Upper Uncompahgre Basin Water Supply Protection and Enhancement Project

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Table of Acronyms Used in This Report

Acronym	Term
AF	Acre-Feet
CDPHE	Colorado Department of Public Health and Environment
CDSS	Colorado Decision Support Systems
CDWR	Colorado Division of Water Resources
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
DCWC	Dallas Creek Water Company
DPR	Definite Plan Report
EQR	Equivalent Residential Users
HOA	Home Owners Association
GBIP	Gunnison Basin Implementation Plan
IPPs	Identified Projects and Processes
ISF	Instream Flow
IWR	Irrigation Water Requirement
M&I	Municipal and Industrial
M&D	Montrose and Delta Canal
NRCS	Natural Resources Conservation Service
PUC	Public Utilities Commission
SFE	Single Family Equivalent
SSI	Self-Supplied Industrial
SWSI	Statewide Water Supply Initiative
TCW	Tri-County Water Conservancy District
TNC	The Nature Conservancy
USBR	United States Bureau of Reclamation
USFS	United States Forest Service
USGS	United States Geological Survey
UUB	Upper Uncompahgre Basin
UVWUA	Uncompahgre Valley Water Users Association
WD	Water District
WWE	Wright Water Engineers, Inc.

1.0 PROJECT DESCRIPTION

This engineering study assesses the existing and future water needs of agricultural, domestic, municipal, industrial, recreational and environmental water uses, as well as options for stabilizing and augmenting existing and future water uses within the Upper Uncompahgre River Basin, located in Ouray County, Colorado.

This study was developed in collaboration with local stakeholders including Ouray County, Ouray County Water Users Association, City of Ouray, Town of Ridgway, Dallas Creek Water Company (DCWC), Log Hill Homeowners, Colorado Water Conservation Board (CWCB), Uncompahgre Valley Water Users Association (UVWVA), Tri-County Water Conservancy District (TCW), The Nature Conservancy (TNC) and Trout Unlimited. The Colorado River Water Conservation District has also provided financial and technical support for this study. WWE thanks these participants as well as any other participants that are not listed above for their input in the development of estimated current and future water use information in this analysis.

2.0 UPPER UNCOMPAHGRE BASIN DESCRIPTION

2.1 Location

For purposes of this report, The Upper Uncompahgre Basin (UUB), designated by the Colorado Division of Water Resources (CDWR) as Water District 68, and has the same boundary as Ouray County. The Uncompahgre River is a tributary of the Gunnison River and is part of the Gunnison River Basin. Map 1 shows the project vicinity and location.

2.2 Human Geography

The UUB is a small, rural community with a current population of approximately 4,500 residents, with many of the residents living in unincorporated parts of the county. Municipalities within the UUB include the Town of Ridgway and the City of Ouray.

2.3 Physical Description

The UUB watershed contains a variety of topography ranging from rugged mountain peaks exceeding 14,000 feet in the headwaters to productive agricultural lands in the valleys. The Uncompahgre River's headwaters are located in the San Juan Mountains near Lake Como. From Lake Como the Uncompahgre River flows generally northwest until it is impounded in Ridgway

Reservoir, located less than ten miles north of Ridgway, CO, and then resumes its flow below Ridgway Reservoir Dam for approximately seven more miles before reaching the UUB northern boundary line near Colona. The Uncompahgre River joins the Gunnison River in the City of Delta, approximately 75 miles from its source.

2.4 Watershed Basins for this Study

To better understand the water supply and demand in the UUB this report has divided the UUB into four subbasins or regions based roughly on watershed boundaries. Region 1-Uncompahgre River downstream of Ridgway Reservoir, Region 2-Dallas Creek, Region 3-Uncompahgre River upstream of Ridgway Reservoir, Region 4- Cow Creek. For the purposes of this report many of the analyses for water supply and demand are evaluated on a subbasin- regional level.

2.5 Hydrology

The UUB consists of the main stem Uncompahgre River, and several major tributaries which include Dallas Creek and Cow Creek (see Map 1). The UUB drainage basin is 550 square miles in area and has an average elevation of approximately 9,500 feet. The average annual temperature is 44 degrees Fahrenheit and the annual precipitation is 17.1 inches per year for the Ridgway Climate Station (USC00057020) (see Table 1 and 2). August typically has the highest monthly precipitation averaging 2.9 inches, and January has the lowest precipitation averaging 0.8 inches.

There are several active United States Geological Survey (USGS) and CDWR stream gage stations within the UUB (see Map 2). The main stem of the Uncompahgre River has two active USGS gage stations above Ridgway Reservoir and two active gage stations below. Table 3 summarizes the average annual discharge for gage stations of interest. USGS gage station 9146200 on the Uncompahgre River near Ridgway for the period of record from 2002-2012 had an average discharge of 116,248 acre-feet (AF). In the dry year of 2002, the discharge was only 54,429 AF.

USGS gage station 9147000 located on Dallas Creek near Ridgway for the period of record from 2002-2012 had an average annual discharge of 22,556 AF. This average annual discharge approximately captures the amount of water that is contributed from the Dallas Creek drainage to the Uncompahgre River in an average year. In the dry year of 2002, the discharge was only 10,640 AF. The furthest downstream gage station in the UUB is USGS gage station 9147500 on the

Uncompahgre River at Colona; it has an average annual discharge of 170,756 AF for the period of record 2002-2012.

The Uncompahgre River and its major tributaries streamflow during a dry year are less that 50 percent of the average annual flow (see Table 3). For example, the CDWR gage station on Cow Creek (COWCRKCO) has an average annual discharge of 47,612 AF. In the dry year of 2012 the Cow Creek gage station discharge was 16,777 AF, only 35 percent of average year flow.

For purposes of this report a period of record of 2002 through 2012 is analyzed. This eleven-year period is chosen because the data is likely more accurate during these more recent years and the average discharge is slightly drier than the average discharge during the full 56 years of record. The average discharge for USGS gage station 09146200 Uncompahgre River near Ridgway for the 56 years of record is 119,000 AF per year and the average discharge for the 2002 through 2012 period of record is 116,000 AF per year (see Table 4).

2.6 Literature Review

WWE conducted a literature review of available water supply and demand information with the goal of taking a closer look at water supply and demand issues specifically within the UUB and to build upon past analysis efforts. The reports forming the basis of this analysis include the United States Bureau of Reclamation’s (USBR) Dallas Creek Project Definite Plan Report (DPR), Water Supply and Needs Report for the Gunnison Basin, Statewide Water Supply Initiative 2010, Gunnison Basin Consumptive Needs Assessment and the Colorado River Water Availability Study Gunnison Basin Implementation Plan. Major takeaways from these studies include:

<u>Dallas Creek Project: Definite Plan Report, 1976</u>

- Presents a scaled down version of the original Dallas Creek Project.
- Identifies the water use allocated for irrigation, municipal, industrial and recreational uses within Ridgway Reservoir.
- Identifies acres of irrigated area for supplemental supply and canals administered by the UVWUA.

- Identifies 2,850 acres of supplemental irrigation service area near Colona and in the Dallas Creek basin. Average annual supplemental irrigation supply needed for these areas is estimated at 1,820 AF. Since the Dallas Creek and the Colona Area supplemental service are upstream of the UVWUA canals, an additional irrigation supply of 900 AF is proposed in the report.
- Identifies the water rights owned by TCW associated with the Dallas Creek Project including Ridgway Reservoir, Ram's Horn Reservoir, Dallas Divide Reservoir and others.

Water Supply and Needs Report for the Gunnison Basin, 2006

The Water Supply and Needs Report for the Gunnison Basin (CDM, 2006) presents information developed by State Wide Supply Initiative that is specific to the Gunnison Basin. The estimates in this report included reconnaissance level existing water supply and demand estimates and projected water demands to the year 2030. Findings of this study include:

- Rapid population growth in Ouray County is a concern that will require additional water management strategies.
- Addressing agricultural irrigation water shortages is important to the community.
- The area between Ouray and Montrose is growing rapidly in population. Tourism is important in the headwater, but agriculture is also dominant in the UUB. Agricultural uses in the area are changing due to development and changing population demographics.
- Federal issues such as threatened and endangered species are an ongoing concern.
- There are concerns over possible future transbasin diversions and the effect these might have on the future of the Gunnison Basin.

Statewide Water Supply Initiative 2010 (SWSI)

The SWSI is a compilation of information for use in development of a common understanding of existing and future water supplies and demands throughout Colorado, and is overseen by the CWCB. Roundtables for individual basins within Colorado work to supplement the overall SWSI efforts. SWSI provides analysis of existing and future water demands, and investigates possible means of meeting both consumptive and nonconsumptive water needs. Water and supply projections extended to 2050. Findings of this study include:

- Water demands were estimated based on population growth scenarios on a basin-level.
- Low, medium, and high population scenarios were considered for water demand forecasting using information provided by the State Demographer. The projected percent population change for the Gunnison Basin from 2008 to 2050 listed in the report is 96 to 129 percent.
- Municipal, industrial, and agricultural water demand gaps were quantified through modeling efforts.
- Identified Projects and Processes (IPPs) were developed to address water demand gaps.
- The increase for Municipal and Industrial (M&I) and self-supplied industrial (SSI) demands for Ouray County in 2050 are estimated at; Low 300 AF/year, Medium 500 AF/year and High 800 AF/ year.

<u>Gunnison Basin Consumptive Needs Assessment (Gunnison Basin Report), 2011</u>

The Gunnison Basin Consumptive Needs Assessment provides a perspective on the SWSI 2010 report specific to the Gunnison Basin. The report was prepared in consultation with the Gunnison Basin Roundtable. Findings of this study include:

- Discusses IPPs for the Gunnison Basin such as agricultural water transfers, reuse of existing fully consumable supplies, growth into existing supplies, regional in-basin projects, new transbasin projects, firming in-basin water rights, and firming transbasin water rights.
- Municipal and domestic water demands are estimated at 840 AF for Ouray County in 2008, and between 1,300 AF and 1,800 AF in 2050.
- M&I water demands for Ouray County make up approximately four percent of Gunnison Basin M&I water demands across all the projections.

<u>Colorado River Water Availability Study, 2012</u>

- Combines consumptive use models developed for previous analysis efforts in the Gunnison Basin and integrates possible future changes in climatic conditions to forecast future water availability in the Colorado Basin.
- Analysis of Ridgway Reservoir in the 2040 and 2070 climate projection scenarios shows the reservoir is able to fill to the same maximum storage in most modeled years.
- On a monthly time step, the modeled storage content of Ridgway Reservoir is approximately 10,000 AF to 30,000 AF less than the historical average during the months of June through November.

Gunnison Basin Implementation Plan, 2015

The 2015 Gunnison Basin Implementation Plan (GBIP) defines basin goals, summarizes water supply needs, and identifies strategies and projects to address water supply needs. This report draws upon information from the SWSI 2010 and is the product of the Gunnison Basin Roundtable's efforts to address water needs in the Gunnison Basin. Findings of this study include:

- Identifies recreational and environmental water needs in the Gunnison Basin. Identified segments include: Uncompahgre River and Tributaries from headwaters to Ouray, Uncompahgre River Ouray to South Canal outfall and West Canal Flume, Ridgway Reservoir, lower Cow Creek (final five miles to confluence with Uncompahgre River), and East and West Dallas Creeks.
- Nate Creek from the headwaters to the confluence with Cow Creek is subject to fish stocking regulations that prohibit stocking of fish in native cutthroat trout waters.
- Identifies Gunnison Basin-wide goals including improving agricultural water supplies, restoring and maintaining critical water infrastructure, and addressing municipal and industrial water shortages.
- Identifies proposed projects for addressing agricultural irrigation, municipal, and industrial water demand gaps by Water District.
- Identifies an agricultural irrigation consumptive use shortage in the UUB of 3,100 AF.
- Projects to address the environmental and recreational needs in the focus segments include:

- Diversion infrastructure improvements that increase accuracy and reduce maintenance costs while preserving stream connectivity
- Temporary and voluntary instream flow leasing arrangements that sustain flows during critical drought periods
- Voluntary partial instream flow donations that maintain historical irrigation practices on a more limited basis
- Multipurpose storage projects that include operational flow agreements and/or dedicated environmental and recreational flow components
- Monitoring and management for important river reaches

- The Gunnison Basin Roundtable members identified the main goal for the Gunnison Basin as protecting existing water uses in the Gunnison Basin. They also identified eight additional basin goals to support the main goal:
  - Discourage the conversion of productive agricultural land to all other uses within the context of private property rights
  - Improve agricultural water supplies to reduce shortages
  - Identify and address municipal and industrial water shortages
  - Quantify and protect environmental and recreational water uses
  - Maintain, or where necessary, improve water quality throughout the Gunnison Basin
  - Describe and encourage the beneficial relationship between agricultural and environmental recreational water uses
  - Restore, maintain, and modernize critical water infrastructure, including hydropower
  - Create and maintain active, relevant, and comprehensive public education, outreach and stewardship processes involving water resources in the six sectors of the Gunnison Basin

3.0 WATER RIGHTS AND ADMINISTRATION

3.1 Ridgway Reservoir

A prominent hydrologic feature in the UUB is Ridgway Reservoir. Ridgway Reservoir, part of the USBR Dallas Creek Project, was planned and constructed as a multi-purpose project to provide municipal, industrial, recreation and irrigation water to areas within the Upper Colorado Basin, under the Colorado River Storage Act. Additional benefits of the reservoir are hydropower, flood control, recreation and benefits to wildlife and the fishery (Tri-County Water Management Plan, 2003). Ridgway Reservoir was constructed by the USBR in 1989 with a storage capacity of 84,410 AF. The reservoir is administered by TCW. There are various pools within Ridgway Reservoir that are allocated for different purposes (see Figure 1). According to the USBR DPR 25,100 AF is inactive storage for recreation, 28,100 AF is available for municipal and industrial purposes, 11,200 AF is available for irrigation, 15,600 AF is considered an administrative pool and 4,410 AF of water is unallocated. Ridgway Reservoir provides important services and its ability to fill each year is important for water delivery, primarily downstream in Montrose and Delta Counties. Figure 1 is a summary of daily storage contents for Ridgway Reservoir from November 2001-October 2012.

The DPR for Ridgway Reservoir proposed an allocation of 900 AF of the 11,200 AF of irrigation water for use in the supplemental service areas of Colona and Dallas Creek (see Appendix A). The water shortage for the Dallas Creek area is identified by the DPR as 1,640 AF. The Dallas Creek Project also contains conditional water rights on other reservoirs and canals that have not been built within the UUB. For a summary of Dallas Creek Projects water rights see Table 5.

3.2 Montrose and Delta Canal

There are senior calling water rights such as the Montrose and Delta (M&D) Canal that are located downstream of the UUB. These senior water rights have the ability to curtail structures in the UUB, limiting many users ability to divert water during times of water shortage.

The primary calling water right that affects water rights administration in the UUB is the M&D Canal, which is administered by the UVWUA (see Map 2). During dry years, the M&D Canal calls can affect the entire UUB including tributaries such as Dallas Creek and Cow Creek. The M&D Canal conveys ten water rights totaling 306.8 cubic feet per second (cfs). Tables 6 and 7 show call records for the dry years of 2002 and 2012, respectively. All of the M&D Canal calls in these tables affect the entire system. The Division Engineer has set a policy that the UVWUA cannot place a call until the Uncompahgre River gage at Olathe reads 0 cfs, and the Uncompahgre River gage at Delta reads 100 cfs.

3.3 UUB Water Rights

Internal water rights calls also affect water rights administration within the UUB. The primary senior calling right on Dallas Creek is the Hosner Rowell Ditch (see Map 2). Other senior calling water rights in the Dallas Creek basin include the Reed Overman, and the Mayol Sisson Ditch (see Map 2). The majority of the calling water rights in the Dallas Creek basin pre date the Colorado River Compact. Three calls were placed on Dallas Creek in 2002, but none in 2012, as shown in Tables 6 and 7, respectively.

Water rights on the main stem of Cow Creek historically have not placed any calls. The Chaffee Ditch is the senior-most water right on the main stem of Cow Creek, and typically its water right is satisfied by adequate return flows and local inflows (see Map 2). The Sneva Ditch holds the second most senior water right and is located high enough in the drainage so there are no water rights upstream to call out. The Sneva Ditch is also a transbasin diversion that irrigates land along the main stem of the Uncompahgre River (see Map 2 and Map 6).

3.4 CWCB Instream Flow Water Rights

The CWCB holds a number of instream flow (ISF) water rights within the UUB (see Map 2). A tabulation of ISF water right information is provided in Table 8. The ISF on the Uncompahgre River above Ridgway Reservoir varies seasonally from 65 cfs during irrigation season to 20 cfs outside of irrigation season. The ISF on the main stem of Dallas Creek varies seasonally from 20 cfs during irrigation season to 9 cfs outside of irrigation season. The ISF on Cow Creek varies seasonally from 18 cfs during irrigation season to 5 cfs outside of irrigation season.

4.0 WATER DEMANDS AND SHORTAGES

4.1 Agricultural Water Use

The primary water demand in the UUB is for agricultural use. Agricultural irrigation water is typically distributed from diversion structures on the main stem Uncompahgre River and its tributaries, and delivered to agricultural operations by a system of canals and ditches. For purposes of this study agricultural irrigation water demand is assumed to remain steady into the future.

WWE analyzed agriculture water use shortages in a dry-year (2002) and average year (2002-2012) on a reconnaissance-level for the UUB using two methods: the Gunnison Model and analyzing actual diversion records and irrigation water requirements (IWR). The Gunnison Model is a water rights allocation model that determines water availability based on hydrology, water rights, and operating rules and practices, to estimate various water availability scenarios in the Gunnison Basin. (GBIP 2010) The Gunnison Model utilized Colorado Decision Support System (CDSS) irrigated acreage data from 2000, 2005 and 2010. Shortages were calculated by subtracting the IWR from the modeled available water on a structure basis. The IWR represents the crops water needs less precipitation; it is calculated by multiplying the Unit IWR by the irrigated acreage. The IWR applied using the Gunnison Model is procured by crop mixes from Hydrobase as part of CDSS. Crops are assigned and split on an individual parcel level, and read into the model. The IWR values for the Gunnison Model analysis were applied based on a monthly time step. The model accounts for groundwater return flows back to the stream for use by other water rights. The model limits diversion based on decreed water rights. However, in reviewing the diversion records, WWE found that during free river conditions some structures divert in excess of their decreed water right.

The analysis based on diversion records only used CDSS irrigated acreage data from 2010. The diversion shortage is calculated by totaling diversion records and subtracting the IWR. An additional shortage calculation was performed assigning an efficiency factor of 40 percent to the diversion quantities before subtracting IWRs to account for conveyance and application efficiencies. This analysis based on diversion records does not account for rediversion of return flows. Dry-year (2002) and average year (2002-2012) shortages were analyzed on a subbasin level. The subbasins analyzed include Region 1 - Uncompahgre River downstream of Ridgway Reservoir, Region 2 - Dallas Creek, Region 3 - Uncompahgre River upstream of Ridgway Reservoir, Region 4 - Cow Creek (see Map 3 through Map 6).

Agricultural Irrigation Water Shortage Analysis

Based on CDSS 2010 irrigable acreage data, there are approximately 16,000 acres in agricultural production in the UUB (see Tables 9 and 10). Region 2 (Dallas Creek) accounts for approximately 35 percent of the agriculture land in the UUB and Region 4 Cow Creek accounts for approximately

31 percent. In the dry year of 2002 the IWR was 35,216 AF for the entire UUB, with 66 percent of the water demand needed in the Dallas Creek and Cow Creek tributaries.

Dry Year Irrigation Analysis-2002 Results

For the dry year of 2002 the Gunnison Model identified a total consumptive use shortage of approximately 12,400 AF (see Table 9) in the UUB. Region 2 (Dallas Creek) accounted for approximately 8,100 AF or 65 percent of the total shortage. Region 4 (Cow Creek) accounted for approximately 3,300 AF or 27 percent of the total shortage. Based on the Gunnison Model, 92 percent of the irrigation shortages in the UUB in a dry year are in Dallas Creek and Cow Creek drainages.

Analyzing actual diversion data, there is an approximate 14,000 AF of C.U. shortage in the UUB in the dry year of 2002. Agricultural irrigation shortages are observed in this analysis in the dry year of 2002 before considering any irrigation efficiency factors, which indicates the severity of the drought experienced that year. The difference between the 14,000 AF shortage based on diversion records and the 12,400 AF shortage based on the Gunnison Model is largely due to the analysis based on diversions does not account for the availability of return flows. This highlights the importance of return flows in the system.

Using actual diversion data and applying an irrigation efficiency factor of 40 percent, every region within the UUB experienced shortages in the dry year analysis. Region 2 (Dallas Creek) and Region 4 (Cow Creek) experienced the greatest shortages in the UUB, with shortages in each region exceeding 6,000 AF. As mentioned in the above Hydrology section, Dallas Creek in the dry year of 2002 had an annual discharge of approximately 10,000 AF and an IWR of approximately 12,000 AF. In a dry year there is a physical water shortage in this UUB and Dallas Creek and Cow Creek are affected the most.

Average Year Irrigation Analysis (2002 to 2012) Results

In an average year the IWR for the entire UUB is approximately 31,800 AF, approximately 3,400 AF less than in a dry year. For the 2002-2012 period of record the Gunnison Model predicts an average shortage of 3,822 AF throughout the UUB (see Table 10). This is similar to the 3,100 AF shortage the GBIP identified based on climate data for a 1975 to 2006 modeling period. Region 2

(Dallas Creek) had an average consumptive use shortage of approximately 2,600 AF or 68 percent of the total shortage during the 2002-2012 period of record and Region 4 (Cow Creek) had an average shortage of approximately 1,000 AF or 27 percent of the total shortage (see Table 10).

Analyzing actual diversion data, with an applied efficiency factor of 40 percent, the entire UUB was short by approximately 3,000 AF. The majority of the shortages were found within Region 2 (Dallas Creek) and Region 4 (Cow Creek).

Comparison of Results to Existing Models and Previous Studies

Several factors account for differences between the Gunnison Model results and the actual diversion results for estimated agricultural shortages in the UUB. The Gunnison Model does not allow modeled users to divert water in excess of decreed amounts, while the analysis based on actual diversion may capture users who are over diverting. Diversion in excess of decreed water rights is an important component, especially early in the irrigation season as these excess diversions generate return flow that will accrue to the stream later in the year that would be available to other water users. Also, the reported shortage based on actual diversion records does not account for the return flow of diverted water or soil moisture content.

WWE recommends using both the Gunnison Model and the diversion shortages to determine the probable range of irrigation water shortage in the UUB. The total average annual water shortage in the UUB is approximately between 3,000 AF and 3,800 AF. The total dry year irrigation shortage is approximately between 12,400 AF and 14,000 AF.

4.2 Municipal and Domestic Water Use

According to the Gunnison Basin Consumptive Needs Assessment (2011) it is estimated that Ouray County accounts for 4 percent of the M&I water consumed in the Gunnison River Basin. This report also states that municipal and domestic water use in Ouray County was approximately 840 AF in 2008 and anticipated to be between 1,300 AF and 1,800 AF in 2050. Likewise, the SWSI (2010) anticipates an approximate 300 AF to 800 AF of increase in M&I demand in the UUB by 2050.

For purposes of this report municipal water is consumed by constituents or residents who live in areas served by centralized community water systems such as TCW, DCWC, the City of Ouray or the Town of Ridgway and domestic water is consumed by residents who are located in low density unincorporated areas within Ouray County.

4.2.1 City of Ouray

The City of Ouray is working on a plan to provide enough water supply to provide municipal water to the residents who live within the city's serving limits (see Map 7).

The city's future use is estimated at a 50-year projection totaling 4,365 equivalent residential users (EQR's). This was calculated by applying a historical annual growth rate of 2.3 percent to the 2011 EQR count for the period of 2013 to 2063. A rate of 350 gallons per day per EQR and 100 percent year-round occupancy was also assumed. The historical annual growth rate is taken from DOLA census data from 1990 to 2010. Future water demands also include dust suppression, irrigation, commercial development, hot spring pools, the Ice Park and hydropower. Using these assumptions, a total demand of 2,407 AF is projected for the city's future water demand.

The city is currently working on a Plan for Augmentation that ensures adequate water supply based on current and future growth projections. New development of water rights on the Red Mountain Ditch are also being pursued to firm the municipal water supply. Some of the city's water rights may be subject to calls from senior water rights located downstream, including the M&D Canal, and efforts to minimize or augment calls by downstream water rights would likely benefit the city's water supply.

4.2.2 Town of Ridgway

The Town of Ridgway municipal water service area is within the corporate Town Boundary (see Map 7). According to the Colorado Department of Public Health and Environment (CDPHE), Ridgway has 550 total service connections as of August 2015. According to the Ridgway Ditch and Otonowanda Reservoir Feasibility Study completed by the Applegate Group in January of 2011, Ridgway's current potable water use is 169 AF per year and the raw water demand is 111 AF per year.

According to the Applegate study, the town's treated water demands through 2030 increase to an average 448 AF per year and raw water demands increase to 149 AF per year. The Town of Ridgway is currently making improvements to the Lake Otonowanda reservoir to restore its physical capacity and to ensure a firm municipal water supply in the future. The reservoir after improvements will hold over 600 AF when full. It is WWE's understanding that the Town of Ridgway has adequate legal and physical water supplies for future growth through year 2030 and there are legal ramifications of using Lake Otonowanda outside of the Town of Ridgway. Some of the Town of Ridgway water rights may be subject to calls from senior water rights located downstream, including the M&D Canal, and efforts to minimize or augment calls by downstream water rights would likely benefit the town's water supply.

4.2.3 Tri-County Water Conservancy District

The TCW provides water to over 7,000 metered users through over 600 miles of pipeline. The service area boundary for TCW is shown on Map 7 which is based on physical and geographical limitations of where TCW is able to serve. There are places within the TCW service area boundary in the UUB that are not served due to difficulties associated with connecting to the distribution system. TCW receives and distributes water treated by Project 7 located near Montrose using water from the Gunnison Tunnel under an exchange agreement with UVWUA.

Based on correspondence with TCW, there are 782 active accounts in Ouray County as of May 2016. The 2014 billed residential usage in Ouray County was 144 AF from 831 meters. The 2014 billed commercial usage was 22 AF from three meters, for a total municipal and commercial water use of 165 AF.

The 2010 TCW Water Conservation Plan addresses drought year water use by providing an analysis of water use in 2002. According to TCW, the 2002 drought year total demand was 8,776 AF, 31 percent of the Ridgway Reservoir M&I allocation.

Future water use estimates presented in the 2010 TCW Water Conservation Plan are based on a population growth rate of 2.7 percent annual growth, as provided by the State Demographer. According to discussions with TCW staff, M&I water demand may not increase at the same rate as population growth, and the estimates presented in the 2010 report may be overly conservative based on trends in water use they have observed in recent years. The 2010 TCW Water Conservation Plan reports that the total estimated water demand in terms of Project 7 purchase water after the implementation of conservation measures is 3,309 AF/year in the year 2025. TCW is actively implementing their Water Conservation Plan and anticipates having adequate water supplies through their planning horizon.

Since TCW pumps water from the Montrose area into the UUB, TCW has evaluated potential water sources in the UUB. A source of water in the UUB would reduce pumping costs and provide system redundancy especially in the TCW's service area in the UUB. All new water lines to be connected to the TCW water distribution system shall be installed and connected at the developer's expense. Utility plans must be approved by TCW before construction. TCW does not sell any construction materials. All TCW District construction is subject to approval before transfer of the system to the District. Construction specifications, guidelines, and standard detail drawings are available on the TCW website: http://tricountywater.org/info-tech-standards.htm

4.2.4 Dallas Creek Water Company

DCWC provides domestic water for residents within their service area which includes the South Mesa Zone (see Map 7). Ouray County's South Mesa land use zone is located at the southern end of Log Hill Mesa. The county has identified the South Mesa Zone as an area designated for high-density residential development in the unincorporated part of the county if, according to Ouray County land use code, the infrastructure can support it. Water needs in the South Mesa Zone are primarily municipal, fire protection and Divide Ranch and Club Golf Course irrigation.

Current Water Use

Two pumping stations move water from the infiltration gallery located on Dallas Creek near County Road 24 at the base of the escarpment to a treatment plant on Log Hill Mesa. A report by Beach Environmental, LLC in 2006 stated that the Mike Cuddigan and Hyde-Sneva priorities 39 and 42 water rights (totaling 0.75 cfs) and the Loghill Pumping Plant are physically capable of providing a reliable water supply for up to 1,393 single family equivalent units (SFE). One SFE is equal to 350 gallons per day, and is the measure used by Ouray County's Planning Department. The Public Utilities Commission (PUC) confirmed in its September 2006 recommended decision that the 0.75 cfs provided by the Mike Cuddigan and Hyde-Sneva water rights were adequate to sufficiently serve 1,393 SFEs. DCWC annual report data between 2011 and 2013 shows an average of 49 AF of water delivered per year, with a delivery of 48 AF in 2012, the driest year of the three. System losses vary from 21 percent to 49 percent, with a decreasing annual trend. According to DCWC's 2015 Annual Report DCWC metered 405 taps and sold 50 AF of treated water to its customers.

Irrigation Water Demands

The Divide Ranch and Club Golf Course requires 60 AF to 80 AF of raw or irrigation water per year, much of which is required during the usually dry spring months. Irrigation water for the golf course is provided by groundwater wells (Fairway Pines Project), ditch diversions, runoff, and a 10-year contract with DCWC to supply 30 AF of untreated raw water.

Future Water Supplies

According to written information from the President of DCWC James A. Willey, upon completion of the "Water Supply Facilities Plan, Phase II" infrastructure improvements, DCWC will be capable of serving 2,554 SFEs at capacity. The Phase II improvements include installing new pumps and replacing a 6-inch transmission line with a 12-inch transmission line to accommodate expansion to the ultimate plant capacity.

According to discussions with Ouray County Planning Director, Mark Castrodale, the maximum buildout for the South Mesa Zone is currently estimated at approximately 1,550 units. Therefore, after DCWC completes the infrastructure improvements DCWC will have the capacity to serve the currently estimated full buildout.

Physical Water Supply Limitations during Sever Drought

While there may be enough water supply for the DCWC to serve the full buildout needs of the South Mesa Zone during average and moderately dry years, according to the CDWR water commissioner, there may be a physical water supply issue in Dallas Creek in severe drought years (2002). Stream flow of less than 1 cfs occurred for 88 days in 2002 according to the USGS Dallas

Creek near Ridgway gage station. In 2002 the water commissioner reports multiple complaints about water quality due to low flow conditions from South Mesa residents served by DCWC.

Options for Meeting South Mesa Zone Water Demands

Based on discussions with DCWC representatives, and a review of available reports and data, WWE suggests investigating the following options for alleviating DCWC water demand concerns, which include a potential merger with TCW, developing a supplemental water supply intake location with a more reliable physical water supply, and continuing to address system losses to conserve physical water supplies.

Tri-County Water Conservancy Merger

The DCWC filed a merger request with the TCW in January 2015. At the time of the merger request, the customer base was 867 taps with 404 metered customers, and an anticipated additional 300 taps pending the completion of the Fairway Pines/Divide Ranch Development. The merger request was declined in September of 2015, as the terms were not consistent with existing TCW policies.

Mike Berry, TCW's General Manager, says they would be willing to revisit a merger if the terms were more in line with their policies. He has further said that TCW and DCWC are discussing the idea of connecting the two systems for emergency water exchange only. The interconnecting of the two systems may be mutually beneficial for both water providers.

Supplemental Water Supply Intake

During times of drought, the DCWC water supply intake may be subject to a physical shortage. Supplementing the water supply intake with an additional intake at a location where it can withdraw water from a more reliable source or developing groundwater supply near the intake could be investigated.

Efficiency Improvements and System Loss

Average water system losses reported by the PUC have been reduced from 50 percent between 2005 and 2012 to approximately 20 percent in 2014. WWE recommends continuing to address system water loss issues to improve efficiency. An option to further address system efficiency could be achieved through the development and implementation of a Water Conservation Plan.

4.2.5 Other Centralized Water Systems

There are small developed areas that are not associated with an established water provider but are also planned by the county to see a higher density of development than one dwelling unit per thirty-five acres. These include small subdivisions such as Elk Meadows and Dallas Meadows (see Map 7). According to the water commissioner there are no known shortages associated with these smaller subdivisions.

Dallas Meadows is a privately owned homeowner's association (HOA) with a domestic water system served by a well. A total of forty-two lots are served by this water system. One lot within Dallas Meadows is served by the Tri-County water line which runs along CR 24 and CR 25 (information from personal correspondence Gordon Mull, Dallas Meadows HOA, October 2015).

Elk Meadows is a subdivision located approximately eight miles south of Ridgway, Colorado and served by a community water system. WWE has contacted Elk Meadows representatives, but has not received a response confirming the service limits of the water system.

4.2.6 Unincorporated Ouray County Domestic Water Use

Most of the private land within the UUB is composed of area that is not incorporated with a centralized water service provider (see Map 7). Based on conversations with the County Planner, it is estimated that currently there are approximately 235 homes in unincorporated Ouray County not served by a centralized water system. The water demand calculation for each dwelling unit is approximately 350 gallons per day with approximately 2,000 square feet of irrigated landscaped area. The total approximate current water demand for the unincorporated areas of Ouray County is 112 AF per year. If the unincorporated areas within the county grow in line with the historic annual growth rate of 2.3 percent, there is an estimated total of 716 housing units or 341 AF of water use in 2066.

Within unincorporated areas of the UUB, there are certain areas that have been identified as having difficulty obtaining water. One area that has self-identified with the water commissioner as having difficulty obtaining adequate domestic water supply is the Portland area. Portland is located between the TCW service limit and the City of Ouray service limit (see Map 7). The Portland area is composed of approximately 35 lots. Based on each lot requiring 350 gallons per day, 365 days per year, these lots in total would require approximately 14 AF of domestic water supply annually. Assuming 20 percent of these homes will build accessory dwelling units there is the potential for 42 housing units in the Portland area, which would require approximately 16 AF of water annually. For this area to receive adequate domestic water supply there may be a need to pursue augmentation water for future wells.

Other areas that may see water shortages are residential units that are located on Sims Mesa, Mackenzie Butte, or other typically dry sections of the UUB. These areas do not have a large stream system easily accessible and in a dry year the groundwater supply for their well may be unavailable. When unincorporated residential units do not have an adequate water supply they may have to haul water. While it is unknown at this time how many residents of Ouray County participate, water hauling is a prominent source of water for many people in both the Lower and Upper Uncompahgre Basin (Region 1 and Region 3). It is estimated that of the total 235 housing units in unincorporated Ouray County 110 are located along the Lower Uncompahgre (Region 1) and 73 are located on the Upper Uncompahgre (Region 3). These two regions account for nearly 80 percent of the water use in unincorporated areas within the UUB. The county does not regard water hauling as a sustainable source of water supply for the future.

4.3 Industrial Water Use

The UUB has historically seen a large demand for industrial water. These historical uses primarily consisted of hard rock mining. Currently, there are only a few hard rock mines operable in the UUB. For purposes of this report, these mines are responsible for securing the supply for their water demand.

Other industrial water uses in the UUB are the production of construction materials including gravel pits. Ouray County operates a gravel pit near Colona, CO. Based on discussions with county staff it is estimated that Ouray County will need to secure enough water to produce 60,000 tons of gravel per year. Producing this amount of gravel on an annual basis assuming the gravel is washed and mined from a wet pit would require approximately 21 AF of water per year. Assuming an average pit depth of 10 feet, there will be approximately 2 acres of exposed surface area per year.

There are currently 18 acres of exposed pit area in Ouray County. Since gravel demand in the county is anticipated to remain steady, it can be estimated that in 2050 there will be approximately 228 AF of water needed for evaporation within the pits, 10 AF for road and bridge construction and 21 AF for dust control, totaling 260 AF of water.

4.4 Environmental and Recreational Water Use

Environmental and recreational water use in the UUB is recognized as being an important social and economic driver for Ouray County.

4.4.1 Previous Report Findings for Environmental and Recreational Water Uses

The Uncompahgre River and tributaries have been identified as a focus segment for environmental and recreational purposes by the GBIP and the SWSI 2010. These reports have identified various environmental and recreation water uses in the UUB. Recreational and environmental water uses are identified below.

Recreational Water Uses:

- Whitewater and flatwater boating
- Wildlife viewing
- Waterfowl hunting
- Cold and warm water fishing
- High use recreation areas (Ridgway State Park)
- Ouray Ice Park
- Hot Springs

Environmental Water Uses:

- Riparian vegetation and wetlands
- Wildlife habitat
- Groundwater recharge
- Providing adequate instream fish flows
- Threatened and endangered species

4.4.2 CWCB Instream Flow Reaches

Instream flow reaches are designated by the CWCB for the preservation and improvement of the natural environment for a specified stream segment to a reasonable degree. There are several streams with ISF reaches within the UUB including Dallas Creek, Cow Creek, and the Uncompahgre River. For ISF reaches and decreed flow amount information see Table 8 and Map 8. WWE analyzed stream discharge data for Dallas Creek, Cow Creek and the Uncompahgre River and compared it to ISF requirements to determine if there are physical water shortages affecting the surface water available for these stream reaches.

Dallas Creek ISF Reach

The ISF on Dallas Creek is 20 cfs between May 1st and October 14th, and 9 cfs between October 15th and April 30th. In 2002, average daily discharge measured by USGS Gage Station 09147000, Dallas Creek near Ridgway, was below the ISF for a total of 139 days (see Figure 2). Additionally, an average daily discharge of less than 1 cfs was measured for 88 days. During 2002, the total volume of shortage between the average daily discharge and the ISF on days where the average daily discharge was less than the ISF was approximately 4,700 AF. During an average year the gage station is below the ISF for 18 days and the total volume of shortage is approximately 100 AF (see Figure 3).

Uncompahgre River ISF Reach

The ISF on the Uncompahgre River is 65 cfs between May 1st and October 14th, and 20 cfs between October 15th and April 30th. In 2002, average daily discharge measured by USGS Gage Station 09146200, Uncompahgre River near Ridgway, was below the ISF for a total of 66 days (see Figure 4). The total volume of shortage between the average daily discharge and the ISF on days where the average daily discharge was less than the ISF was approximately 2,000 AF. In an average year the ISF on the Uncompahgre River is not typically short of water (see Figure 5).

Cow Creek ISF Reach

The ISF on Cow Creek is 18 cfs between April and July, and 5 cfs between August and March. The ISF on Cow Creek is located upstream of the Sneva Ditch (see Map 2). Historical stream gage data is available from two gaging stations on Cow Creek. CDWR currently administers the

COWCRKCO gage, which has been active since approximately 2008 (see Map 2). There is also an inactive USGS stream gage with records from 1955 to 1973. Since neither of these gages collected data in 2002, CDWR gage data from 2012 was chosen for this analysis. The CDWR gage station is located downstream of the ISF on Cow Creek. The data gathered downstream from the ISF is not representative of actual shortages due to diversion structures in between the ISF and the gage station. In 2012, average daily discharge measured by the CDWR COWCRKCO gage was below the ISF for a total of 47 days (see Figure 6). The total volume of shortage between the average daily discharge and the ISF on days where the average daily discharge was less than the ISF was approximately 800 AF. With the shortened period of record of 2008 to 2012, there is not enough information determine if there is a shortage with the ISF during an average year. Given the location of the ISF high up in the basin it may be difficult to augment the existing Cow Creek ISF. WWE understands the CWCB is evaluating an ISF on Cow Creek from the existing ISF to the confluence of Cow Creek and the Uncompahgre River. A flow rate has not been proposed at this time. WWE has contacted CWCB regarding a proposed flow rate in order to conduct a shortage analysis.

ISF Shortages

Dallas Creek, Cow Creek and the Uncompahgre were all below their ISF designation in the dry year of 2002 or 2012. This suggests that all three water basins could benefit from additional water availability for instream flow purposes, especially in dry years. River reaches obtaining there ISF designation is an indicator of good river health and water availability in the basin.

Key Areas to Address Environmental and Recreational Water Use

To better address the environmental and recreational water shortage WWE met with TNC and Trout Unlimited to determine areas in the UUB that were candidates for projects that would result in the highest benefit for these purposes. WWE primarily considered areas that include infrastructure with interbasin irrigation ditches. For the purposes of this report an interbasin irrigation ditch diverts water from one tributary to another tributary within the UUB. A transbasin diversion is a structure that transports water from another Water Division into the UUB (Water Division 4). By focusing on improving interbasin irrigation ditch efficiencies, impacts to the basin of origin can be limited. Map 8 shows selected interbasin irrigation ditches that could be updated with higher efficiency infrastructure to limit water loss from the basin of origin on interbasin diversions.

Another option to firm the recreational and environmental water available in the UUB is to have water right owners participate in various instream flow programs with the CWCB. Appendix B provides a matrix of possible options. Some of these options represent both short and long term solutions. Participating in ISF programs with the CWCB could be beneficial to water users who voluntarily want to dedicate or donate water to the instream flow program.

Another area brought up during the discussions is the reach of river downstream of Ridgway Reservoir and the possibility of changes in release patterns during the shoulder months before and after irrigation season to help the downstream fishery.

The development of a stream management plan was identified as tool and mechanism to further evaluate and implement the issues and items discussed above.

5.0 STUDY OF POTENTIAL AUGMENTATION SUPPLIES AND COMBINATIONS

5.1 Potential Water Supplies in Ridgway Reservoir for Exchange

Ridgway Reservoir has a total storage of 84,410 AF. As discussed in the Water Rights and Administration section there are both internal and external calls placed on structures within the UUB. To help alleviate downstream callers to the UUB more water could be made available for release from Ridgway Reservoir for downstream users. As discussed in the above Ridgway Reservoir section the DPR estimated a shortage of 1,640 AF in the Dallas Creek supplemental service area and thus recommended allocating 900 AF of irrigation water for this area. Based on communication with the water commissioner, it is WWE's understanding that the 900 AF is not currently in use for water users in the UUB. With potential downstream callers satisfied, upstream users particularly on Dallas Creek and Cow Creek, could divert more water to help manage their water shortages. However, there are physical water supply issues that would ultimately limit the amount of water diverted even when removing the downstream call. WWE, using the Gunnison Model, estimates that if all users in the UUB were able divert at their full decreed capacity, there would be a maximum of 4,500 AF and an average total of approximately 2,100 AF of addition water available for users in the UUB. During an average year there would be 840 AF available in

Region 2 (Dallas Creek) and 580 AF available in Region 4 (Cow Creek) (see Figure 7). WWE recommends seeking a 4,500 AF allocation in Ridgway Reservoir to use as exchange water to satisfy downstream callers in dry years. On average, the UUB will be able to use 2,100 AF of this allocation.

WWE also recommends the UUB develop a plan to address water shortages in both dry and average years. Table 11 summarizes the total water shortage by region for a dry year (totaling 20,000 AF) and Table 12 summarizes total water shortages by region for an average year (totaling 4,000 AF). For example, Region 2 (Dallas Creek) will need an estimated total of nearly 13,000 AF of supplemental water supply in a dry year and 2,800 AF in an average year. If exchange water with Ridgway Reservoir was available, a portion of the water shortage in each region would decrease (see Table 13). After utilizing the average exchange potential within Ridgway Reservoir the UUB would need to develop an estimated additional water supply of approximately 18,000 AF in a dry year and approximately 2,700 AF in an average year (see Table 13). When utilizing the exchange potential with Ridgway Reservoir it will be important to not deplete the ISF segments that are currently appropriated in the UUB (see Map 8).

In the dry year of 2002, there were physical supply limitations, separate from any call on the river. To combat the supply issue in dry years WWE recommends developing additional water supplies that can serve the tributaries as well as the main stem of the Uncompahgre River.

5.2 Potential Augmentation Supplies

WWE has provided Ouray County with a separate memo describing potential preliminary augmentation sources. These augmentation sources include transbasin diversion structures, interbasin diversion structures, Dallas Creek Project structures and others.

5.3 C.R.S. 37-92-102(3)(b) Provision

Many of the irrigators in the UUB are currently able to divert water in excess of decreed amounts under free river conditions. The addition of new ISF reaches in the UUB may restrict these senior water right holders to diverting only their decreed amounts unless provisions are made to protect these senior water rights. One way to protect these diversions may be to file a C.R.S. 37-92-102(3)(b) provision. The C.R.S. 37-92-102(3)(b) provision may help protect existing users by allowing them to continue diverting water based on historical diversions, even if a new ISF reach is appropriated.

In 1995, water users on the Dallas Creek and Upper Uncompahgre River diverted a total of 2,000 AF above their decreed amount. The ISF on the Upper Uncompahgre River and Dallas Creek was appropriated in 1998. The irrigators who were over diverting before the ISF was appropriated may be able to use the C.R.S. 37-92-102(3)(b) provision to protect the additional 2,000 AF of water that was diverted at the time of the ISF appropriation. C.R.S. 37-92-102(3)(b) provision protection would require additional legal analysis and evaluation on an individual water rights structure basis. If a C.R.S. 37-92-102(3)(b) provision was approved, additional water supply may need to be developed to augment shortages to the ISF.

6.0 SUMMARY AND CONCLUSION

This engineering study conceptually quantifies the existing and future water needs of agricultural, domestic, municipal, industrial, recreational and environmental water uses for the UUB. Agricultural water needs account for approximately 91 percent of the water shortages in an average year in the UUB and municipal, domestic and industrial water shortages account for approximately 7 percent. WWE recommends focusing on developing additional water supplies in the UUB that address multiple shortage types. Ouray County should consider approaching the USBR and TCW concerning the allocation of 4,500 AF to use as exchange water to satisfy downstream callers in dry years. On average, the UUB will be able to use 2,100 AF of this allocation. This 4,500 AF allocation will help alleviate shortages in all four regions. During an average year if 2,100 AF of exchange water is utilized, there would be approximately 2,700 AF of water shortage in the UUB that would require upstream sources of water supply (see Table 13).

To satisfy water demand during average dry years it is likely that additional supplies need to be developed for each upstream basin. During dry years there is a large recreation and environmental water shortage. For example, Dallas Creek has a 4,700 AF environmental shortage in dry years but only a 100 AF environmental shortage in an average year (see Table 11 and Table 12). Preliminary potential additional water supplies for Ouray County have been provided in a separate memo to county staff.

Other key findings in this report include:

- In dry years, the UUB can see as much as 50 percent less water, compared to an average year.
- Dallas Creek and Cow Creek experience a much larger water shortage compared to the main stem Uncompahgre River.
- Agriculture water use is the largest consumptive use of water in the UUB, according to the Gunnison Model, there is approximately a 12,400 AF consumptive use shortage in a dry year and a 4,000 AF consumptive use shortage in an average year. Shortages at the diversion structures are greater.
- The City of Ouray, Town of Ridgway and TCW all report having adequate water supplies for their planning horizons.
- DCWC may benefit from securing an additional supply of water, as Dallas Creek has experienced water supply issues in dry years.
- Municipal water delivery may be firmed if the water service providing entities of DCWC and TCW are interconnected or merge.
- The Portland area has self-identified as being water short.
- Future buildout in Ouray County is uncertain, and should be addressed with a refined population growth study especially in areas not currently served by a centralized water provider.
- Ridgway Reservoir may be available for water exchange at a maximum of 4,500 AF and an average of 2,100 AF, which may help alleviate shortages throughout the UUB.
- Recreational and environmental water uses should be considered a top priority for protection and enhancement to protect the scenic value in Ouray County. Improvements to conveyance structures and on farm efficiencies for interbasin ditches to protect the source basin should be considered. Development of a Stream Management Plan is recommended to further evaluate and detail implementation of the environmental and recreational concepts detailed in this report, while protecting vested water rights and other uses of water.

- Use of existing ISF programs for temporary and permanent ISF donations should also be considered.
- WWE recommends securing additional water supplies along the main stem of the Uncompahgre River, as well as in its major tributaries Dallas Creek and Cow Creek.
- WWE recommends pursuing projects that have benefits across agricultural, municipal, domestic, industrial, environmental and recreational water uses.
- Upon review of the models WWE found delayed groundwater return flows from flood irrigation of agricultural land to be an important component of supply for water users later in the irrigation season. However, the Gunnison Model does not allow for excess diversions during spring runoff. WWE recommends enhancements to the model to better evaluate delayed groundwater return flows. Irrigation efficiency practices should be carefully evaluated for impacts to historically available delayed groundwater return flows.
- More importantly delayed return flows from early season irrigation is an important practice that results in more water available later in the irrigation season due to storage and naturally delayed release from the alluvial aquifer. Administration by ISF may reduce early season irrigation and reduce delayed return flows. WWE recommends evaluating irrigation practices that may increase storage in the alluvial aquifer and enhance late season stream flows. Use of C.R.S 37-92-102(3)(b) may be warranted but may require site by site legal and engineering review. If C.R.S 37-92-102(3)(b) protection is provided, additional water supplies may need to be developed for the ISF. WWE recommends coordinating closely with the CWCB on these issues.

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TABLES

Table 1
Ridgway Climate Station Monthly Temperature Data Summary (1982-2015)
Upper Uncompahgre Basin (Ouray County)
All Values in Fahrenheit

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Min	38.3	24.7	16.0	11.9	17.3	29.1	33.6	45.5	53.8	59.1	58.9	50.3
Max	48.4	36.3	29.6	32.2	35.5	40.7	46.4	56.5	62.9	69.3	66.9	59.4
Mean	43.6	32. 57	22.8	22.4	27.1	35.1	41.8	50.4	58.7	64.4	62.4	54.8
Min Average Month- January												22.4
Max Average Month-July												64.4
Annual Average												**44.0**

Notes: Data from Climate Station USC00057020, Ridgway CO, accessed through CDSS

Table 2
Ridgway Climate Station Monthly Precipitation Data Summary (1982-2015)
Upper Uncompahgre Basin (Ouray County)
All Values in Inches

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Min	0.0	0.2	0.1	0.2	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.0
Max	3.6	4.6	2.5	1.9	1.9	3.6	3.6	4.8	2.4	4.3	3.8	4.9
Mean	1.5	1.3	1.0	0.8	0.9	1.5	1.5	1.6	1.0	2.1	2.2	1.9
Min Average Month- January												0.8
Max Average Month-August												2.2
Annual Average												**17.1**

Notes: Data from Climate Station USC00057020, Ridgway CO, accessed through CDSS

Table 3
Selected Gage Station Summary
Upper Uncompahgre Basin (Ouray County)
All Values in AF/ year

Gage Station	Station Name	Gage Station Discharge 2002	Gage Station Discharge 2002-2012	Dry Year Percent of Average
		1		2
USGS 9146200	Uncompahgre River near Ridgway	54,429	116,248	47%
USGS 9147000	Dallas Creek near Ridgway	10,640	22,556	47%
* CDWR COWCRKCO	Cow Creek near Ridgway Dam	16,777	47,612	35%
USGS 9147500	Uncompahgre River at Colona	84,033	170,756	49%

Notes:
(1) Gage Station Data
(2) (2002 Gage Station Discharge)/ (2002-2012 Gage Station Discharge)
* COWCRKCO Gage Station has a shortened period of record from 2008-2012

Table 4
Average Annual Discharge at USGS Stream Gage 09146200 Uncompahgre River near Ridgway, CO
Upper Uncompahgre Basin (Ouray County)

Water Year	Cubic Feet per Second	Acre Feet
1959	131.7	95,347
1960	162.0	117,283
1961	148.6	107,582
1962	172.4	124,812
1963	121.1	87,673
1964	157.8	114,242
1965	205.8	148,993
1966	144.3	104,469
1967	127.5	92,306
1968	175.0	126,695
1969	157.2	113,808
1970	196.7	142,405
1971	168.4	121,916
1972	116.8	84,560
1973	199.1	144,142
1974	140.1	101,428
1975	201.5	145,880
1976	122.6	88,759
1977	72.6	52,560
1978	189.7	137,337
1979	197.3	142,839
1980	138.4	100,197
1981	111.2	80,505
1982	197.2	142,767
1983	244.3	176,866
1984	270.0	195,472
1985	225.4	163,183
1986	209.8	151,889
1987	188.7	136,613
1988	134.9	97,663
1989	113.0	81,808
1990	118.9	86,080
1991	164.6	119,165
1992	163.0	118,007
1993	187.0	135,382
1994	140.7	101,862
1995	235.9	170,784
1996	149.6	108,306
1997	236.4	171,146
1998	161.7	117,066
1999	182.9	132,414
2000	126.7	91,727
2001	149.7	108,378
2002	75.2	54,442
2003	135.1	97,808
2004	157.9	114,315
2005	187.9	136,034
2006	152.8	110,622
2007	189.9	137,482
2008	213.3	154,423
2009	180.4	130,604
2010	168.2	121,772
2011	202.1	146,314
2012	103.9	75,220
2013	112.7	81,591
2014	168.3	121,844
Average 1959-2014	**164.4**	**119,014**
Average 2002-2012	**160.6**	**116,276**

Table 5
Dallas Creek Project Water and Storage Water Rights Summary
Upper Uncompahgre Basin (Ouray County)

Storage Water Rights Summary

Structure	Adjudication	Appropriation	Decreed Rate AF	Status	*Use	Court Case	Source	Comments
Ridgway Reservoir	4/14/1961	11/16/1956	84,602	Absolute	124569PQ	94CW052	Uncompahgre River	
	12/31/1996	11/6/1956	84,602	Conditional	124569PQ	96CW140	Uncompahgre River	Refill Right
Dallas Divide Reservoir	4/14/1961	11/16/1956	14,089.1	Conditional	1248	CA 2440	Pleasant Valley Creek	
	9/13/1971	11/16/1956	3489.7	Conditional	12489	CA 2710	Enlargement	
Ramshorn Reservoir	4/14/1961	11/16/1956	24,349.1	Conditional	1248	CA 2440	Cow Creek and Red Creek	
Sneva Reservoir	9/13/1971	2/13/1963	823	Conditional	12489	CA 2710	Cow Creek and Red Creek	

Direct Flow Water Rights Summary

Structure	Adjudication	Appropriation	Decreed Rate cfs	Status	*Use	Court Case	Source	Comments
Dallas Feeder Canal	9/13/1971	2/13/1963	150	Conditional	12489	CA 2710	Dallas Creek	
Hydroplant Ridgway Reservoir	12/31/1996	11/6/1956	300	Conditional	P	96CW139	Uncompahgre River	

Source: Tri County 2003 Water Conservancy District Water Management Plan

*Use Type:

1 Irrigation
2 Municipal
4 Industrial
5 Recreation
6 Fishery
8 Domestic
9 Stock
P Power Generation
Q Other

Table 6
Division 4 River Calls Water District 68 (Year 2002)
Upper Uncompahgre Basin (Ouray County)

Stream Affected	Name of Calling Structure	Administration Number of Calling Structure	Date of Call	Duration of Call	Person Placing Call	Most Senior Curtailed Structure	Administration Number of the Most Senior Curtailed Structure
Horsefly	Albush Ditch	24221.22524	4/15/2002	5/4/2002	Mardell Sanders	Tierra Colorado Ditch	27184.21672
Dallas	Hosner Rowell Ditch	11779	5/1/2002	5/12/2002	Mike Stanton	Dallas Ditch	12905
Dallas	Reed Overman Ditch	10348	7/8/2002	9/9/2002	Tom Harrington	Barker Ditch	10713
Dallas	Mayol Sisson Ditch	9967	7/8/2002	9/9/2002	Tom Harrington	Barker Ditch	10713
Uncompahgre	Charley Logan Ditch	9649	7/12/2002	7/30/2002	Michael Potter	Morrison Ditch	10348
Uncompahgre	Moody Ditch	10348	7/12/2002	7/30/2002	Michael Potter	Hosner Brownyard Ditch	10360
Uncompahgre	Morrison Ditch	9622	7/12/2002	7/30/2002	Michael Potter	Moody Ditch	10348
System wide	M&D Canal	11665	7/11/2002	9/2/2002	Marc Catlin	McDonald No. 145 Ditch	11749
System wide	M&D Canal	11715	7/1/2002	7/11/2002	Marc Catlin	McDonald No. 145 Ditch	11749
System wide	M&D Canal	12516	4/26/2002	5/15/2002	Marc Catlin	Burger Ditch	12571
System wide	M&D Canal	12516	6/17/2002	6/24/2002	Marc Catlin	Burger Ditch	12571
System wide	M&D Canal	29554.09618	6/4/2002	6/17/2002	Marc Catlin	Morrison Ditch	29554.09649
System wide	M&D Canal	12442	6/24/2002	7/1/2002	Marc Catlin	Hieland Ditch	12475
System wide	M&D Canal	14198	5/15/2002	6/3/2002	Marc Catlin	Alkali Ditch No. 1	14336

Note:
(1) Source: Colorado Division of Water Resources, Division 4 records.

Table 7
Division 4 River Calls Water District 68 (Year 2012)
Upper Uncompahgre Basin (Ouray County)

Stream Affected	Name of Calling Structure	Administration Number of Calling Structure	Date of Call	Duration of Call	Person Placing Call	Most Senior Curtailed Structure	Administration Number of the Most Senior Curtailed Structure
Horsefly Creek	Albush Ditch	24221.22524	3/28/2012	5/23/2012	Randy Sanders	Tierra Colorado Ditch	27184.21672
Horsefly Creek	Tierra Colorado Ditch	27184.21672	3/29/2012	5/23/2012	Henry Jupille	Williams D Nos. 1,2&3	29554.23861
Cottonwood Creek	Tidwell Ditch	14715.00000	6/18/2012	8/11/2012	Joe Hess	Happy Hollow Ditch	15401.00000
Coal Creek	Coal Creek Ditch	10379.00000	6/25/2012	10/10/2012	Tyler Ferguson	Flora Ditch	11414.00000
System Wide	M&D Canal	12150.00000	5/2/2012	5/4/2012	Steve Fletcher	Mayol Lateral Ditch	12174.00000
System Wide	M&D Canal	12516.00000	5/4/2012	5/11/2012	Steve Fletcher	Lower Pleasant Valley Ditch	12540.00000
System Wide	M&D Canal	12874.00000	5/11/2012	5/17/2012	Steve Fletcher	Charley Logan Ditch	12875.00000
System Wide	M&D Canal	39036.00000	5/17/2012	6/20/2012	Steve Fletcher	Hacds Ditch No.1	39230.00000
System Wide	M&D Canal	29554.14762	6/20/2012	6/21/2012	Steve Fletcher	Dallas Ditch	29554.14915
System Wide	M&D Canal	29554.11475	6/21/2012	6/22/2012	Steve Fletcher	Hosner Rowell Ditch	29554.11779
System Wide	M&D Canal	19551.16541	6/22/2012	6/25/2012	Steve Fletcher	Ridgway Ditch	19904.14762
System Wide	M&D Canal	13605.00000	6/25/2012	6/26/2012	Steve Fletcher	Cronenberg Ditch	13635.00000
System Wide	M&D Canal	12150.00000	6/26/2012	7/10/2012	Steve Fletcher	Mayol Lateral Ditch	12174.00000
System Wide	M&D Canal	12516.00000	7/10/2012	7/24/2012	Steve Fletcher	Lower Pleasant Valley Ditch	12540.00000
System Wide	M&D Canal	14189.00000	7/24/2012	8/28/2012	Steve Fletcher	Alkali Ditch D No. 80	14336.00000
System Wide	M&D Canal	29554.11475	8/28/2012	9/26/2012	Steve Fletcher	Hosner Rowell Ditch	29554.11779

Note:

(1) Source: Colorado Division of Water Resources, Division 4 records.

Table 8
CWCB Instream Flow Water Rights Tabulation
Upper Uncompahgre Basin (Ouray County)

STRUCTURE	STRUCTURE ID	ADMINISTRATION NUMBER	ADJUDICATION DATE	APPROPRIATION DATE	CASE NUMBER	DECREED RATE (CFS)	STATUS	DECREED USE
Beaver Creek	1084	49673.49067	12/31/1986	5/4/1984	4-84CW0425	1.5 cfs (year round)	Absolute	Instream flow to preserve the natural environment to a reasonable degree
Cow Creek	1097	49673.49067	12/31/1986	5/4/1984	4-84CW420	18.0 cfs (April - July) 5.0 cfs (Aug - Mar)	Absolute	
Dallas Creek	1447	54250.00000	12/31/1998	7/13/1998	4-98CW234	20.0 cfs (May 1-Oct 14) 9.0 cfs (October 15-May 1)	Absolute	
East Fork Dallas Creek	1103	49673.49067	12/31/1986	5/4/1984	4-84CW0424	10.0 cfs (Mar-Sep) 5.0 cfs (Oct-Feb)	Absolute	
Middle Fork Spring Creek	1354	57003.00000	12/31/2006	1/25/2006	4-06CW0169	3.5 cfs (April 1-Oct 31 1.5cfs (Nov 1-Mar31)	Absolute	
Nate Creek	1127	49673.49067	12/31/1986	5/4/1984	4-84CW0422	2.0cfs (year round)	Absolute	
Owl Creek	1129	49673.49067	12/31/1986	5/4/1984	4-84CW0421	1.5 cfs (year round)	Absolute	
Spring Creek	1457	56275.00000	12/31/2004	1/28/2004	4-04CW163	5.3 cfs (April 1- June 30) 2.6 cfs (July 1- August 31) .9 cfs (Aug 1- March 31)	Absolute	
Uncompahgre River	1456	54250.00000	12/31/1998	7/13/1998	4-98CW222	65.0 cfs (May 1-Oct 14) 20.0 cfs (Oct 15-April 30)	Absolute	
West Fork Dallas Creek	1153	49673.49067	12/31/1986	5/4/1984	4-84CW0423	2.5 cfs (year round)	Absolute	
West Fork Spring Creek	1501	57003.00000	12/31/2006	1/25/2006	4-06CW0173	1.4 cfs (April 1-Oct 31) .8 cfs (Nov 1-Marc 31)	Absolute	

Source: CWCB - Colorado Water Conservation Board

Table 9

Dry Year Irrigation Demand Analysis based on 2002 Climate Data and Diversion Records

Upper Uncompahgre Basin (Ouray County)

Subbasin	Total Acreage[1]
Region 1- Uncompahgre River downstream of Ridgway Reservoir	2,747
Region 2- Dallas Creek	5,487
Region 3- Uncompahgre River upstream of Ridgway Reservoir	2,765
Region 4- Cow Creek	4,923
Division 68 Total Acreage	**15,922**

2002 Monthly Average Diversion by Region (AF)[2]

Region	April	May	Jun	July	Aug	Sep	Oct	Total
1	1,267	2,657	3,402	2,123	2,156	2,684	1,770	**16,059**
2	510	1,471	3,750	3,076	2,935	1,860	1,223	**14,826**
3	803	2,602	3,831	2,776	2,470	1,826	797	**15,106**
4	497	2,488	3,454	2,327	1,063	1,058	1,046	**11,933**
Total	**3,077**	**9,219**	**14,437**	**10,303**	**8,624**	**7,427**	**4,836**	**57,924**

Irrigation Water Requirement (IWR) (AF)[3]

Region	April	May	Jun	July	Aug	Sep	Oct	Total
1	239	1,373	1,566	1,209	884	607	197	**6,075**
2	477	2,744	3,128	2,414	1,767	1,213	394	**12,137**
3	241	1,382	1,576	1,217	890	611	199	**6,115**
4	428	2,462	2,806	2,166	1,585	1,088	353	**10,889**
Total	**1,385**	**7,961**	**9,076**	**7,006**	**5,127**	**3,519**	**1,143**	**35,216**

Diversion minus IWR (AF)[4]

Region	April	May	Jun	July	Aug	Sep	Oct	Total Shortage
1	1,028	1,284	1,836	914	1,271	2,077	1,573	**0**
2	33	(1,272)	622	662	1,168	647	829	**(1,272)**
3	562	1,220	2,255	1,560	1,580	1,215	599	**0**
4	69	27	648	161	(522)	(30)	692	**(553)**
Sum of Shortages	**0**	**(1,272)**	**0**	**0**	**(522)**	**(30)**	**0**	**(1,825)**

Diversion minus IWR based on a 40 percent Irrigation Efficiency (AF)[5]

Region	April	May	Jun	July	Aug	Sep	Oct	Total Sum Of Shortage	Gunnison Model Shortage*
1	268	(310)	(205)	(359)	(22)	466	511	**(897)**	**(919)**
2	(273)	(2,155)	(1,628)	(1,184)	(593)	(469)	95	**(6,302)**	**(8,080)**
3	81	(342)	(43)	(106)	98	119	120	**(491)**	**(41)**
4	(230)	(1,466)	(1,425)	(1,235)	(1,160)	(665)	65	**(6,181)**	**(3,341)**
Sum of Shortages	**(503)**	**(4,273)**	**(3,301)**	**(2,885)**	**(1,775)**	**(1,134)**	**0**	**(13,870)**	**(12,381)**

Notes:

(1) Source: GIS Data accessed through CDSS, 2010 Irrigated Lands Dataset.

(2) Source: Division of Water Resources records, accessed through CDSS.

(3) Irrigation Water Requirement (IWR) based on the IWR used in the Gunnison Basin Implementation Plan for Water District 68, based on 2002 climate data. Equals (Monthly unit IWR) x (Regional acreage).

(4) Equals (2002-2012 Monthly Diversion by Region) - (IWR).

(5) Equals (2002-2012 Monthly Diversion by Region) x (Selected Irrigation Efficiency of 40 percent) - (IWR).

* Gunnison Model Shortage is not based on the 40 percent efficiency. The Gunnison Model Shortage was analyzed as a consumptive use shortage.

Table 10

Average Year Irrigation Demand Analysis Based on 2002 to 2012 Climate Data and Diversion Records Upper Uncompahgre Basin (Ouray County)

Subbasin	Total Acreage[1]
Region 1- Uncompahgre River downstream of Ridgway Reservoir	2,747
Region 2- Dallas Creek	5,487
Region 3- Uncompahgre River upstream of Ridgway Reservoir	2,765
Region 4- Cow Creek	4,923
Division 68 Total Acreage	**15,922**

2002-2012 Monthly Average Diversion by Region (AF)[2]

Region	Total
1	28,872
2	31,572
3	23,654
4	26,511
Total	**110,609**

Irrigation Water Requirement (AF)[3]

Region	Total
1	5,484
2	10,956
3	5,520
4	9,829
Total	**31,788**

Diversion minus IWR based on a 40 percent Irrigation Efficiency (AF)[4]

Region	Sum of Shortages	Gunnison Model Shortage*[1]
1	(178)	(188)
2	(1,344)	(2,611)
3	(216)	(10)
4	(1,591)	(1,014)
Sum of Shortages*[2]	**(3,028)**	**(3,823)**

Notes:

(1) Source: GIS Data accessed through CDSS, 2010 Irrigated Lands Dataset.

(2) Source: Division of Water Resources records, accessed through CDSS.

(3) Irrigation Water Requirement (IWR) based on the average year unit IWR used in the Gunnison Basin Implementation Plan for Water District 68. Equals (unit IWR) x (Regional acreage).

(4) Equals (2002-2012 Diversion by Region multiplied by an efficiency of 40 percent) - (IWR).

*[1] Gunnison Model Shortage is not based on the 40 percent efficiency. The Gunnison Model Shortage was analyzed as a consumptive use shortage.

*[2] Shortage found for each year in the 2002-2012 period of record and then averaged based on the 11 year period.

Table 11
Total Water Shortages by Region: Dry Year
Upper Uncompahgre Basin (Ouray County)
All Values in Acre Feet (AF)/year

Region	Irrigation Water Shortage	Municipal, Domestic and Industrial Water Shortage	Recreation and Environmental Water Shortage	Estimated Total Water Shortage
[1]**Region 1: Uncompahgre River Downstream of Ridgway Reservoir**	919	280	0	1,199
[2]**Region 2: Dallas Creek**	8,080	6	4,700	12,786
[3]**Region 3: Uncompahgre River Upstream of Ridgway Reservoir**	41	14	2,000	2,055
[4]**Region 4: Cow Creek**	3,341	3	800	4,144
Total	**12,381**	**303**	**7,500**	**20,184**

Source:

(1) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 9.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: No ISF appropriated in Region 1.

(2) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 9.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: Based on ISF Analysis. See Figure 2

(3) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 9.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: Based on ISF Analysis. See Figure 4

(4) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 9.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: Based on ISF Analysis. See Figure 6

Table 12

Total Water Shortages by Region: Average Year
Upper Uncompahgre Basin (Ouray County)
All Values in Acre Feet (AF)/ year

Region	Irrigation Water Shortage	Municipal, Domestic, and Industrial Water Shortage	Recreation and Environmental Water Shortage	Estimated Total Water Shortage
[1] Region 1: Uncompahgre River Downstream of Ridgway Reservoir	188	280	0	468
[2] Region 2: Dallas Creek	2,611	6	100	2,717
[3] Region 3: Uncompahgre River Upstream of Ridgway Reservoir	10	14	0	24
[4] Region 4: Cow Creek	1,014	3	0	1,017
Total	**3,823**	**303**	**100**	**4,226**

Source:

(1) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 10.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: No ISF appropriated in Region 1.

(2) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 10.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: Based on ISF Analysis. See Figure 3

(3) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 10.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: Based on ISF Analysis. See Figure 5

(4) Irrigation: Based on irrigation water shortage identified by the Gunnison Model, see Table 10.
Municipal, Domestic and Industrial: WWE estimate based on water service provider service limits and industrial water use in region.
Environment and Recreation: WWE estimate based on historical stream flow.

Table 13
Water Shortages by Region with Exchange Potential from Ridgway Reservoir
Upper Uncompahgre Basin (Ouray County)
All Values in Acre Feet (AF)/ year

Region	Estimated Total Water Shortage Dry Year	Estimated Total Water Shortage Average Year	Average Exchange Potential with Ridgway Reservoir	Estimated Total Additional Water Supply Dry Year	Estimated Total Additional Water Supply Average Year
	(1)	(2)	(3)	(4)	(5)
Region 1: Uncompahgre River downstream of Ridgway Reservoir	1,199	468	88	1,111	380
Region 2: Dallas Creek	12,786	2,717	844	11,942	1,873
Region 3: Uncompahgre River upstream of Ridgway Reservoir	2,055	24	589	1,466	-
Region 4: Cow Creek	4,144	1,017	576	3,568	441
Total	**20,184**	**4,226**	**2,097**	**18,087**	**2,694**

Source:

(1) Based on Table 11, Estimated Total Water Shortage

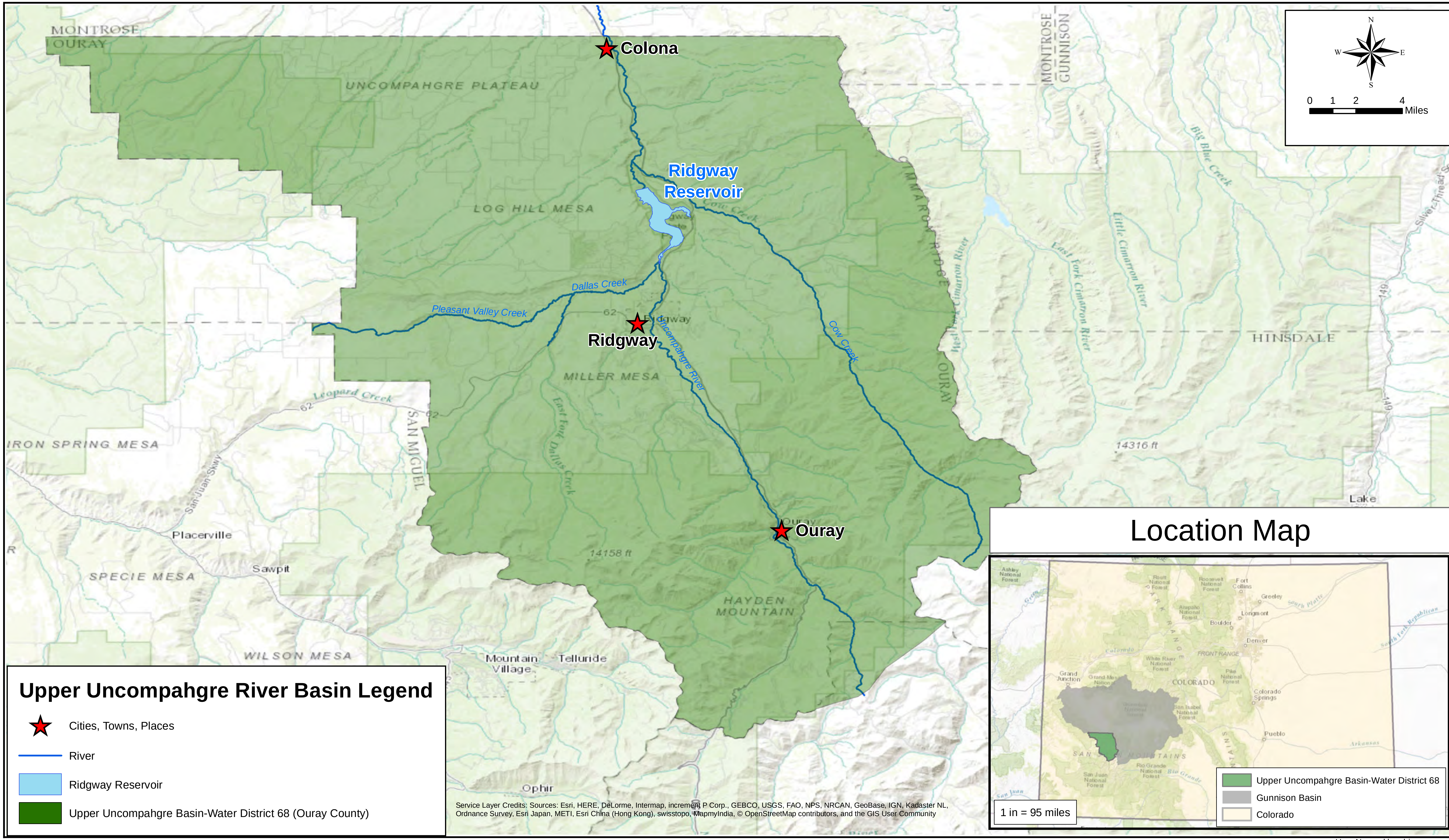
(2) Based on Table 12, Estimated Total Water Shortage

(3) Based on Figure 7

(4) Column (1)-Column (3)

(5) Column (2)-Column (3)

MAPS



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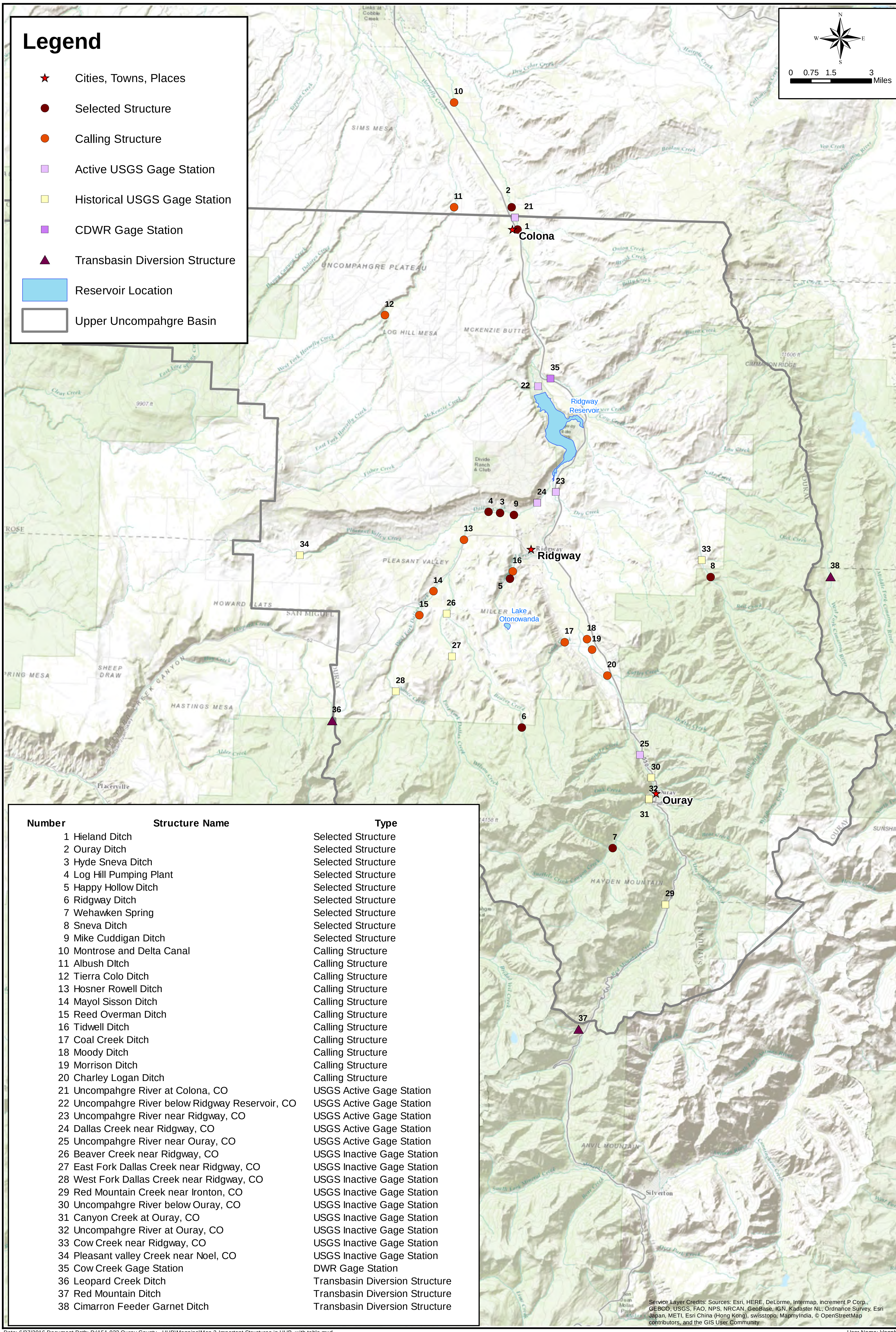
OURAY COUNTY, COLORADO

UPPER UNCOMPAHGRE BASIN-WATER DISTRICT 68
LOCATION MAP

UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO.
151-032.000

MAP
1



Number	Structure Name	Type
1	Hieland Ditch	Selected Structure
2	Ouray Ditch	Selected Structure
3	Hyde Sneva Ditch	Selected Structure
4	Log Hill Pumping Plant	Selected Structure
5	Happy Hollow Ditch	Selected Structure
6	Ridgway Ditch	Selected Structure
7	Wehawken Spring	Selected Structure
8	Sneva Ditch	Selected Structure
9	Mike Cuddigan Ditch	Selected Structure
10	Montrose and Delta Canal	Calling Structure
11	Albush DItch	Calling Structure
12	Tierra Colo Ditch	Calling Structure
13	Hosner Rowell Ditch	Calling Structure
14	Mayol Sisson Ditch	Calling Structure
15	Reed Overman Ditch	Calling Structure
16	Tidwell Ditch	Calling Structure
17	Coal Creek Ditch	Calling Structure
18	Moody Ditch	Calling Structure
19	Morrison Ditch	Calling Structure
20	Charley Logan Ditch	Calling Structure
21	Uncompahgre River at Colona, CO	USGS Active Gage Station
22	Uncompahgre River below Ridgway Reservoir, CO	USGS Active Gage Station
23	Uncompahgre River near Ridgway, CO	USGS Active Gage Station
24	Dallas Creek near Ridgway, CO	USGS Active Gage Station
25	Uncompahgre River near Ouray, CO	USGS Active Gage Station
26	Beaver Creek near Ridgway, CO	USGS Inactive Gage Station
27	East Fork Dallas Creek near Ridgway, CO	USGS Inactive Gage Station
28	West Fork Dallas Creek near Ridgway, CO	USGS Inactive Gage Station
29	Red Mountain Creek near Ironton, CO	USGS Inactive Gage Station
30	Uncompahgre River below Ouray, CO	USGS Inactive Gage Station
31	Canyon Creek at Ouray, CO	USGS Inactive Gage Station
32	Uncompahgre River at Ouray, CO	USGS Inactive Gage Station
33	Cow Creek near Ridgway, CO	USGS Inactive Gage Station
34	Pleasant valley Creek near Noel, CO	USGS Inactive Gage Station
35	Cow Creek Gage Station	DWR Gage Station
36	Leopard Creek Ditch	Transbasin Diversion Structure
37	Red Mountain Ditch	Transbasin Diversion Structure
38	Cimarron Feeder Garnet Ditch	Transbasin Diversion Structure

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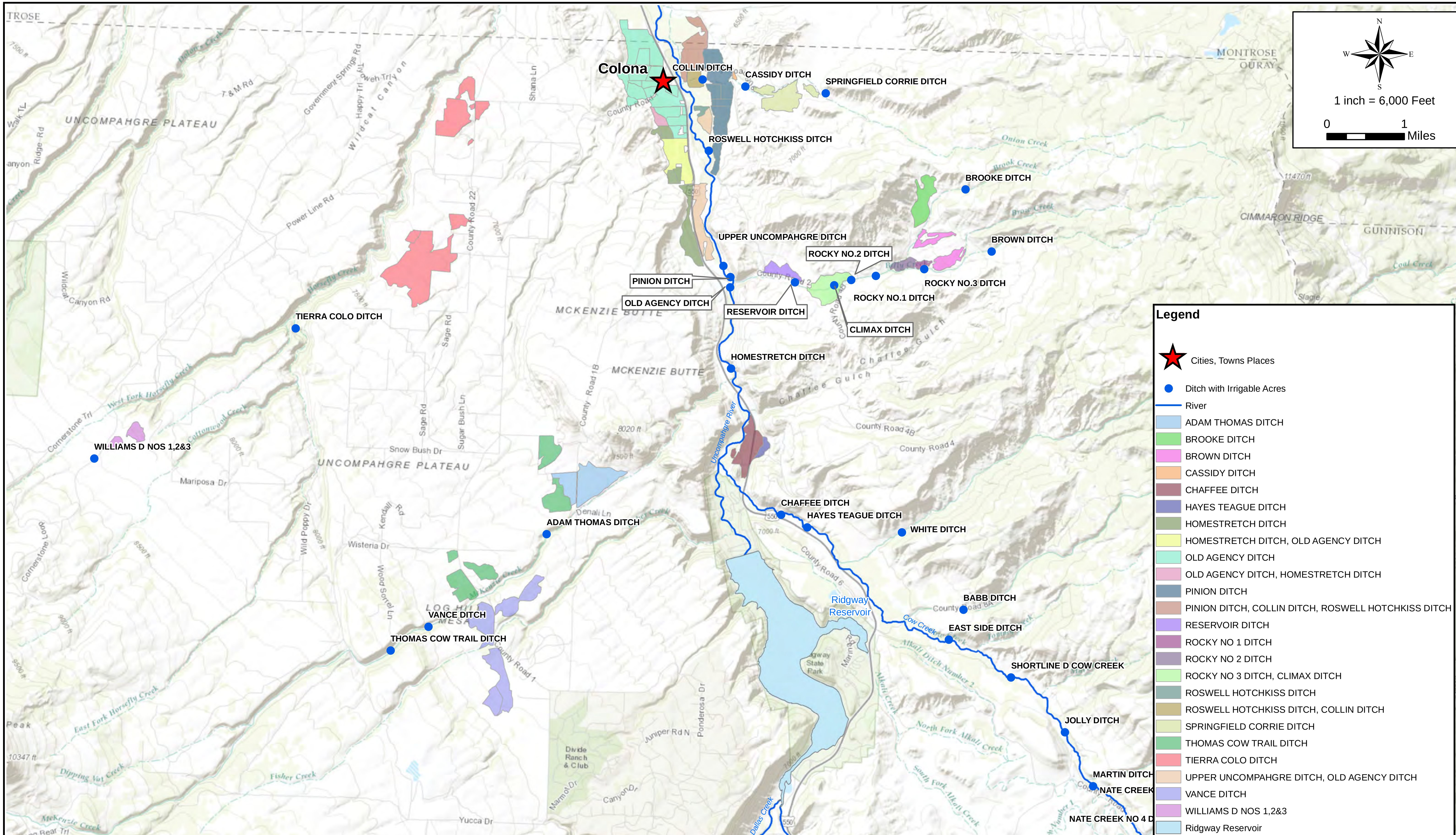
OURAY COUNTY, COLORADO

SELECTED STRUCTURES IN THE UUB

UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO. 151-032.000

Map 2



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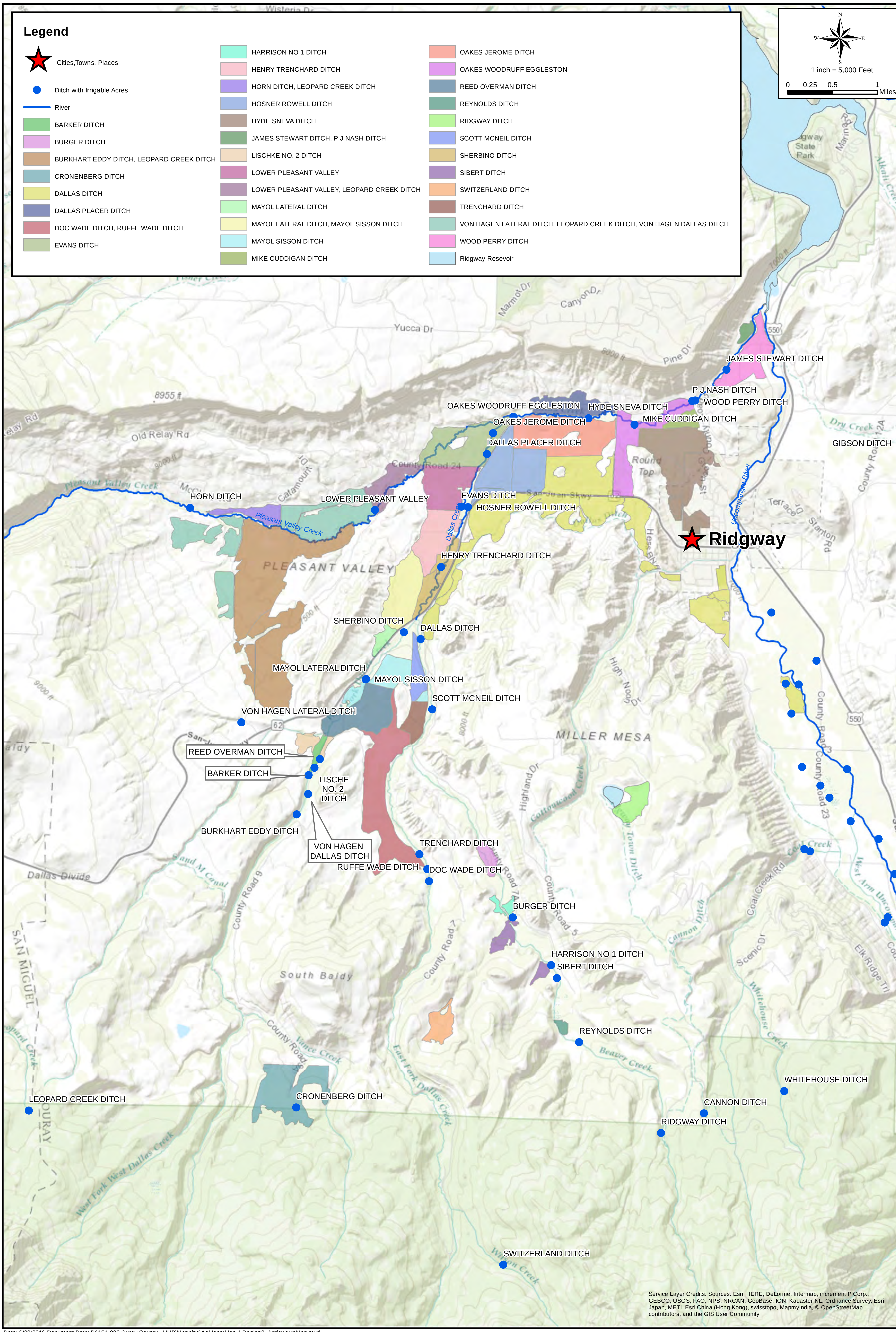
REGION 1- UNCOMPAHGRE RIVER DOWNSTREAM OF RIDGWAY RESEVOIR

UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO. 151-032.000

MAP 3



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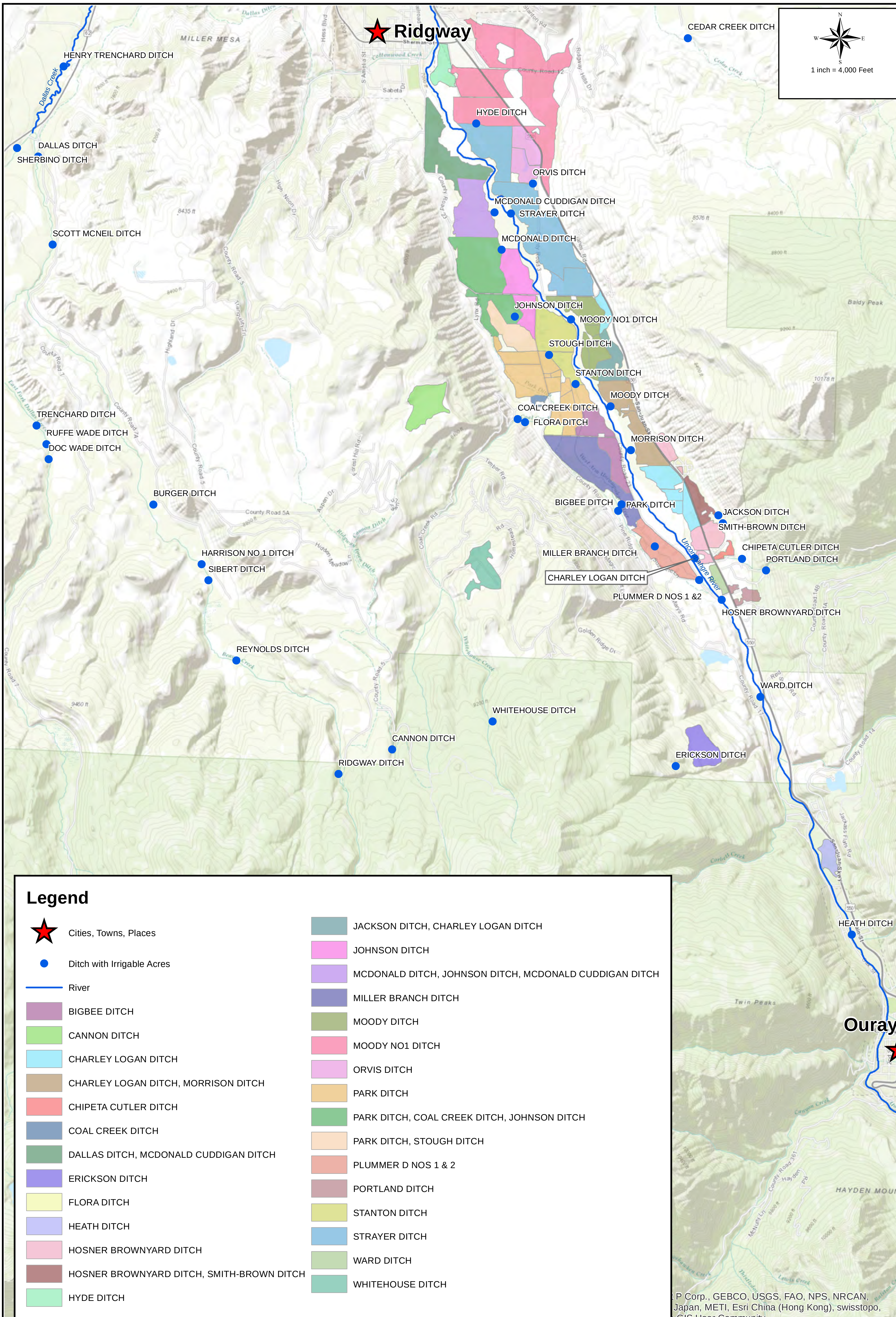
OURAY COUNTY, COLORADO

REGION 2-DALLAS CREEK

UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO.
151-032.000

Map
4



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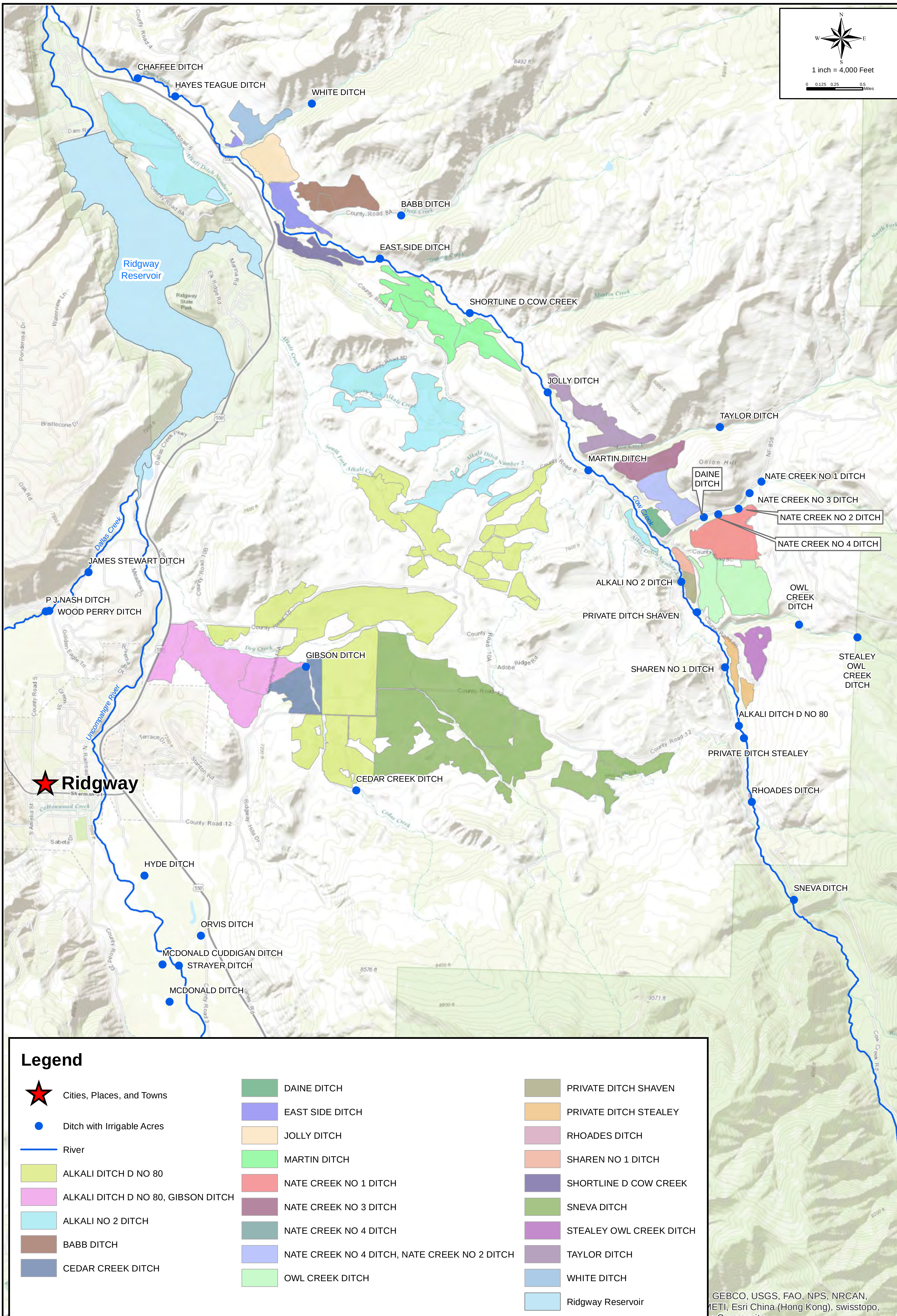
REGION 3-UNCOMPAHGRE RIVER UPSTREAM OF RIDGWAY RESERVOIR

UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO. 151-032.000

MAP 5



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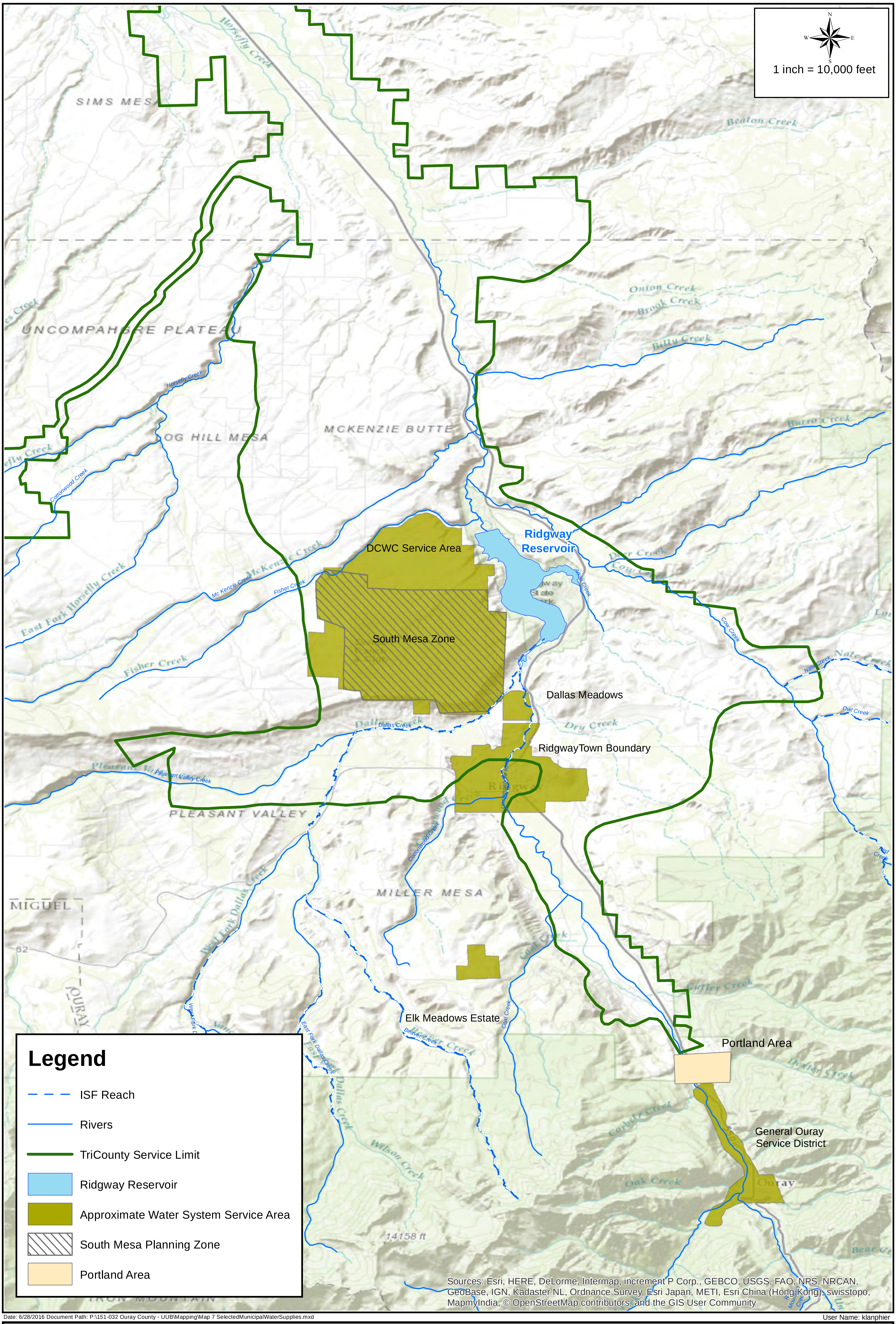
OURAY COUNTY, COLORADO

REGION 4-COW CREEK

UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO. 151-032.000

MAP 6



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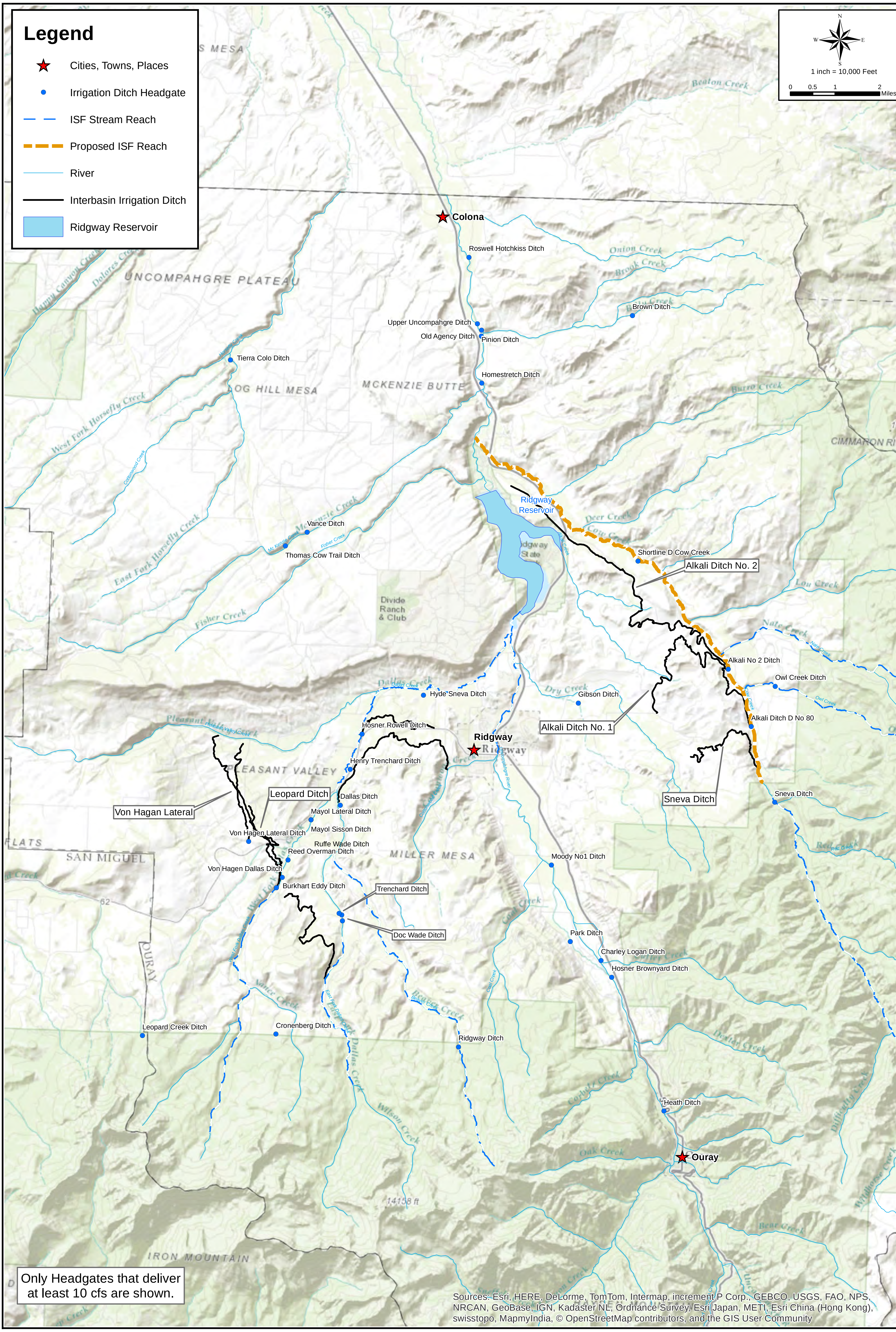
OURAY COUNTY, COLORADO

SELECTED MUNICIPAL WATER SUPPLIERS

OURAY COUNTY

PROJECT NO.
151-032.000

Map
7



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OURAY COUNTY, COLORADO

ENVIRONMENTAL AND RECREATIONAL WATER USES

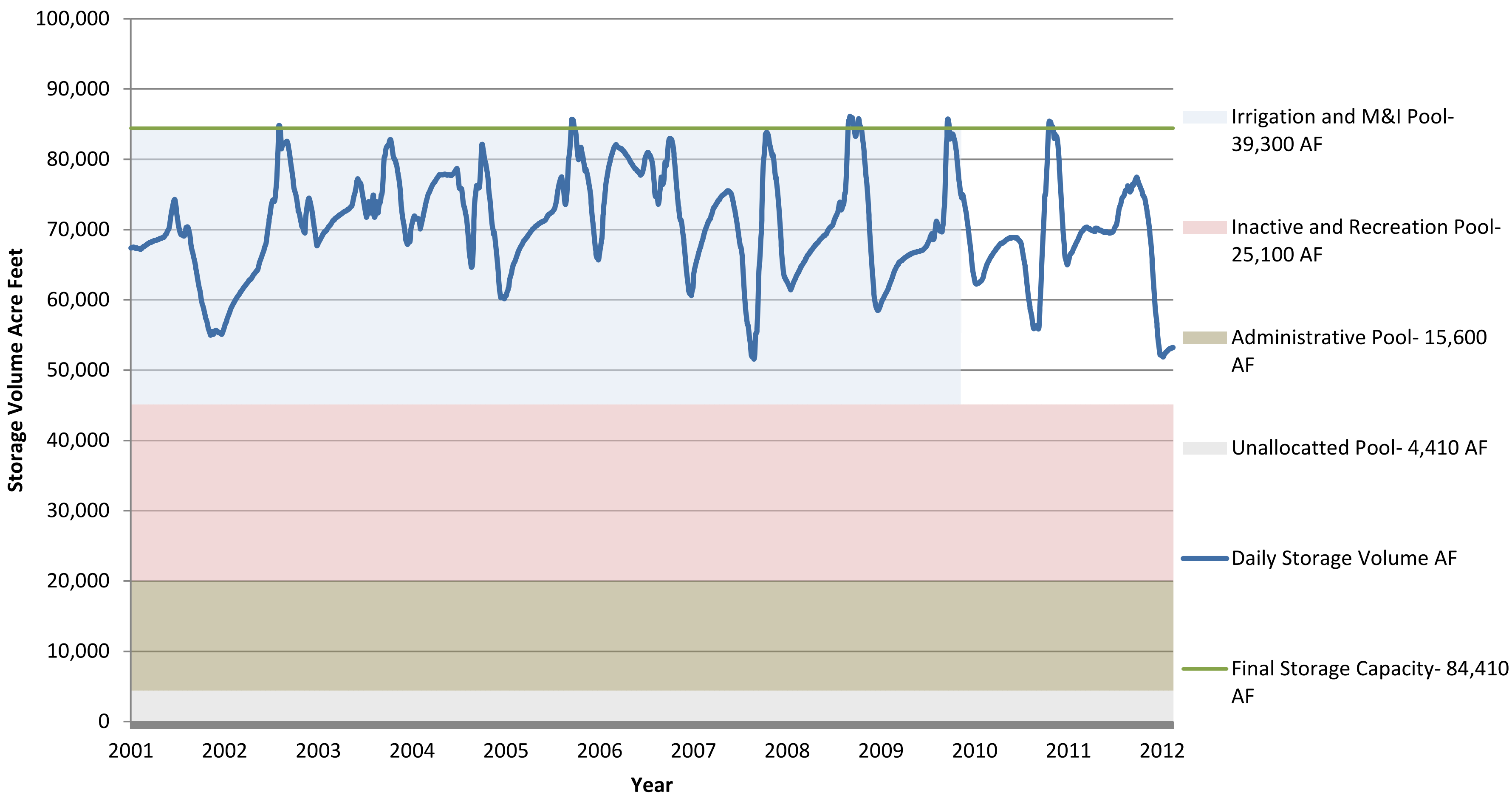
UPPER UNCOMPAHGRE BASIN (OURAY COUNTY)

PROJECT NO. 151-032.000

MAP 8

FIGURES

Figure 1
Daily Storage in Ridgway Reservoir (2001-2012)
Ridgway Reservoir Pools



Source: Tri-County Water Conservancy District 2003 Water Conservation Plan.
Daily Storage Volume proposed by Colorado Division of Water Resources accounting spreadsheets.

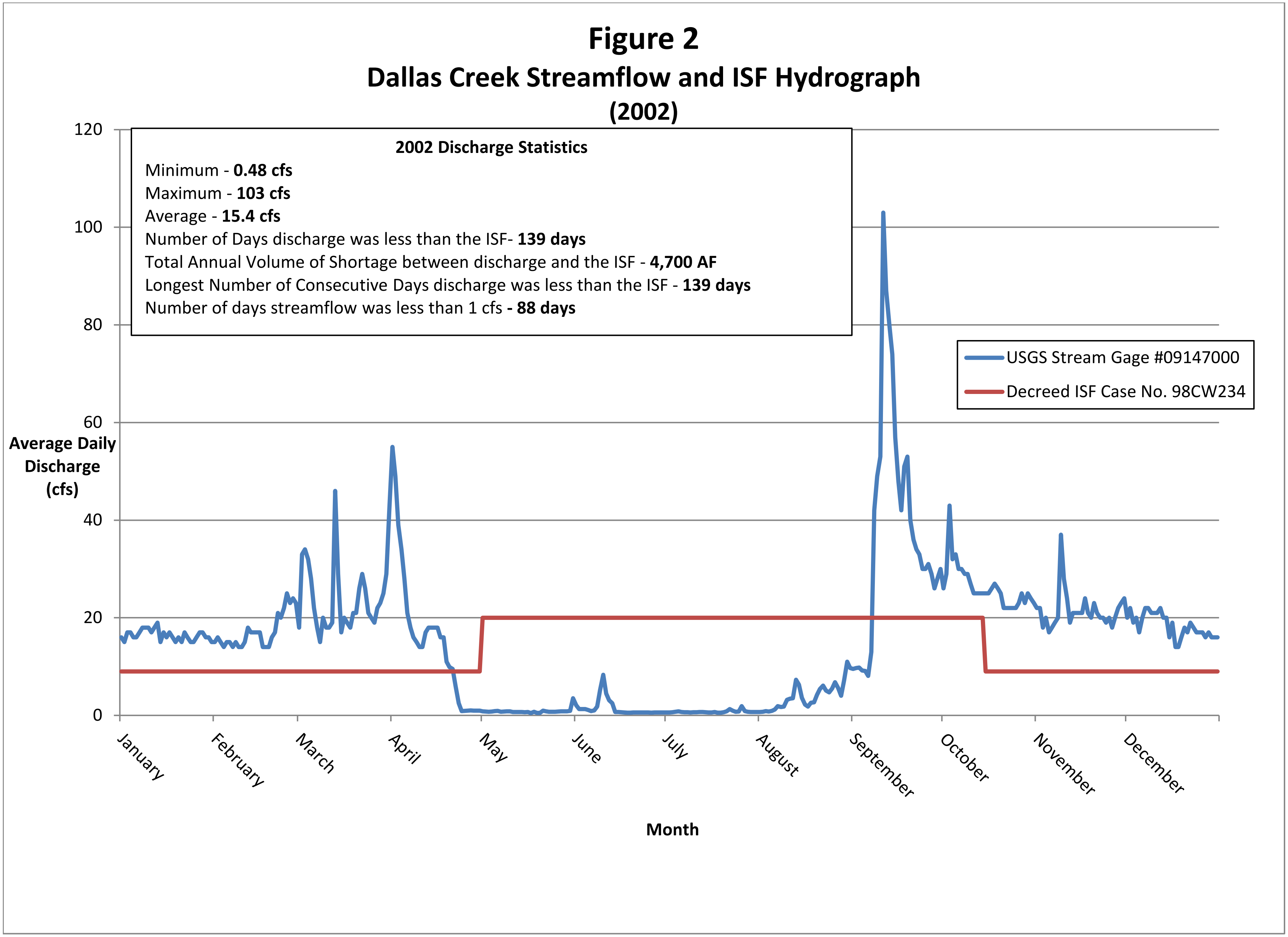
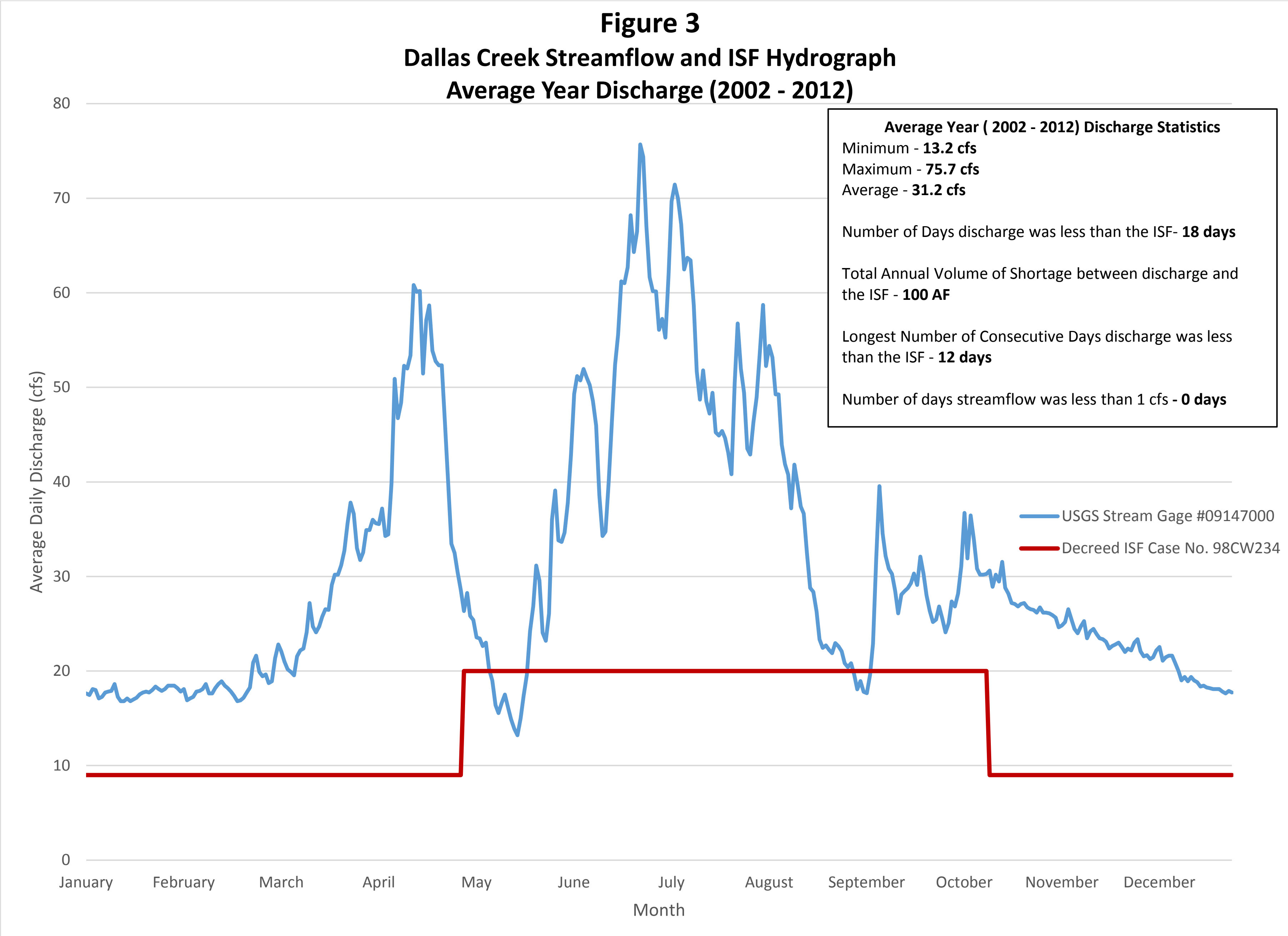


Figure 2
Dallas Creek Streamflow and ISF Hydrograph
(2002)
2002 Discharge Statistics
Minimum - **0.48 cfs**
Maximum - **103 cfs**
Average - **15.4 cfs**
Number of Days discharge was less than the ISF- **139 days**
Total Annual Volume of Shortage between discharge and the ISF - **4,700 AF**
Longest Number of Consecutive Days discharge was less than the ISF - **139 days**
Number of days streamflow was less than 1 cfs **- 88 days**
USGS Stream Gage #09147000
Decreed ISF Case No. 98CW234
Average Daily Discharge (cfs)
0
20
40
60
80
100
120
January
February
March
April
May
June
July
August
September
October
November
December
Month



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Dallas Creek Avg Year Hydrograph Analysis.xlsx

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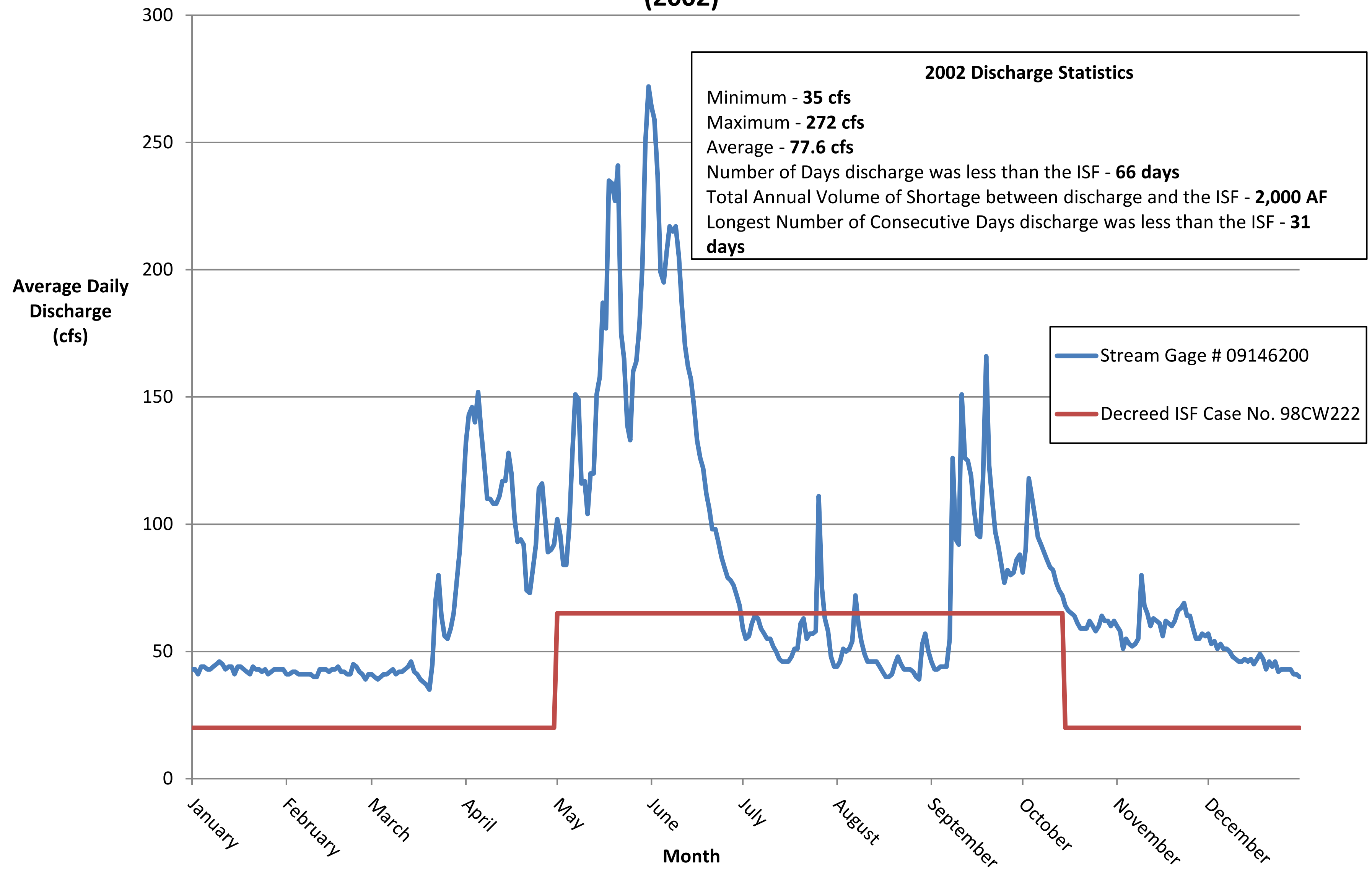
6/23/2016

des by: MCD
ckd by: PRF

Figure 4

Uncompahgre River Streamflow and ISF Hydrograph (2002)



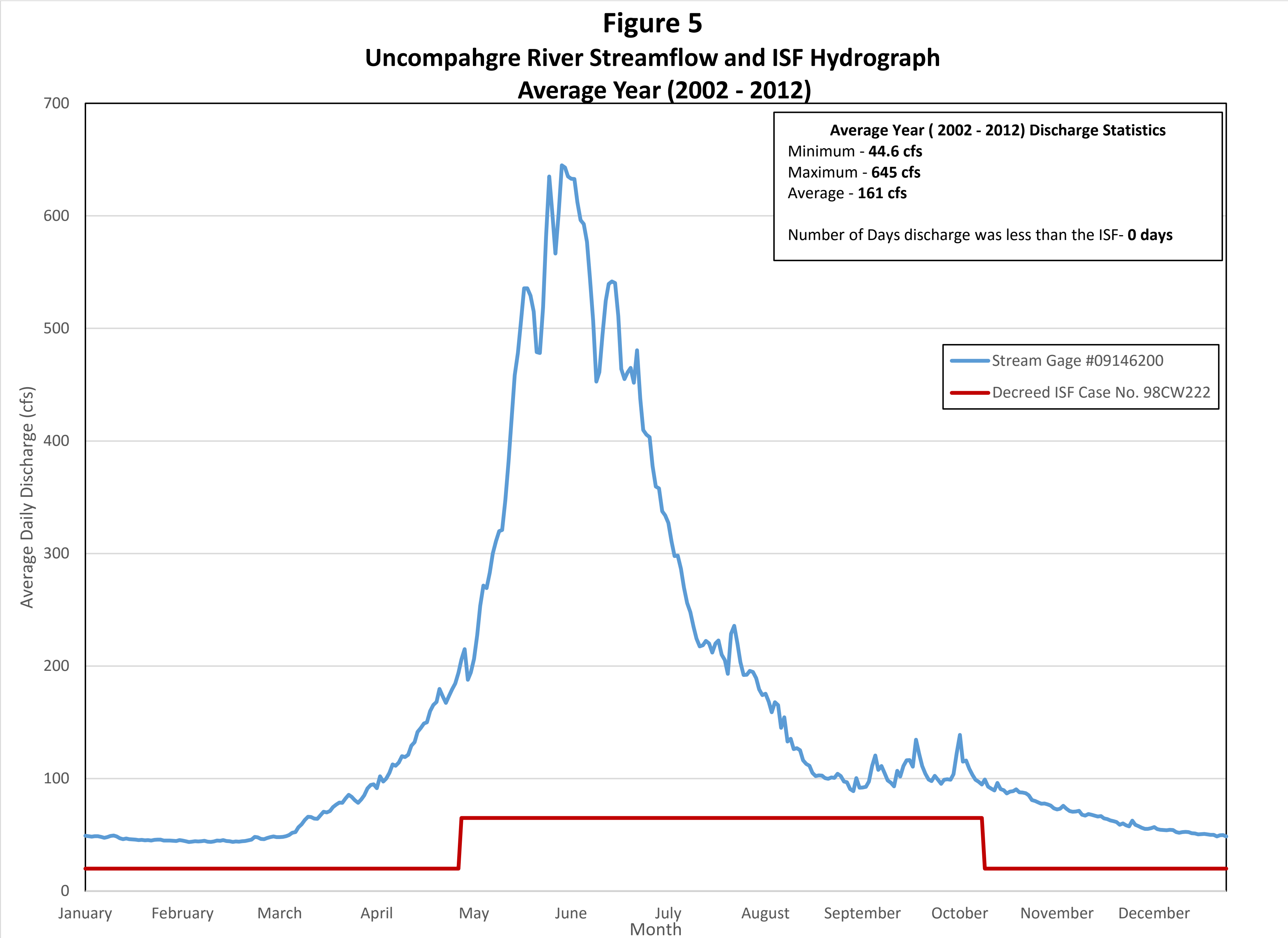
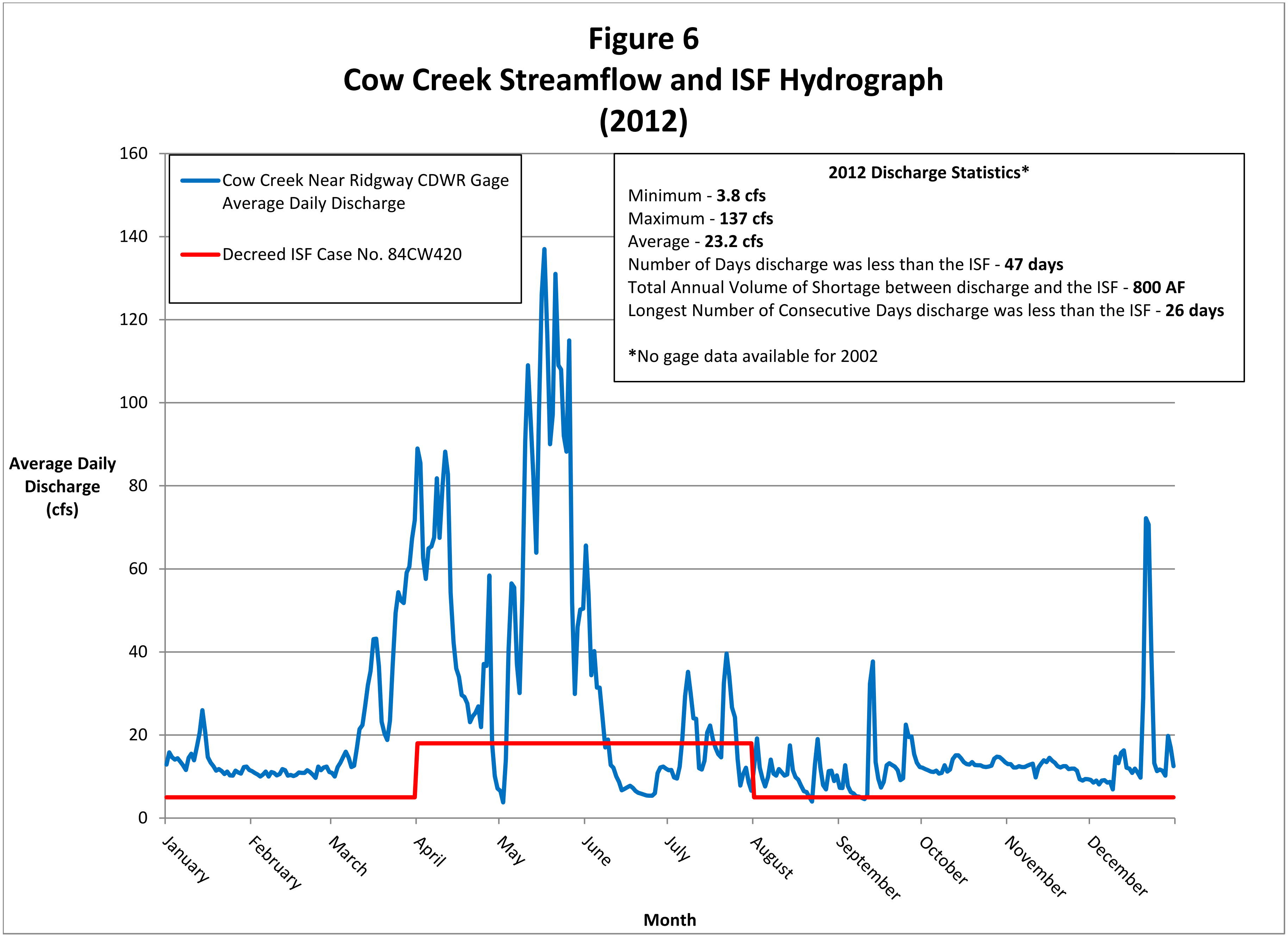


Figure 5
Uncompahgre River Streamflow and ISF Hydrograph
Average Year (2002 - 2012)
Average Year (2002 - 2012) Discharge Statistics
Minimum - 44.6 cfs
Maximum - 645 cfs
Average - 161 cfs
Number of Days discharge was less than the ISF- 0 days
Stream Gage #09146200
Decreed ISF Case No. 98CW222
Average Daily Discharge (cfs)
700
600
500
400
300
200
100
0
January
February
March
April
May
June
July
August
September
October
November
December
Month



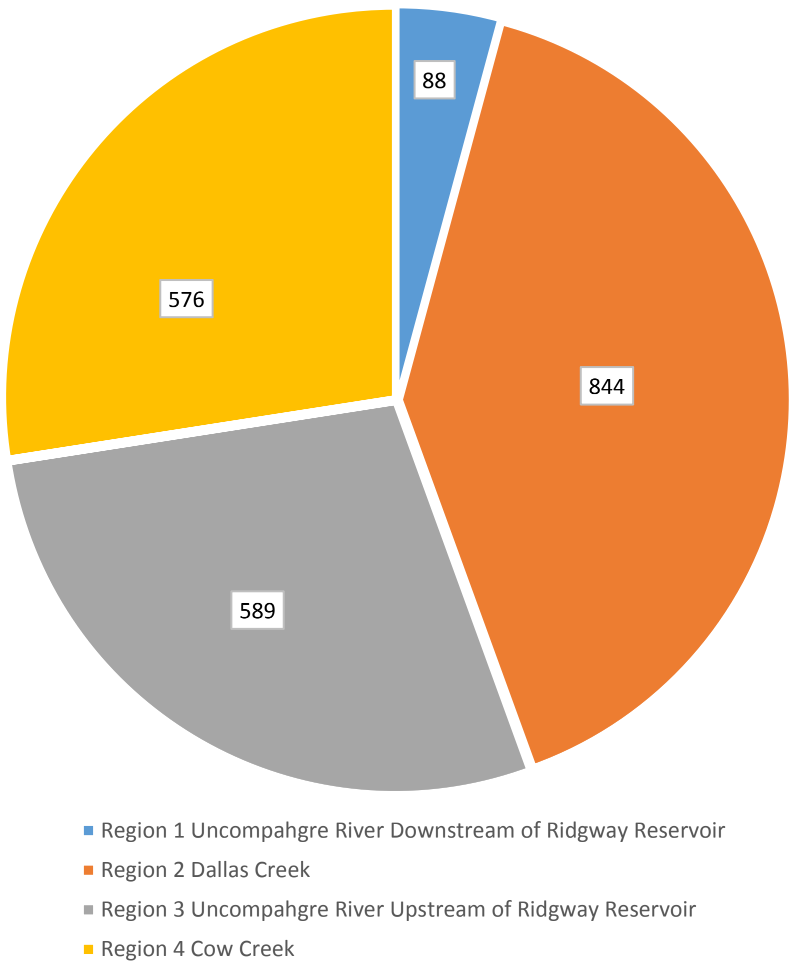
P:\151-032 Ouray County - UUB\Hydrology\CowCrreek StreamFlow Hydrograph.xlsx

WWE
6/28/2016

Des by:KL
Ckd by:PF

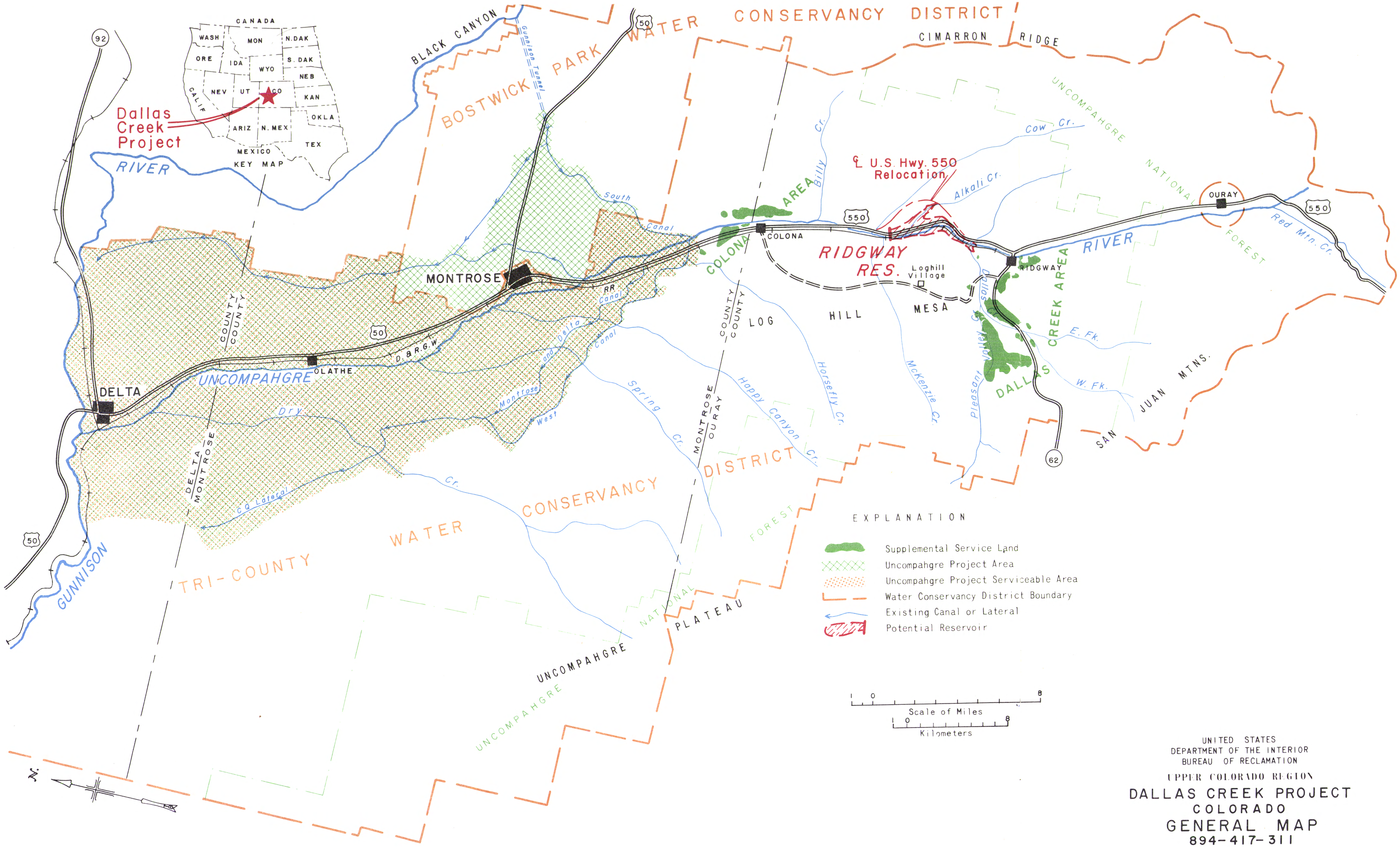
Figure 7
Average Ridgway Reservoir Exchange Potential per Region
AF/ year

Total 2,100 AF



APPENDIX

APPENDIX A



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
UPPER COLORADO REGION

DALLAS CREEK PROJECT
COLORADO
GENERAL MAP
894-417-311
Revised July 1976

CHAPTER V

WATER SUPPLY

Water Requirements

The requirements for municipal and industrial water are discussed in Chapter II. Irrigation diversion requirements estimated for various areas are shown below, along with the water supplies presently available to those areas. Variations by areas result from differences in growing season, soil characteristics, cropping patterns, and other factors.

		Total diversion requirement		Existing supplies		Remaining requirement	
	Acreage	Per acre	Total	Per acre	Total	Per acre	Total
Colona area	750	2.89	2,170	2.65	1,990	0.24	180
Dallas Creek area	2,100	3.35	7,030	2.56	5,390	.79	1,640
Uncompahgre Project							
Serviceable area	61,810	5.46	337,480	5.00	308,920	.46	28,560
Total	64,660		346,680		316,300		30,380

Water Resources

Available supplies

Water supplies in the project area are presently obtained from the Uncompahgre and Gunnison Rivers and their tributaries. Most of the project water supplies would be obtained from the Uncompahgre River, and limited supplies would come from Cow Creek, Pleasant Valley Creek, Dallas Creek, and the East and West Forks of Dallas Creek. Only streamflows in excess of requirements for prior rights and fishery flows were considered to be available for project uses. Project return flows would be insignificant in project operation.

Water quality

The project water supplies would be of good to excellent quality for irrigation. The natural flow of the Uncompahgre River above Ridgway Reservoir site is marginal for municipal and some industrial uses because the water contains relatively high concentrations of dissolved solids and sediment and other pollutants from mining operations or mine drainage in the headwater tributaries. To assure that no water is used for municipal purposes that does not meet Colorado drinking water standards, the Bureau of Reclamation is undertaking an intensive water monitoring program to determine the present quality of the river flows and the effect of reservoir impoundment on that quality. If the monitoring program indicates that the water does not meet drinking water standards of the State of Colorado, the municipal water would be obtained from the South Canal of the Uncompghre Project under an exchange agreement discussed on page 22. The monitoring program would continue until water quality changes due to the reservoir had stabilized and were firmly established. Analyses would be made of water samples collected from the Uncompahgre River and Dallas Creek above the reservoir, Uncomphgre River just below the reservoir, and at various locations and at various water levels within the reservoir. Samples of bottom materials from the reservoir also would be analyzed. Also as a part of the monitoring program, pre- and post-project impoundment studies would be made of aquatic organisms to determine concentrations of heavy metals and toxic substances. Such information would be used in any further consideration given to the establishment of a fishery in the reservoir.

Water Rights

The water rights for the Dallas Creek Project shown on the following page are owned by the Tri-County Water Conservancy District. They include rights for features in the present project plan as well as some features of earlier plans.

In December 1971 the United States of America filed application under Water Case No. W-426, Water Division 4, covering essentially the same features as Civil Action No. C-2710, Decree of September 1971. The United States is asking a priority date of April 11, 1956, and for expanded water use. The proposed uses are irrigation, municipal, domestic, stock watering, industrial, and fish and wildlife protection and propagation. The application of the United States in W-426 is pending in the Water Court of Water Division No. 4 of the State of Colorado. Some amendments in the water rights would be necessary to meet the requirements of the current project plan.

It is estimated that adequate water for the Dallas Creek Project is available to the State of Colorado within the State's entitlement to water of the Colorado River system under the Upper Colorado River Basin Compact of 1948.

Water Utilization

Project operation

The project water supply and methods of operating Ridgway Reservoir were analyzed by means of a simulated project operation made on the

Water rights owned by Tri-County Water Conservancy District

Decree of April 14, 1961, Civil Action No. 2440, conditional water right with appropriation date of November 16, 1956, for irrigation, domestic, municipal and industrial, and flood control uses

	Source	Storage (acre-feet)
Willow Swamp Reservoir	East Dallas Creek	12,736.60
Ridgway Reservoir	Dallas Creek and Uncompahgre River	223,046.14
Ramshorn Reservoir	Red Creek and Cow Creek	25,359.15
Dallas Divide Reservoir	Pleasant Valley Creek	14,089.16

Decree of September 13, 1971, Civil Action No. C-2710, conditional water rights for irrigation, domestic, municipal, industrial, power, stockwater, and other beneficial uses, with the appropriation dates listed

	Source	Date	Storage (acre-feet)
Sneva Reservoir	Cow Creek by Sneva Ditch	2-13-63	823.02
Dallas Divide Reservoir enlargement	Pleasant Valley Creek and Dallas Feeder Canal	2-13-63	3,489.69
			Flow (second-feet)
Dallas Feeder Canal	Branches of East and West Dallas Creeks	2-13-63	150
Log Hill Mesa Canal	Dallas Divide Reservoir	2-13-63	110
Pleasant Valley Canal	Pleasant Valley Creek	2-13-63	25
Sneva Outlet Canal	Sneva Reservoir outlet	2-13-63	25
Cow Creek Feeder Canal	Cow Creek	2-13-63	325
Ridgway Reservoir		2-13-63	
Ridgway Penstock	Ridgway Reservoir	2-13-63	900
Ridgway Pumpstock	Ridgway Penstock	2-13-63	205
McKenzie Canal	Outlet of pumpstock	2-13-63	205
Log Hill Laterals A-L		11-16-65	
and A1-M1	Various drainages	11-16-65	range 5-30

basis of streamflows available over the 19-year period 1952 through 1970. In the study comparisons were made of available water supplies and requirements on a monthly basis.

Surplus flows of the Uncompahgre River and Dallas Creek would normally be accumulated in Ridgway Reservoir from April through June. Releases generally would be made in the summer months for irrigation and throughout the year for municipal and industrial uses. To reduce flood damage downstream, reservoir storage would be evacuated for control of snowmelt floods as the need was indicated by forecasts. In normal years the reservoir would fill or reach its maximum content in June and reach its minimum content the end of September. The reservoir would have an average surface area of 910 acres and an average shoreline of 8.7 miles during the May 15 to September 15 recreation season. The reservoir would have filled in 15 of the 19 years of the study period and would have been drawn down near its dead and inactive capacity of 25,000 acre-feet only once during the period.

Surplus flows of Cow Creek would be used as part of the project water supply in the Uncompahgre River below Ridgway Reservoir. These flows would be available primarily during the spring high runoff period and their use would allow storage water to be retained in Ridgway Reservoir for use when direct flows were not available later in the irrigation season.

Releases from Ridgway Reservoir would be made to meet downstream rights, to provide fishery flows, and to provide project water for irrigation in the Colona and Uncompahgre Project areas and for municipal and industrial purposes in the river valley. Some of the releases to the Uncompahgre River would be made to replace to existing downstream rights the water supplies that would be diverted out of priority from the Dallas Creek system for project irrigation in the Dallas Creek area. Diversions of municipal and industrial supplies above the Montrose and Delta Canal would be limited to an average of 5,100 acre-feet in order that adequate flows for fish would be available in the river. Minimum flows to be maintained for fish in accordance with recommendations of the Fish and Wildlife Service are discussed on page 57.

The table on the following page summarizes the water operations for the project.

Summary of project supplies

Based on simulated operation of the project over the 1952-70 study period, about 28,100 acre-feet of the project supply would be developed for municipal and industrial use, 11,200 acre-feet for irrigation use, and 100 acre-feet for use at project recreation areas. Approximately 900 acre-feet of the irrigation supply would be provided to supplemental service lands in the Dallas Creek and Colona areas and 10,300 acre-feet to the Uncompahgre Project Serviceable area.

Summary of project water supply
(Unit--1,000 acre-feet)

Year	Dallas Creek area irrigation from local sources[1/]	Munici-pal sup-ply from direct flow of Cow Creek	Ridgway Reservoir operation: Inflow from Uncompahgre River[2/]	Fishery bypasses	Down-stream rights	Supplemental irrigation supply: Colona area	Supplemental irrigation supply: Uncompahgre Project Service-able area	Municipal and industrial supply: Total supply	Municipal and industrial supply: Required for use at or below Mont-trose and Delta Canal	Municipal and industrial supply: Available for diver-sion at other points	Total by-passes and releases	Use at recrea-tional areas	Evapo-ration	Spills	End-of-year content	Total pro: Irri-gation	Total pro: Municipal and indu trial us
1952	0.9	2.0	182.8	8.1	65.9	0.1	4.5	26.1	21.0	5.1	104.7	0.1	2.0	21.7	79.9	5.5	28.1
1953	1.7	1.1	116.4	5.6	53.8	.2	12.9	27.0	21.9	5.1	99.5	.1	2.2	36.9	58.3	14.8	28.1
1954	.5		80.9	7.0	42.4	.1	15.4	28.1	23.0	5.1	93.0	.1	1.9		44.8	16.0	28.1
1955	1.4	.4	93.3	4.2	51.0	.6	15.4	27.7	22.6	5.1	98.9	.1	1.7		37.7	17.4	28.1
1956	.9	.1	95.7	4.5	57.7	.5	15.4	28.0	22.9	5.1	106.1	.1	1.4		26.2	16.8	28.1
1957	.3	5.2	232.9	7.3	16.0	.2		22.9	17.8	5.1	46.4	.1	1.8	131.2	80.0	.5	28.1
1958	1.1	1.3	215.8	6.8	66.0	.4	15.4	26.8	21.7	5.1	115.4	.1	2.4	119.8	59.0	16.9	28.1
1959	1.1		111.0	5.3	60.6	.3	15.4	28.1	23.0	5.1	109.7	.1	2.1		58.7	16.8	28.1
1960	1.3	2.0	131.1	7.1	63.1	.5	15.4	26.1	21.0	5.1	112.2	.1	2.2	21.1	54.9	17.2	28.1
1961	.7	.9	131.4	5.4	45.3	.2	15.4	27.2	22.1	5.1	93.5	.1	2.3	19.4	71.8	16.3	28.1
1962	.4	2.1	144.2	7.2	55.3		11.3	26.0	20.9	5.1	99.8	.1	2.3	44.8	69.8	11.7	28.1
1963	.4		100.3	7.6	57.8		15.4	28.1	23.0	5.1	108.9	.1	2.1	3.6	56.0	15.8	28.1
1964	.2		139.1	6.3	35.0		9.1	28.1	23.0	5.1	78.5	.1	2.3	34.8	80.0	9.3	28.1
1965	.4	5.1	195.4	9.0	18.5			23.0	17.9	5.1	50.5	.1	2.4	143.2	80.0	.4	28.1
1966	1.3	1.3	118.5	6.0	58.7	.2	15.4	26.8	21.7	5.1	107.1	.1	2.4	33.3	56.5	16.9	28.1
1967	.2		105.0	8.2	32.6		11.7	28.1	23.0	5.1	80.6	.1	2.2	6.3	72.9	11.9	28.1
1968	.5	1.2	145.5	7.4	33.4		.8	26.9	21.8	5.1	68.5	.1	2.3	69.3	78.9	1.3	28.1
1969	.2	.5	139.6	7.3	37.2		6.6	27.6	22.5	5.1	78.7	.1	2.4	58.1	80.0	6.8	28.1
1970	.2	5.9	171.6	9.2	25.8			22.2	17.1	5.1	57.2	.1	2.4	112.7	80.0	.2	28.1
Total	13.7	29.1	2,650.5	129.5	876.1	3.3	195.5	504.8	407.9	96.9	1,709.2	1.9	40.8	856.2		212.5	533.9
Average	.7	1.5	139.5	6.8	46.1	.2	10.3	26.6	21.5	5.1	90.0	.1	2.1	45.1		11.2	28.1

1/ Includes flows from East and West Forks of Dallas Creek, Dallas Creek, and Pleasant Valley Creek.
2/ Reduced by project depletions above reservoir.

The municipal and industrial water supplies and the water supply for recreation use would be provided each year without shortage. Supplemental irrigation supplies to the Colona area would offset all shortages in that area. Shortages in irrigation supplies would occur in the Dallas Creek and Uncompahgre Project Serviceable areas. In the simulated project operation, irrigation supplies met about 87 percent of the total estimated requirements in the Dallas Creek area and about 95 percent of the total estimated requirements in the Uncompahgre Project Serviceable area. During the 19-year study period, shortages occurred during 18 years in the Dallas Creek area. Shortages in the Uncompahgre Project area occurred during 7 years of the study period because of limitations in water supplies from the Dallas Creek Project and during all years because of the limitations of the Uncompahgre Project's distribution system. The largest shortages under project conditions were 35 percent in 1956 in the Dallas Creek area and 15.8 percent in 1954 in the Uncompahgre Project area.

Effects of Project on Colorado River System

Return flows and salt loads

Of the total supply diverted for project use, approximately 23,900 acre-feet is expected to return to local stream channels and ultimately to the Uncompahgre, Gunnison, and Colorado Rivers. Most of the returns would be from water for municipal use, with smaller amounts from small industrial uses and irrigation.

The quantities of return flow from municipal use have been estimated at about 65 percent of the supply diverted, while returns from industries are estimated at about 55 percent of the supply diverted. The return flows from the supplemental service lands in the Dallas Creek and Colona areas would contain a large amount of surface runoff. The returns would amount to about 48 percent of the project water applied and the salinity concentration would be comparatively low. The return flows from irrigation on the Uncompahgre Project would be about 55 percent of the supply diverted because of the low supplemental requirement over such a large area. The salinity concentration would be comparatively high.

The salt content of the water diverted for project use would range from 154 to 370 milligrams per liter (mg/l). The salt content of the return flows, including the salt content of the application water and the salt pickup from project use, would range from a low of 370 mg/l from use at the Ridgway recreation areas to a high of 1,910 mg/l for return flows from irrigation on Uncompahgre Project lands. It is estimated that approximately 19,600 tons of salt would be removed from the river annually by project diversions while about 29,400 tons of salt would enter the stream system in return flows as a result of project operation. As a result the salt load of the Colorado River would be increased by an average of 9,800 tons annually. The table on page 43 shows the anticipated quantity and quality of project diversions and of return flows.

Stream depletions

The Dallas Creek Project would deplete the flow of the Colorado River by an estimated average of 17,100 acre-feet annually. Estimates of depletions by project purpose are shown below.

Purpose	Consumptive use	Share of reservoir evaporation	Total
Municipal use	7,900	200	8,100
Industrial use	2,500	100	2,600
Irrigation	5,100	400	5,500
Recreation pool		900	900
Total	15,500	1,600	17,100

Changes in salinity concentrations

Estimates have been made of the project's effects on the salinity of the Colorado River. The salinity of the river at Imperial Dam would be increased by an estimated 0.9 mg/l as a result of the increase in salt load and by 1.8 mg/l as a result of the concentrating effect of stream depletions. The total salinity concentration at Imperial Dam, which was 879 mg/l in 1972, would be increased by 0.1 percent as a result of the salt loading and by 0.2 percent as a result of the stream depletions.

The estimated effects of the project on the salinity of the Colorado River are based on the Bureau of Reclamation's report of January 1973, entitled Quality of Water, Colorado River, Progress Report No. 6. This report shows modifications of the stream conditions made to December 1970. The conditions were further modified to reflect the impacts of all developments constructed since 1970 or currently under construction. The salinity increases from the Dallas Creek Project were then computed as if the project were the next development constructed.

Annual water use and salt load of return flows

Project use	Source	Diversion: Quantity (acre-feet)	Diversion: Quality[1] (mg/l)	Diversion: Salt removed[2] (tons)	Return flow: Quantity (acre-feet)	Return flow: Quality[1] (mg/l)	Return flow: Salt returned[2] (tons)	Project depletion (acre-feet)	Increase in salt load (tons)	Salinity increase at Imperial Dam (mg/l): Depletion	Salinity increase at Imperial Dam (mg/l): Salt load
Municipal use	Ridgway Reservoir	22,600	370	11,400	14,700	570	11,400	7,900		0.8	
Industrial use	Ridgway Reservoir	5,500	370	2,800	3,000	690	2,800	2,500		.3	
Irrigation											
Dallas Creek area	Pleasant Valley Creek, Dallas Creek, and Forks	700	145	100	300	600	300	400	200		
Colona area	Ridgway Reservoir	200	370	100	100	1,000	100	100			
Uncompahgre Project											
Serviceable area	Ridgway Reservoir	10,300	370	5,200	[3]5,700	1,910	14,800	4,600	9,600	.5	0.9
Subtotal--irrigation		11,200		5,400	6,100		15,200	5,100	9,800	.5	.9
Recreation	Ridgway Reservoir	100	370		100	370					
Reservoir evaporation	Ridgway Reservoir	1,600						1,600		.2	
Total project use		[4]41,000		19,600	23,900		29,400	17,100	9,800	1.8	.9

1/ Rounded to the nearest 5 mg/l. The figures include the concentrating effects of reservoir evaporation.
2/ Rounded to the nearest 100 tons.
3/ Comprised of 2,800 acre-feet of deep percolation return flow at 3,470 mg/l and 2,860 acre-feet of surface flow of 410 mg/l. The total has been rounded to 5,700 acre-feet.
4/ Beneficial project uses would consume 39,400 acre-feet of the total.

APPENDIX B

Appendix B
CWCB Instream Flow Program Options
Upper Uncompahgre Basin (Ouray County)

ISF Option	Water Court Required?	Short Term, Long Term, or Permanent	Notes
Permanent Transaction	Yes	Permanent	Historical use must be ceased to free up water right for ISF use.
Long-Term Lease	Yes	Long Term	Historical use must be ceased to free up water right for ISF use.
Temporary Transfer (3-in-10 Lease)	No	Short Term	Can be used 120 days in a calendar year, and only 3 years over a 10-year period. Future consumptive use analyses exclude years where right was used for ISF.
Substitute Water Supply Plan (SWSP)	No	Short Term	Approval is for 1 year, cannot renew past 5 years.
Interruptible Water Supply Agreement (IWSA)	No	Short Term	Can transfer a portion of a consumptive use to ISF, upon showing non-injury. Only 2 renewals allowed. Term is a 10-year period.
Trust Agreement	Yes	Long Term	Can retain ownership of rights, and remove the water rights for other uses in the future.
Split-Season Agreement	Yes	Short Term	Allows for a partial season dry up of fields, where the CWCB could contract for ISF water for part of an irrigation season.
Use of an ISF Augmentation Plan	Yes	Long Term	Water right needs to have an augmentation use.
Senate Bill 19 Conservation Plan	No	Long Term	Approval is by a State Agency, water conservation district, water district, water authority, or formal written ordinance.
Non-Diversion Agreement	No	Short Term or Long Term	Is most successful based on the location of distance between non-diverted right and next senior right.
Undecreed Reservoir Release	No	Short Term or Long Term	May have storage implications for the following season.

Sources: 1. Discussions between Wright Water Engineers (WWE) and Colorado Water Conservation Board (CWCB)

2. CWCB Website http://cwcb.state.co.us/Pages/CWCBHome.aspx accessed July 2015

3. Colorado Water Trust Website http://www.coloradowatertrust.org/ accessed July 2015

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