPLY TARGETS

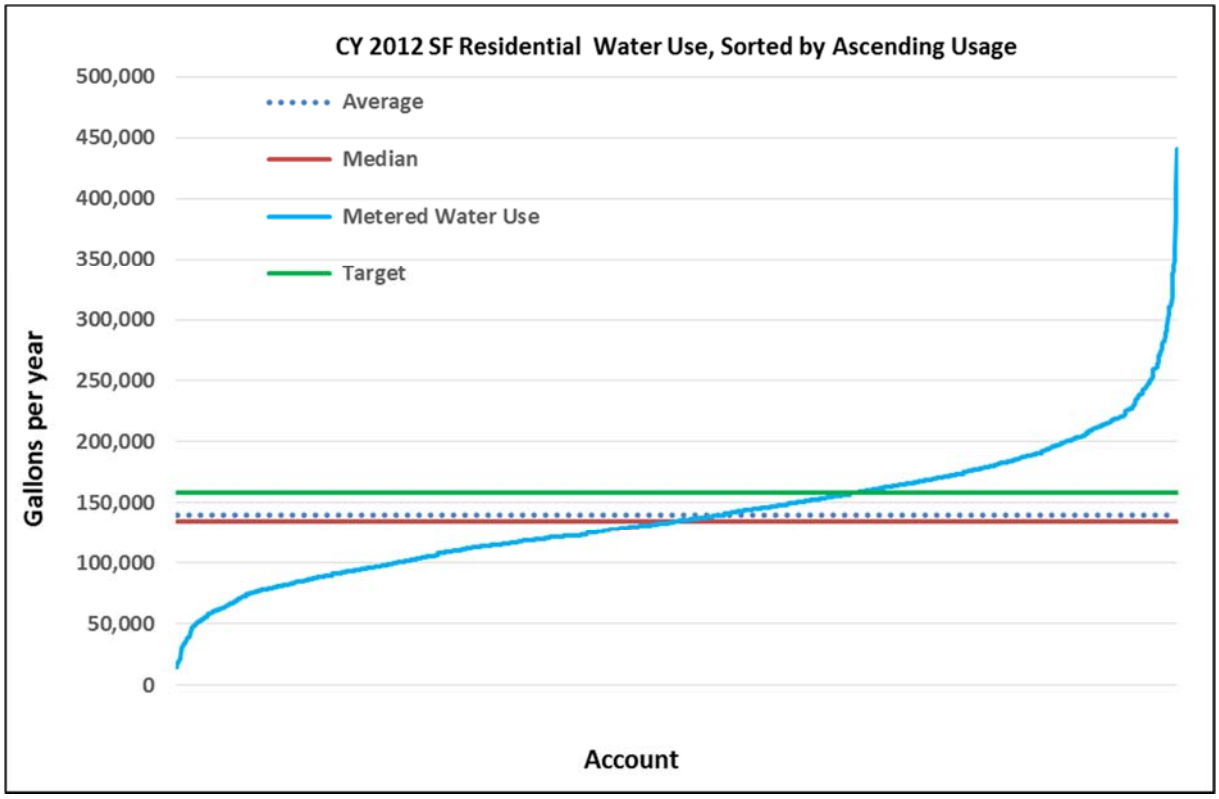
The Firestone raw water dedication requirements are defined in Chapter 13.08 of the Firestone Municipal Code. The amount of water that must be transferred to the Town is based on projected demand for potable water, which is based on land use, including lot size for single family residential uses. The raw water dedication requirement for a single family home on a lot of 10,000 square feet or less is based on meeting an annual demand of about 158,000 gallons at the single family residential meter. This creates a demand of about 195,500 gallons, or 0.60 acre-feet at Carter Lake per single family dwelling unit. This is the amount of water supplied when the C-BT quota is 0.60 acre-feet.

To compare this dedication requirement to historical demands we made a detailed analysis of 2012 water use metered to 1,984 single family taps serving lots of 10,000 square feet or less and that had 12 months of data available. Meters that had zero water use data in any month were excluded from the analysis, to eliminate data from new homes or homes that had an apparent vacancy during the year.

A total of 629 taps, or about 32 percent of the meters analyzed delivered 158,000 gallons or more in 2012. The average use reported by the 1,984 meters analyzed was 139,800 gallons. The median annual water usage was 135,000 gallons, or about 85 percent of the 158,000 gallon target. This means that 50 percent of the individual taps used more than 135,000 gallons.

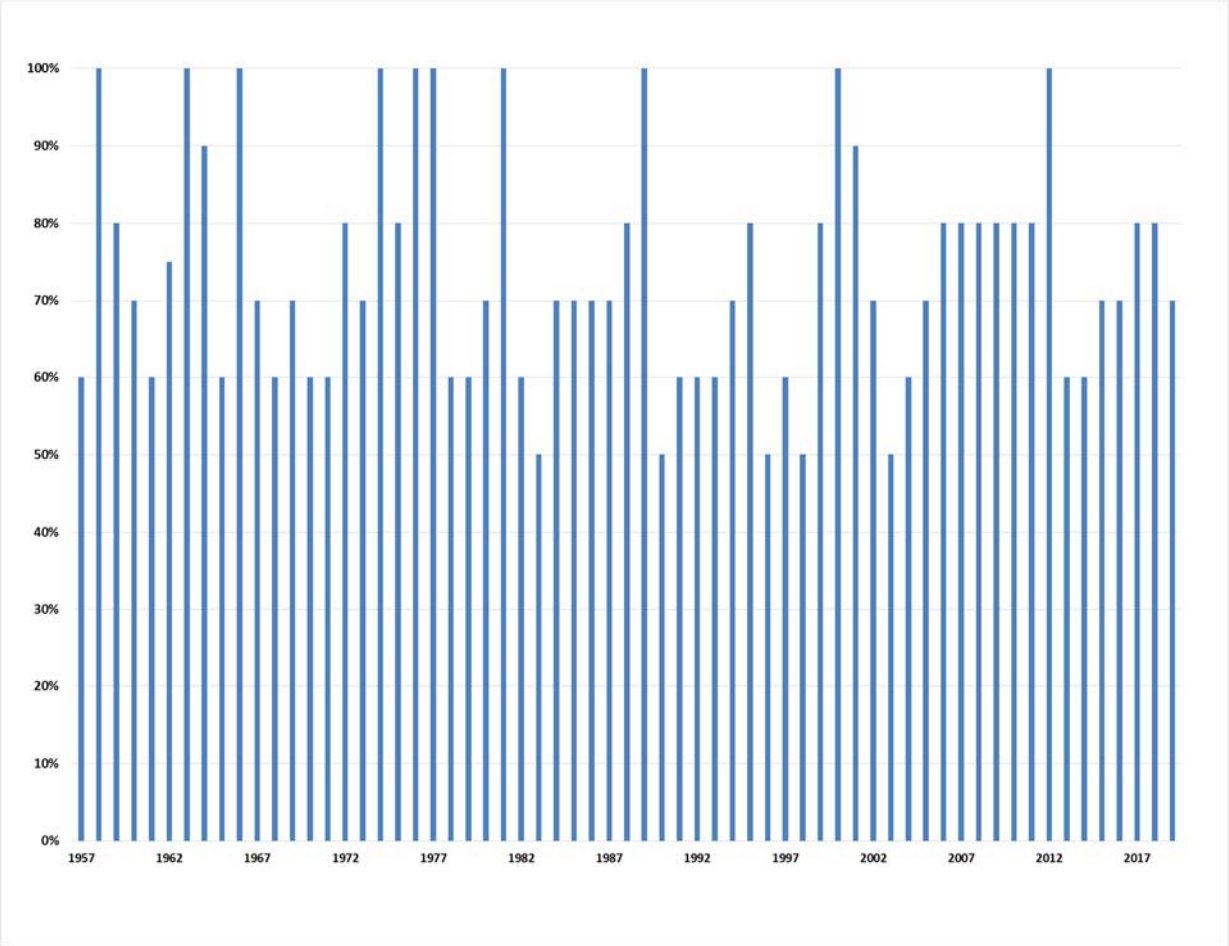
Figure 3 shows the actual annual metered water use for each of the 1,984 meters analyzed.

Figure 3
2012 Residential Water Use by 1,984 Accounts



To compare the single family lot dedication requirement based 0.60 acre-feet per lot to historical supply conditions, we looked at the frequency of declared allocation quotas of less than 0.60 acre-feet per C-BT unit. In the 63 years of data (1957-2019), there were five years of 0.50 acre-feet quota. This means that the C-BT water supply available would not have been adequate to meet the planned target approximately 8 percent of the time.

Figure 4
Final Quota for C-BT, 1957-2019



There is always uncertainty when projecting the availability of water supplies. In the case of the availability of C-BT project water, the hydrologic and climatic uncertainty is compounded by political uncertainty. There have been many changes in C-BT contract unit ownership and federal and state water allocation processes since the Colorado-Big Thompson project was developed. In addition, there is considerable uncertainty about long-term future operations of the C-BT project. This means that C-BT users cannot rely on historical data to indicate the magnitude of future water deliveries.

The Town is not going to increase or to decrease its water dedication requirement of 0.60 acre-feet per single family (5/8-inch water tap) at this time. The Town expects to re-evaluate this dedication requirement in the next 5 to 10 years after new supplies are available, new raw water storage facilities are available, and new treatment options are fully operational.

SECTION 3: WATER DEMAND PROJECTIONS

This section projects future water demands based on land use, population, and unit water demands. Water demands described below are "at the meter," meaning that demands need to be adjusted upwards to account for delivery system losses or treatment system losses that occur after the master meter. This adjustment will be addressed at the end of the section.

Projections are made from 2016 as the baseline year. That year was selected as the baseline year because the population of the Town in 2016 only included residents within the portion of the Town served water through the Town's distribution system. In other words, in 2016 all the residents of the Town were within the Firestone service area and were using C-BT water treated by Central Weld.

The projections based on land use are based on the 2019 Town of Firestone growth boundary, as shown in Figure 5, the 2018 zoning, as shown in Figure 6, and land use, as shown in Figure 7.

Links to a high resolution version of Figures 5, 6 and 7 are included in the references listed at the end of this document.

Figure 5
2019 Town of Firestone Growth Boundary

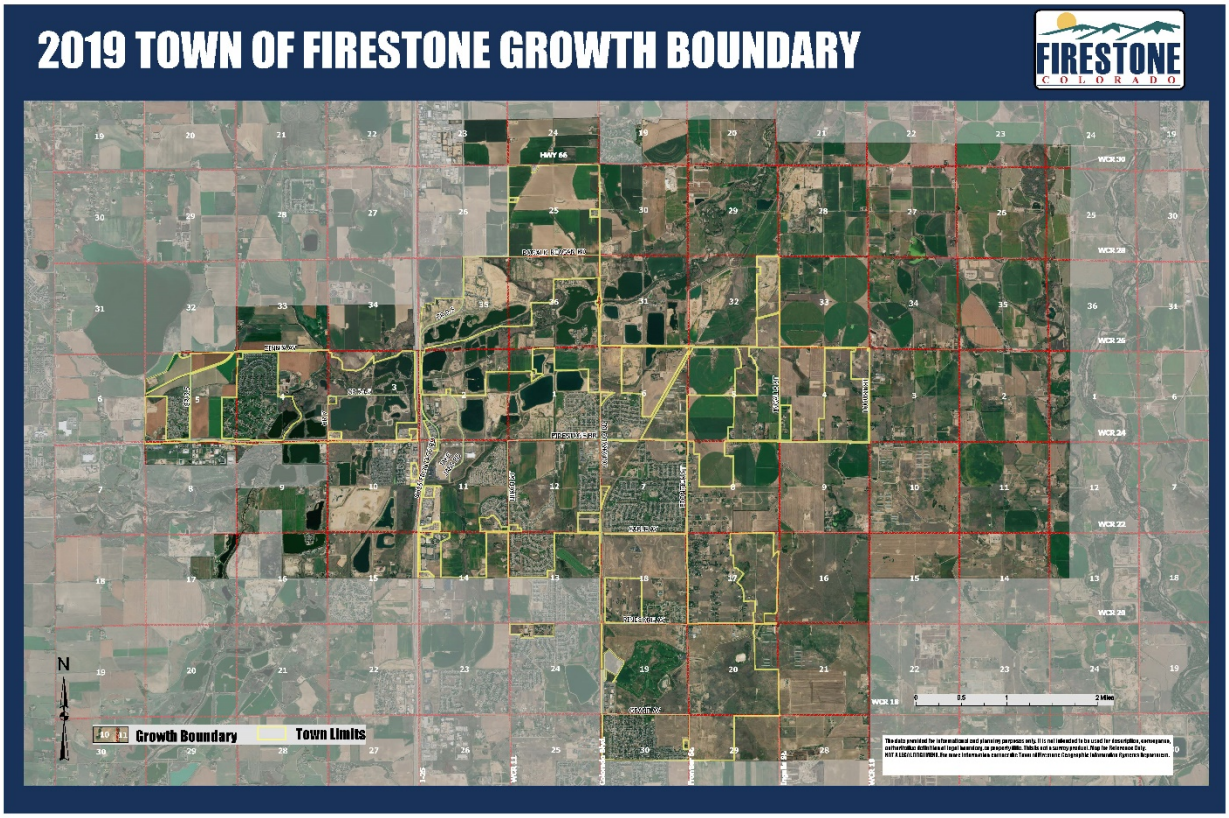


Figure 6
2018 Town of Firestone Zoning Map

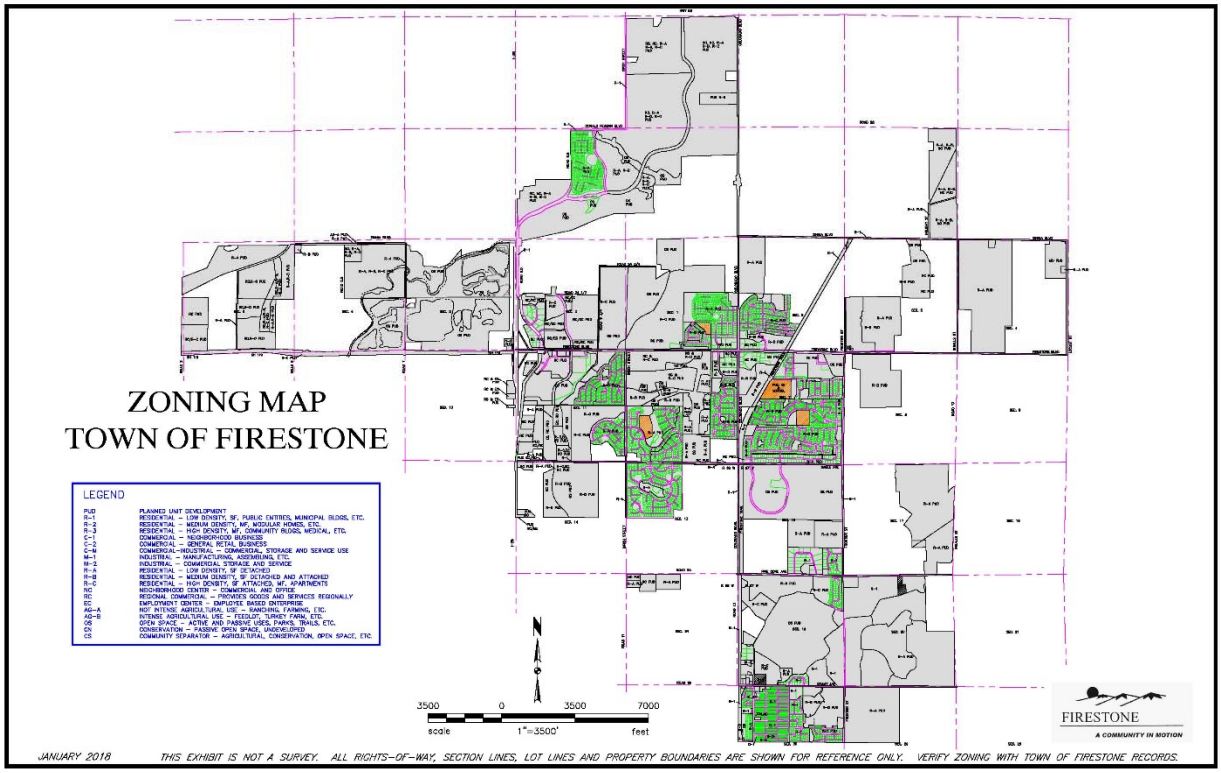
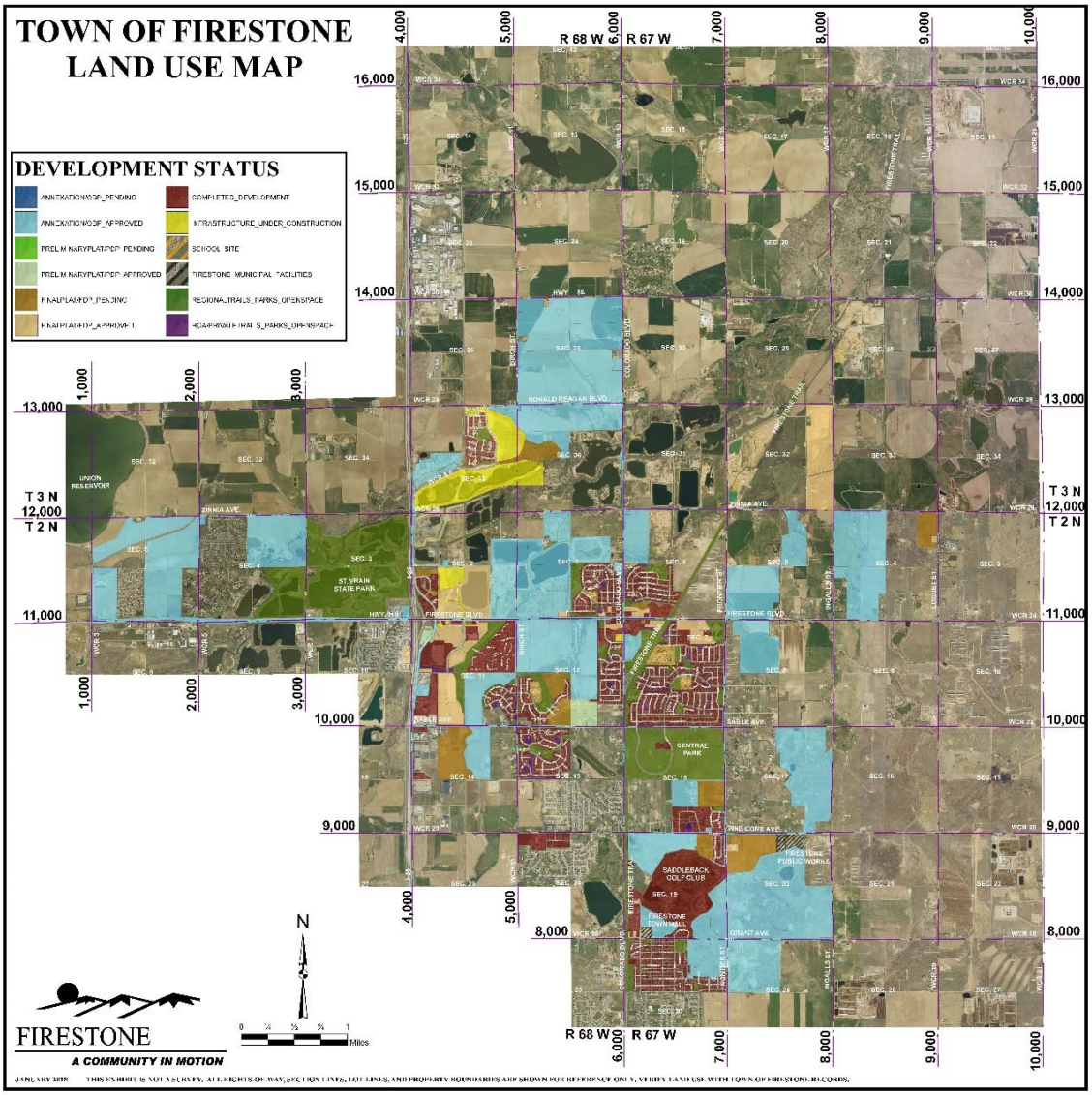


Figure 7
Town of Firestone Land Use Map



3.1 FUTURE WATER DEMAND BASED ON LAND USE PROJECTIONS

The following table of land use projections has been adopted from Table G.1 of the 2019 Firestone Potable Water Distribution System Master Plan prepared by Colorado Civil Group, Inc. It is based on the growth boundaries, zoning, and land use as shown in Figures 5, 6 and 7, above.

Table 2 does not include land use projections for those portions of Firestone that are served by the Little Thompson Water District (north of St. Vrain Creek) or the Left Hand Water District (west of I-25). The table below, and all projections that follow, are based on development anticipated in the areas within the Firestone service area.

Figure 8, below is based on Figure 6 and is included to show the general locations of the service areas of the LHWD, Little Thompson and Firestone.

Figure 8
2018 Town of Firestone Zoning Map with Service Areas Identified

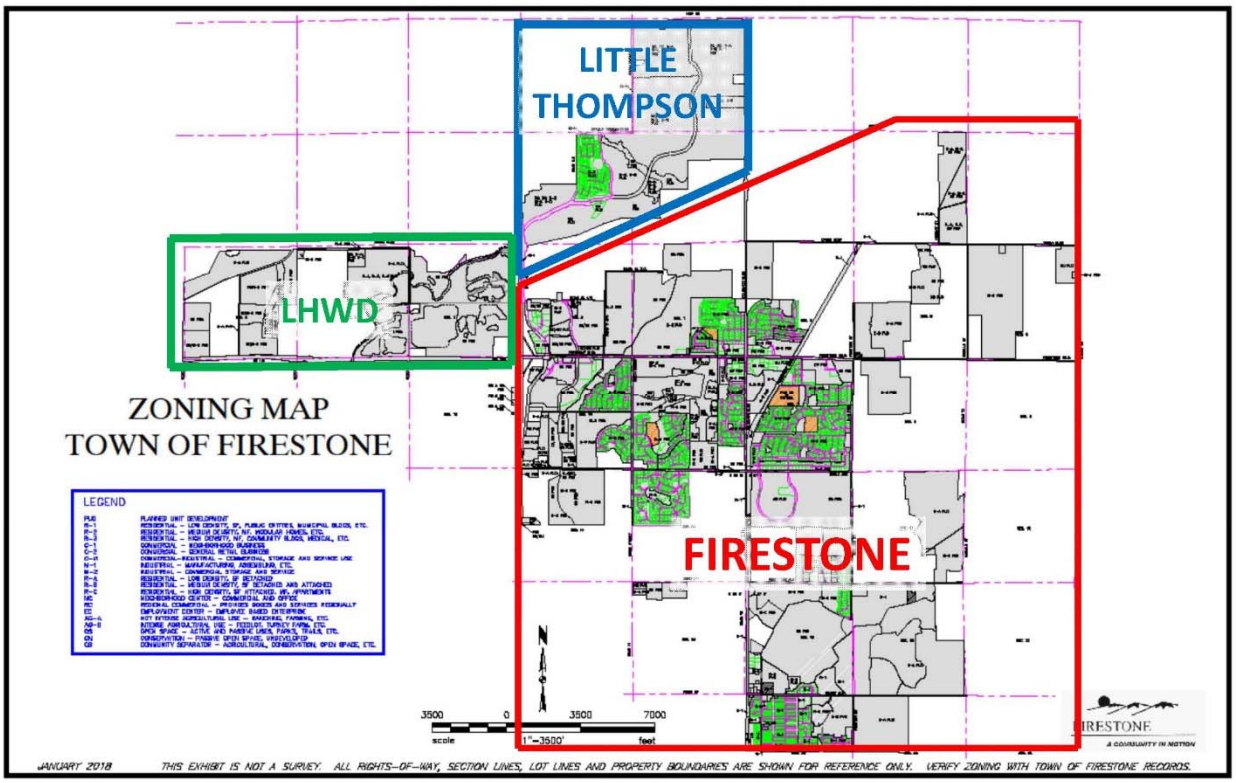


Table 2
Firestone Service Area Land Use Projection

TOWNSHIP RANGE	SECTION I.D.	LAND USE CATEGORY						
		PARKS (acres)	C/OF & E/OF (acres)	MU (acres)	R-L (acres)	R-M (acres)	R-H (acres)	TOTAL (acres)
T03N R67W	21		10	134				144
	22		11	135				145
	23			151				151
	24			46				46
	25			44		126		169
	26		20	378		234		631
	27	10	9	140	404			563
	28	10	10	66	457	72		615
	31	4			119			123
	32	5			528			533
	33	8			622			630
	34	6			584			590
	35	4		325		306		634
	36					159		159
T02N R67W	1		10	63		72		145
	2	17	10	70		540		636
	3		20	141	470			631
	4	13		29	114			156
	5	14			424			438
	6				231	6		237
	8	4			418	95		518
	9	12	20	29	384	182		627
	10		10	30	474	118		632
	11	11	10	77		535		633
	12		10	62		71		142
	13					69		69
	14	6				309		315
	15			73	238			311
	16	10		312	319			641
	17	10			597			607
	18	262	17	42	67			389
	20			80				80
	21	10	20	389	231			650
	28		10	50	256			316
	29		10		149			159
T03N R68W								
	35				16			16
	36				95			95
T02N R68W	1				146			146
	2				36			36
	11		65		23			88
	12				35			35
	13		4				69	72
	14		63		80		16	159
TOTAL		**415**	**338**	**2,865**	**7,516**	**2,893**	**85**	**14,111**

The March 2010 Potable Water Master Plan provided estimates of unit water use rates (acre-feet per acre, for example) for categories of zoning and land use, based on historical Firestone data. In addition, some unit demands have been adjusted or updated for this Action Plan, and will be described below.

3.2 DEMAND BASED ON RESIDENTIAL ZONING LANDS

Table 3 shows the total acres for Residential-Low, Residential-Medium and Residential-High zoned lands. The assumed densities in dwelling units per acre for those three zoning designations in the table are based on the analysis conducted by CCG for Firestone lands east of I-25.

Table 3
Residential Density for Zoning Category

LAND USE CATEGORY	Acres	DENSITY, DU/acre
R-L	7,516	1.14
R-M	2,893	2.94
R-H	85	6.3

Single family residential demand for lands developed between now and 2050 will be based on a total average year future water demand per single family residence of 162,295 gallons, or 0.5 acre-feet per year. This demand is "at the meter" of the individual water user.

Table 4
Water Demand for Residential Zoning
(Acre-feet per year, at the Meter)

Land Use Category	Density (DU/acre)	Average Annual Total Use, (af/acre)	Average Annual Outdoor Use, (af/acre)
R-L	1.14	0.570	0.325
R-M	2.94	1.470	0.838
R-H	6.3	3.150	1.796

3.3 DEMAND BASED ON COMMERCIAL ZONING LANDS

Lands annexed for commercial land use are estimated to have an average year demand of 1.52 acre-feet per acre. Based on 2012 meter data, about 46 percent water delivered to commercial meters is forecast to be used outdoors.

Table 5
Water Demand for Commercial Zoning
(At the Meter)

Land Use Category	Acres	Average Annual Total Use, (af)	Average Annual Outdoor Use, (af)	Average Annual Indoor Use, (af)
Commercial	**338**	**514**	**236**	**278**

3.4 DEMAND BASED ON MIXED USE ZONING LANDS

Mixed Use is a category of future land use specified in many annexations of parcels into the Town of Firestone. The actual amount of commercial, residential, office or park land of any individual annexed parcel that is zoned as Mixed Use is not known until much later in the development process. The future water demand has been projected based on a distribution of zoning and demand in acre-feet per acre used in previous planning reports, as shown in the following table:

Table 6
Distribution of Land Use Within Mixed Use Zoning and Water Demand

Zoning	% of Total	Annual af/acre	Weighted annual af/acre
Commercial/Office	15%	1.520	0.228
Employment/Office	25%	1.374	0.343
R-M	35%	1.470	0.515
R-H	25%	3.150	0.788
Total	100%		**1.873**

Based on the above distribution, the net new water demand for Mixed Use lands is:

Table 7
Water Demand for Mixed Use Zoning
(Acre-feet per year, at the Meter)

Land Use Category	Acres	Average Annual Total Use, (af)	Average Annual Outdoor Use, (af)	Average Annual Indoor Use, (af)
Mixed Use	2,865	5,366	3,027	2,340

3.5 DEMAND BASED ON FUTURE PARK LANDS

Based on assumed demand of 1.8 acre-feet per acre in an average year, the net water demand for new park lands is projected as 746 acre-feet per year.

Table 8
Water Demand for Parks
(Acre-feet per year, at the Meter)

Land Use Category	Acres	Average Annual Total Use, (af)	Average Annual Outdoor Use, (af)	Average Annual Indoor Use, (af)
Parks	415	746	746	0

3.6 SUMMARY

The total new water demand projected to be needed by the lands tabulated on Table 2, is listed below. The total annual demand for additional water supplies is projected to be in the range of 15,430 acre-feet in an average year. These are demands measured "at the meter" of the Firestone water customers.

Table 9
Summary of Total Water Demand Based on Projected Land Use
(Acre-feet per year, at the Meter)

Land Use Category	Average Annual Total Use	Average Annual Outdoor Use	Average Annual Indoor Use
Residential	8,803	5,018	3,785
Commercial	514	236	278
Mixed Use	5,366	3,027	2,340
Parks	746	746	-
Total	**15,430**	**9,027**	**6,403**

SECTION 4: POPULATION PROJECTIONS

The demand for new water supplies to serve new lands in the Firestone service area, as shown in Table 9, is not for a point in time. The projected annual water demand is for the time when these lands are fully developed. This section will apportion the projected future water demand to year 2030 and year 2050 based on population growth projections.

4.1 POPULATION SUPPORTED BY LAND USE PROJECTIONS

Based on density of dwelling units on acreage that has been annexed into Firestone or based on the approved development plans or zoning, the population that will be supported by development of 10,493 acres of residential developments and 1,719 acres of residential lands within mixed use developments is estimated to be about 75,200 new residents. The assumed occupancy per dwelling unit is 3.0 persons, based on historical Firestone data.

Table 10
Summary of New Population Based on Projected Land Use

Land Use Category	DU/acre	Residential			Mixed Use			Total
		Acres	DU total	At 3.0/DU	Acres	DU total	At 3.0/DU	Population
R-L	1.14	7,516	8,568	25,705	-	-	-	25,705
R-M	2.94	2,893	8,504	25,512	1,003	2,948	8,843	34,355
R-H	6.30	85	534	1,603	716	4,512	13,535	15,137
TOTAL	-	**10,493**	**17,606**	**51,411**	**1,719**	**7,459**	**21,781**	**75,197**

Adding 75,200 new residents to the estimated 2016 population of about 13,050 people, means that a total of about 88,250 people will live in the Firestone service area. The table above shows that lands in the Firestone service area will include about 25,100 new single family residential units. At historic growth rates it would take many decades for Firestone's population and housing stock to reach that level.

4.2 TOTAL NEW WATER DEMAND BASED ON POPULATION GROWTH: 2030 AND 2050

To convert the estimated new demand presented above into new demand for water in the year 2030 and year 2050, we compare the projected population at those points in time to the total population supported by the land uses, as shown in Table 10, above. Then, assuming that all growth in water demand by type of use will be in proportion to population growth we can project the amount of new water required in 2030 and 2050.

To project the population of Firestone that will be in the Firestone service area in 2030 and in 2050 we compared three different projections. For all three projections, we started with the estimated population of 13,059 that was within the Firestone service area in 2016.

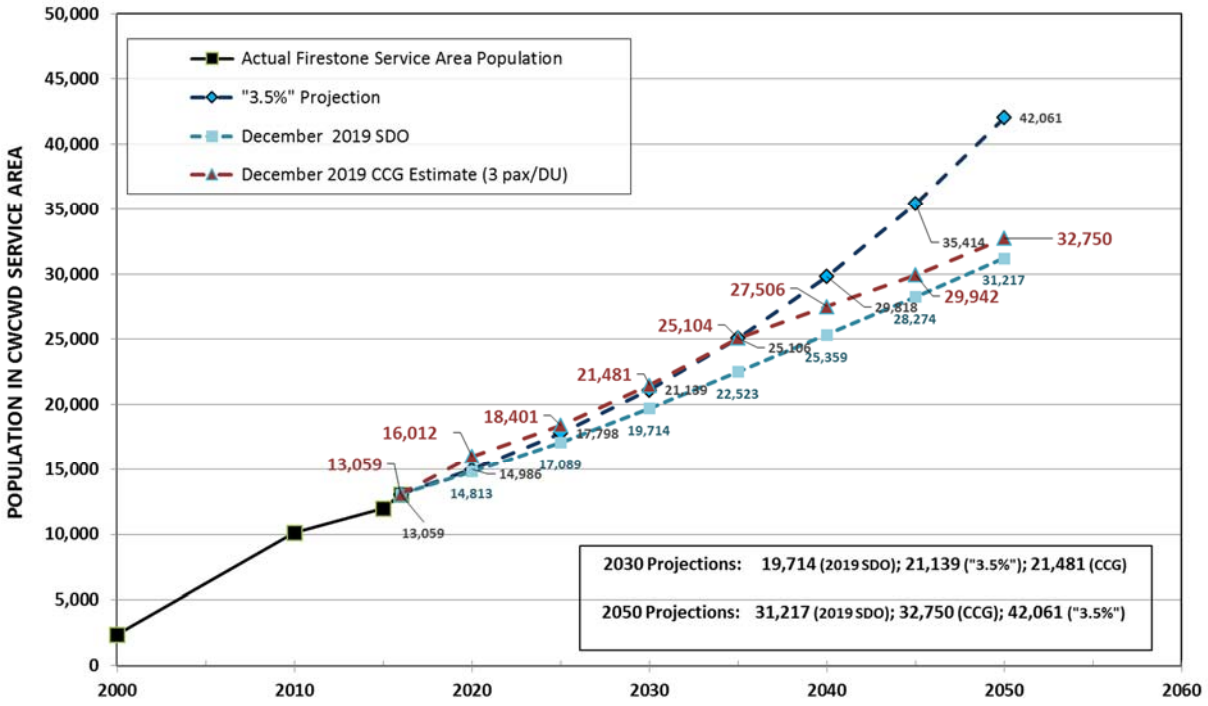
In the first projection we used the December 2019 State Demography Office (SDO) projections of growth rates in Weld County. The SDO projections are made for 5-year increments, and ranged from 3.2 percent projected growth from 2015 to 2020 to 2.0 percent growth from 2045 to 2050. These SDO projections are an assumed average growth rate for all parts of Weld County.

Second, we used a straight line projection of 3.5 percent growth in each 5-year increment.

Third, we used a December 2019 projection that CCG developed for future population within the Firestone service area. CCG based their projection on actual new housing units built between 2016 and 2019 and projected development based on actual zoning applications or annexation agreements. The CCG population growth rates ranged from an average of 4.3 percent per year from 2020 to 2025, to 2 percent per year from 2034 to 2050.

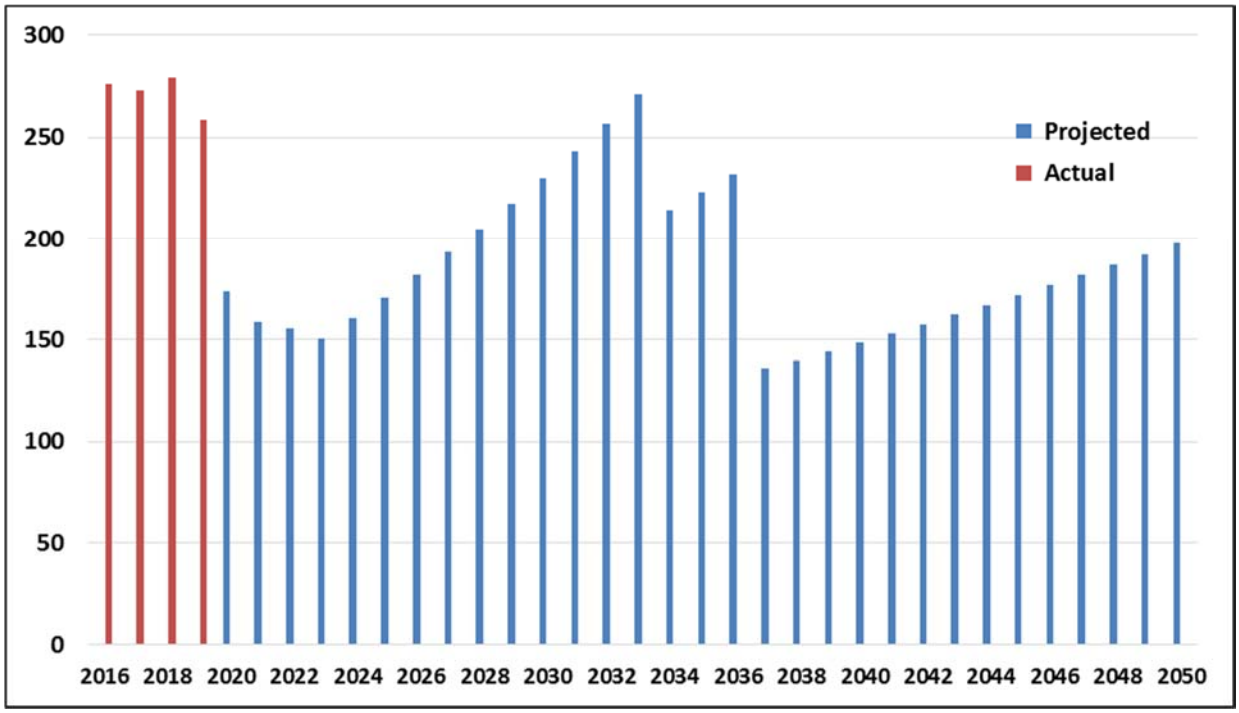
In summary, the graph below shows population projections for the Firestone service area ranging from about 20,400 to 21,500 by the year 2030, and a population between about 32,000 and 42,000 in the year 2050.

Figure 9
Population Data and Projections, Firestone Service Area 2000-2050



Because the CCG projections are based on the most Firestone-specific data and land use-specific data, we use the CCG projected population of about 21,500 in 2030 and about 33,000 in 2050 in calculations below. While this growth appears substantial, the CCG projection is based on a range of about 150 to 275 new dwelling units per year in the Firestone service area, which is similar to or less than recent experience. Figure 10 shows the number of dwelling units added per year that was assumed in the CCG population projection.

Figure 10
New Dwelling Units per Year Added to Firestone Service Area



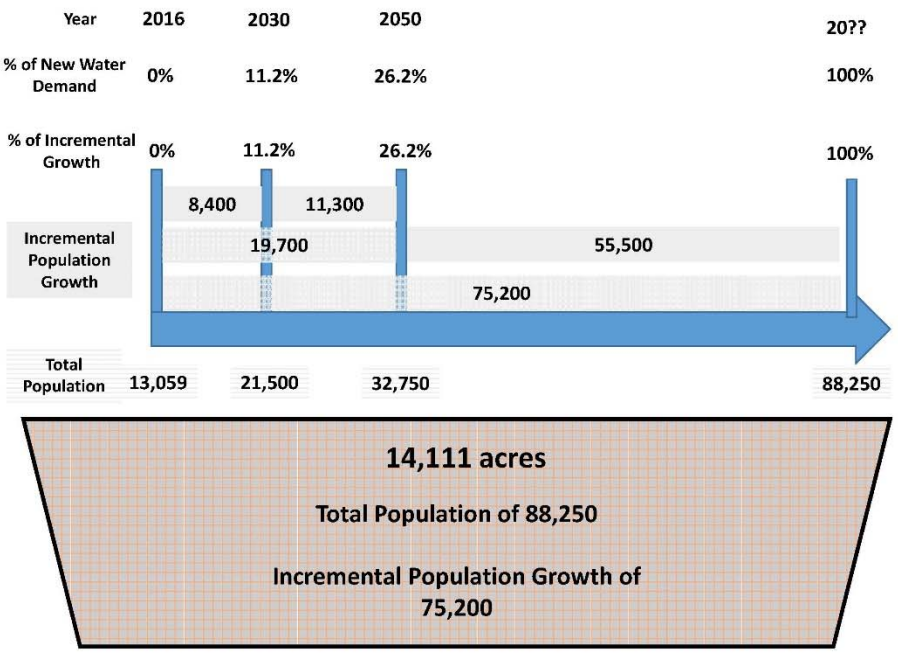
The incremental growth in population between 2016 and 2030 and between 2016 and 2050, compared to the total projected incremental growth in population based on land use is shown in the following table. The data that will be used in the following sections is in the far right column of Table 11.

Table 11
Summary of Population Projections for 2030 and 2050

	Projected Population in CWCWD Service Area						Period Incremental Growth (2016-2030 and 2016-2050) as Percent of Total Incremental Growth		
YEAR	Dec 2019 SDO		"3.5 %" line		Dec 2019 CCG		Dec 2019 SDO	"3.5 %" line	Dec 2019 CCG
	Population	Incremental Growth	Population	Incremental Growth	Population	Incremental Growth			
2016	13,059	-	13,059	-	13,059	-	-		-
2030	19,714	6,655	21,139	8,080	21,481	8,422	8.2%	10.0%	11.2%
2050	31,217	18,158	42,061	29,002	32,750	19,691	22.4%	35.8%	26.2%
-	88,256	75,197	88,256	75,197	88,256	75,197	100.0%	100.0%	100.0%

The following schematic shows, for the portion of the Town within the Firestone service area, the relationship between total projected population based on all the lands available for development and the projected population in 2030 and 2050.

Figure 11
Total and Incremental Population Projections



4.2.1 New Water Demand for Year 2030

Based on the November 2019 CCG estimate of population in 2030, we estimate that the new water demand for the year 2030 will be 11.2 percent of total projected demand growth for the Town of Firestone lands in the Firestone service area. Table 12, below, is calculated as 11.2 percent of the values in Table 9, above. The total annual demand is in the range of 1,720 acre-feet, at the individual customer meter in an average year.

This projection is for the incremental new water supply required to support growth between 2017 and 2030. Accordingly, the reusable component of the Windy Gap water supply recently acquired by the Town (discussed later) is available to meet the new water demands in 2030 and beyond.

Table 12
2030 New Water Demand
(Acre-feet per year, at the Meter)

Land Use Category	Average Annual Total Use, (af)	Average Annual Outdoor Use, (af)	Average Annual Indoor Use, (af)
Residential	986	562	424
Commercial	58	26	31
Mixed Use	601	339	262
Parks	84	84	-
Total	**1,728**	**1,011**	**717**

4.2.2 New Water Demand for 2050

Based on the November 2019 CCG estimated of population in 2050, we estimate that the new water demand for the year 2050 will be 26.2 percent of the total water demand to serve all the lands in the Firestone service area. The total annual new demand at year 2050 is in the range of 4,040 acre-feet.

Table 13, below, is calculated as 26.2 percent of the values in Table 9, above

Table 13
2050 New Water Demand
(Acre-feet per year, at the Meter)

Land Use Category	Average Annual Total Use, (af)	Average Annual Outdoor Use, (af)	Average Annual Indoor Use, (af)
Residential	2,305	1,314	991
Commercial	135	62	73
Mixed Use	1,405	793	613
Parks	195	195	-
Total	**4,040**	**2,364**	**1,677**

Table 14 shows the incremental growth in demand between 2031 and 2050, which is calculated as the difference between Table 13 and Table 12. The incremental additional annual demand for water is about 2,310 acre-feet.

Table 14
2031—2050 Incremental New Water Demand
(Acre-feet per year, at the Meter)

Land Use Category	Average Annual Total Use	Average Annual Outdoor Use	Average Annual Indoor Use
Residential	1,319	752	567
Commercial	77	35	42
Mixed Use	804	454	351
Parks	112	112	-
Total	**2,312**	**1,353**	**960**

4.3 SUMMARY OF NEW WATER DEMANDS, 2030 AND 2050

Table 15 summarizes the new water demand at the individual meter, at the master meter, and at the treatment plant. Of the 4,582 acre-feet listed as demand at the treatment plant, as much as 307 acre-feet may actually be used for park irrigation, delivered directly by the non-potable irrigation system as it is developed. The values in the right column are the new raw water supply targets that will be discussed below.

Table 15
Summary of New Water Demand
(Acre-feet per year)

Time Period	At the Meter	At the Master Meter	To Treatment Plant
2016--2030	1,728	1,782	1,960
2031--2050	2,312	2,384	2,622
2016--2050	4,040	4,165	4,582

SECTION 5: CURRENT WATER SUPPLIES

5.1 COLORADO-BIG THOMPSON

The Town owns about 5,332 units of Colorado-Big Thompson (C-BT) acre-foot contracts. Each unit receives a variable yield, based on the quota as declared by the Board of the Northern Colorado Water Conservancy District ("Northern") each year. While the average final quota over the last 30 years is about 0.71 acre-feet per year, the final quota declared in 11 of the last 30 years was 0.60 or 0.50 acre-feet per unit. The Town bases all water supply plans on a C-BT quota of 0.60 acre-feet per unit each year.

C-BT water is delivered to the Carter Lake Filter Plant for treatment by Central Weld.

The 2019 supply of C-BT water is assumed to be 2,949 acre-feet. This is based on 4,915 units, at 0.6 acre-feet per unit. (An additional 417 C-BT units are assumed dedicated to providing 250 acre-feet for Windy Gap "in-lieu" water, discussed below.) Some of the 4,915 C-BT units that have been transferred to the Town by developers are for water taps that have not yet been activated because the individual homes within the development have not all been built.

5.2 WINDY GAP

The Town owns five units of Windy Gap water; these units are not part of the Windy Gap Firming Project, so the variability in their yield is projected to be quite large. While each unit has a nominal yield of 100 acre-feet, Northern considers the annual firm yield to be 50 acre-feet per unit (see Resolution D-962-02-95). For purposes of this Action Plan, the Town is planning for an annual yield of 50 acre-feet per unit, and also assumes that to achieve this firm yield the Town will need to dedicate 50 acre-feet of C-BT yield per unit as "in-lieu" water. This requires a dedication of the yield from 417 C-BT units, at a yield of 0.6 acre-feet per unit.

Windy Gap water is delivered to Carter Lake for delivery to the Carter Lake Filter Plant for treatment by Central Weld.

5.3 LEASED WATER

The Town has a lease for 300 acre-feet of water from the City of Loveland. That lease expires on July 1, 2026, and it may be extended for five years to July 1, 2031.

When this water is requested by Firestone, it can be delivered to Carter Lake for delivery to the Carter Lake Filter Plant for treatment by Central Weld.

Although this lease is an important short-term supply, it is not considered to be available to meet future demands in 2030 or 2050. This supply will not be discussed in the text or tables below.

5.4 SUMMARY OF WATER SUPPLY AVAILABLE AT CARTER LAKE

Table 16
Water Supplies Available at Carter Lake, 2020

Water Source	Units or Shares	Annual Acre-feet
C-BT	4,915 units	2,949
C-BT "in lieu" Windy Gap	417 units 5 shares	250
Total		**3,199**

5.5 NATIVE ST. VRAIN CREEK WATER

5.5.1 Senior Water Rights

The Town has recently acquired shares in senior irrigation ditches to support the Town's non-potable irrigation system and augmentation needs. These include shares in the Lower Boulder Ditch, the Rural Ditch, and the Godding Ditch. The total average annual yield of these sources is estimated at 308 acre-feet.

5.5.1.1 Lower Boulder Ditch Company

The Town owns 3.97 Preferred shares and 6.667 Common shares of the Lower Boulder Ditch Company stock. These shares are included in the augmentation plan discussed below.

The estimated average annual delivery of water from these Lower Boulder shares to the Firestone Reservoir No. 1 or No. 2, or to the storage planned at Central Park is about 250 acre-feet. Of that amount, it is estimated that about 139 acre-feet is fully consumable water that can support irrigation needs or augmentation needs, and the remaining 111 acre-feet will be returned to the St. Vrain Creek system to maintain historical return flow patterns. The dry year yield of these shares is estimated to be about 65 percent of the average year yield, or about 90 acre-feet, however the operation of the Firestone Reservoir No. 1 will allow the Town to deliver the annual average supply each year.

5.5.1.2 Rural Ditch Company

The Town owns 2.41 shares in the Rural Ditch Company. In addition, the Town has 1.9 shares under option from the L.G. Everist Company. These shares are included in the augmentation plan discussed below.

The estimated average yield of the 2.41 shares currently owned by the Town is about 236 acre-feet per year that can be delivered to the Firestone Reservoir No. 1 or Firestone Reservoir No. 2. The net amount that will be fully consumable by the Town is estimated at about 129 acre-feet per year; the remainder of the water delivered to the reservoir will be returned to the St. Vrain Creek to maintain historical return flow patterns. The dry year yield of these shares is estimated

to be about 50 percent of the average year yield, or about 118 acre-feet. However the operation of the Firestone reservoirs will allow the Town to deliver the annual average supply each year.

Only the 2.41 shares currently owned by the Town are reflected in table 17, below, with an estimated average annual historical consumptive use of 129 acre-feet per year.

5.5.1.3 Godding Ditch Company

The Town owns 4 shares in the Godding Ditch Company. These shares are not included in the augmentation plan discussed below.

The Town has not yet developed estimates of deliveries to storage or return flow requirements for these shares. Previous water court cases that changed of use of Godding Ditch Company water rights have decreed average yields ranging from 7.3 acre-feet per share to 12.1 acre-feet per share.

This supply is estimated to produce about 40 acre-feet per year of average annual supply, and is estimated to be available by 2024.

5.6 SUMMARY OF CURRENT NATIVE WATER SUPPLIES

Table 17 summarizes the native water supplies owned by the Town in 2020 that will be available at the Firestone Reservoir upon completion of water court change cases.

Table 17
Water Supplies Available at Firestone Reservoir No. 1, 2020

Water Source	Shares	Annual Acre-feet	Year Available
Lower Boulder Ditch	3.97 Preferred 6.667 Common	103 36	2022
Rural Ditch	2.41	129	2022
Godding Ditch	4	40	2024
Total		**308**	

SECTION 6: FUTURE WATER SUPPLIES AND FACILITIES

The Town has a variety of planned water supplies and infrastructure projects to meet raw water and treated water demands over the next 30 years. This section describes the water rights, water sources, and infrastructure included in the 2020—2050 Water Action Plan.

6.1 CHANGE OF WATER RIGHTS AND PLAN FOR AUGMENTATION

The Town filed Case No. 19CW3236, a change of water rights and plan for augmentation, in the Division 1 Water Court in December 2019. The water court application is complex; some of the major elements of the application include:

- A change of type of use and location of use of water rights based on shares of New Consolidated Lower Boulder Reservoir and Ditch Company (LBDC) and the Rural Ditch, for water that was historically used on lands that have been developed within and around Firestone.

- A change of storage right for the Firestone Reservoir No. 1.

- A claim for junior water rights for
    1) Diversion from Boulder Creek and St. Vrain Creek through existing ditches, for storage in the Firestone Reservoir No. 1, which is constructed but not fully operational; and
    2) Diversion from Boulder Creek for storage in Central Park Reservoir, which is planned but not constructed; and
    3) Diversion from St. Vrain Creek for all municipal uses, including storage.

- A plan for augmenting or replacing out-of-priority pumping from:
    1) The Gould Well and two other planned wellfields; and
    2) Wells designed to provide irrigation water, at Mountain Shadows Park, for example.

- An exchange on St. Vrain Creek, from the St. Vrain Sanitation District outfall upstream to the Gould Well and St. Vrain Creek diversion.

- A claim to recharge the alluvial aquifer in the vicinity of the Gould Well.

6.2 RAW WATER DELIVERY

6.2.1 Wells and Wellfields

The Town is planning to construct several wells and wellfields to supply the non-potable irrigation system and the SVWA treatment plant. These wells will all be developed into the St. Vrain Creek alluvial aquifer; all of the wells will need to operate under the terms of a plan for augmentation to replace depletions to St. Vrain Creek or its tributaries.

6.2.1.1 Gould Well

The first well that the Town is developing to collect and divert alluvial ground water is located on the parcel that the Town purchased from the Gould family, which is at the northeast corner of Colorado Boulevard and Zinnia Avenue in Section 31, Township 3 North, Range 67 West (T3N R67W). This well is in the final design phase and is anticipated to be constructed in 2020.

The water rights claim for this well field is for 2,400 gpm, or 5.35 cubic feet per second.

6.2.1.2 Other Future Wellfields

The Town is anticipating the need for more than one additional alluvial wellfield to supply the SVWA treatment plant. At this time it is assumed that the next wellfield will be located on ground owned by the St. Vrain Sanitation District, in Section 31, Township 3 North, Range 67 West. This wellfield is anticipated to be constructed in about year 2032.

In addition, wellfield sites have been identified on the Varra Property in Section 31, T3N R67W and at the Firestone Trail where it intersects Zinnia Avenue in Section 6, T3N R67W. This plan assumes that both of these wellfields will be developed before 2050.

The water rights claim for the St. Vrain Sanitation District well field and the Varra wellfield are each for a pumping rate of 2,400 gpm, or 5.35 cubic feet per second. The Firestone Trail Wellfield water right claim is for 1,800 gpm, or 4.01 cubic feet per second.

6.2.2 Mountain Shadows Non-Potable Irrigation Well

The Mountain Shadows well has been developed within the Mountain Shadows Park in Section 1, T2N R68W. This well is anticipated to be completed and ready to irrigate the park in 2021. If the non-potable irrigation system at Mountain Shadows Park is ready to be used before the augmentation plan has been decreed, the Town will apply for a temporary substitute water supply plan with the State Engineers Office in Division 1.

The water rights claim for this well is for a pumping rate of 800 gpm, or 1.78 cubic feet per second.

6.2.3 NISP pipeline

The pipeline that will deliver water from the NISP project to users located south of Highway 66 is currently planned to run parallel to Weld County Road 13 (which becomes Colorado Boulevard in the Town of Firestone), and terminates at Highway 66. This location is two miles due north of Zinnia Avenue where the SVWA treatment plant will be located. This pipeline is not anticipated to be constructed until about 2028.

The Town currently anticipates average annual deliveries of 1,300 acre-feet from the NISP pipeline.

6.2.4 St. Vrain Creek Diversion

The Town's 2019 water rights application includes a junior water right to divert water into the Firestone-St. Vrain Pump Station, located at a point on the St. Vrain Creek approximately one-half mile due north of the SVWA treatment plant. That diversion is anticipated to be constructed in about 2032, perhaps before the second alluvial wellfield is constructed.

The water rights claim for the St. Vrain Creek diversion is for a pumping rate of 2,400 gpm, or 5.35 cubic feet per second.

6.3 RAW WATER STORAGE

6.3.1 Firestone Reservoir No. 1

The Firestone Reservoir No. 1, located south of Zinnia Avenue in Section 6 T2N R67W, was purchased in 2017, and is expected to be fully operational by 2021. This reservoir will be used to store water derived from the change of water rights and junior water rights claimed by the Town in the Case No. 19CW3236 application. The capacity of Firestone Reservoir No. 1 is estimated at 1,218.6 acre-feet.

Water will be delivered from Firestone Reservoir No. 1 to:

1) the Town's non-potable irrigation system, and

2) the St. Vrain Creek to make return flow deliveries in accordance with terms and conditions that will be in the Case No. 19CW3236 decree.

6.3.2 Firestone Reservoir No. 2 (Brooks Pit)

The Town has an option to purchase the Brooks Farm Water Storage Reservoir when the LG Everist Company has completed mining operations. This reservoir has an estimated capacity of 800 acre-feet. Mining is expected to be completed within the next 3 to 5 years. The current plan is for this reservoir to be operated in a similar manner to Firestone Reservoir No. 1.

6.3.3 Central Park Reservoir

The Town's non-potable irrigation system plan includes development of a reservoir in Central Park in Firestone; this reservoir will be able to be filled from the Coal Ridge Ditch or from Firestone Reservoir No. 1. The capacity planned for the Central Park Reservoir is 100 acre-feet, and it is expected to be built in about 2028.

6.3.4 Other potential storage

6.3.4.1 Dry Creek

The Town has communicated with the Little Thompson Water District and Central Weld to express interest in purchasing up to 500 acre-feet of storage in a proposed expansion of the existing Dry Creek Reservoir, which is located in Larimer County, near Carter Lake. The Town does not have an expected date for acquiring this storage.

6.4 POTENTIAL NEW WATER SUPPLIES

6.4.1 Native St. Vrain Creek Water

The Town is actively looking to acquire senior water rights from ditches in the St. Vrain Creek basin that historically irrigated lands within and around the Town of Firestone development area or Town boundaries. The Town is focusing on shares that irrigated parcels in locations that have already developed or will be developed, and that are located such that the Town can easily deliver historical return flows to required locations.

These ditches include:

- Lower Boulder Ditch, which diverts from Boulder Creek;
- Godding Ditch (also known as the Highland/Southside Ditch), which diverts from Idaho Creek, which diverts from Boulder Creek;
- New Coal Ridge Ditch, which is an extension of the Lower Boulder Ditch;
- Rural Ditch, which diverts from Boulder Creek; and
- Last Chance Ditch, which diverts from St. Vrain Creek.

The Town already owns shares in the Lower Boulder Ditch, the Rural Ditch and the Godding Ditch. Shares in the Lower Boulder Ditch and the Rural Ditch have been included in Case No. 19CW3236.

6.4.1.1 Potential for Water Dedication of Native Water Rights

The Town's current raw water dedication policy requires that developers transfer sufficient water rights to the Town to meet the requirements of the proposed development. At this time, C-BT units or Windy Gap shares are the only raw water source that may be used to satisfy dedication requirements. The raw water dedication process is codified in Chapter 13 of the Firestone Municipal code.

In addition, the Town Board of Trustees can allow credits for other water rights by approving a written agreement with a developer. Because the Firestone Reservoir No. 1 can store raw water from St. Vrain Creek sources, and because the SVWA treatment plant is being designed to treat St. Vrain Creek water supplies, the Town is currently discussing this raw water dedication agreement alternative with developers. An agreement with one or more developers may be completed in 2020 or 2021, for delivery of treated water after 2022. Each agreement will be unique to each development because the terms related to credit for the water rights and requirements of each development will be specific to the land use supported and to the water rights transferred. At this time the Town does not have an estimate of when it might complete a native water dedication agreement.

6.4.2 Right of First Refusal

Annexation agreements that have been approved by the Town include a provision that if the developer receives a bona fide offer to sell senior irrigation water that was historically used on the lands that were annexed, then the developer must offer a right of first refusal to the Town to match the terms of the offer.

The Town is planning to exercise such purchase opportunities when they will allow the acquisition of water rights that can be used by the Town. At this time there are no estimates of when a right of first refusal might be exercised.

6.4.3 Northern Integrated Supply Project

The Town is a participant in the Northern Integrated Supply Project (NISP). This project is an enterprise of the Northern Colorado Water Conservancy District. This project is designed to deliver about 40,000 acre-feet of Cache la Poudre River and South Platte River water annually to the participants. Firestone has subscribed to 1,300 acre-feet of this supply.

NISP is in the final stages of a 15-year environmental permitting process. Current projections are for construction of the diversion structures, dams and reservoirs, and pipelines to be completed by 2028. This Action Plan assumes that NISP water will be delivered to Highway 66 and Colorado Boulevard, and that the Town will construct a two mile pipeline to deliver the water to the SVWA water treatment plant at Colorado Boulevard and Zinnia Avenue. This plan assumes that treated water will be deliverable to the Town in 2030.

The current cost estimate for the NISP project is $1.2 billion, or $30,000 per acre-foot. The 1,300 acre-feet that the Town is committed to purchase represents $39 million that will be spent between now and 2030.

The 40,000 acre-feet yield of NISP project is fully subscribed at this time. However, there have been some transfers of ownership between participants in the past few years, and we expect that there will be opportunities for the Town to acquire more NISP water between now and 2030. Like other water supply projects, we also expect that once NISP is fully operational there will be very few, if any, opportunities to acquire more yield from the project.

6.4.4 Windy Gap Return Flow Credits

The Town anticipates that about 50 percent of Windy Gap water that is delivered to water meters in Firestone will become reusable return flow credits that can be exchanged from the St. Vrain Sanitation District outfall into St. Vrain Creek to a Town diversion structure or used to augment out-of-priority pumping from a well or wellfield.

Windy Gap return flows that are returned to St. Vrain Creek from the St. Vrain Sanitation District wastewater treatment plant will be accounted for so that they can become augmentation supply credits. A like amount of water may be pumped from the Gould Well, for delivery to the SVWA treatment plant. These credits are assumed to create somewhere between about 110 acre-feet and 190 acre-feet of future supply at the Gould wellfield once Case No. 19CW3236 is decreed. For purposes of this plan we are assuming that 125 acre-feet of Windy Gap return flow credits will be available when the Town is using 250 acre-feet of Windy Gap water.

The Town is planning on that water being available in 2022.

The Town has had conversations with other water providers who own Windy Gap source water and who also discharge reusable Windy Gap return flow credits into tributaries of St. Vrain Creek or directly into St. Vrain Creek. The Town would consider acquiring a lease or purchasing Windy Gap return flow credits as a new source of water. The Town does not have an expected date for acquiring water from Windy Gap return flow credits.

6.4.5 NISP Return Flow Credits

The Town anticipates that a portion of the NISP water that is delivered to the Town will generate return flow credits. Depending on delivery schedules, the amount of estimated return flow credits will be somewhere in the range of 15 to 38 percent of NISP deliveries. For purposes of this plan we are assuming that 325 acre-feet of NISP return flow credits will be available when the Town is using 1,300 acre-feet of NISP water.

The Town plans to approach water providers who will have NISP source water and that may discharge reusable return flow credits into tributaries of St. Vrain Creek, or directly into St. Vrain Creek, about possible leases or purchase of

NISP reusable return flow credits. These discussions are not planned until the NISP project is closer to delivering water, probably in 2028 or later.

6.5 ESTIMATES OF ADDITIONAL WATER NEEDED FOR DELIVERY TO SVWA TREATMENT PLANT

The 2020—2050 Water Action Plan assumes that the Town is not able to acquire additional Windy Gap or C-BT water for delivery to the Carter Lake Filter Plant. It is assumed that the SVWA Treatment Plant will be required to meet all new treated water demands between 2020 and 2030. This means that the SVWA Treatment Plant will have to rely on native St. Vrain Creek sources, at least until NISP water is available.

Table 18 shows the estimated amount of additional native water needed for delivery to the SVWA Treatment Plant to meet treated water demands in 2030. The table reflects the "at the meter" demand shown in Table 12, and then adds the three percent distribution system loss and the 10 percent treatment system loss to arrive at the amount of water needed to deliver to the SVWA Treatment Plant.

Table 18
Estimated Additional Annual Native Water Needed,
2016—2030 to Meet 2030 Demands

	AF at the Individual meter	AF at Master meter	AF at SVWA (Raw Water)
2030 New Demand	1,728	1,782	1,960
WG Return Flow Credits	110	114	125
Native Water Needed	**1,618**	**1,668**	**1,835**

This plan assumed that the Town will be taking up to 1,300 acre-feet per year of NISP water after about year 2030. Table 19 shows the estimated amount of additional water needed between 2030 and 2050. The table includes the new demand from Table 15, and an estimated 325 acre-feet of NISP return flow credits available at the Town's wellfields. The table reflects the 10 percent treatment system loss and the three percent distribution system loss in delivering water to the individual meters.

To calculate the amount of additional water needed, Table 19 includes water from NISP and credits from NISP return flow as supplies that will be available to meet the year 2050 demands.

Table 19
Estimated Additional Annual Native Water or NISP Water Needed, 2031—2050 to Meet 2050 Demands

	AF at the Individual meter	AF at Master meter	AF at SVWA (Raw Water)
2050 New Demand	2,312	2,384	2,622
NISP	1,146	1,182	1,300
NISP return flows	287	295	325
Native Water or NISP Water Needed	**879**	**907**	**997**

SECTION 7: PROJECTED COSTS FOR IMPLEMENTATION OF THE 2020—2050 WATER ACTION PLAN

This section details the estimated costs of the individual projects planned for implementation of the 2020—2050 Water Action Plan with more information about the individual elements. Estimates of the cash or debt financing required for the individual line items are also presented.

Figure 12 shows the location of some of the major elements of the plan, including the SVWA Treatment Plant and injection well sites, as well as Firestone's Gould Well site, Brooks Pit and Firestone Reservoir No. 1.

Figure 12
Location of SVWA and Firestone Facilities at Colorado Blvd. and Zinnia Ave.

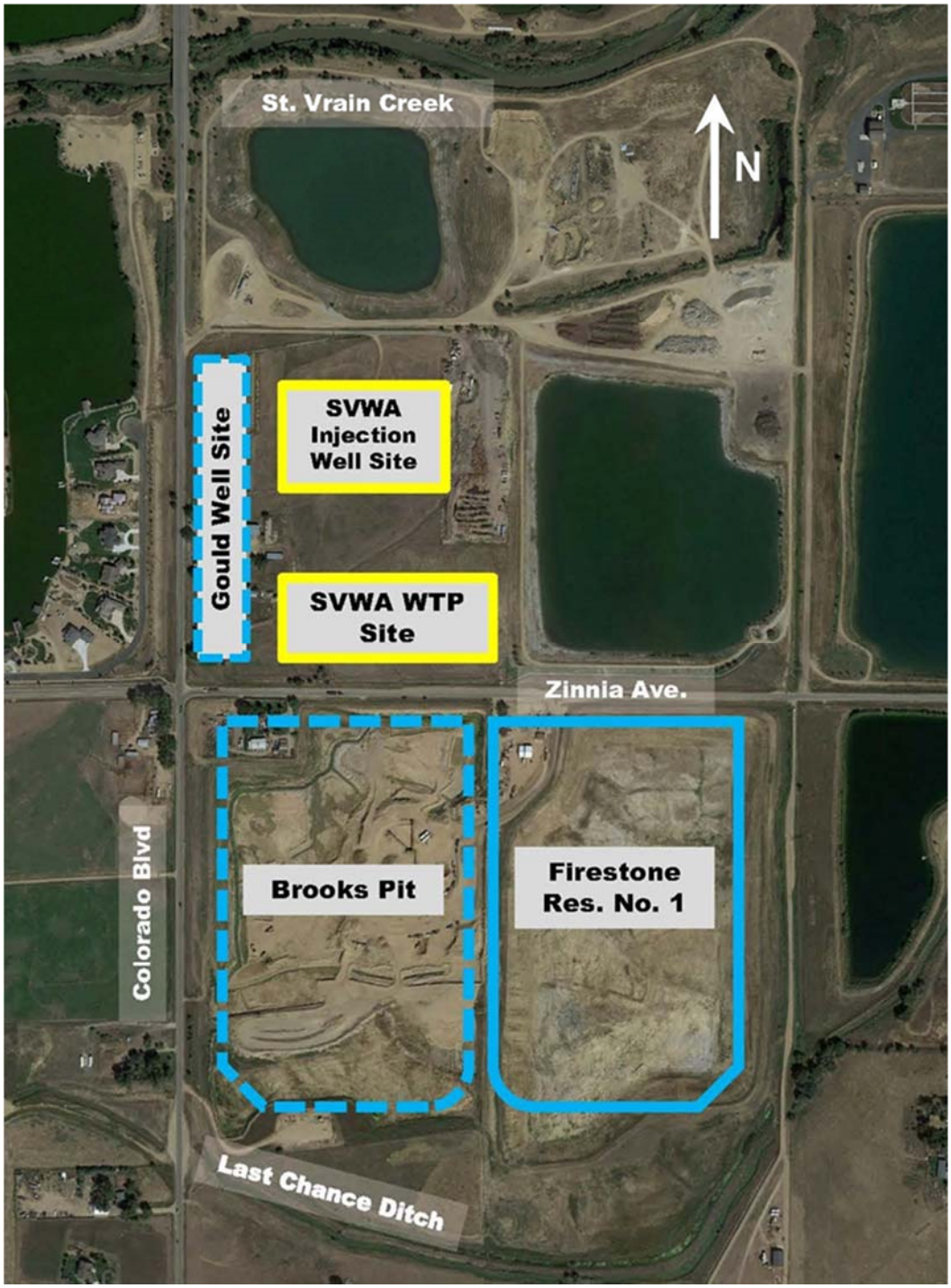


Table 20 shows the estimated costs of acquiring the water sources and developing the treatment and delivery systems to meet projected demands to support growth between 2020 and 2050. Costs of financing are not included in the values below. This table shows the elements of the plan that are anticipated during the 2020—2050 time period.

Table 20
Estimated Costs for 5 MGD Water Supply, 2019 Dollars

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Alluvial Wells					
	Gould Alluvial Well (Phase 1)	$4,100,000	2020	$4,100,000	
	Mountain Shadows Park Irrigation Well	$253,000	2020		$253,000
	Gould Alluvial Well (Phase 2)	$1,000,000	2027		$1,000,000
	Alluvial Well Site No. 2	$5,100,000	2032		$5,100,000
	Alluvial Well Site No. 3	$5,100,000	2048		$5,100,000
Other Source Water					
	Windy Gap	$10,000,000	2020	$10,000,000	
	Windy Gap Reuse		2022		
	NISP	$39,000,000	2023		$39,000,000
	NISP Reuse		2030		
	St Vrain Creek Diversion	$3,200,000	2032		$3,200,000
Augmentation Infrastructure and Water Sources					
	Firestone Reservoir No. 1	$11,650,000	2020	$11,650,000	
	Firestone Reservoir No. 2	$4,150,000	2023		$4,150,000
	Reservoir No. 2 Plumbing	$4,970,000	2024		$4,970,000
	Native Water Rights	$8,350,000	2022		$8,350,000
	Native Water Rights	$10,000,000	2027		$10,000,000
	Native Water Rights	$9,970,000	2032		$9,970,000
Water Treatment					
	1.5 MGD WTP (Phase 1a)	$27,850,000	2020		$27,850,000
	2.25 MGD WTP (Phase 1b)	$1,000,000	2030		$1,000,000
	5 MGD WTP (Phase 2)	$12,000,000	2041		$12,000,000
Pipelines and Tanks					
	Blend Pipeline (Phase 1)	$3,990,000	2020		$3,990,000
	1.5 MG Elevated Tank	$4,539,000	2024		$4,539,000
	Blend Pipeline (Phase 2)	$5,130,000	2026		$5,130,000
	NISP Pipeline	$2,510,000	2028		$2,510,000
Non-Potable Irrigation					
	Phase 1 Irrigation System	$1,120,000	2021		$1,120,000
	Mountain Shadows Park Irrigation Well	$253,000	2020		$253,000
	Native Water Rights (Phase 1)	$1,500,000	2020	$1,500,000	
	Phase 2 Irrigation System	$2,000,000	2023		$2,000,000
	Central Park Reservoir and Supply	$4,891,000	2028		$4,891,000
Total Estimated Cost for 5 MGD Water Supply		**$183,626,000**		**$27,250,000**	**$156,376,000**

7.1 CENTRAL WELD CARTER LAKE FILTER PLANT

In this action plan, the Town assumes that Central Weld will continue to treat all of the Town's C-BT and Windy Gap supplies at the Carter Lake Filter Plant. This supply currently totals about 3,200 acre-feet per year, as shown in Table 16.

Raw water delivered by NISP may eventually be treated by either Central Weld or SVWA. To the Town's knowledge neither entity has yet developed a definite plan for treating NISP water. The Town does not anticipate making a decision on this until after 2022. For planning purposes, this action plan assumes that NISP water will be treated by the SVWA.

This action plan assumes there is no expansion of the existing treatment or distribution system that is used to deliver water from the Carter Lake Filter Plant to the Town of Firestone.

7.2 OTHER SOURCE WATER—WINDY GAP AND NISP

The Town has acquired five units of Windy Gap project water, and is subscribed to the NISP project for an annual supply of 1,300 acre-feet. Return flow credits from Windy Gap are estimated at 125 acre-feet per year and return flow credits from NISP are estimated at 325 acre-feet per year.

Table 21 shows the estimated cost and year that funds are needed for these water sources. The $10,000,000 of cost listed for Windy Gap in 2020 was paid by the Town with cash. This table also shows the dates when the Windy Gap and NISP return flow credits are anticipated to be available to the Town.

Table 21
Cash and Debt Financing Needs
Other Water Sources

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Other Source Water					
	Windy Gap	$10,000,000	2020	$10,000,000	
	Windy Gap Reuse		2022		
	NISP	$39,000,000	2023		$39,000,000
	NISP Reuse		2030		
	St Vrain Creek Diversion	$3,200,000	2032		$3,200,000
Total Other Source Water		**$52,200,000**		**$10,000,000**	**$42,200,000**

7.3 ALLUVIAL WELL SYSTEMS

The Town is developing an alluvial well system on the Gould parcel that will pump groundwater from the St. Vrain Creek alluvium for delivery to the SVWA treatment plant. The horizontal well that will be installed on the Gould property is in the final design and permitting stage, and is expected to be installed in 2020 and then expanded by 2027.

One additional alluvial wellfield is planned for installation in about 2032, with a third wellfield to be installed in about 2048. An additional wellfield may be required after 2050. An alternative to one or more of these wellfields is a direct diversion from the St. Vrain Creek at the Firestone-St. Vrain Pump Station. For budgeting purposes, only the alluvial wellfields are shown in the cost table below. Table 22 shows the estimated cost and the year that funds are needed for the alluvial wellfield systems.

Table 22
Cash and Debt Financing Needs
Alluvial Well Systems

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Alluvial Wells					
	Gould Alluvial Well (Phase 1)	$4,100,000	2020	$4,100,000	
	Mountain Shadows Park Irrigation Well	$253,000	2020		$253,000
	Gould Alluvial Well (Phase 2)	$1,000,000	2027		$1,000,000
	Alluvial Well Site No. 2	$5,100,000	2032		$5,100,000
	Alluvial Well Site No. 3	$5,100,000	2048		$5,100,000
Total Alluvial Wells		**$15,553,000**		**$4,100,000**	**$11,453,000**

7.4 AUGMENTATION INFRASTRUCTURE AND WATER SOURCES

The Town is developing the Firestone Reservoir No. 1 as a non-potable irrigation reservoir and an augmentation reservoir. In addition to being operated to support the non-potable irrigation system it will serve to replace return flows required as part of the change case and facilitate necessary replacements under the augmentation plan. Under the terms of the change case and augmentation plan the reservoir will make releases to St. Vrain Creek to replace historical return flows from native water rights that have been changed to municipal uses. It will also be used to deliver water to St. Vrain Creek to augment out-of-priority pumping from the irrigation wells and the alluvial wells that will feed the St. Vrain Water Authority Treatment Plant.

The Town has an option to purchase the Brooks Pit, located next to Firestone Reservoir No. 1. The mining operation at the Brooks Pit is expected to be completed in the next three to five years. The Town is projecting that it will purchase the Brooks Pit in 2023 and it will add the infrastructure to convert it to Firestone Reservoir No. 2 in 2024.

The Town is planning to purchase native St. Vrain Creek water rights to be used to increase the amount of augmentation water available to the Town. A total of $28,320,000 is allocated for the acquisition of 2,832 acre-feet of native supplies. Those water rights will be changed in water court, and the water from those native sources will be delivered to the Town's reservoirs for operation of the augmentation plan.

Table 23 shows the estimated cost and the year that funds are needed for the augmentation sources and projects. Costs labeled as cash or other were funded by the Town prior to 2020.

Table 23
Cash and Debt Financing Needs
Augmentation Infrastructure and Water Sources

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Augmentation Infrastructure and Water Sources					
	Firestone Reservoir No. 1	$11,650,000	2020	$11,650,000	
	Firestone Reservoir No. 2	$4,150,000	2023		$4,150,000
	Reservoir No. 2 Plumbing	$4,970,000	2024		$4,970,000
	Native Water Rights	$8,350,000	2022		$8,350,000
	Native Water Rights	$10,000,000	2027		$10,000,000
	Native Water Rights	$9,970,000	2032		$9,970,000
Total Alluvial Wells		**$49,090,000**		**$11,650,000**	**$37,440,000**

7.5 NON-POTABLE IRRIGATION SYSTEM

The Town has purchased water rights and facilities to begin the development of a non-potable system for irrigation of parks and other open space areas.

The Town purchased shares in the Lower Boulder Ditch Company and the Rural Ditch Company to support the non-potable irrigation system demands. These shares were cash purchased prior to 2020.

The irrigation well installation in the Mountain Shadows Park is scheduled for completion in 2020.

The first phase of the distribution system to deliver non-potable water from Firestone Reservoir No. 1 to other parks is planned for 2021. The irrigation system is scheduled to expand by installing additional delivery pipeline in 2023. The non-potable irrigation system is also scheduled to add an additional 100 acre-feet of storage at the Central Park Reservoir in about 2028 to continue the implementation of the plan.

Table 24 shows the estimated costs and financing needs for the non-potable irrigation system.

Table 24
Cash and Debt Financing Needs
Non-Potable Irrigation System

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Non-Potable Irrigation					
	Phase 1 Irrigation System	$1,120,000	2021		$1,120,000
	Mountain Shadows Park Irrigation Well	$253,000	2020		$253,000
	Native Water Rights (Phase 1)	$1,500,000	2020	$1,500,000	
	Phase 2 Irrigation System	$2,000,000	2023		$2,000,000
	Central Park Reservoir and Supply	$4,891,000	2028		$4,891,000
Total Non-Potable System		**$9,764,000**		**$1,500,000**	**$8,264,000**

7.6 ST. VRAIN WATER AUTHORITY WATER TREATMENT PLANT

The SVWA treatment plant is in the final design and permitting stage; construction is expected to start in the 3rd quarter of 2020. Firestone is paying for all of the SVWA facilities, and will contribute the facilities in-kind instead of paying a plant investment fee.

The treatment plant will contain pre-treatment, ultrafiltration, reverse osmosis filtration and disinfection technologies, along with all the required tanks, pumps, and other infrastructure necessary to operate the plant.

The treatment plant technologies were selected so that the plant may treat St. Vrain Creek alluvial ground water sources or St. Vrain Creek surface water sources. The current plan is to use alluvial ground water sources in the first phase of the treatment plant operation.

The water treatment plant is being designed to facilitate expansion to an ultimate capacity of 5 million gallons per day (MGD). It will be developed in phases that allow capacity to expand as the population and water demand grows. Phase 1a will construct treatment capacity of 1.5 MGD. The entire Phase 1a capacity is currently dedicated to Firestone's needs. The SVWA plant capacity will be expanded to 2.25 MGD in Phase 1b. Phase 2 will add facilities to reach the total 5 MGD capacity.

Table 25
Cash and Debt Financing Needs
Water Treatment Plant and Delivery System

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Water Treatment					
	1.5 MGD WTP (Phase 1a)	$27,850,000	2020		$27,850,000
	2.25 MGD WTP (Phase 1b)	$1,000,000	2030		$1,000,000
	5 MGD WTP (Phase 2)	$12,000,000	2041		$12,000,000
Total Water Treatment		**$40,850,000**		**$0**	**$40,850,000**

7.7 PIPELINES AND TANKS

The delivery system and storage needed to distribute treated water from the SVWA treatment plant to the Town of Firestone includes a "blend pipeline" to connect to the lower water pressure zones near the treatment plant, to be built at the beginning of Phase 1 in 2020. As daily water demands grow, a new 1.5 million gallon treated water storage tank and the pipeline to deliver treated water to the storage tank will be constructed. Storage tank construction and extension of the pipeline to serve the new tank are expected to occur in 2024 and 2026, respectively.

In addition to the above treated water facilities, a raw water pipeline is planned to deliver NISP water from the NISP pipeline terminus at County Road 13 and Highway 66 to the St. Vrain Water Authority plant. Current planning is to install the NISP raw water pipeline in 2028.

Table 26 shows the estimated costs for pipelines and the treated water storage tank.

Table 26
Cash and Debt Financing Needs
Pipelines and Tanks

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
Pipelines and Tanks					
	Blend Pipeline (Phase 1)	$3,990,000	2020		$3,990,000
	1.5 MG Elevated Tank	$4,539,000	2024		$4,539,000
	Blend Pipeline (Phase 2)	$5,130,000	2026		$5,130,000
	NISP Pipeline	$2,510,000	2028		$2,510,000
Total Pipelines and Tanks		**$16,169,000**		**$0**	**$16,169,000**

7.8 SUMMARY OF PROJECT COSTS BY PROJECT TYPE

Table 27 summarizes the cost and financing needs for the 2020—2050 period, by project type.

Table 27
Cash and Debt Financing Needs
Summary of Project Costs by Project Type

PROJECT TYPE	ESTIMATED COST	CASH or OTHER	DEBT FINANCED
Other Source Water	$52,200,000	$10,000,000	$42,200,000
Alluvial Wells	$15,553,000	$4,100,000	$11,453,000
Augmentation Infrastructure and Water Sources	$49,090,000	$11,650,000	$37,440,000
Non-Potable Irrigation	$9,764,000	$1,500,000	$8,264,000
Water Treatment	$40,850,000	$0	$40,850,000
Pipelines and Tanks	$16,169,000	$0	$16,169,000
Total Costs 2020-2050	**$183,626,000**	**$27,250,000**	**$156,376,000**

SECTION 8: PHASED IMPLEMENTATION OF THE 2020—2050 WATER ACTION PLAN

The current plans for phasing the development of the Firestone water system, based on total SVWA treatment plant capacity and time frame of development is:

Phase 1a: 1.5 MGD treatment capacity, funding and construction in years 2020—2024;

Phase 1b: 2.25 MGD treatment capacity, funding and construction in years 2025—2030; and

Phase 2: 5 MGD treatment capacity, funding and construction in years 2031—2050.

8.1 2020—2024: PHASE 1a

Phase 1a will generally consist of:

- Purchasing and developing the infrastructure for Firestone Reservoir No. 1;
- Purchasing five units of Windy Gap water;
- Purchasing native St. Vrain Creek water rights to support non-potable irrigation and future augmentation needs;
- Building the alluvial well system to irrigate Mountain Shadows Park;
- Building the first phases of the non-potable irrigation delivery system;
- Building the 1.5 MGD St. Vrain Water Authority Treatment Plant;
- Building the Gould alluvial horizontal well;
- Building the pipeline to deliver treated water from the plant;
- Purchasing and developing the infrastructure for Firestone Reservoir No. 2;
- Funding the NISP project at the 1,300 acre-feet subscription level;
- Building the pipeline to deliver water to the 1.5 million gallon tank; and
- Building the 1.5 million gallon treated water storage tank.

The first phase of the treatment plant is being designed to produce 1.5 MGD. The estimated cost of the 1.5 MGD Phase 1a water treatment plant is about $27.9 million, which includes land, the treatment plant, and a deep injection well to dispose of reverse osmosis reject water. The Phase 1a treatment plant is designed to support a growth in population of about 8,000 people.

The native water rights that will be acquired in Phase 1a will be included in an augmentation plan that will enable the wells that supply the non-potable irrigation system and the SVWA treatment plant to divert groundwater from the St. Vrain Creek alluvial aquifer. In addition, reusable return flow credits from Windy Gap and other sources of water that are fully consumable will be included in the augmentation plan. These sources will allow decreed augmentation credits to offset depletions to St. Vrain Creek caused by pumping of alluvial groundwater from the wells, which are junior (2019) water rights.

Table 28 summarizes the cash and debt financing needs for Phase 1a in 2020 through 2022 and Table 29 summarizes the needs for Phase 1a in 2023-2024.

Table 28
Cash and Debt Financing Needs
Phase 1a Project Costs 2020—2022

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
2020--2022					
	Gould Alluvial Well (Phase 1)	$4,100,000	2020	$4,100,000	
	Mountain Shadows Park Irrigation Well	$253,000	2020		$253,000
	Windy Gap	$10,000,000	2020	$10,000,000	
	Firestone Reservoir No. 1	$11,650,000	2020	$11,650,000	
	1.5 MGD WTP (Phase 1a)	$27,850,000	2020		$27,850,000
	Blend Pipeline (Phase 1)	$3,990,000	2020		$3,990,000
	Mountain Shadows Park Irrigation Well	$253,000	2020		$253,000
	Native Water Rights (Phase 1)	$1,500,000	2020	$1,500,000	
	Phase 1 Irrigation System	$1,120,000	2021		$1,120,000
	Windy Gap Reuse		2022		
	Native Water Rights	$8,350,000	2022		$8,350,000
Total Costs 2020-2022		**$69,066,000**		**$27,250,000**	**$41,816,000**

Table 29
Cash and Debt Financing Needs
Phase 1a Project Costs 2023—2024

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
2023--2024					
	NISP	$39,000,000	2023		$39,000,000
	Firestone Reservoir No. 2	$4,150,000	2023		$4,150,000
	Phase 2 Irrigation System	$2,000,000	2023		$2,000,000
	Reservoir No. 2 Plumbing	$4,970,000	2024		$4,970,000
	1.5 MG Elevated Tank	$4,539,000	2024		$4,539,000
Total Costs 2020-2022		**$54,659,000**		**$0**	**$54,659,000**

8.2 2025--2030: PHASE 1b

Phase 1b will include:

- Extension of the treated water pipeline from the SVWA treatment plant to the new storage tank;
- Expansion of the Gould alluvial horizontal well;
- Purchase of additional native water rights;
- Construction of the raw water pipeline to deliver NISP water to the SVWA treatment plant;
- Construction of Central Park Reservoir; and
- Addition of filter elements within the treatment plant to expand the capacity to 2.25 MGD.

The 0.75 MGD capacity expansion of capacity is expected to serve a growth in population of about 4,000 people.

As mentioned above, NISP water is assumed to be delivered to the SVWA treatment plant for treatment. The final decision about where Firestone's NISP water will be treated is not expected to be finalized until after 2022; this plan assumes construction of the pipeline to deliver NISP raw water to the SVWA during Phase 1b.

The native water rights acquired in Phase 1b will be included in the Town's augmentation plan to allow additional pumping from the Gould well and future wellfields.

Table 30 summarizes the cash and debt financing needs for Phase 1b.

Table 30
Cash and Debt Financing Needs
Phase 1b Project Costs 2025—2030

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
2025--2030					
	Blend Pipeline (Phase 2)	$5,130,000	2026		$5,130,000
	Gould Alluvial Well (Phase 2)	$1,000,000	2027		$1,000,000
	Native Water Rights	$10,000,000	2027		$10,000,000
	NISP Pipeline	$2,510,000	2028		$2,510,000
	Central Park Reservoir and Supply	$4,891,000	2028		$4,891,000
	2.25 MGD WTP (Phase 1b)	$1,000,000	2030		$1,000,000
Total Costs 2025-20230		**$24,531,000**		**$0**	**$24,531,000**

8.3 2031--2050: PHASE 2

Phase 2 will include:

- Addition of two new alluvial wellfields to supply raw water to the SVWA Treatment Plant;
- Expansion of the treatment plant to a total capacity of 5.0 MGD;
- Construction of the St. Vrain Creek diversion and pump station; and
- Purchase of additional native water rights.

The 2.75 MGD capacity expansion of capacity is expected to serve a growth in population of about 15,000 people.

The native water rights acquired in Phase 2 will be included in the Town's augmentation plan to allow additional pumping from the Gould well and future wells.

Table 31
Cash and Debt Financing Needs
Phase 2 Project Costs 2031—2050

PROJECT		ESTIMATED COST	YEAR FUNDS NEEDED	CASH or OTHER	DEBT FINANCED
2031--2050					
	Alluvial Well Site No. 2	$5,100,000	2032		$5,100,000
	St Vrain Creek Diversion	$3,200,000	2032		$3,200,000
	Native Water Rights	$9,970,000	2032		$9,970,000
	5 MGD WTP (Phase 2)	$12,000,000	2041		$12,000,000
	Alluvial Well Site No. 3	$5,100,000	2048		$5,100,000
Total Costs 2031--2050		**$35,370,000**		**$0**	**$35,370,000**

SECTION 9: SINGLE FAMILY EQUIVALENT TAPS

When the Town can sell water taps for users in the Firestone service area that will be served treated water from the SVWA water treatment plant, all of those tap fees will be used to support future projects or payment of debt.

Table 32, below (based on data in Tables 12 and 14) shows the amount of new raw water supply needed for mixed use, commercial and residential uses—all uses except irrigation of parks and open space. The far right column in Table 31 shows the estimated number of equivalent single family residential taps (at 0.6 acre-feet per tap) that can be supported by the amount of raw water that will be acquired for delivery to the treatment plant and available to support commercial and residential uses.

Table 32
Mixed Use, Commercial and Residential Water Demand
and Estimated Single Family Equivalent Taps

Time Period	At the Meter, AF	At the Master Meter, AF	To Treatment Plant, AF	Equivalent Single Family Taps
2016--2030	1,645	1,695	1,865	3,108
2031--2050	2,200	2,269	2,495	4,159
2016--2050	3,845	3,964	4,360	7,267

The new raw water supplies that will support treated water delivery total about 4,360 acre-feet in Phases 1a, Phase 1b and Phase 2. This supply will support the equivalent of about 7,270 single family equivalent water taps.

The Town will conduct a rate and fee analysis in 2021 to evaluate a revision to the current tap fee structure and the water dedication requirement. The Town will likely develop a cash-in-lieu of water dedication option as well.

SECTION 10: REFERENCES

Links to reference materials available on Firestone website:

2010 Potable Water Master Plan
https://www.firestoneco.gov/DocumentCenter/View/47/Potable-Water-Master-Plan?bidId=

2010 Raw Water Irrigation System Master Plan
https://www.firestoneco.gov/DocumentCenter/View/48/Raw-Water-Irrigation-System-Master-Plan?bidId=

2015 Water Efficiency Master Plan
https://www.firestoneco.gov/DocumentCenter/View/2033/Firestone-MWEP-Update-Report-v1-28-2015?bidId=

2018 Land Use Map
https://www.firestoneco.gov/DocumentCenter/View/51/Land-Use-Map?bidId=

2018 Zoning Map
https://www.firestoneco.gov/DocumentCenter/View/52/Zoning-Map?bidId=

2019 Growth Boundary
https://www.firestoneco.gov/DocumentCenter/View/2601/Firestone-Growth-Boundary-Map?bidId=

2018 Water Rate Study
https://www.firestoneco.gov/DocumentCenter/View/5482/2018-Water-Rate-Study-Update

Links to reference sources:

NCWCD Resolution D-962-02-95
https://www.northernwater.org/docs/AllotteeInfo/LimitationsOnOwnership1995D9620295.pdf

NCWCD C-BT
https://www.northernwater.org/WaterProjects/C-BTProject.aspx

NCWCD NISP
https://www.northernwater.org/WaterProjects/NISP.aspx/

State Demography Office population data
https://demography.dola.colorado.gov/population/