# <u>Stream:</u> Red Canyon Creek

## Executive Summary

Water Division: 4
Water District: 60
CDOW#: 42452
CWCB ID: 10/4/A-009

**Segment:** CONFLUENCE WITH BIG A CREEK TO CONFLUENCE WITH HORSEFLY CREEK
**Upper Terminus**: CONFLUENCE WITH BIG A CREEK
(Latitude 38° 16’ 18.13”N) (Longitude 108° 12’ 18.56”W)

**Lower Terminus**: CONFLUENCE WITH HORSEFLY CREEK
(Latitude 38° 14’ 22.51”N) (Longitude 108° 13’ 24.10”W)

**Watershed:** San Miguel (HUC#: 14030003)
**Counties**: Montrose
**Length**: 2.69 miles
**USGS Quad(s)**: Antone Spring, Sanborn Park
**Flow Recommendation:** 1.2 cfs (April 1 – June 30)
0.25 cfs (July 1 – October 31)

# Staff Analysis and Recommendation

## Summary

The information contained in this report and the associated instream flow file folder forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in ISF Rule 5i.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. The U.S. Forest Service (USFS) recommended this segment of Red Canyon Creek to the CWCB for inclusion into the Instream Flow Program. Red Canyon Creek is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

Red Canyon Creek originates on the south end of the Uncompahgre Plateau at an elevation of 9,510 feet and flows generally in an easterly direction through Uncompahgre National Forest for 6.8 miles as it drops to an elevation of 8,760 feet at its confluence with Horsefly Creek. One hundred percent of the land on the 2.69 mile segment addressed by this report is publicly owned. Red Canyon Creek is located within Montrose County and the total drainage area of the creek is approximately 13.2 square miles.

The subject of this report is a segment of Red Canyon Creek, beginning at the confluence with Big A Creek and extending downstream to confluence with Horsefly Creek. The proposed segment is located approximately 8.5 miles northeast of Norwood. Staff has received one recommendation for this segment from the USFS. The recommendation for this segment is discussed below.

## Instream Flow Recommendation

The USFS recommended 1.2 cfs (May 1 – June 30), 0.5 cfs (July 1 – October 31) and 0.25 cfs (November 1 – April 30) These recommendations were based on data collection efforts on June 27, 2007, USFS water availability analyses, CWCB staff water availability analyses and professional judgment. CWCB Staff subsequently reduced the USFS recommendation for the period of July 1 – November 1 to 0.25 cfs and eliminated the recommendation from November 1 – April 30 because its analysis indicated that water may not be available in the amounts recommended by the USFS.

## Land Status Review

| Upper Terminus | Lower Terminus | Total Length (miles) | Land Ownership | |
|---|---|---|---|---|
| | | | % Private | % Public |
| Confluence with Big A Creek | Confluence with Horsefly Creek | 2.69 | 0% | 100% |

100% of the public lands are owned by the USFS.

## Biological Data

Fisheries surveys in the watershed indicate that the stream environment supports self-sustaining populations of native Colorado River cutthroat trout (CRCT) and mottled sculpin. A small rainbow trout population is also located near the mouth of the creek. Colorado River cutthroat trout are of limited distribution across the state of Colorado, particularly in the San Miguel River sub-basin, where Red Canyon Creek is one of only three populations that currently exist. Distribution of these genetically pure CRCT populations is limited to approximately 5-7% of their native distribution on the Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG NF) (James and Speas 2005). Electro-fishing surveys completed in 2005 indicate that there are approximately 40 adult fish per mile in Red Canyon Creek (USFS unpublished). Sampling was done again on July 6, 2009. Over a 188 ft sampling reach, 27 CRCT were collected.

Low flows are common in the late summer and fall, and may be a limiting factor for fish production and movement during this time. The stream channel provides good pool habitat during summer and winter low flows. However, depth appears to limit movement and distribution of CRCT during this time. Low flows also limit aquatic insect production during this low period as well. Despite these natural flow limitations in the summer and winter seasons, the stream does support a fully functional riparian community, and suitable fish habitat to support the long-term persistence of native CRCT.

## Field Survey Data

USFS staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

## Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types will result in the maintenance of aquatic habitat in pools and runs for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, three data sets were collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected (Date), the measured

discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria. It is believed that recommendations that fall outside of the accuracy range of the model, over 250% of the measured discharge or under 40% of the measured discharge may not give an accurate estimate of the necessary instream flow required.

Table 1: Data

| Party | Date | Q | 250%-40% | Summer (3/3) | Winter (2/3) |
|---|---|---|---|---|---|
| USFS | 6/27/2007 | 1.3 | 3.3 – 0.5 | 1.2 | 1.2 |
| USFS | 6/27/2007 | 2.08 | 5.2 – 0.8 | 0.98 | 0.52* |
| USFS | 6/27/2007 | 1.11 | 2.8 – 0.4 | 1.2 | 0.99 |

* = Out of Range

The summer flow recommendation, which meets 3 of 3 criteria and is within the accuracy range of the R2CROSS model, is 1.2 cfs. Due to water availability constraints the late summer and early autumn flow recommendation was lowered to 0.25 cfs, and the winter flow recommendation was eliminated.

## Hydrologic Data and Analysis

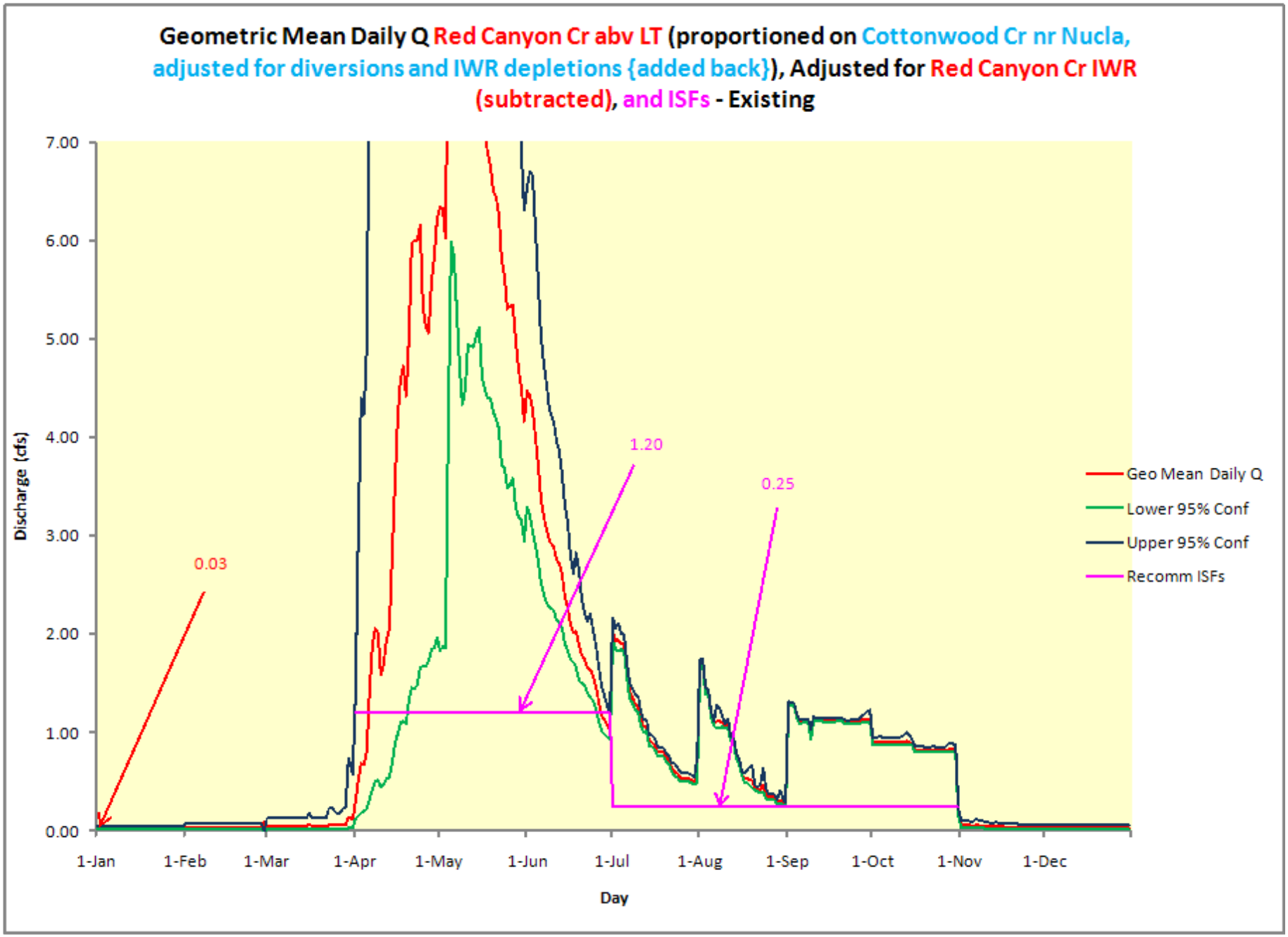
After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept, a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended instream flow appropriation. Of course, this analysis must be a practical exercise rather than a lengthy and costly scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case, this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of Red Canyon Creek, no such gage is available at the LT. In fact, there is no gage on Red Canyon Creek. It is thus

necessary to describe the normal flow regime at Red Canyon Creek above the LT through a "representative" gage station. The gage station selected for this purpose was COTTONWOOD CREEK NEAR NUCLA, CO (USGS 09174500), a gage with a 10 year period of record (POR) collected between 1942 and 1951, two of which are partial. The gage is at an elevation of 6,080 ft above mean sea level (amsl) and has a drainage area of 38.8 $mi^2$. The hydrograph (plot of discharge over time) produced from this gage includes the effects of seven upstream diversions. These diversions were partially consumptive to the basin. To make the measured data from Cottonwood Creek transferrable to Red Canyon Creek above the LT, these diversions were added back to the measured Cottonwood Creek hydrograph. The resulting "adjusted" hydrograph could then be used on Red Canyon Creek above the LT by multiplying the "adjusted" hydrograph by an area ratio; specifically, the area of Red Canyon above the LT (13.15 $mi^2$ above the LT) to Cottonwood Creek nr Nucla, CO (38.8 $mi^2$ above the gage). Next, the resulting proportioned "adjusted" hydrograph would itself be "adjusted" (decreased) to reflect the existing depletions on Red Canyon Creek above the LT resulting from upstream consumptive irrigation uses. (The one diversion on record had no records of diversion and the Structure Summary Report identified it as having an unusable structure.) The final hydrograph represents a distribution of flow over time that has been reduced to reflect existing human uses.

{The following discussion is based upon the US Geological Survey's *Techniques of Water-Resources Investigations* Series, *Book 4: Hydrologic Analysis and Interpretation, Chapter A3: Statistical Methods in Water Resources* (Chapter 3: Describing Uncertainty) by D.R. Helsel and R. M. Hirsch. This technical reference provides the scientific background and guidance important to the systematic interpretation of hydrologic data. The document is available online and is a valuable aid to understanding and interpreting the analyses described here.}

The next step in producing a representation of the discharge at Red Canyon Creek is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Cottonwood Creek nr Nucla, CO hydrograph. This step is of value because of the inherent statistical limitation found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently limited, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. In this particular case, the short period of record lends even greater merit to the use of this statistical tool. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed in Figure 1 with the data displayed in Table 2.


Geometric Mean Daily Q Red Canyon Cr abv LT (proportioned on Cottonwood Cr nr Nucla, adjusted for diversions and IWR depletions {added back}), Adjusted for Red Canyon Cr IWR (subtracted), and ISFs - Existing
Discharge (cfs)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Day
0.03
1.20
0.25
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISFs

| Table 2. Geometric Mean Existing Cond (IWR subtracted) Red Canyon Cr Prop on Cottonwood Cr nr Nucla abv Gage Baseline Cond | | | | |
|---|---|---|---|---|
| **Date** | **GM (abv LT) Prorated by 33.89%** | **Lower 95% Conf Prorated by 33.89%** | **Upper 95% Conf Prorated by 33.89%** | **Recommended ISF (cfs)** |
| 1-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 2-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 3-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 4-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 5-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 6-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 7-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 8-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 9-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 10-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 11-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 12-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 13-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 14-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 15-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 16-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 17-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 18-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 19-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 20-Jan | 0.028114 | 0.017805 | 0.044394 | |
| 21-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 22-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 23-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 24-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 25-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 26-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 27-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 28-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 29-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 30-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 31-Jan | 0.030372 | 0.019682 | 0.046869 | |
| 1-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 2-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 3-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 4-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 5-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 6-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 7-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 8-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 9-Feb | 0.034719 | 0.01714 | 0.070328 | |

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|---|---|---|---|---|
| 10-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 11-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 12-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 13-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 14-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 15-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 16-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 17-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 18-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 19-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 20-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 21-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 22-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 23-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 24-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 25-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 26-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 27-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 28-Feb | 0.034719 | 0.01714 | 0.070328 | |
| 1-Mar | 0.107175 | 0 | 0 | |
| 2-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 3-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 4-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 5-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 6-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 7-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 8-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 9-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 10-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 11-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 12-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 13-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 14-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 15-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 16-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 17-Mar | 0.069677 | 0.025038 | 0.193897 | |
| 18-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 19-Mar | 0.049412 | 0.019042 | 0.12822 | |
| 20-Mar | 0.05338 | 0.021454 | 0.132816 | |
| 21-Mar | 0.05338 | 0.021454 | 0.132816 | |
| 22-Mar | 0.05338 | 0.021454 | 0.132816 | |
| 23-Mar | 0.05338 | 0.021454 | 0.132816 | |
| 24-Mar | 0.064292 | 0.018349 | 0.225266 | |
| 25-Mar | 0.066607 | 0.01771 | 0.250512 | |
| 26-Mar | 0.062608 | 0.018827 | 0.208198 | |
| 27-Mar | 0.055413 | 0.018019 | 0.170414 | |
| 28-Mar | 0.057967 | 0.017263 | 0.194644 | |
| 29-Mar | 0.06102 | 0.016394 | 0.227128 | |

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|---|---|---|---|---|
| 30-Mar | 0.062269 | 0.016052 | 0.241558 | |
| 31-Mar | 0.140018 | 0.026236 | 0.747264 | |
| 1-Apr | 0.123484 | 0.026527 | 0.574821 | 1.2 |
| 2-Apr | 0.304994 | 0.135833 | 1.409159 | 1.2 |
| 3-Apr | 0.52841 | 0.165053 | 3.098694 | 1.2 |
| 4-Apr | 0.687802 | 0.184137 | 4.406301 | 1.2 |
| 5-Apr | 0.667553 | 0.198431 | 4.226662 | 1.2 |
| 6-Apr | 0.815831 | 0.225549 | 4.949248 | 1.2 |
| 7-Apr | 1.439539 | 0.33803 | 8.296269 | 1.2 |
| 8-Apr | 1.884198 | 0.415996 | 10.81676 | 1.2 |
| 9-Apr | 2.063739 | 0.501826 | 10.641 | 1.2 |
| 10-Apr | 2.010979 | 0.515833 | 9.685643 | 1.2 |
| 11-Apr | 1.59315 | 0.447496 | 7.379774 | 1.2 |
| 12-Apr | 1.699178 | 0.476055 | 7.896379 | 1.2 |
| 13-Apr | 1.938782 | 0.531 | 9.309582 | 1.2 |
| 14-Apr | 2.050792 | 0.545867 | 10.07831 | 1.2 |
| 15-Apr | 2.772127 | 0.695153 | 13.5374 | 1.2 |
| 16-Apr | 3.508279 | 0.892971 | 18.31418 | 1.2 |
| 17-Apr | 4.183985 | 0.984328 | 23.07539 | 1.2 |
| 18-Apr | 4.586373 | 1.10676 | 26.53965 | 1.2 |
| 19-Apr | 4.722542 | 1.117515 | 28.12254 | 1.2 |
| 20-Apr | 4.411542 | 1.091555 | 25.21112 | 1.2 |
| 21-Apr | 5.008214 | 1.32992 | 27.97008 | 1.2 |
| 22-Apr | 5.971208 | 1.458223 | 37.49271 | 1.2 |
| 23-Apr | 5.993046 | 1.441559 | 38.63659 | 1.2 |
| 24-Apr | 6.003846 | 1.483324 | 37.27846 | 1.2 |
| 25-Apr | 6.152427 | 1.661586 | 33.61176 | 1.2 |
| 26-Apr | 5.324519 | 1.671567 | 26.28627 | 1.2 |
| 27-Apr | 5.118995 | 1.668331 | 24.33349 | 1.2 |
| 28-Apr | 5.050796 | 1.725603 | 23.01187 | 1.2 |
| 29-Apr | 5.556356 | 1.846532 | 25.69309 | 1.2 |
| 30-Apr | 5.828126 | 1.864001 | 28.40206 | 1.2 |
| 1-May | 6.214568 | 1.977605 | 31.08365 | 1.2 |
| 2-May | 6.336477 | 1.826303 | 28.53829 | 1.2 |
| 3-May | 6.329231 | 1.872284 | 27.79822 | 1.2 |
| 4-May | 6.014728 | 1.863743 | 25.40661 | 1.2 |
| 5-May | 8.420436 | 4.158368 | 18.07116 | 1.2 |
| 6-May | 10.06044 | 5.990802 | 17.31343 | 1.2 |
| 7-May | 9.864449 | 5.847533 | 17.08274 | 1.2 |
| 8-May | 9.469007 | 5.291042 | 17.65258 | 1.2 |
| 9-May | 8.840968 | 4.718298 | 17.46526 | 1.2 |
| 10-May | 8.316348 | 4.332215 | 17.02428 | 1.2 |
| 11-May | 8.288936 | 4.479425 | 16.30031 | 1.2 |
| 12-May | 8.887617 | 4.945125 | 16.80251 | 1.2 |
| 13-May | 8.71431 | 4.921899 | 16.27193 | 1.2 |
| 14-May | 8.203677 | 4.912066 | 14.38722 | 1.2 |
| 15-May | 8.398457 | 5.044087 | 14.69269 | 1.2 |
| 16-May | 8.282021 | 5.118832 | 14.03437 | 1.2 |

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|---|---|---|---|---|
| 17-May | 7.573617 | 4.609118 | 13.15229 | 1.2 |
| 18-May | 7.113871 | 4.478796 | 11.89201 | 1.2 |
| 19-May | 6.878935 | 4.399076 | 11.29794 | 1.2 |
| 20-May | 6.762662 | 4.407183 | 10.88813 | 1.2 |
| 21-May | 6.498841 | 4.257826 | 10.43659 | 1.2 |
| 22-May | 6.44351 | 4.192382 | 10.44046 | 1.2 |
| 23-May | 6.259811 | 4.088684 | 10.13273 | 1.2 |
| 24-May | 5.801065 | 3.711232 | 9.735322 | 1.2 |
| 25-May | 5.641926 | 3.685661 | 9.294083 | 1.2 |
| 26-May | 5.300084 | 3.493478 | 8.672899 | 1.2 |
| 27-May | 5.330515 | 3.521719 | 8.674402 | 1.2 |
| 28-May | 5.348238 | 3.587201 | 8.517764 | 1.2 |
| 29-May | 4.991112 | 3.28764 | 8.219563 | 1.2 |
| 30-May | 4.689359 | 3.179972 | 7.46167 | 1.2 |
| 31-May | 4.505496 | 3.155291 | 6.903834 | 1.2 |
| 1-Jun | 4.163686 | 2.946649 | 6.296541 | 1.2 |
| 2-Jun | 4.46845 | 3.298141 | 6.543509 | 1.2 |
| 3-Jun | 4.43332 | 3.204184 | 6.697045 | 1.2 |
| 4-Jun | 4.278624 | 3.044696 | 6.657548 | 1.2 |
| 5-Jun | 4.003838 | 2.898426 | 6.133345 | 1.2 |
| 6-Jun | 3.701502 | 2.735259 | 5.553472 | 1.2 |
| 7-Jun | 3.3721 | 2.519328 | 5.02104 | 1.2 |
| 8-Jun | 3.189803 | 2.403594 | 4.745002 | 1.2 |
| 9-Jun | 3.05346 | 2.321791 | 4.525242 | 1.2 |
| 10-Jun | 2.93987 | 2.270327 | 4.272453 | 1.2 |
| 11-Jun | 2.892291 | 2.251201 | 4.15776 | 1.2 |
| 12-Jun | 2.752305 | 2.141922 | 3.951826 | 1.2 |
| 13-Jun | 2.722886 | 2.133568 | 3.855954 | 1.2 |
| 14-Jun | 2.596517 | 2.061025 | 3.61945 | 1.2 |
| 15-Jun | 2.375216 | 1.907387 | 3.296091 | 1.2 |
| 16-Jun | 2.257285 | 1.829603 | 3.130878 | 1.2 |
| 17-Jun | 2.104155 | 1.751239 | 2.79376 | 1.2 |
| 18-Jun | 2.019111 | 1.712027 | 2.61134 | 1.2 |
| 19-Jun | 2.031527 | 1.663301 | 2.824995 | 1.2 |
| 20-Jun | 1.888778 | 1.537759 | 2.646466 | 1.2 |
| 21-Jun | 1.792971 | 1.500217 | 2.364329 | 1.2 |
| 22-Jun | 1.739733 | 1.484429 | 2.214426 | 1.2 |
| 23-Jun | 1.655722 | 1.401659 | 2.136012 | 1.2 |
| 24-Jun | 1.641974 | 1.359455 | 2.213879 | 1.2 |
| 25-Jun | 1.570105 | 1.326427 | 2.041999 | 1.2 |
| 26-Jun | 1.468536 | 1.24754 | 1.882146 | 1.2 |
| 27-Jun | 1.313075 | 1.118372 | 1.673559 | 1.2 |
| 28-Jun | 1.178032 | 1.010897 | 1.472236 | 1.2 |
| 29-Jun | 1.13074 | 0.989574 | 1.368109 | 1.2 |
| 30-Jun | 1.081103 | 0.963386 | 1.274169 | 1.2 |
| 1-Jul | 1.031016 | 0.934135 | 1.180452 | 0.25 |
| 2-Jul | 2.026576 | 1.938024 | 2.166815 | 0.25 |
| 3-Jul | 1.92556 | 1.841127 | 2.058032 | 0.25 |

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|---|---|---|---|---|
| 4-Jul | 1.938193 | 1.836062 | 2.111862 | 0.25 |
| 5-Jul | 1.907801 | 1.839126 | 2.008156 | 0.25 |
| 6-Jul | 1.897668 | 1.829068 | 2.000048 | 0.25 |
| 7-Jul | 1.626253 | 1.567746 | 1.70957 | 0.25 |
| 8-Jul | 1.413191 | 1.34929 | 1.508761 | 0.25 |
| 9-Jul | 1.35845 | 1.297254 | 1.44919 | 0.25 |
| 10-Jul | 1.294965 | 1.234115 | 1.386293 | 0.25 |
| 11-Jul | 1.281067 | 1.219571 | 1.375628 | 0.25 |
| 12-Jul | 1.13229 | 1.076165 | 1.217063 | 0.25 |
| 13-Jul | 1.055413 | 1.003946 | 1.131256 | 0.25 |
| 14-Jul | 1.058365 | 1.010386 | 1.127469 | 0.25 |
| 15-Jul | 0.909771 | 0.864604 | 0.975001 | 0.25 |
| 16-Jul | 0.902482 | 0.856394 | 0.971342 | 0.25 |
| 17-Jul | 0.88043 | 0.838102 | 0.94304 | 0.25 |
| 18-Jul | 0.803376 | 0.764149 | 0.86037 | 0.25 |
| 19-Jul | 0.797946 | 0.760492 | 0.851541 | 0.25 |
| 20-Jul | 0.798202 | 0.760775 | 0.851696 | 0.25 |
| 21-Jul | 0.739361 | 0.701462 | 0.792515 | 0.25 |
| 22-Jul | 0.730806 | 0.694945 | 0.781017 | 0.25 |
| 23-Jul | 0.641778 | 0.608845 | 0.687602 | 0.25 |
| 24-Jul | 0.604256 | 0.554697 | 0.690423 | 0.25 |
| 25-Jul | 0.589421 | 0.550077 | 0.650916 | 0.25 |
| 26-Jul | 0.541972 | 0.504168 | 0.600196 | 0.25 |
| 27-Jul | 0.5387 | 0.504152 | 0.590306 | 0.25 |
| 28-Jul | 0.536811 | 0.503952 | 0.585147 | 0.25 |
| 29-Jul | 0.535669 | 0.49635 | 0.595065 | 0.25 |
| 30-Jul | 0.524288 | 0.492869 | 0.569134 | 0.25 |
| 31-Jul | 0.50177 | 0.471172 | 0.546517 | 0.25 |
| 1-Aug | 0.57296 | 0.491121 | 0.748764 | 0.25 |
| 2-Aug | 1.677356 | 1.633606 | 1.746498 | 0.25 |
| 3-Aug | 1.71638 | 1.686756 | 1.757104 | 0.25 |
| 4-Aug | 1.4205 | 1.395312 | 1.453632 | 0.25 |
| 5-Aug | 1.424766 | 1.407837 | 1.445056 | 0.25 |
| 6-Aug | 1.177489 | 1.160559 | 1.197779 | 0.25 |
| 7-Aug | 1.09319 | 1.070228 | 1.122805 | 0.25 |
| 8-Aug | 1.119653 | 1.046694 | 1.288164 | 0.25 |
| 9-Aug | 1.112549 | 1.044792 | 1.265628 | 0.25 |
| 10-Aug | 1.096173 | 1.054444 | 1.165341 | 0.25 |
| 11-Aug | 1.058533 | 1.040235 | 1.082199 | 0.25 |
| 12-Aug | 1.080287 | 1.038645 | 1.150461 | 0.25 |
| 13-Aug | 0.931629 | 0.9114 | 0.958375 | 0.25 |
| 14-Aug | 0.930129 | 0.908694 | 0.95921 | 0.25 |
| 15-Aug | 0.759219 | 0.734842 | 0.794435 | 0.25 |
| 16-Aug | 0.696126 | 0.672941 | 0.729477 | 0.25 |
| 17-Aug | 0.572508 | 0.55387 | 0.598101 | 0.25 |
| 18-Aug | 0.527731 | 0.494376 | 0.584933 | 0.25 |
| 19-Aug | 0.536807 | 0.489663 | 0.636942 | 0.25 |
| 20-Aug | 0.513338 | 0.44867 | 0.672975 | 0.25 |

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| 21-Aug | 0.44491 | 0.421792 | 0.477811 | 0.25 |
| 22-Aug | 0.41885 | 0.396938 | 0.450154 | 0.25 |
| 23-Aug | 0.424762 | 0.394726 | 0.473241 | 0.25 |
| 24-Aug | 0.473464 | 0.399953 | 0.646786 | 0.25 |
| 25-Aug | 0.375775 | 0.337904 | 0.435044 | 0.25 |
| 26-Aug | 0.342306 | 0.319987 | 0.37477 | 0.25 |
| 27-Aug | 0.340495 | 0.321369 | 0.367773 | 0.25 |
| 28-Aug | 0.342362 | 0.321479 | 0.372942 | 0.25 |
| 29-Aug | 0.289376 | 0.270408 | 0.317175 | 0.25 |
| 30-Aug | 0.319282 | 0.273315 | 0.413659 | 0.25 |
| 31-Aug | 0.299803 | 0.275826 | 0.336235 | 0.25 |
| 1-Sep | 0.26895 | 0.251758 | 0.293383 | 0.25 |
| 2-Sep | 1.288583 | 1.271391 | 1.313016 | 0.25 |
| 3-Sep | 1.284698 | 1.268011 | 1.308822 | 0.25 |
| 4-Sep | 1.284698 | 1.268011 | 1.308822 | 0.25 |
| 5-Sep | 1.168607 | 1.15192 | 1.192731 | 0.25 |
| 6-Sep | 1.110561 | 1.093874 | 1.134685 | 0.25 |
| 7-Sep | 1.112141 | 1.096655 | 1.133588 | 0.25 |
| 8-Sep | 1.112141 | 1.096655 | 1.133588 | 0.25 |
| 9-Sep | 1.114446 | 1.097254 | 1.138879 | 0.25 |
| 10-Sep | 0.969014 | 0.938307 | 1.024908 | 0.25 |
| 11-Sep | 1.133922 | 1.111352 | 1.170507 | 0.25 |
| 12-Sep | 1.126985 | 1.112025 | 1.14799 | 0.25 |
| 13-Sep | 1.126985 | 1.112025 | 1.14799 | 0.25 |
| 14-Sep | 1.126985 | 1.112025 | 1.14799 | 0.25 |
| 15-Sep | 1.123504 | 1.109362 | 1.143468 | 0.25 |
| 16-Sep | 1.123504 | 1.109362 | 1.143468 | 0.25 |
| 17-Sep | 1.123504 | 1.109362 | 1.143468 | 0.25 |
| 18-Sep | 1.123504 | 1.109362 | 1.143468 | 0.25 |
| 19-Sep | 1.130716 | 1.11523 | 1.152163 | 0.25 |
| 20-Sep | 1.130716 | 1.11523 | 1.152163 | 0.25 |
| 21-Sep | 1.126985 | 1.112025 | 1.14799 | 0.25 |
| 22-Sep | 1.103767 | 1.088807 | 1.124772 | 0.25 |
| 23-Sep | 1.100286 | 1.086143 | 1.12025 | 0.25 |
| 24-Sep | 1.103767 | 1.088807 | 1.124772 | 0.25 |
| 25-Sep | 1.103767 | 1.088807 | 1.124772 | 0.25 |
| 26-Sep | 1.107497 | 1.092012 | 1.128945 | 0.25 |
| 27-Sep | 1.113238 | 1.095686 | 1.137809 | 0.25 |
| 28-Sep | 1.126168 | 1.096827 | 1.174623 | 0.25 |
| 29-Sep | 1.131506 | 1.097683 | 1.190257 | 0.25 |
| 30-Sep | 1.136679 | 1.096769 | 1.211999 | 0.25 |
| 1-Oct | 1.139993 | 1.096354 | 1.226363 | 0.25 |
| 2-Oct | 0.898778 | 0.870172 | 0.949768 | 0.25 |
| 3-Oct | 0.898778 | 0.870172 | 0.949768 | 0.25 |
| 4-Oct | 0.903996 | 0.874362 | 0.95518 | 0.25 |
| 5-Oct | 0.903996 | 0.874362 | 0.95518 | 0.25 |
| 6-Oct | 0.900895 | 0.872973 | 0.948625 | 0.25 |
| 7-Oct | 0.898778 | 0.872629 | 0.942452 | 0.25 |

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|---|---|---|---|---|
| 8-Oct | 0.898778 | 0.872629 | 0.942452 | 0.25 |
| 9-Oct | 0.900112 | 0.872385 | 0.947665 | 0.25 |
| 10-Oct | 0.900112 | 0.872385 | 0.947665 | 0.25 |
| 11-Oct | 0.900112 | 0.872385 | 0.947665 | 0.25 |
| 12-Oct | 0.905436 | 0.874244 | 0.960574 | 0.25 |
| 13-Oct | 0.908511 | 0.874264 | 0.971608 | 0.25 |
| 14-Oct | 0.91513 | 0.87267 | 1.003746 | 0.25 |
| 15-Oct | 0.903996 | 0.869852 | 0.970307 | 0.25 |
| 16-Oct | 0.895183 | 0.869914 | 0.938038 | 0.25 |
| 17-Oct | 0.82174 | 0.798234 | 0.860873 | 0.25 |
| 18-Oct | 0.824452 | 0.801897 | 0.860044 | 0.25 |
| 19-Oct | 0.824452 | 0.801897 | 0.860044 | 0.25 |
| 20-Oct | 0.819888 | 0.798177 | 0.854953 | 0.25 |
| 21-Oct | 0.817377 | 0.797496 | 0.848675 | 0.25 |
| 22-Oct | 0.814976 | 0.796988 | 0.84245 | 0.25 |
| 23-Oct | 0.819888 | 0.798177 | 0.854953 | 0.25 |
| 24-Oct | 0.819888 | 0.798177 | 0.854953 | 0.25 |
| 25-Oct | 0.814976 | 0.796988 | 0.84245 | 0.25 |
| 26-Oct | 0.817377 | 0.797496 | 0.848675 | 0.25 |
| 27-Oct | 0.817377 | 0.797496 | 0.848675 | 0.25 |
| 28-Oct | 0.82174 | 0.800993 | 0.853779 | 0.25 |
| 29-Oct | 0.833265 | 0.803631 | 0.884449 | 0.25 |
| 30-Oct | 0.834192 | 0.804627 | 0.884695 | 0.25 |
| 31-Oct | 0.825998 | 0.799103 | 0.872861 | 0.25 |
| 1-Nov | 0.168959 | 0.143816 | 0.212065 | |
| 2-Nov | 0.060337 | 0.035194 | 0.103443 | |
| 3-Nov | 0.060771 | 0.035516 | 0.103984 | |
| 4-Nov | 0.058859 | 0.035354 | 0.097993 | |
| 5-Nov | 0.058859 | 0.035354 | 0.097993 | |
| 6-Nov | 0.05277 | 0.030107 | 0.092494 | |
| 7-Nov | 0.060324 | 0.030293 | 0.120123 | |
| 8-Nov | 0.05472 | 0.026373 | 0.113535 | |
| 9-Nov | 0.0517 | 0.026151 | 0.102213 | |
| 10-Nov | 0.0517 | 0.026151 | 0.102213 | |
| 11-Nov | 0.045759 | 0.023679 | 0.088432 | |
| 12-Nov | 0.04577 | 0.025061 | 0.083592 | |
| 13-Nov | 0.042368 | 0.022069 | 0.081336 | |
| 14-Nov | 0.04432 | 0.022422 | 0.087605 | |
| 15-Nov | 0.043744 | 0.02207 | 0.0867 | |
| 16-Nov | 0.042672 | 0.022206 | 0.082 | |
| 17-Nov | 0.039509 | 0.020814 | 0.074999 | |
| 18-Nov | 0.038266 | 0.020934 | 0.069949 | |
| 19-Nov | 0.038266 | 0.020934 | 0.069949 | |
| 20-Nov | 0.038266 | 0.020934 | 0.069949 | |
| 21-Nov | 0.038266 | 0.020934 | 0.069949 | |
| 22-Nov | 0.038266 | 0.020934 | 0.069949 | |
| 23-Nov | 0.037063 | 0.021134 | 0.064995 | |
| 24-Nov | 0.034308 | 0.018885 | 0.062326 | |

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|---|---|---|---|---|
| 25-Nov | 0.037063 | 0.021134 | 0.064995 | |
| 26-Nov | 0.037063 | 0.021134 | 0.064995 | |
| 27-Nov | 0.037063 | 0.021134 | 0.064995 | |
| 28-Nov | 0.03543 | 0.021156 | 0.059334 | |
| 29-Nov | 0.038266 | 0.022274 | 0.065742 | |
| 30-Nov | 0.038266 | 0.022274 | 0.065742 | |
| 1-Dec | 0.038266 | 0.022274 | 0.065742 | |
| 2-Dec | 0.03543 | 0.021156 | 0.059334 | |
| 3-Dec | 0.03543 | 0.021156 | 0.059334 | |
| 4-Dec | 0.03543 | 0.021156 | 0.059334 | |
| 5-Dec | 0.03543 | 0.021156 | 0.059334 | |
| 6-Dec | 0.036581 | 0.020849 | 0.064184 | |
| 7-Dec | 0.03543 | 0.021156 | 0.059334 | |
| 8-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 9-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 10-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 11-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 12-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 13-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 14-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 15-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 16-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 17-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 18-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 19-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 20-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 21-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 22-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 23-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 24-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 25-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 26-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 27-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 28-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 29-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 30-Dec | 0.033869 | 0.021337 | 0.053763 | |
| 31-Dec | 0.033869 | 0.021337 | 0.053763 | |

## Existing Water Right Information

Staff has analyzed the water rights tabulation and contacted the Division Engineer Office (DEO) to identify any potential water availability problems. There are no decreed surface diversions within this reach of stream. Staff has determined that water is available for appropriation on Red Canyon Creek, between the confluence with Big A Creek and the confluence with Horsefly Creek, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

## CWCB Staff's Instream Flow Recommendation

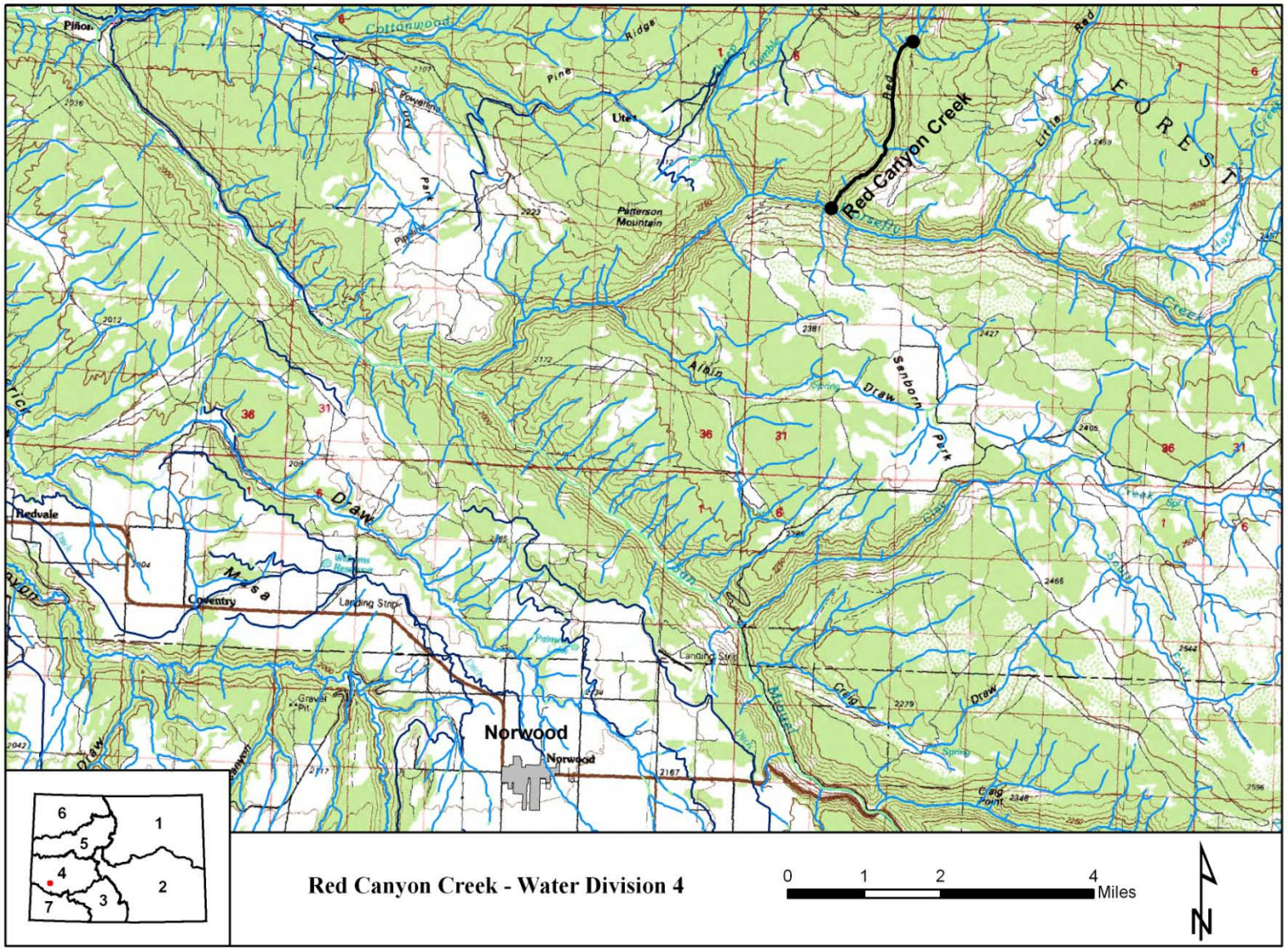
Staff recommends the Board form its intent to appropriate on the following stream reach:

**Segment:** CONFLUENCE WITH BIG A CREEK TO CONFLUENCE WITH HORSEFLY CREEK
**Upper Terminus**: CONFLUENCE WITH BIG A CREEK
(Latitude 38° 16' 18.13"N) (Longitude 108° 12' 18.56"W)
UTM North: 4240822.17 UTM East: 219603.08
SW NW S4 T46N R12W NMPM
159' East of the West Section Line; 1691' South of the North Section Line

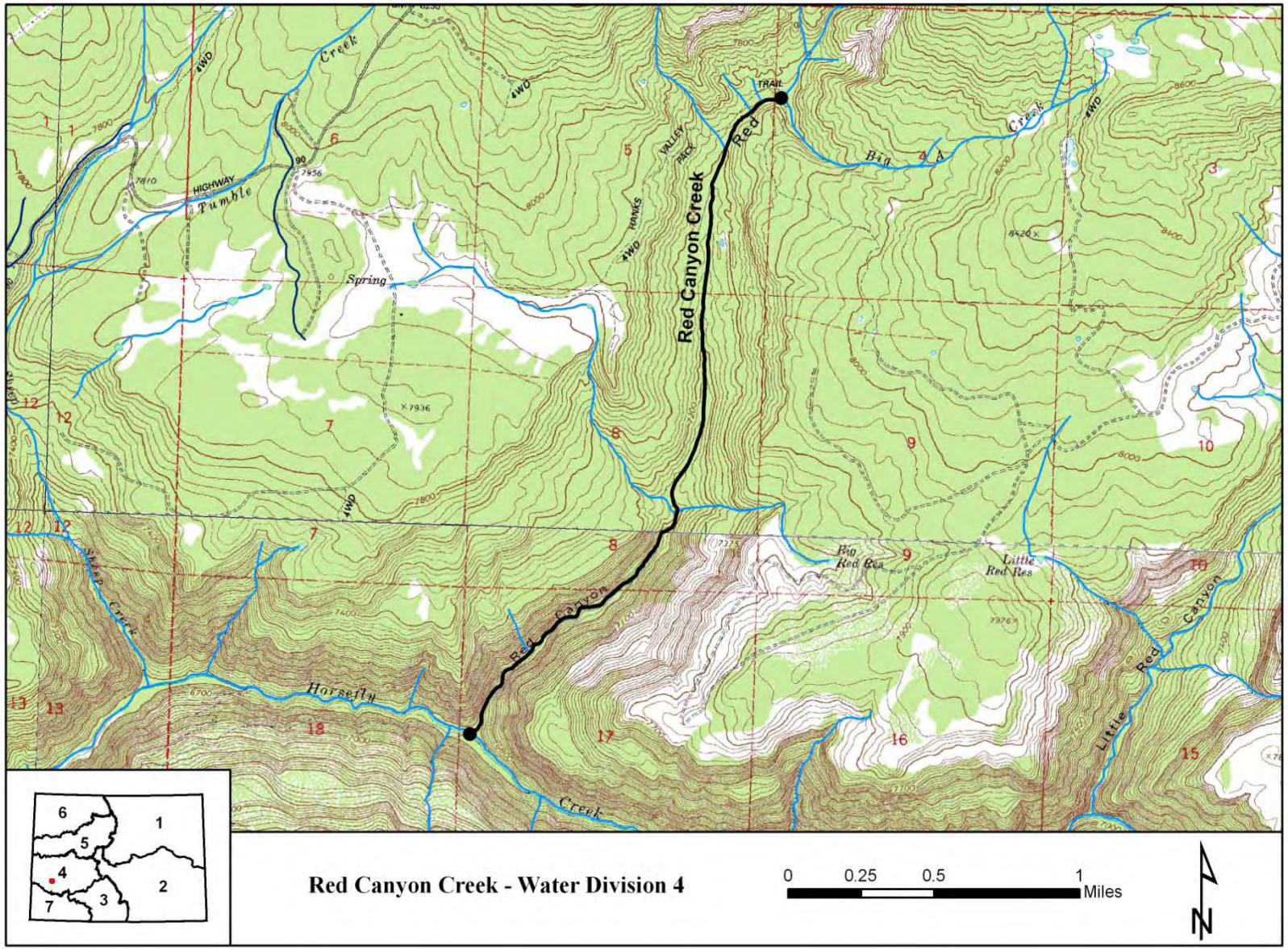
**Lower Terminus**: CONFLUENCE WITH HORSEFLY CREEK
(Latitude 38° 14' 22.51"N) (Longitude 108° 13' 24.10"W)
UTM North: 4237312.91 UTM East: 217885.59
NW SW S17 T46N R12W NMPM
177' East of the West Section Line; 2630' North of the South Section Line

**Watershed:** San Miguel (HUC#: 14030003)
**Counties**: Montrose
**Length**: 2.69 miles
**USGS Quad(s)**: Antone Spring, Sanborn Park
**Flow Recommendation:** 1.2 cfs (April 1 – June 30)
0.25 cfs (July 1 – October 31)

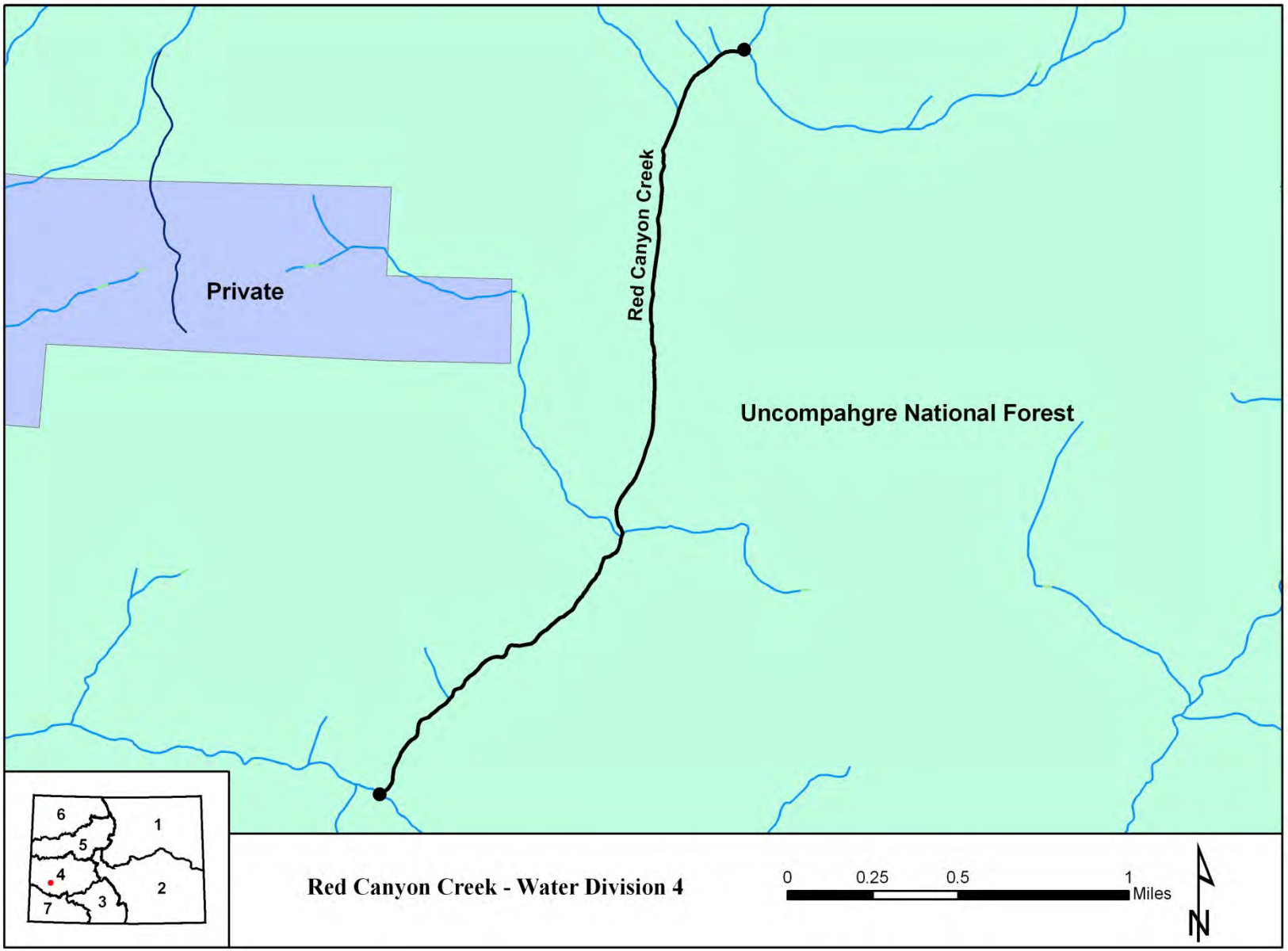
# Vicinity Map



# Water Rights Map



# Land Use Map


Private
Red Canyon Creek
Uncompahgre National Forest
6
1
5
4
2
3
7
Red Canyon Creek - Water Division 4
0
0.25
0.5
1
Miles
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