<u>Stream:</u> Unnamed Tributary to Muddy Creek

Executive Summary

Water Division: 5
Water District: 50
CWCB ID: 11/5/A-001

Segment: HEADWATERS TO THE CONFLUENCE WITH MUDDY CREEK
Upper Terminus: HEADWATERS IN THE VICINITY OF
(Latitude 40° 19’ 40.72”N) (Longitude 106° 38’ 52.14”W)

Lower Terminus: CONFLUENCE WITH MUDDY CREEK
(Latitude 40° 19’ 50.51”N) (Longitude 106° 37’ 0.37”W)

Watershed: Colorado Headwaters (HUC#: 14010001)
Counties: Grand, Routt
Length: 1.88 miles
USGS Quad(s): Lake Agnes, Walton Peak
Flow Recommendation: 1.25 cfs (April 15 – June 30)
0.4 cfs (July 1 – August 15)
0.2 cfs (August 16 – October 31)
0.1 cfs (November 1 – March 31)
0.4 cfs (April 1 – April 14)

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. Trout Unlimited (TU) recommended this segment of an unnamed tributary to Muddy Creek to the CWCB for inclusion into the Instream Flow Program. This unnamed tributary to Muddy 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.

This unnamed tributary to Muddy Creek originates in the headwaters of the Gore Range at an elevation of 9,800 feet and flows generally in an easterly direction through Arapaho National Forest for 1.88 miles as it drops to an elevation of 8,760 feet at its confluence with the Muddy Creek. One hundred percent of the land on the 1.88 mile segment addressed by this report is publicly owned. This unnamed tributary to Muddy Creek is located within Grand and Routt Counties and the total drainage area of the creek is approximately 1.75 square miles.

The subject of this report is a segment of an unnamed tributary to Muddy Creek beginning at the headwaters and extending downstream to confluence with Muddy Creek. The proposed segment is located approximately 21 miles northwest of Kremmling. Staff has received one recommendation for this segment from TU. The recommendation for this segment is discussed below.

Instream Flow Recommendation

TU recommended 1.25 cfs (April 15 – June 30), 0.4 cfs (July 1 – August 15), 0.2 cfs (August 16 – October 31), 0.1 cfs (November 1 – March 31) and 0.4 cfs (April 1 – April 14). These recommendations were based on their data collection efforts on September 15, 2009 and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Headwaters	Confluence with Muddy Creek	1.88	0%	100%

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

Biological Data

In September 2009, TU collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW and rod and reel sampling by TU staff indicates that the stream supports healthy populations of Colorado River cutthroat trout.

Field Survey Data

TU 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, one set of data was 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)
TU	9/15/2009	0.63	1.6 – 0.3	1.25	0.40

The summer flow recommendation, which meets 3 of 3 criteria and is within the accuracy range of the R2CROSS model, is 1.25 cfs. The winter flow recommendation, which meets 2 of 3 criteria and is within the accuracy range of the R2CROSS model is 0.40 cfs. Due to water availability constraints the winter recommendation was lowered to 0.10 cfs.

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 the Unnamed Tributary to Muddy Creek no such gage is available at the LT. In fact, there is no gage on the Unnamed Tributary to Muddy Creek. It is thus necessary to describe the normal flow regime at the Unnamed Tributary to Muddy Creek above the LT through a "representative" gage station. The gage station selected for this purpose was MUDDY CREEK NEAR KREMMLING, CO (USGS 09041000), a gage with a 28 year period of record (POR) collected between 1937 and 1999. The gage is at an elevation of 7,856 ft above mean sea level (amsl) and has a drainage area of 87.4 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes

the effects of twenty two upstream diversions, none of which appear to be transbasin diversions. These diversions were partially consumptive to the basin so, to make the measured data from Muddy Creek transferrable to the Unnamed Tributary to Muddy Creek above the LT, these diversions were added back to the measured Muddy Creek hydrograph. The resulting "adjusted" hydrograph could then be used on the Unnamed Tributary to Muddy Creek above the LT by multiplying the "adjusted" hydrograph by an area ratio; specifically, the area of the Unnamed Tributary to Muddy Creek above the LT (1.75 mi^2 above the LT) to Muddy Creek nr Kremmling, CO (87.4 mi^2 above the gage). Next, the resulting proportioned "adjusted" hydrograph would itself be "adjusted" (decreased) to reflect the existing depletions on the Unnamed Tributary to Muddy Creek above the LT resulting from upstream consumptive irrigation uses. 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 the Unnamed Tributary to Muddy Creek is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Muddy Creek nr Kremmling, CO hydrograph. This step is of value because of the inherent statistical limitations 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, even with the long period of record, there is still 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.

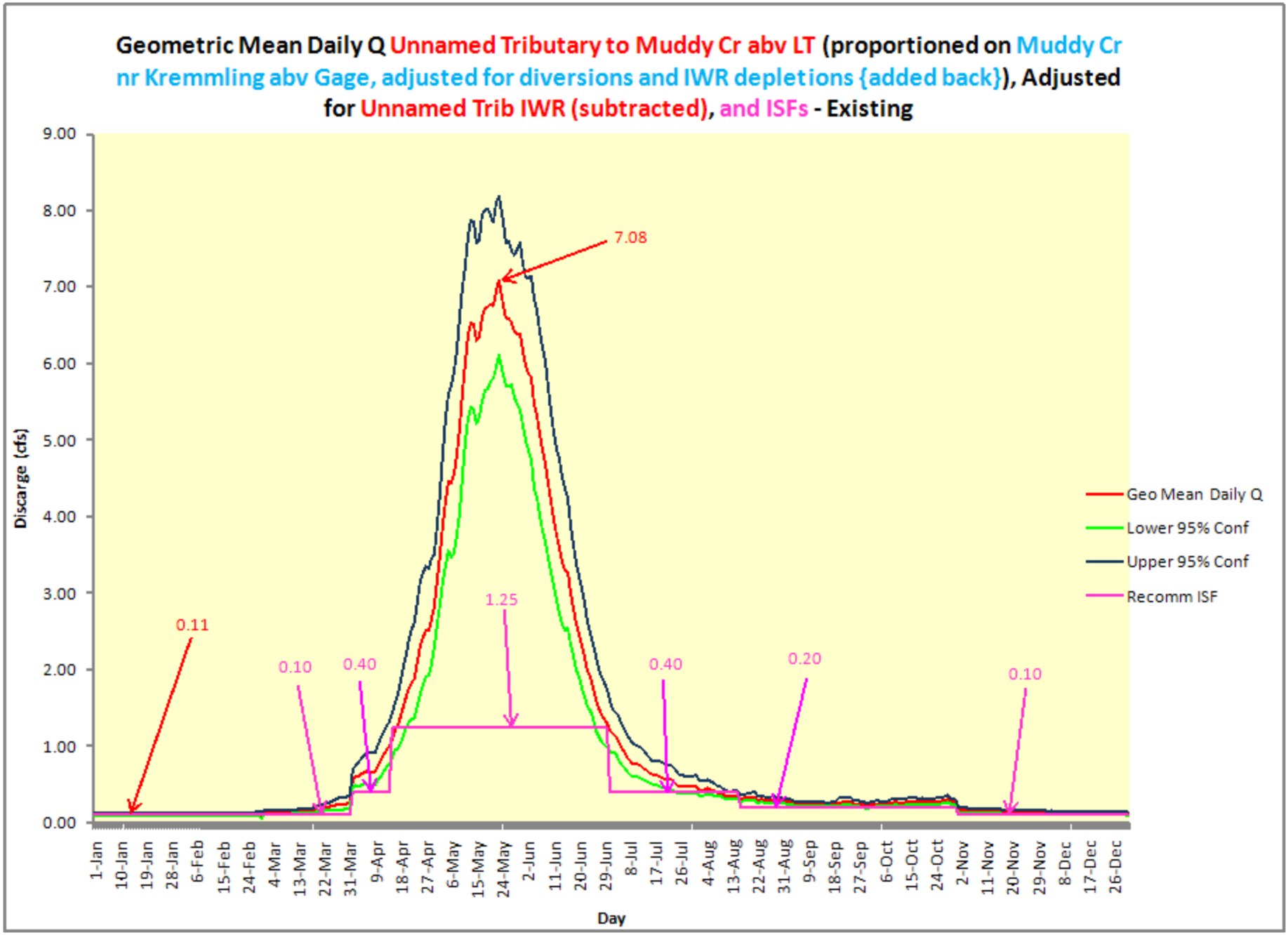

Geometric Mean Daily Q Unnamed Tributary to Muddy Cr abv LT (proportioned on Muddy Cr nr Kremmling abv Gage, adjusted for diversions and IWR depletions {added back}), Adjusted for Unnamed Trib IWR (subtracted), and ISFs - Existing
Discarge (cfs)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
7.08
1.25
0.11
0.10
0.40
0.40
0.20
0.10
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISF
1-Jan
10-Jan
19-Jan
28-Jan
6-Feb
15-Feb
24-Feb
4-Mar
13-Mar
22-Mar
31-Mar
9-Apr
18-Apr
27-Apr
6-May
15-May
24-May
2-Jun
11-Jun
20-Jun
29-Jun
8-Jul
17-Jul
26-Jul
4-Aug
13-Aug
22-Aug
31-Aug
9-Sep
18-Sep
27-Sep
6-Oct
15-Oct
24-Oct
2-Nov
11-Nov
20-Nov
29-Nov
8-Dec
17-Dec
26-Dec
Day

Table 2. Geometric Mean Existing Cond (with IWR subtracted) Unnamed CProp on Muddy nr Kremmling abv Gage Baseline Cond				
Date	**GM (abv LT) Prorated by 2.0%**	**Lower 95% Conf Prorated by 2.0%**	**Upper 95% Conf Prorated by 2.0%**	**Recommended ISF (cfs)**
1-Jan	0.109523	0.092937	0.129068	0.1
2-Jan	0.108816	0.092493	0.128021	0.1
3-Jan	0.108016	0.091988	0.126838	0.1
4-Jan	0.107952	0.091857	0.126867	0.1
5-Jan	0.108465	0.092419	0.127296	0.1
6-Jan	0.10852	0.092392	0.127463	0.1
7-Jan	0.108107	0.091883	0.127195	0.1
8-Jan	0.108246	0.091991	0.127373	0.1
9-Jan	0.108354	0.091932	0.12771	0.1
10-Jan	0.108405	0.09195	0.127804	0.1
11-Jan	0.108397	0.091697	0.128138	0.1
12-Jan	0.108648	0.09188	0.128476	0.1
13-Jan	0.108918	0.092158	0.128725	0.1
14-Jan	0.109136	0.092209	0.129171	0.1
15-Jan	0.108946	0.092023	0.128981	0.1
16-Jan	0.109049	0.092153	0.129041	0.1
17-Jan	0.10961	0.092773	0.129502	0.1
18-Jan	0.110198	0.093014	0.130557	0.1
19-Jan	0.110241	0.09294	0.130762	0.1
20-Jan	0.110599	0.092962	0.131582	0.1
21-Jan	0.110063	0.092414	0.131082	0.1
22-Jan	0.110469	0.092743	0.131583	0.1
23-Jan	0.109647	0.092067	0.130585	0.1
24-Jan	0.109548	0.091807	0.130718	0.1
25-Jan	0.109582	0.091494	0.131245	0.1
26-Jan	0.110062	0.092125	0.131491	0.1
27-Jan	0.111156	0.09328	0.132457	0.1
28-Jan	0.110839	0.093141	0.1319	0.1
29-Jan	0.110727	0.092841	0.132059	0.1
30-Jan	0.110388	0.092666	0.1315	0.1
31-Jan	0.109844	0.092408	0.130569	0.1
1-Feb	0.108041	0.091379	0.12774	0.1
2-Feb	0.10781	0.091086	0.127605	0.1
3-Feb	0.107691	0.0911	0.127304	0.1
4-Feb	0.107361	0.090975	0.126698	0.1
5-Feb	0.107802	0.091114	0.127547	0.1
6-Feb	0.108275	0.09137	0.128307	0.1
7-Feb	0.108734	0.091975	0.128548	0.1
8-Feb	0.108347	0.091951	0.127668	0.1

9-Feb	0.108994	0.093006	0.127731	0.1
10-Feb	0.109406	0.093753	0.127672	0.1
11-Feb	0.109819	0.094055	0.128225	0.1
12-Feb	0.109669	0.093796	0.128228	0.1
13-Feb	0.108838	0.092833	0.127604	0.1
14-Feb	0.108614	0.092498	0.127537	0.1
15-Feb	0.109274	0.093157	0.12818	0.1
16-Feb	0.109654	0.093448	0.128671	0.1
17-Feb	0.109367	0.093027	0.128576	0.1
18-Feb	0.110227	0.09343	0.130043	0.1
19-Feb	0.110278	0.093252	0.130412	0.1
20-Feb	0.109798	0.092599	0.130191	0.1
21-Feb	0.110435	0.093269	0.13076	0.1
22-Feb	0.111135	0.093715	0.131792	0.1
23-Feb	0.111432	0.093941	0.13218	0.1
24-Feb	0.111016	0.093507	0.131805	0.1
25-Feb	0.111096	0.093697	0.131727	0.1
26-Feb	0.11302	0.095053	0.134383	0.1
27-Feb	0.113392	0.095091	0.135215	0.1
28-Feb	0.112811	0.094123	0.135209	0.1
1-Mar	0.089822	0.058199	0.138628	0.1
2-Mar	0.128975	0.107848	0.15424	0.1
3-Mar	0.129873	0.108032	0.156131	0.1
4-Mar	0.130562	0.10853	0.157066	0.1
5-Mar	0.131306	0.108857	0.158383	0.1
6-Mar	0.13342	0.110547	0.161025	0.1
7-Mar	0.133013	0.110203	0.160544	0.1
8-Mar	0.132964	0.109509	0.161441	0.1
9-Mar	0.135925	0.112226	0.164629	0.1
10-Mar	0.13827	0.114412	0.167103	0.1
11-Mar	0.139439	0.115755	0.167969	0.1
12-Mar	0.139921	0.116286	0.16836	0.1
13-Mar	0.140631	0.116502	0.169756	0.1
14-Mar	0.14227	0.117755	0.17189	0.1
15-Mar	0.144873	0.120226	0.174572	0.1
16-Mar	0.145597	0.121072	0.175091	0.1
17-Mar	0.149181	0.124104	0.179324	0.1
18-Mar	0.156098	0.129478	0.188192	0.1
19-Mar	0.162474	0.133457	0.1978	0.1
20-Mar	0.168862	0.135447	0.21052	0.1
21-Mar	0.169065	0.135959	0.210234	0.1
22-Mar	0.188745	0.150336	0.236967	0.1
23-Mar	0.196427	0.155087	0.248786	0.1
24-Mar	0.201583	0.157005	0.258818	0.1
25-Mar	0.211586	0.159786	0.280177	0.1

26-Mar	0.220117	0.162131	0.298841	0.1
27-Mar	0.22678	0.163355	0.314832	0.1
28-Mar	0.233397	0.166086	0.327989	0.1
29-Mar	0.235743	0.169509	0.327858	0.1
30-Mar	0.241911	0.175411	0.333622	0.1
31-Mar	0.248034	0.181722	0.338545	0.1
1-Apr	0.261714	0.191645	0.357402	0.4
2-Apr	0.568631	0.46954	0.700542	0.4
3-Apr	0.606502	0.49656	0.754892	0.4
4-Apr	0.605878	0.477402	0.784744	0.4
5-Apr	0.636945	0.493034	0.841494	0.4
6-Apr	0.662096	0.50686	0.885465	0.4
7-Apr	0.671062	0.506699	0.908283	0.4
8-Apr	0.668138	0.50155	0.907922	0.4
9-Apr	0.666049	0.492731	0.916279	0.4
10-Apr	0.666935	0.4938	0.913272	0.4
11-Apr	0.757918	0.572666	1.019325	0.4
12-Apr	0.822131	0.611399	1.121928	0.4
13-Apr	0.887644	0.670256	1.194215	0.4
14-Apr	0.95694	0.737143	1.259809	0.4
15-Apr	1.000391	0.767494	1.321439	1.25
16-Apr	1.084809	0.836437	1.422914	1.25
17-Apr	1.208885	0.942244	1.566722	1.25
18-Apr	1.262602	0.969698	1.660395	1.25
19-Apr	1.391901	1.05117	1.859588	1.25
20-Apr	1.517521	1.139683	2.035996	1.25
21-Apr	1.646009	1.242127	2.198646	1.25
22-Apr	1.766087	1.309955	2.402704	1.25
23-Apr	1.836676	1.348634	2.526975	1.25
24-Apr	1.882838	1.367216	2.614988	1.25
25-Apr	2.111984	1.544494	2.905223	1.25
26-Apr	2.307259	1.692917	3.158902	1.25
27-Apr	2.41545	1.797774	3.260301	1.25
28-Apr	2.517427	1.897768	3.360049	1.25
29-Apr	2.518768	1.916891	3.326169	1.25
30-Apr	2.663234	2.06504	3.446175	1.25
1-May	2.832563	2.29263	3.505915	1.25
2-May	3.156491	2.581783	3.865979	1.25
3-May	3.4927	2.845679	4.294806	1.25
4-May	3.881899	3.146763	4.798596	1.25
5-May	4.19699	3.34694	5.274725	1.25
6-May	4.455945	3.552582	5.599626	1.25
7-May	4.448151	3.474846	5.708688	1.25
8-May	4.541079	3.51607	5.880074	1.25
9-May	4.812364	3.760174	6.171299	1.25

10-May	5.149788	4.030464	6.591852	1.25
11-May	5.60842	4.508336	6.987163	1.25
12-May	6.007243	4.976007	7.259139	1.25
13-May	6.358824	5.291765	7.647634	1.25
14-May	6.538329	5.432551	7.875629	1.25
15-May	6.513567	5.401735	7.860669	1.25
16-May	6.285464	5.218484	7.577863	1.25
17-May	6.339649	5.300714	7.589481	1.25
18-May	6.605283	5.500862	7.939466	1.25
19-May	6.723198	5.652494	8.00333	1.25
20-May	6.734372	5.660883	8.017616	1.25
21-May	6.763906	5.761542	7.946148	1.25
22-May	6.745028	5.803983	7.843714	1.25
23-May	6.935727	5.950511	8.089392	1.25
24-May	7.077419	6.118396	8.191679	1.25
25-May	6.777708	5.851931	7.855104	1.25
26-May	6.58071	5.713804	7.58404	1.25
27-May	6.583268	5.705647	7.601052	1.25
28-May	6.529678	5.71565	7.464056	1.25
29-May	6.421923	5.565884	7.414969	1.25
30-May	6.389032	5.463692	7.477831	1.25
31-May	6.390684	5.394774	7.578367	1.25
1-Jun	6.156501	5.196404	7.301434	1.25
2-Jun	5.954134	4.986177	7.118365	1.25
3-Jun	5.874597	4.859087	7.112051	1.25
4-Jun	5.820415	4.753771	7.138227	1.25
5-Jun	5.46558	4.37251	6.847171	1.25
6-Jun	5.325216	4.250104	6.688093	1.25
7-Jun	5.078443	4.024188	6.426016	1.25
8-Jun	4.857003	3.816891	6.199169	1.25
9-Jun	4.692944	3.66097	6.035731	1.25
10-Jun	4.433305	3.464054	5.694128	1.25
11-Jun	4.193243	3.287879	5.368224	1.25
12-Jun	3.969895	3.102429	5.101408	1.25
13-Jun	3.759034	2.912627	4.874581	1.25
14-Jun	3.595166	2.732643	4.757521	1.25
15-Jun	3.407101	2.587706	4.514003	1.25
16-Jun	3.301853	2.510974	4.369794	1.25
17-Jun	3.274146	2.54811	4.229956	1.25
18-Jun	3.001628	2.331507	3.888162	1.25
19-Jun	2.803318	2.181705	3.625428	1.25
20-Jun	2.594975	2.002653	3.387987	1.25
21-Jun	2.471131	1.904456	3.232549	1.25
22-Jun	2.311525	1.758333	3.067961	1.25
23-Jun	2.170107	1.656258	2.871855	1.25

24-Jun	1.981401	1.513361	2.623328	1.25
25-Jun	1.902407	1.469707	2.489055	1.25
26-Jun	1.784122	1.378694	2.335585	1.25
27-Jun	1.612626	1.21224	2.180104	1.25
28-Jun	1.504124	1.13676	2.024041	1.25
29-Jun	1.408129	1.057526	1.912311	1.25
30-Jun	1.356748	1.028615	1.825293	1.25
1-Jul	1.299695	0.987661	1.745861	0.4
2-Jul	1.208434	0.931645	1.599021	0.4
3-Jul	1.16328	0.921495	1.492769	0.4
4-Jul	1.14	0.909335	1.452005	0.4
5-Jul	1.068727	0.829466	1.408034	0.4
6-Jul	0.993448	0.776889	1.300832	0.4
7-Jul	0.937938	0.733107	1.2318	0.4
8-Jul	0.866222	0.671055	1.153703	0.4
9-Jul	0.823713	0.635357	1.105297	0.4
10-Jul	0.773704	0.594752	1.044694	0.4
11-Jul	0.771197	0.59858	1.02852	0.4
12-Jul	0.761359	0.593732	1.010245	0.4
13-Jul	0.748591	0.586619	0.989101	0.4
14-Jul	0.720848	0.567951	0.947386	0.4
15-Jul	0.691628	0.548913	0.902408	0.4
16-Jul	0.665063	0.533311	0.855938	0.4
17-Jul	0.630806	0.505711	0.813283	0.4
18-Jul	0.621948	0.501166	0.796891	0.4
19-Jul	0.626798	0.494073	0.827275	0.4
20-Jul	0.606857	0.47679	0.807652	0.4
21-Jul	0.582664	0.457148	0.779833	0.4
22-Jul	0.572027	0.451077	0.762659	0.4
23-Jul	0.558744	0.440644	0.74931	0.4
24-Jul	0.557094	0.440732	0.740462	0.4
25-Jul	0.533525	0.423654	0.70718	0.4
26-Jul	0.489353	0.389441	0.652494	0.4
27-Jul	0.468872	0.374067	0.623688	0.4
28-Jul	0.470564	0.379312	0.616271	0.4
29-Jul	0.466754	0.379626	0.603938	0.4
30-Jul	0.465629	0.382096	0.596321	0.4
31-Jul	0.473043	0.386838	0.609873	0.4
1-Aug	0.486228	0.395624	0.630971	0.4
2-Aug	0.442592	0.360295	0.57359	0.4
3-Aug	0.426284	0.349482	0.548928	0.4
4-Aug	0.431728	0.360755	0.539952	0.4
5-Aug	0.455195	0.382795	0.563825	0.4
6-Aug	0.439325	0.369149	0.547221	0.4
7-Aug	0.427273	0.359112	0.535206	0.4

8-Aug	0.413516	0.350318	0.514046	0.4
9-Aug	0.39133	0.337832	0.473497	0.4
10-Aug	0.394614	0.345597	0.468003	0.4
11-Aug	0.366113	0.318339	0.438172	0.4
12-Aug	0.353015	0.307417	0.422217	0.4
13-Aug	0.344434	0.302844	0.406806	0.4
14-Aug	0.35012	0.309384	0.410504	0.4
15-Aug	0.354331	0.315223	0.411798	0.4
16-Aug	0.359866	0.323037	0.414172	0.4
17-Aug	0.31076	0.277777	0.359409	0.2
18-Aug	0.319264	0.285085	0.370156	0.2
19-Aug	0.323671	0.288981	0.375958	0.2
20-Aug	0.326631	0.289092	0.386261	0.2
21-Aug	0.335176	0.296756	0.394515	0.2
22-Aug	0.354407	0.316215	0.413516	0.2
23-Aug	0.297349	0.262893	0.349188	0.2
24-Aug	0.300188	0.26625	0.351454	0.2
25-Aug	0.306398	0.272075	0.359211	0.2
26-Aug	0.287592	0.258317	0.329707	0.2
27-Aug	0.288993	0.260512	0.329433	0.2
28-Aug	0.299311	0.269657	0.34096	0.2
29-Aug	0.297536	0.261975	0.349393	0.2
30-Aug	0.288047	0.257907	0.331225	0.2
31-Aug	0.287881	0.257362	0.332444	0.2
1-Sep	0.291949	0.262659	0.334425	0.2
2-Sep	0.274336	0.248982	0.309823	0.2
3-Sep	0.268835	0.244134	0.303659	0.2
4-Sep	0.263259	0.237218	0.300695	0.2
5-Sep	0.252147	0.227195	0.288122	0.2
6-Sep	0.243103	0.219044	0.277806	0.2
7-Sep	0.243374	0.218605	0.27954	0.2
8-Sep	0.240766	0.216165	0.276762	0.2
9-Sep	0.244061	0.218815	0.280676	0.2
10-Sep	0.244942	0.221101	0.278569	0.2
11-Sep	0.2373	0.214868	0.268677	0.2
12-Sep	0.241429	0.219757	0.271577	0.2
13-Sep	0.2466	0.225082	0.276562	0.2
14-Sep	0.256899	0.236393	0.284307	0.2
15-Sep	0.236097	0.215087	0.264002	0.2
16-Sep	0.234213	0.212695	0.263256	0.2
17-Sep	0.230539	0.210095	0.257889	0.2
18-Sep	0.238811	0.216888	0.267971	0.2
19-Sep	0.245435	0.222603	0.275742	0.2
20-Sep	0.251152	0.221265	0.293569	0.2
21-Sep	0.260221	0.22166	0.318216	0.2

22-Sep	0.273513	0.233574	0.333538	0.2
23-Sep	0.26743	0.231833	0.318757	0.2
24-Sep	0.278088	0.243387	0.327071	0.2
25-Sep	0.289733	0.254772	0.33893	0.2
26-Sep	0.24877	0.215261	0.295738	0.2
27-Sep	0.242364	0.208924	0.289414	0.2
28-Sep	0.24674	0.210809	0.297175	0.2
29-Sep	0.233796	0.202157	0.277693	0.2
30-Sep	0.227413	0.195731	0.271908	0.2
1-Oct	0.219479	0.18801	0.262684	0.2
2-Oct	0.230111	0.201735	0.268363	0.2
3-Oct	0.231891	0.203866	0.269437	0.2
4-Oct	0.243824	0.211491	0.288127	0.2
5-Oct	0.247238	0.217177	0.287325	0.2
6-Oct	0.236554	0.208035	0.274151	0.2
7-Oct	0.240382	0.211583	0.278077	0.2
8-Oct	0.251481	0.218748	0.294977	0.2
9-Oct	0.257669	0.223425	0.303439	0.2
10-Oct	0.264517	0.22941	0.311349	0.2
11-Oct	0.26726	0.230876	0.316009	0.2
12-Oct	0.256003	0.222611	0.300227	0.2
13-Oct	0.258683	0.223542	0.3056	0.2
14-Oct	0.265218	0.229665	0.312328	0.2
15-Oct	0.27602	0.239248	0.324495	0.2
16-Oct	0.279842	0.242657	0.32887	0.2
17-Oct	0.27281	0.236527	0.320594	0.2
18-Oct	0.27483	0.238344	0.322949	0.2
19-Oct	0.265174	0.229168	0.312718	0.2
20-Oct	0.268865	0.231601	0.318306	0.2
21-Oct	0.268076	0.232568	0.314621	0.2
22-Oct	0.268343	0.23398	0.312987	0.2
23-Oct	0.271382	0.237369	0.315244	0.2
24-Oct	0.272617	0.237698	0.317622	0.2
25-Oct	0.275205	0.23698	0.32559	0.2
26-Oct	0.280465	0.242316	0.330676	0.2
27-Oct	0.285822	0.249499	0.333252	0.2
28-Oct	0.295989	0.261338	0.340732	0.2
29-Oct	0.308849	0.272999	0.355198	0.2
30-Oct	0.292097	0.25746	0.336406	0.2
31-Oct	0.273973	0.24034	0.316991	0.2
1-Nov	0.26986	0.236327	0.312802	0.1
2-Nov	0.15929	0.125877	0.201572	0.1
3-Nov	0.158592	0.124847	0.201458	0.1
4-Nov	0.154433	0.121851	0.195727	0.1
5-Nov	0.154629	0.123732	0.193241	0.1

6-Nov	0.149318	0.12239	0.182172	0.1
7-Nov	0.148169	0.120821	0.181708	0.1
8-Nov	0.149558	0.121276	0.184436	0.1
9-Nov	0.146418	0.117637	0.182241	0.1
10-Nov	0.152837	0.1247	0.187323	0.1
11-Nov	0.152385	0.124308	0.186802	0.1
12-Nov	0.152519	0.124926	0.186207	0.1
13-Nov	0.150598	0.12329	0.183954	0.1
14-Nov	0.147305	0.120644	0.179859	0.1
15-Nov	0.146237	0.121105	0.176585	0.1
16-Nov	0.143616	0.118393	0.174213	0.1
17-Nov	0.144268	0.11881	0.175181	0.1
18-Nov	0.138338	0.112617	0.169935	0.1
19-Nov	0.140408	0.114456	0.172245	0.1
20-Nov	0.140329	0.114421	0.172103	0.1
21-Nov	0.14087	0.115463	0.171868	0.1
22-Nov	0.135966	0.11224	0.164707	0.1
23-Nov	0.135789	0.112127	0.164444	0.1
24-Nov	0.136358	0.111699	0.166461	0.1
25-Nov	0.138219	0.114111	0.167421	0.1
26-Nov	0.139135	0.114721	0.168745	0.1
27-Nov	0.136146	0.11207	0.165396	0.1
28-Nov	0.137146	0.113312	0.165994	0.1
29-Nov	0.133391	0.110579	0.16091	0.1
30-Nov	0.130538	0.108287	0.157361	0.1
1-Dec	0.129857	0.10813	0.155949	0.1
2-Dec	0.127281	0.105363	0.153758	0.1
3-Dec	0.128288	0.106307	0.154814	0.1
4-Dec	0.124886	0.102733	0.151815	0.1
5-Dec	0.126028	0.103277	0.153789	0.1
6-Dec	0.125332	0.103141	0.152297	0.1
7-Dec	0.12434	0.102563	0.15074	0.1
8-Dec	0.123444	0.102146	0.149182	0.1
9-Dec	0.122274	0.101447	0.147376	0.1
10-Dec	0.121677	0.101497	0.145869	0.1
11-Dec	0.122217	0.102258	0.146071	0.1
12-Dec	0.121898	0.101847	0.145896	0.1
13-Dec	0.120999	0.101066	0.144862	0.1
14-Dec	0.121458	0.101533	0.145293	0.1
15-Dec	0.121196	0.101415	0.144834	0.1
16-Dec	0.120811	0.101361	0.143991	0.1
17-Dec	0.121305	0.10205	0.144194	0.1
18-Dec	0.121426	0.102177	0.1443	0.1
19-Dec	0.121601	0.102448	0.144336	0.1
20-Dec	0.120782	0.101499	0.143729	0.1

21-Dec	0.12082	0.101782	0.143419	0.1
22-Dec	0.120451	0.101542	0.142882	0.1
23-Dec	0.120957	0.102095	0.143304	0.1
24-Dec	0.121245	0.102559	0.143336	0.1
25-Dec	0.120908	0.102216	0.143019	0.1
26-Dec	0.12002	0.101223	0.142307	0.1
27-Dec	0.118788	0.099786	0.141408	0.1
28-Dec	0.118722	0.100307	0.140517	0.1
29-Dec	0.119074	0.100611	0.140925	0.1
30-Dec	0.118795	0.100399	0.140561	0.1
31-Dec	0.116956	0.098565	0.138779	0.1

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 this unnamed tributary to Muddy Creek, between the headwaters and the confluence with Muddy 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

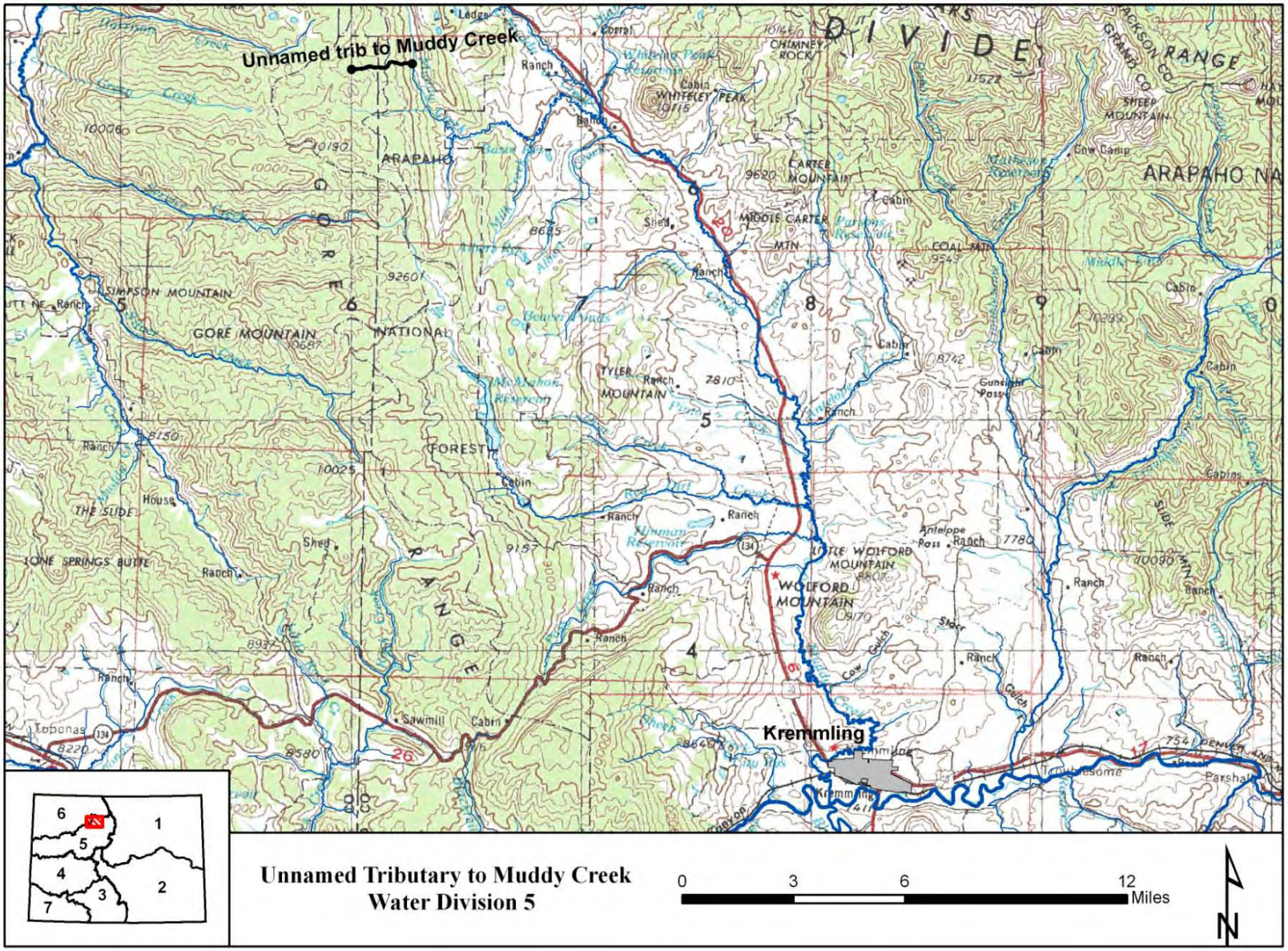
Staff recommends the Board form its intent to appropriate on the following stream reach:

Segment: HEADWATERS TO THE CONFLUENCE WITH MUDDY CREEK
Upper Terminus: HEADWATERS IN THE VICINITY OF
(Latitude 40° 19' 40.72"N) (Longitude 106° 38' 52.14"W)
UTM North: 4465463.59 UTM East: 360014.95
SW SW S12 T4N R83W 6th PM
924' East of the West Section Line; 488' North of the South Section Line

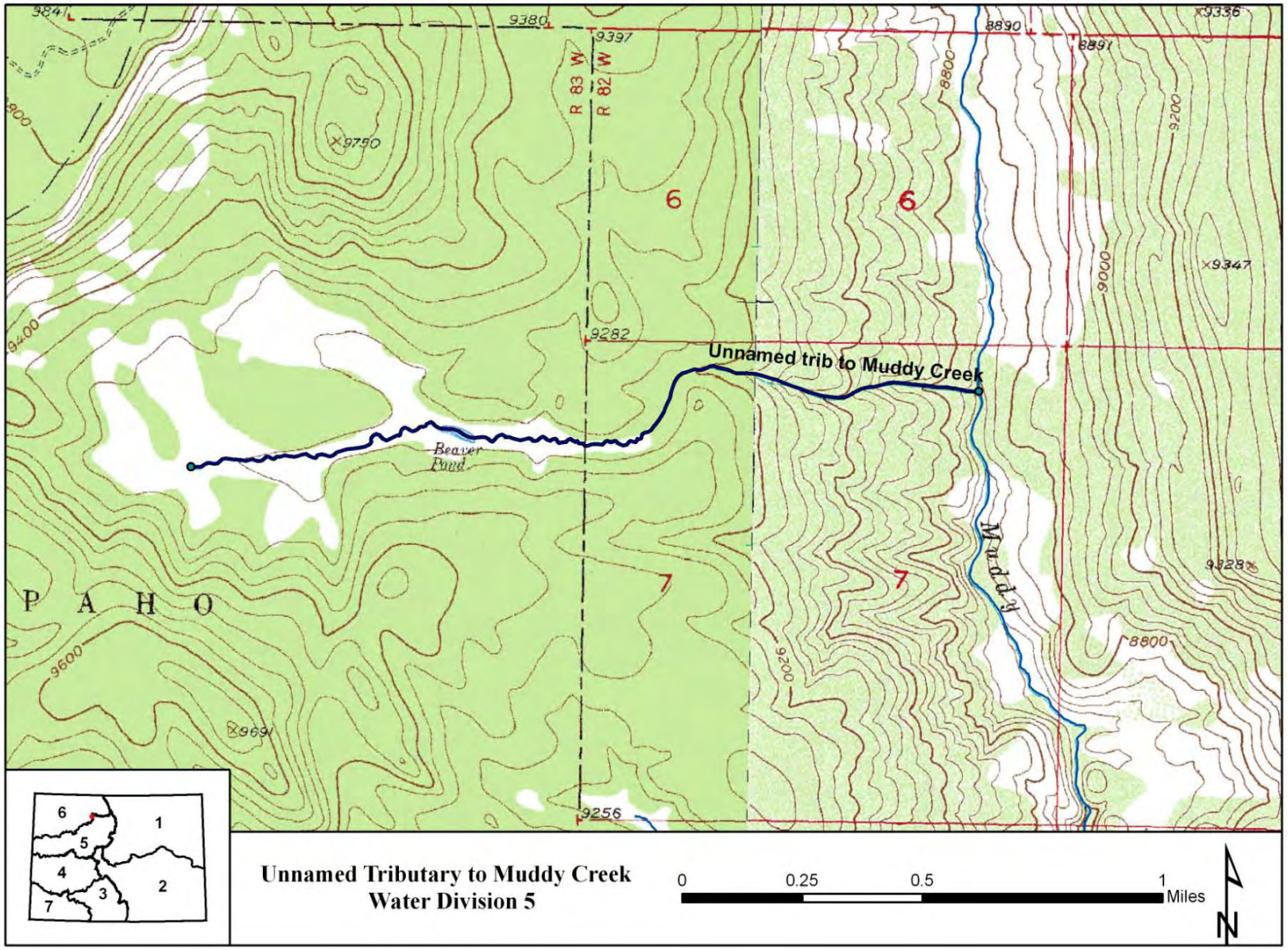
Lower Terminus: CONFLUENCE WITH MUDDY CREEK
(Latitude 40° 19' 50.51"N) (Longitude 106° 37' 0.37"W)
UTM North: 4465716.61 UTM East: 362657.98
NE NE S7 T4N R82W 6th PM
948' East of the West Section Line; 511' South of the North Section Line

Watershed: Colorado Headwaters (HUC#: 14010001)
Counties: Grand, Routt
Length: 1.88 miles
USGS Quad(s): Lake Agnes, Walton Peak
Flow Recommendation: 1.25 cfs (April 15 – June 30)
0.4 cfs (July 1 – August 15)
0.2 cfs (August 16 – October 31)
0.1 cfs (November 1 – March 31)
0.4 cfs (April 1 – April 14)

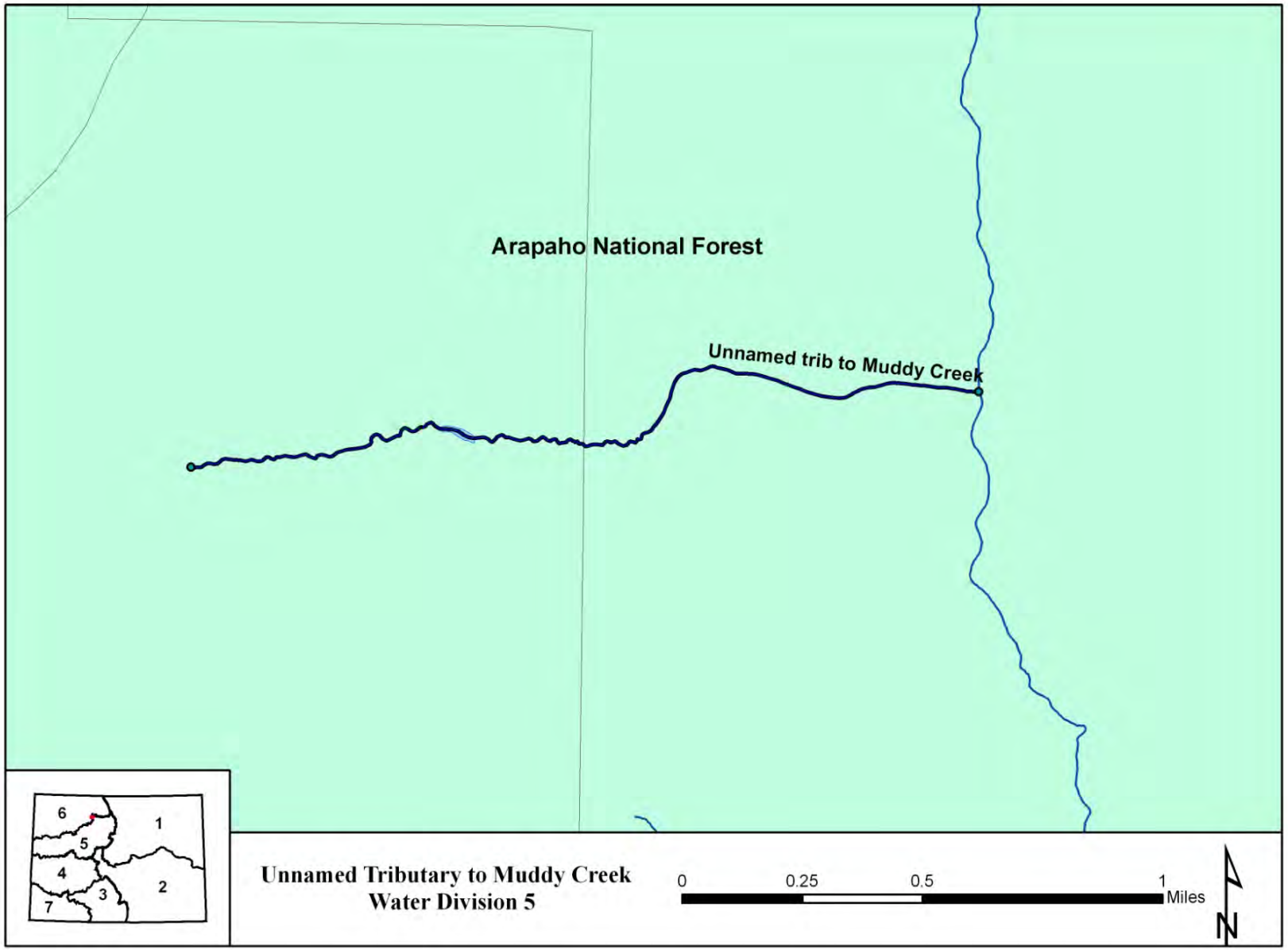
Vicinity Map



Water Rights Map



Land Use Map


Arapaho National Forest
Unnamed trib to Muddy Creek
6
1
5
4
3
2
7
Unnamed Tributary to Muddy Creek
Water Division 5
0
0.25
0.5
1
Miles
N