



# *The Weather Wire*

**July 2019**

**Volume 26 Number 7**

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## **Active Start to the Summer**

The summer of 2019 has been off to a very active start for thunderstorms across Colorado – particularly in the Front Range and over the Eastern Plains. Since thunderstorm season started in May, the total amount of precipitation relative to average has not been overly exceptional. However, the frequency of thunderstorms since late May has been unusually high.

During the month of June alone, DIA officially recorded 21 thunderstorm days, which is more than double the average of 10. Or put in different terms, DIA recorded a thunderstorm on 2 out of every 3 days throughout the month of June. Skyview internal records show similarly impressive lightning statistics from June, with 19 days of lightning recorded in the Denver metro area and 24 days of lightning recorded in Douglas County.

The first week of July picked up right where June left off, and if anything was even more active with several days of severe weather across the Denver metro area.

So why has this summer been so active? There a couple of reasons.

## **Above Average Soil Moisture Across the Rockies and Plains**

One of the key ingredients for thunderstorms is moisture, and there has been an overabundance of low level moisture this year thanks to above average snowpack in the Rockies and above average winter/spring precipitation across the central and southern Plains. This extra moisture adds fuel to the atmosphere for thunderstorm development and has largely been a culprit for frequent thunderstorm activity.

The Front Range cities in Colorado are impacted by moisture and atmospheric conditions both from the Rocky Mountains and the Great Plains, so having extra moisture in both of these locations has had a positive feedback on thunderstorm development locally.

## **An Active Early Summer Jet Stream**

Typically the jet stream retreats northward in June and only occasional weaker pieces of the jet will dip into Colorado to impact the weather. However, the jet stream has been much stronger and more persistent than usual across the Intermountain West through June and now even into early July. This has resulted in more frequent cold troughs of low pressure tracking across Colorado and the Central Rockies, which also has supported frequent thunderstorm activity.

Temperatures have been cooler than average this spring and into the early summer, and the active jet stream and frequent low pressure troughs have largely been responsible for this as well. An unusually active jet stream for early July also fostered an environment favorable for the severe thunderstorms that have occurred in Colorado recently.

## **How Does the Rest of the Summer Look?**

July is already off to an active start, but we may experience some subtle changes over the rest of the month and into August and September. The start of Monsoon Season is nearing, with some indications that it could get started around the weekend of the 13-14<sup>th</sup>.

However, there are signs that the North American Monsoon could be weaker than average this year. Typically, a stronger monsoonal flow develops when a hot subtropical ridge of high pressure sets up over the Southwestern U.S. in June and early July, and anticyclonic (i.e. clockwise) flow around the high gradually transports moisture northward into the Four Corners Region of the U.S.

The subtropical high pressure ridge has been suppressed over the past month given the active jet stream across the Western U.S. Past studies also hint that heavy snowpack years that persist late into the season often stunt the development over a subtropical ridge in the Southwest U.S. While the monsoon does look like it will begin soon, it looks relatively weak and as a result, thunderstorm activity and rainfall may not be as persistent as usual across Colorado.

That doesn't mean we are going to dry out quickly. Even a weak monsoon will still result in relatively frequent thunderstorms in Colorado from mid July through mid August, especially in the high country, but perhaps it won't be as much of a player as usual.

Also, over the next month high surface moisture feedback will still largely play a role across the Front Range and Eastern Colorado, with signals continuing to point toward a relatively active July.

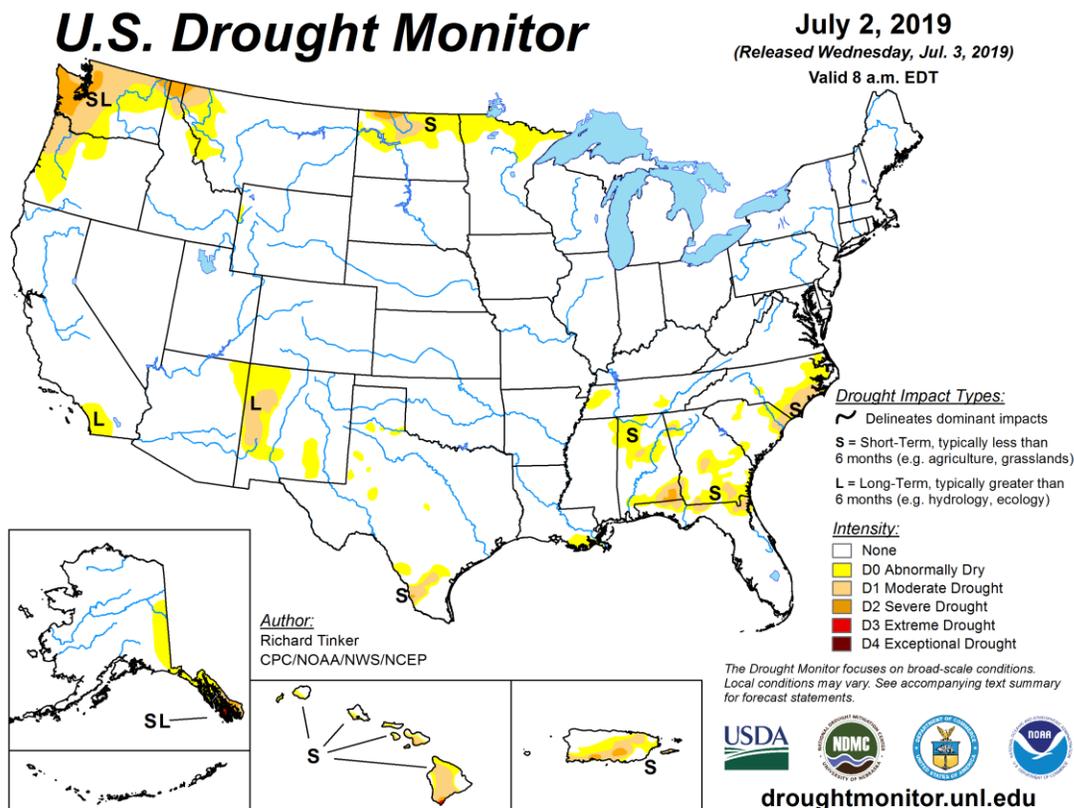
However, once we get past July, the pattern may begin to shift toward drier. The later in the summer we get, the more evaporation that occurs from soil moisture. So even in an unusually wet year, we will start to see less surface moisture available to fuel thunderstorms as we get into August. Therefore, the thunderstorm pattern in August often becomes more dependent on the strength and location of the monsoon as we lose surface moisture and days gradually begin to shorten.

If we do truly have a weak monsoon this year, it will likely begin to relent across Central and Eastern Colorado by mid August, which would lead to a drying trend across the Front Range Cities toward the end of the summer and into September.

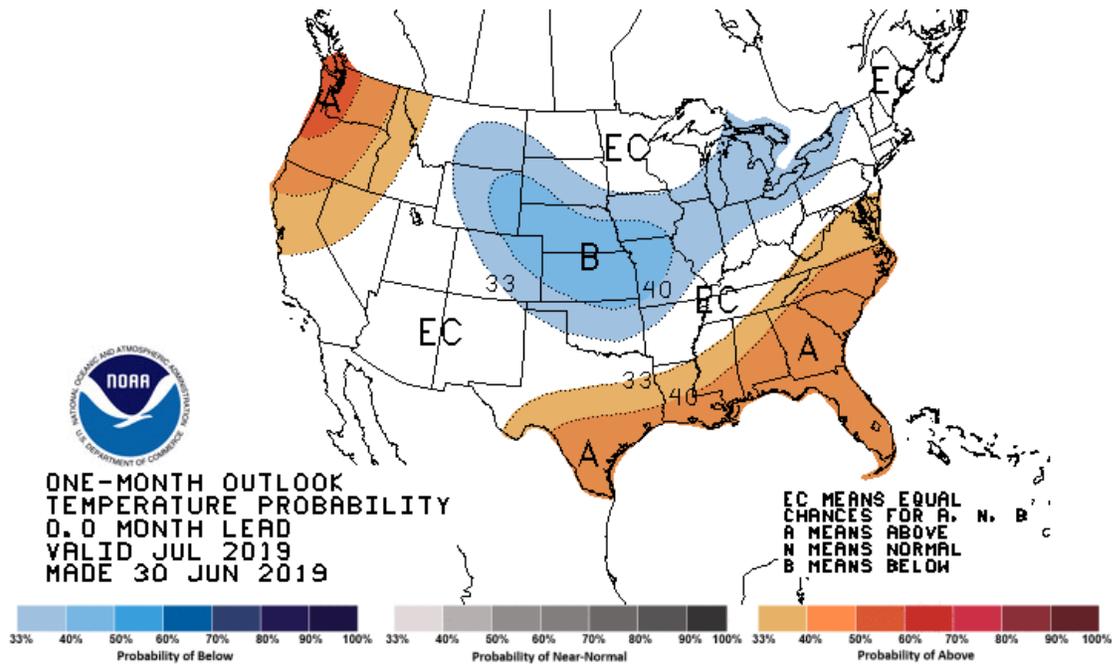
Of course there are many weather elements that cannot be predicted this far in advance, but in general the remainder of the summer pattern looks to be continued active in July (though maybe less so than recent), then potentially trending toward more benign conditions in August and early September.

## Drought Update

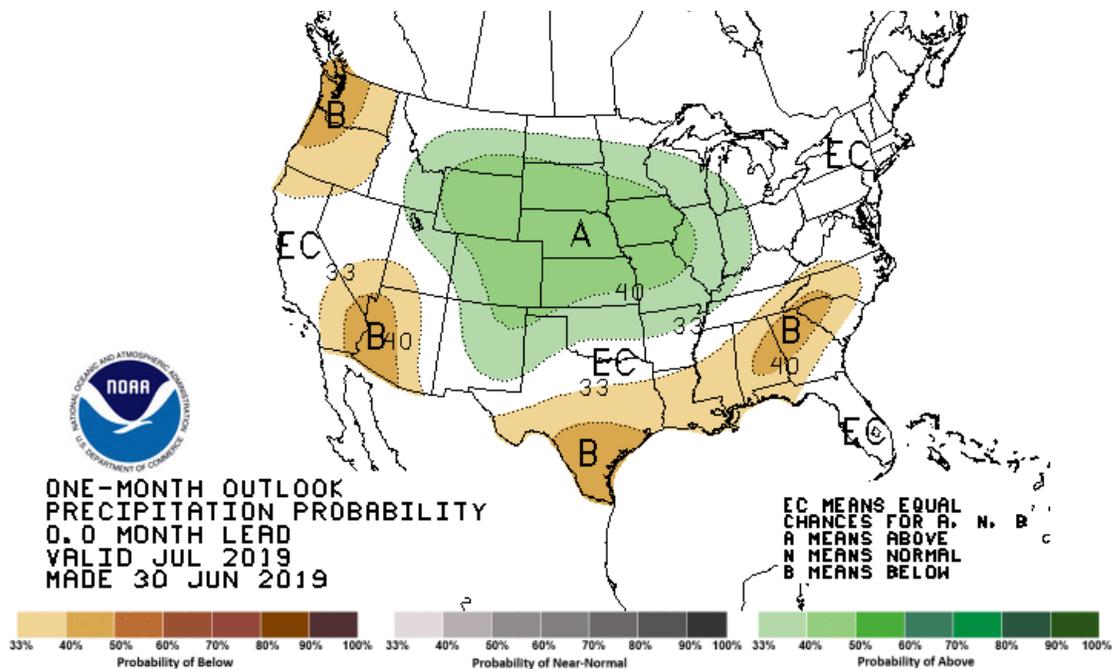
Colorado remains drought-free as does a large portion of the United State. Moderate to severe drought persists across the Pacific Northwest, with only spotty areas of drought elsewhere across the country.



The map below shows forecasted temperature deviances for July 2019. There is a slight bias toward below normal temperatures across Central Colorado including the Front Range, with a moderate bias toward below normal temperatures across far Northeast Colorado. Across the Western Slope and Southwest Colorado, there are equal chances for above or below normal temperatures.



The map below shows forecasted precipitation deviances for July 2019. There is a moderate bias toward above normal precipitation across central and eastern Colorado, with a slight bias toward above normal precipitation across southwest Colorado.

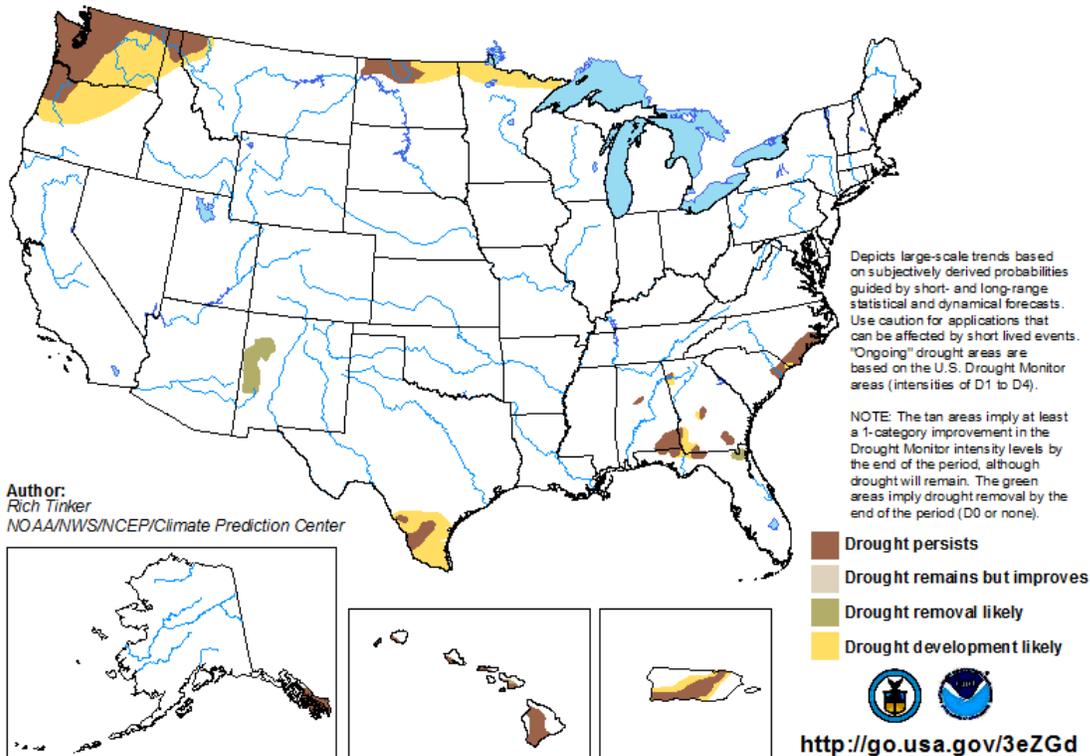


Colorado is expected to remain drought-free over the next month, with drought removal likely in the small area of Western New Mexico that is still experiencing moderate drought conditions. Drought is expected to worsen across the Pacific Northwest this month.

# U.S. Monthly Drought Outlook

## Drought Tendency During the Valid Period

Valid for July 2019  
Released June 30, 2019

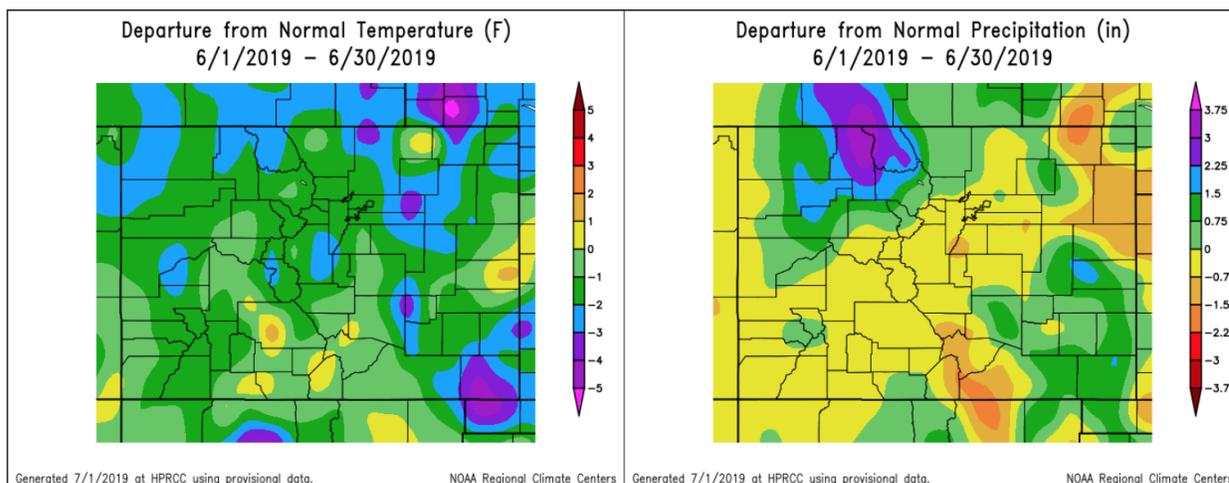


## June Summary

July 2019 was cooler than average throughout the Front Range and most of Colorado, with slightly above average to slightly below average precipitation depending on location. The average high temperature for the month at DIA was 80.1, which is 2.3 degrees below normal, and the average low at DIA was 51.2, which is 1.1 degrees below normal. DIA did not record its first 90-degree day of the year until June 26<sup>th</sup>, which is much later than the normal. In fact, according to Denver's official records, this was the latest first 90-degree day since 1982. There were a total of 5 days in which the high reached 90 at DIA, all of which were the last 5 days of the month. The high temperature for the month was 96, which occurred on both the 28<sup>th</sup> and 29<sup>th</sup>. The low temperature for the month was 42, which occurred on both the 9<sup>th</sup> and the 10<sup>th</sup>. Temperatures were consistently below average for most of the month until the first heat wave of the season arrived on the 26-30<sup>th</sup>. Overall, June was a very active month with numerous low pressure systems impacting the region, leading to frequent thunderstorm activity. DIA recorded a total of 21 thunderstorm days in June, which is more than double the average of 10. Precipitation totals were variable across the I-25 region in June, and did not necessarily reflect how active the pattern was. There were many days in which moisture was elevated with heavy rainfall potential and frequent thunderstorms, yet many areas still managed to finish with below average rainfall. Generally, rainfall totals were slightly below average from metro Denver south to Colorado Springs, while rainfall totals were slightly above average from DIA to Boulder to Ft. Collins. DIA recorded a total of 2.24" of rainfall in June, which is 0.26" above average.

Southeast Colorado also experienced cooler than average temperatures in June, while rainfall ranged from below average in El Paso County to above average in Pueblo County. The average temperature at the Colorado Springs Airport was 0.7 degrees below normal, while rainfall totaled 1.97", which is 0.53" below normal. At the Pueblo Airport, the average temperature was 0.9 degrees below normal, while rainfall totaled 2.25", which is 0.89" above normal.

The maps below show departure from normal temperature and precipitation for the month of June.



## June Stats

### TEMPERATURE (IN DEGREES F)

AVERAGE MAX	80.1	NORMAL 82.4	DEPARTURE -2.3
AVERAGE MIN	51.2	NORMAL 52.3	DEPARTURE -1.1
MONTHLY MEAN	65.6	NORMAL 67.4	DEPARTURE -1.8
HIGHEST	96 on 6/28, 6/29		
LOWEST	42 on 6/9, 6/10		

DAYS WITH MAX 90 OR ABOVE	5	NORMAL 7.9
DAYS WITH MAX 32 OR BELOW	0	NORMAL 0.0
DAYS WITH MIN 32 OR BELOW	0	NORMAL 0.0
DAYS WITH MIN ZERO OR BELOW	0	NORMAL 0.0

### TEMPERATURE RECORDS

None

### HEATING DEGREE DAYS

MONTHLY TOTAL	62	NORMAL 62	DEPARTURE 0
SEASONAL TOTAL	6281	NORMAL 6058	DEPARTURE 223

## COOLING DEGREE DAYS

MONTHLY TOTAL	87	NORMAL 133	DEPARTURE	-46
YEARLY TOTAL	92	NORMAL 155	DEPARTURE	-63

## PRECIPITATION (IN INCHES)

MONTHLY TOTAL	2.24	NORMAL 1.98	DEPARTURE	0.26
YEARLY TOTAL	9.58	NORMAL 7.51	DEPARTURE	2.07
GREATEST IN 24 HOURS	0.97 on 6/18			
DAYS WITH MEASURABLE PRECIP.	12			

## SNOWFALL (IN INCHES)

MONTHLY TOTAL	0.0	NORMAL 0.0	DEPARTURE	0.0
SEASONAL TOTAL	48.1	NORMAL 53.8	DEPARTURE	-5.7
GREATEST IN 24 HOURS	NA			
GREATEST DEPTH	0			

## WIND (IN MILES PER HOUR)

AVERAGE SPEED	9.7 mph		
PEAK WIND GUST	56 mph from the S on 6/2		

## MISCELLANEOUS WEATHER

NUMBER OF DAYS WITH THUNDERSTORM	21	NORMAL	10
NUMBER OF DAYS WITH HEAVY FOG	1	NORMAL	<1
NUMBER OF DAYS WITH HAIL	1		
NUMBER OF SUNNY DAYS	1		
NUMBER OF PARTLY CLOUDY DAYS	26		
NUMBER OF CLOUDY DAYS	3		
AVERAGE RELATIVE HUMIDITY	54%		

## July Preview

July is the hottest month on average in Denver, but also the second wettest on average due to the high frequency of thunderstorms that occur. The average high temperature for the month of July is 89.4 degrees, and the high exceeds 90 degrees an average of 16 days

during the month. The record high for the month is 105, which occurred in 2005, and this is also tied for the hottest temperature on record in Denver. The average low for the month is 58.9 degrees and the coolest temperature on record is 42, which occurred way back in 1873 and again in 1903. Average rainfall during the month of July is 2.10", with an average of 11 thunderstorm days occurring during the month. The North American Monsoon typically ramps up and peaks during the second half of July, which supplies the moisture necessary for frequent thunderstorms to occur in the Denver metro area, and sometimes heavy rainfall can occur from these thunderstorms. Severe weather is common during July as well, even though the peak is typically in June. However, the biggest threats from thunderstorms gradually shift from severe weather to heavy rain and flash flooding as the month progresses. This is typically due to the fact that upper level winds gradually weaken as the summer wears on, resulting in slower-moving thunderstorms, which can produce heavier rainfall during active monsoonal periods. Some of the Front Range's more notable flash flooding events have occurred in July, such as the Big Thompson Flood in 1976 and the Ft. Collins flood in 1997. For July of 2019, we are expecting below normal temperatures and above normal precipitation. The North American Monsoon is expected to start later than normal and be a bit weaker than normal this year. However, a more active than usual upper level pattern looks to persist through at least mid-month with abundant surface moisture across the Rockies and Plains supporting continued frequent thunderstorm activity.

**DENVER'S JULY CLIMATOLOGICALLY NORMAL  
(NORMAL PERIOD 1981-2010 DIA Data)**

**TEMPERATURE**

AVERAGE HIGH	89.4
AVERAGE LOW	58.9
MONTHLY MEAN	74.2
DAYS WITH HIGH 90 OR ABOVE	16
DAYS WITH HIGH 32 OR BELOW	0
DAYS WITH LOW 32 OR BELOW	0
DAYS WITH LOWS ZERO OR BELOW	0

**PRECIPITATION**

MONTHLY MEAN	2.10"
DAYS WITH MEASURABLE PRECIPITATION	8
AVERAGE SNOWFALL IN INCHES	0.0"
DAYS WITH 1.0 INCH OF SNOW OR MORE	0

**MISCELLANEOUS AVERAGES**

HEATING DEGREE DAYS	6
COOLING DEGREE DAYS	289
WIND SPEED (MPH)	8.3mph
WIND DIRECTION	South
DAYS WITH THUNDERSTORMS	11
DAYS WITH DENSE FOG	0
PERCENT OF SUNSHINE POSSIBLE	71%

## EXTREMES

RECORD HIGH	105 on 7/20/2005
RECORD LOW	42 on 7/4/1903, 7/31/1873
WARMEST	78.9 in 2012
COLDEST	67.4 in 1895
WETTEST	6.41" in 1965
DRIEST	0.01" in 1901
SNOWIEST	0.0"
LEAST SNOWIEST	0.0"

## Rainfall

### May 2019 to October 2019

City	May	Jun	Jul	Aug	Sep	Oct	Total
Aurora (Central)	2.71	2.87					5.58
Boulder	3.46	2.62					6.08
Brighton	3.26	1.64					4.90
Broomfield	2.46	2.48					4.94
Castle Rock	2.19	1.68					3.87
Colo Sprgs Airport	2.49	1.97					4.46
Denver DIA	3.23	2.24					5.47
Denver Downtown	3.56	1.31					4.87
Golden	3.01	2.32					5.33
Fort Collins	2.93	2.27					5.20
Highlands Ranch	2.44	1.79					4.23
Lakewood	3.60	1.35					4.95
Littleton	2.68	1.91					4.59
Monument	2.60	1.27					3.87
Parker	2.50	2.19					4.69
Sedalia - Hwy 67	2.02	1.42					3.44
Thornton	2.53	2.21					4.74
Westminster	2.70	1.81					4.51
Wheat Ridge	2.27	1.43					3.70

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