

Hydrogeological Investigation of the Town of Paonia's Water Supply

PREPARED FOR TOWN OF PAONIA



October 2025

241-019.000

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Hydrogeological Investigation of the Town of Paonia's Water Supply

1.0 EXECUTIVE SUMMARY

Wright Water Engineers, Inc. (WWE) performed a hydrogeologic investigation of the springs representing the Town of Paonia's (Town) municipal water supply. The investigation involved field observations with Town personnel and consultants; background research of the hydrogeologic setting and previous engineering studies performed on behalf of the Town; installation of pressure transducers at select locations to collect flow data; development of a hydrologic model; review of the water rights; and geophysics survey of key spring areas.

The site visits with Town staff and RESPEC enabled WWE to better understand the spring collection system and what springs are able to deliver water to the operational Upper Treatment Plant. The existing spring collection boxes were observed to bypass excessive flows during the spring runoff due to lack of pipeline capacity and no raw water storage. Access was also identified as a key limiting factor to methods that could be used to further develop the springs to enhance the Town's water supply.

The hydrogeologic setting of the Town's springs is shaped by diverse geologic units and structural features. These springs, located on mid-elevation slopes, are associated with landslide complexes, rock glaciers, alluvial fans, and the Mancos Shale, and include bedrock/fracture-controlled springs, contact springs at the gravel/shale interface, and gravity springs. The springs are primarily recharged by snowmelt from nearby mountains, with additional potential storage in bedrock fractures. Consequently, spring flows vary seasonally, increasing during snowmelt and declining in late summer and drought periods which highlights the limited capture of peak spring flows and vulnerability to reduced flows during baseflow and drought conditions.

Working with RESPEC and Town staff, pressure transducers were installed at select locations to obtain some flow data of the individual springs collection systems. WWE processed the data and converted it to flow estimates based upon schematics and dimensions of the control structures provided by RESPEC. These data were being collected through September 2025 to provide the most complete data set for analysis.

WWE developed a hydrologic spreadsheet model using both publicly available data and data collected from the Town's spring-collection system and the Upper Plant in order to understand the water balance in the watersheds feeding the spring complexes. The spreadsheet model highlighted the complexities of defining the contributing drainage area of spring flow and that there may be additional physical supplies that can be developed beyond what is currently being captured. In addition, the flow measurements at the sources compared to those at the Upper Treatment Plant indicated that there are potentially significant transit losses or spills in the system.

The water rights task was initially thought to be a simple documentation of the previous studies performed on behalf of the Town. However, it became clear when prioritizing the springs for further study, that the legal availability of the water was just as important as the physical availability of the supply. This realization enabled WWE to focus on the German Creek Springs Collection System and the Old Original/Reynolds Creek Springs as high priority locations due to the senior water rights and relatively higher flow rates.

The 2DR geophysical survey conducted at selected spring sites on Mount Lamborn revealed complex subsurface hydrogeologic conditions, confirming the presence of gravity, contact, and fracture springs—sometimes in combination. WWE's interpretations suggest that there may be opportunities to capture additional shallow groundwater from zones of potential groundwater yield near the existing spring collection systems. The survey identified potential nearby areas with shallow subsurface flow, particularly at Lower German Creek. However, access challenges and infrastructure limitations (e.g., lack of power for pumps) may hinder deeper groundwater exploration. Future efforts should focus on verifying these findings through targeted shallow excavation and evaluating improvements to existing collection systems.

2.0 INTRODUCTION AND PURPOSE

WWE prepared this report in completion of the first phase of a hydrogeological investigation of the Town's water supply. This report summarizes data and evaluates information obtained to date to advance understanding of available and developed quantities of water in sub-basins tributary to the Town's spring-water collection system. The report identifies potential opportunities to gain additional knowledge to enhance and potentially expand the current system to bolster the Town's water supply for the future.

2.1 Introduction

The Town receives the entirety of its water supply from a series of groundwater spring complexes located on the mountainside of Mount Lamborn upstream of the Town. Water is diverted from the mountainside by several spring collection manholes (a.k.a. spring boxes) and transported to the Town's water treatment facility via a system of gravity-fed pipes. In 2019, the Town experienced an interruption to its water supply from a cluster of system failures that resulted in a 23-day period where the Town was left without water. As a result, the Town voted to place a moratorium on tap sales until a plan for water utility improvements could be implemented.

Since the 2019 shortfall, the Town has been actively working to develop such a plan for water system improvements. The Town enlisted RESPEC to conduct a preliminary study on the existing water system. The study, completed in 2021, identified an issue in the existing water system that required remediation. The study also recommended that the Town optimize spring water capture and its transmission to the treatment facilities.

The Town is now working to implement a capital improvement plan with the objective of redeveloping the spring complexes, addressing water loss between the springs and service taps, replacing aging infrastructure, and increasing water storage to accommodate future growth and fire-flow needs. During the planning process, the Town identified the need for an investigation of the hydrogeology of the spring complexes to develop an appropriate plan to redevelop or improve the spring-collection system.

As a result, in late 2023 the Town solicited proposals from qualified engineers and corporations to perform the investigation. WWE was ultimately selected to conduct the work following the competitive bidding process.

2.2 Purpose

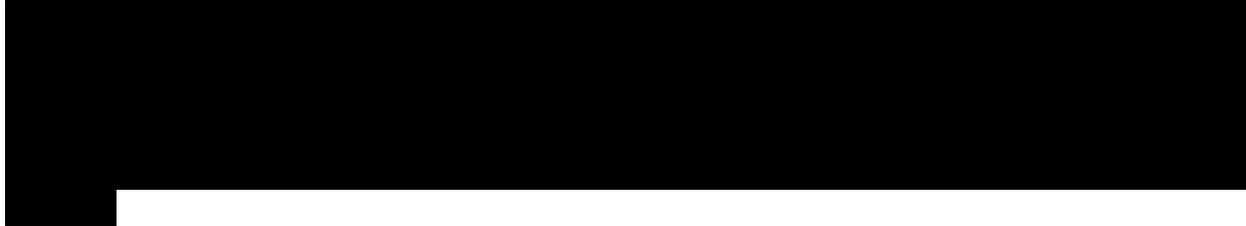
The purpose of this hydrogeological investigation was to assist the Town in better understanding the characteristics of the aquifers and water-bearing systems that are the source for the springs that constitute the Town's water supply. This report is intended to inform future recommendations and strategies for potential improvement projects. Completion of this hydrogeological investigation will also aid in satisfying requirements to lift the moratorium on taps.

This hydrogeological investigation specifically identifies the locations of the springs and evaluates subsurface conditions adjacent to the springs, flow data at the spring collection boxes, and spring water rights to identify where infrastructure improvements can be implemented with maximum benefit to the Town's water supply. Additionally, stakeholders can use the data to develop a better understanding of additional water supply challenges that the Town may face due to climate change.

3.0 BACKGROUND

3.1 Paonia Water Supply and Water System

The Town's water system supplies water to taps located within the Town boundaries and additional taps located outside of the Town boundaries. The Town's Public Water System ID (PWSID) is CO0115601. Water is collected from at least 13 spring complexes. The water from these complexes is classified as Groundwater Under the Direct Influence of Surface Water (Groundwater UDI), according to the 2025 Drinking Water Quality Report. The Town has more than 20 miles of raw water supply pipelines that were designed to transport water from the springs to the Town's two water treatment plants (WTPs): the Upper



3.2 Previous Studies

Several historical studies relevant to the Town's water supply have been conducted in the past 35 years. In 1994, Minion Hydrologic performed an analysis of the Town's water rights in order to understand the Town's available legal water supply. The analysis identified the need for additional clarification of decreed amounts and ownership of several water rights. In addition, the analysis recommended a review of specific locations in the Town's water rights and potential corrections of spring or spring reach locations within the decrees.

Following the 1994 water rights analysis, Consolidated Consulting Services conducted a 1995 reconnaissance assessment of the Town's raw water supply to address the Town's concerns regarding inadequate water supply during extended periods of drought. The assessment identified and evaluated options to increase the Town's raw water supply while considering long-term costs as well as political, social, and environmental impacts. The alternatives evaluated included no action, development of additional raw water storage, purchase of water from existing institutions, groundwater development, and implementation of conservation measures for the existing water supply. The report ultimately recommended that the Town continue to evaluate long-term solutions based on the identification of several promising alternatives.

In 2000, GEI Consultants, Inc. (GEI) presented a draft comprehensive water supply study for the Town. The draft study concluded that the standby taps had the potential to stress the Town's water supply during periods of drought if they were brought online. The draft study also concluded that the Town would benefit from increased storage capacity to capture and store the quantities of water currently spilled from (or bypassed by) the system and presented several storage alternatives for consideration.

W.W. Wheeler and Associates provided an updated comprehensive water supply study for the Town in 2004. That study estimated the Town's firm water yield and performed a water demand analysis, which estimated current and projected water demand based both on 1999/2000 water demand and population growth estimates. The analysis found that the Town's current firm yield would not be able to meet future demands under both the low and high average annual population growth projection scenarios. The study

also identified that the firm yield could result in temporary water shortages during dry years without aggressive conservation practices. The report recommended that the Town focus on reducing system losses and developing carryover storage for water spilled or bypassed in the collection system, as well as implementing a more aggressive water rate structure.

Two additional projects were completed in 2010, including a source water protection plan, developed by the Colorado Rural Water Association, and a 2010 Upper Reynolds Rehabilitation project, performed by Directed Drilling Technologies. The rehabilitation project involved the construction and installation of two horizontally drilled wells at Upper Reynolds Springs 3 and 4 (also referred to as Spore Spring).

In 2021, RESPEC provided a draft report addressing the 2019 water system failure, where they provided a set of recommendations to address the Town's water treatment and storage facilities. The report also provided recommendations for improving the Town's understanding of the raw water supply, including metering of raw water inflows and a study to understand the uncertainty of the long-term sustainability and capacity of the Town's spring sources, as well as the hydrogeology investigation presented in this report.

These previous studies highlighted the seasonality of the Town's spring water supply, which sees increased yields in the spring and summer during the spring runoff and lower yields in the late summer to winter months after the spring runoff has subsided. The Town's in-house water demand fluctuates less. During the spring runoff, the springs produce more water than the Town can capture, with spring water spilling from the collection system back into the respective drainages. After spring runoff, the spring water yields are less certain to meet the Town's demands, particularly during periods of drought. This hydrogeological investigation is meant to increase the Town's understanding of the hydrogeologic conditions of the springs and to identify where the Town may be capable of increasing their firm yield at existing spring locations.

3.3 Geography

The Town has a current population of approximately 1,450 people. The Town is located off of Colorado state highway 133 in Delta County in western Colorado, at the confluence of the North Fork Gunnison River (North Fork) and Minnesota Creek. The Town is located in the North Fork river valley at an approximate elevation of 5,680 feet above mean sea level (ft msl). Near the Town are a series of gravel-topped mesas both to the northwest and the southeast of the North Fork, with the West Elk Mountains located beyond the mesas to the east and southeast of the Town. Mount Lamborn and Landsend Peak to the southwest of the Town are the nearest topographic highs, reaching elevations of 10,806 and 11,396 ft msl, respectively. [REDACTED]

The Town's climate is cool and dry, with low levels of humidity, a high percentage of annual sunshine, and relatively mild winters (https://climate.colostate.edu/climate_long.html). The majority of the annual precipitation in this region occurs as snow in the winter months. These favorable climate conditions support the successful cultivation of fruit trees and other crops, making agriculture a key component of the local economy. As a result, a substantial network of irrigation ditches and canals with complex water rights exists in the North Fork valley. Native vegetation in this area is comprised largely of mixed conifer and aspen forests and Gambel oak shrublands (<https://coloradostateparks.net/parks/paonia/nature>).

The Town is surrounded by large tracts of public lands, primarily managed by the United States Forest Service (USFS) and the Bureau of Land Management (BLM), as shown in Figure 1. As also represented on this figure,

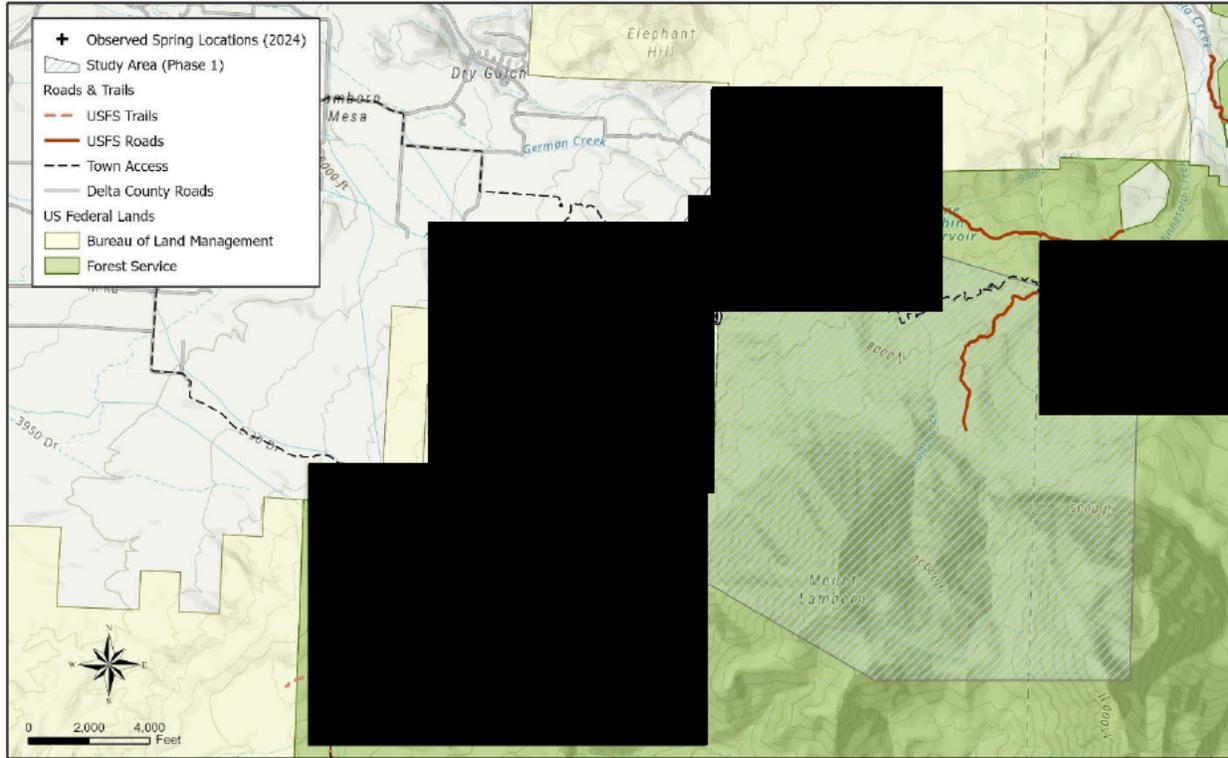


Figure 1. Phase 1 Study Area and observed spring locations with respect to land ownership and access roads of Town of Paonia's spring collection system.

3.4 Geology

Published geologic mapping of the North Fork valley in the vicinity of the Town by the United States Geological Survey (USGS) (Figure 2 Noe, 2015). This mapping shows that the geology of the north and northwest-facing slopes of Mount Lamborn and Landsend Peak is comprised of younger, surficial deposits overlaying older, sedimentary bedrock with several intermediate igneous intrusions. In the Study Area, the bedrock is the Mancos Shale, a 4,000-foot-thick layer from the Upper Cretaceous period. The Mancos Shale is marine in origin (Cross and Purington, 1899; McGookey and others, 1972) and consists of clayey to sandy calcareous shale with minor limestone, sandstone, and bentonite intrusions. Within the Study Area, the Mancos shale is poorly exposed due to the surficial deposits and dense vegetative cover. The igneous rocks intruded in the form of laccoliths, sheets, sills, and dikes into the Cretaceous bedrock in the Study Area. The Tertiary igneous intrusions consist of a hard monzonite porphyry and form both Landsend Peak and Mount Lamborn.

The surficial deposits overlying these bedrock units include alluvial deposits, mudflow and alluvial fan deposits, and mass-wasting deposits. The alluvial deposits are composed of gravel, sand, silt, and clay deposited along river valleys and tributary drainages and alluvial fans. Mudflow deposits and alluvial fans

are made up of well to poorly sorted and poorly consolidated clayey to sandy silt, with localized pockets of gravel. The material for these deposits originates both from the Mancos shale and older debris flow and landslide deposits. The larger mass-wasting deposits include both landslides, rock glaciers, and talus deposits. The landslide deposits are the most common surficial deposit in the Study Area. They are composed of unsorted to moderately sorted clay, silt, sand, gravel, boulders, and rock fragments, potentially containing large blocks of shale bedrock. The landslides are primarily located on the lower slopes of Mount Lamborn and Landsend Peak. The rock glaciers, which are generally located just upslope of the landslide deposits, are comprised of large, angular blocks of the monzonite porphyry that form undulating lobes of talus material on the mountain slopes (Noe, 2015). Talus deposits, also composed of large, angular blocks of monzonite porphyry, sit upslope of the rock glaciers at the base of the steep monzonite porphyry peaks. These deposits are formed by rockfall or snow-avalanche processes.

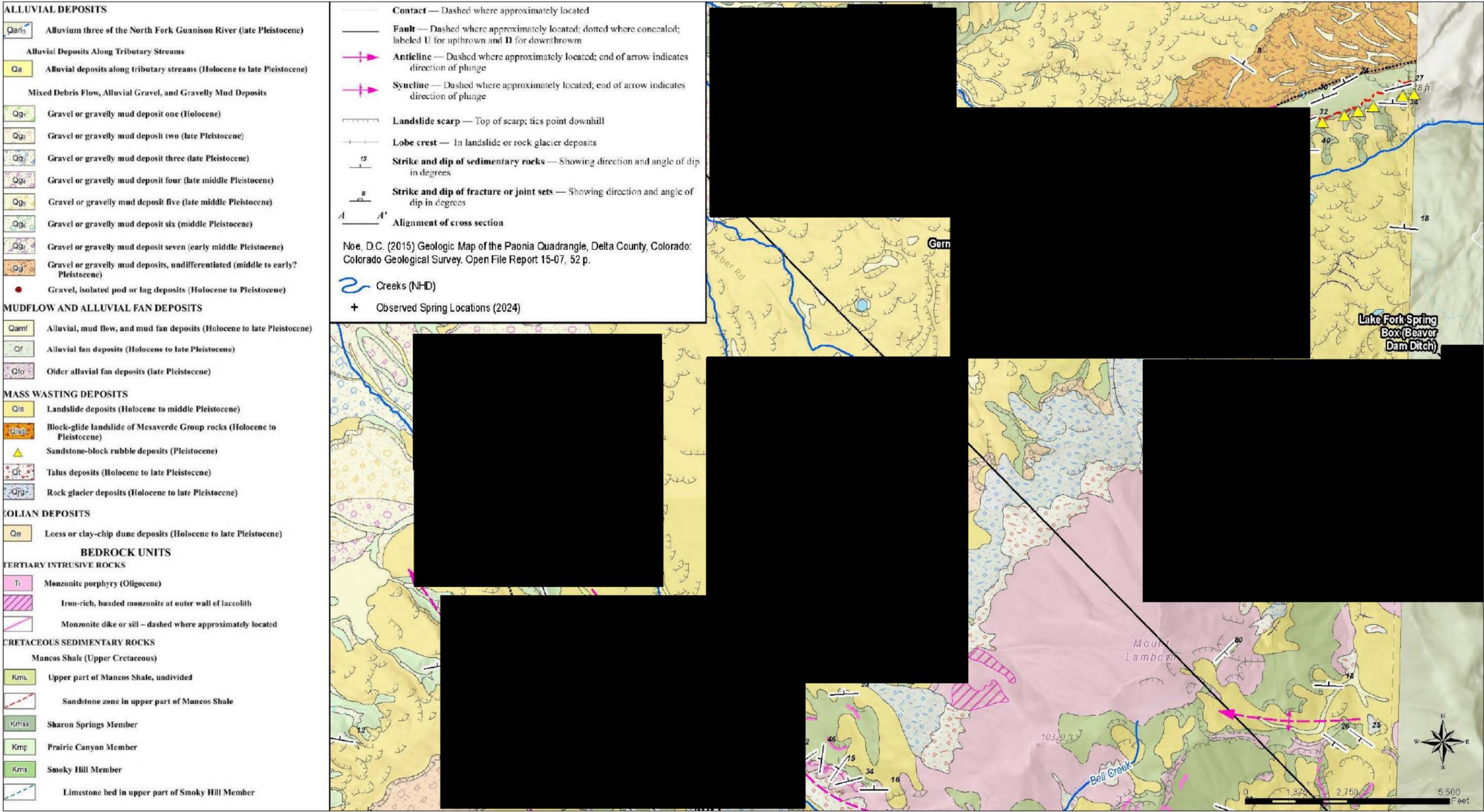


Figure 2. Geology of the Paonia Quadrangle relative to spring locations.

The Study Area is located at the intersection of the Colorado Plateau and the Southern Rocky Mountains physiographic provinces, with the Colorado Plateau lying to the west and the Southern Rocky Mountains to the east. The primary structural feature of the Colorado Plateau in this area is the Gunnison Uplift, which formed during the Laramide orogeny of the Late Cretaceous-Eocene period. The Gunnison Uplift is expressed by outcrops of shallowly dipping Mancos Shale. The Southern Rocky Mountains are represented by the West Elk Mountains, whose structure was greatly impacted by the laccolithic intrusions mentioned previously. These intrusions caused the adjacent Mancos Shale to dip moderately to steeply in some areas proximal to the intrusion, as well as causing localized faulting and folding (Noe, 2015).

3.5 Hydrogeology

The geologic units and structural features in the Study Area have resulted in a variety of hydrogeologic conditions conducive to water supply development in the area, including the variety of springs located along the mid-elevation slopes of Mount Lamborn and Landsend Peak. These springs vary in their geologic setting and are associated with the landslide complexes, rock glaciers, alluvial fans, and also the Mancos Shale (Noe, 2015). There are several types of springs that have been identified in the Study Area, including bedrock or fracture-controlled springs, gravel/shale interface controlled or contact springs, and gravity springs, illustrated in Figure 3 (Kolm and van der Heijde, 2013). The fracture-controlled springs are understood to exist where water within permeable, fractured rock is forced to the surface by contact with adjacent impermeable bedrock feature. Contact springs exist where water flowing through unconsolidated materials as shallow groundwater abuts an impermeable bedrock unit, such as the Mancos Shale. In addition, gravity springs can occur where areas of lower topography intersect the water table within unconsolidated materials. The exact type of springs that make up the Town's water supply is currently unknown.

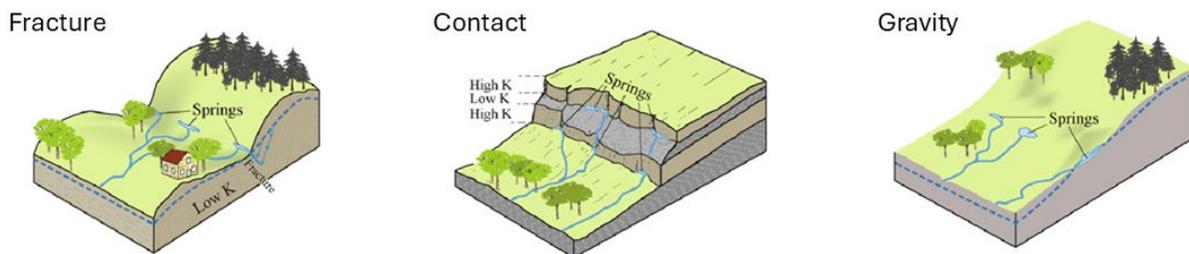


Figure 3. Illustrations of the different spring types found in the Study Area, where K refers to the hydraulic conductivity or permeability of the geologic unit (Figure generated from Kløve et al., 2011).

The source water for these springs is understood to be snowmelt from the adjacent mountains, although additional water may be stored within fractures in the bedrock. Thus, the yield of groundwater springs is highly dependent on annual snowpack, seasonal runoff, and precipitation. A review of the Town's historical groundwater spring supply supports this understanding of a snowmelt-driven water source. The historical data show a rise in water production when snowmelt begins, followed by a reduction in groundwater spring flow during the late summer once snowmelt has subsided. WWE considers the flows from the groundwater springs during the fall and winter baseflow conditions (Figure 4). A review of the hydrograph of streamflow conditions in Minnesota Creek further supports the groundwater springs as a snowmelt driven system, as there is a strong correlation of the hydrograph peaks of the Town's average water supply from the groundwater springs and the streamflow conditions observed at Minnesota Creek

(Figure 4). WWE understands that the Town is unable to capture the full volume of high spring flows during the initial spring snowmelt, and that the Town also is prone to experience a water supply shortage at baseflow conditions during prolonged drought periods due to the lower flows.

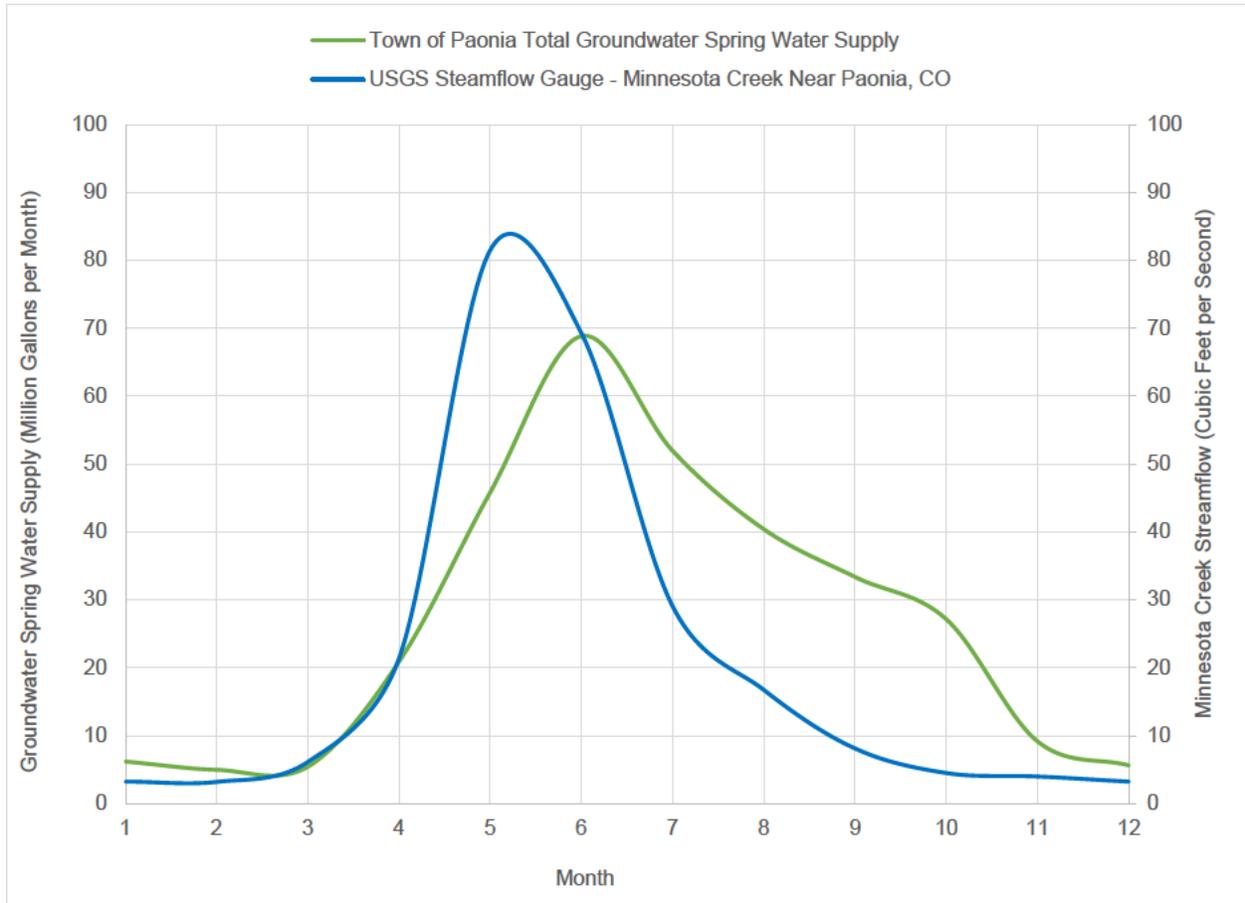


Figure 4. Comparison of Town’s monthly average water supply from groundwater springs and streamflow at USGS Streamflow Gage at Minnesota Creek, Near Paonia.

Study period from 1987 to 1993 (Consolidated Consulting Services, Town of Paonia Reconnaissance Assessment – Raw Water Supply, July 1995 and USGS Streamflow Gage 09134000 – Minnesota Creek Near Paonia, CO; streamflow data from 1987 to 1993).

4.0 FIELD INVESTIGATIONS

WWE conducted three site visits to the Town's spring complexes and performed different field investigations as a part of the hydrogeological study.

4.1 May 2024

In May 2024, WWE conducted an initial site visit to Paonia to observe the spring boxes and accurately map the spring box locations. For the initial site visit, WWE spent three days in the field beginning May 15, 2025. Town staff guided WWE during the visit, navigating and leading staff to the spring locations. WWE recorded high-resolution

in Figure 5. In addition to the GPS survey, WWE also performed a Very Low Frequency (VLF) geophysical survey at the German Creek and Lake Fork springs. The VLF survey was conducted as a part of a reconnaissance evaluation of the spring systems, as it can be used to identify potential water-bearing fracture zones. The results of the VLF survey contributed to the determination of locations for a more comprehensive 2-dimensional resistivity survey (2DR).



Figure 5. Field locating a spring box at Old Original Spring Complex (Credit: Jordan Redden).

4.2 July and August 2024

WWE conducted a site visit in late July 2024. WWE spent four days in the field with Town staff and staff from RESPEC from July 30 to August 2, 2025.

WWE collected additional GPS points at the spring sites to document field observations.

as illustrated by Figure 6.

Measurements from the land surface elevations of each manhole/vault to the water surfaces were made and recorded to program the transducers. Other field measurements were made to obtain detailed dimensions and specifications important for conversion of the transducer data to discharge estimates for each measurement site.



Figure 6. Installation of pressure transducer at Lake Fork Spring Box.

WWE also conducted aerial surveys using a DJI Mavic 3 Enterprise drone to support data collection and mapping efforts. A total of nine separate sites were flown to capture high-resolution ortho-imagery and, in select locations, oblique imagery for 3D data. At each site, flight missions were planned and executed using DJI's FlightHub software. For ortho data collection, the drone was programmed to fly along a single-axis flight path, capturing overlapping images that could later be stitched together to create high-resolution orthomosaics. For oblique data collection, flight paths were oriented along two axes, enabling the creation of dense point clouds suitable for generating detailed 3D models. The drone utilized its terrain-following feature to maintain a consistent above-ground flight elevation, ensuring uniform image resolution across variable terrain.

In total, over 23,000 photographs were collected across all flight sites. Post-processing was performed using Pix4D software, where both the ortho and oblique datasets were processed to produce high-resolution ortho-photos and 3D point cloud data. WWE processed these datasets following the site visit, which required several weeks to complete due to the volume and resolution of the imagery. The resulting products provide detailed visual and topographic information for areas that are extremely difficult to access using conventional ground methods (Figure 7 and Figure 8). These drone-derived datasets were evaluated alongside geologic field observations and correlated with existing geologic mapping publications to support identification of 2DR geophysical survey locations and documentation of the spring sites to enhance the overall accuracy of the mapping effort.



Figure 7. Ortho mosaic view of Old Original Spring Complex.



Figure 8. Oblique view of Old Original Spring Complex.

4.3 July 2025

WWE conducted a site visit in late July 2025 to conduct the 2DR geophysical surveys. Prior to this visit, WWE selected nine planned transects in cooperation with Town personnel. In order for WWE staff to conduct the geophysical survey, the transects needed to be cleared of brush to allow the equipment to be properly placed for the survey. Due to the location of the springs, and thus the transects, on federally owned land, the brush clearing required clearance from the National Environmental Policy Act (NEPA). The brush clearing was approved through NEPA in April 2025 and was completed in June 2025. The geophysical survey began on July 22, 2025.

On July 22, 2025, WWE completed a 2DR survey of the middle reach of the German Creek Spring system. First, sensor lines were set up with tape, flags, and stakes, and field adjustments were made. Later, WWE scouted out Upper German Creek Spring and evaluated where set up of the sensor lines was feasible.

On July 23, 2025, WWE conducted a 2DR survey of Lower German Creek Springs, located and assessed the feasibility of the planned alignments, which were determined to not be feasible. Therefore, WWE scouted out potential alternates, implemented some light brush clearing for an alternate alignment, set up the 2DR lines and then ran the survey. There was a breakdown in the 2DR lines, and the data file was corrupted.

On July 24, 2025, WWE re-ran the Lower German Creek Springs due to the previous day's datafile corruption. WWE set up flags, tapes, stakes, electrodes, and ran the survey successfully. Then, WWE moved the equipment to the Reynolds Creek drainage and scouted out alignments and performed brush clearings to conduct the survey on the following day.

On July 25, 2025, WWE deployed the 2DR equipment to the Reynolds Creek Spring drainage, the attempt to conduct the survey was unsuccessful due to software issues with the instrumentation. WWE conducted a successful survey on July 26, 2025. Following the Reynolds Creek Spring drainage survey, WWE investigated the Old Original Spring watershed to look for a suitable alignment for the next survey. On July 27, 2025, WWE cleared brush on the chosen alignment and conducted the 2DR survey for the Old Original Spring watershed.

On July 28, 2025, WWE obtained equipment software and set up a new 2DR alignment in the Lake Fork Spring drainage. The survey was completed on July 29, 2025. This completed the 2DR survey field work.

5.0 HYDROLOGIC MODEL

5.1 Approach

WWE used a combination of publicly available data and data collected from the Town's spring-collection system and the Upper Plant to construct a simple hydrologic model of the Town's spring collection system. The goal of the hydrologic model in Phase 1 was to establish a baseline understanding of the spring systems that could be updated and improved upon as additional data becomes available. The hydrologic model is a simple water-balance model, which is described by the following equation:

Total Precipitation = Surface Water Runoff + Infiltration to Shallow Groundwater + Evapotranspiration

Monthly total precipitation depth data for the period August 2024 to July 2025 (study period) were obtained from PRISM™. Because there are no gaged streams in the Study Area, a runoff coefficient was estimated from the hydrography of the nearby Minnesota Creek. Evapotranspiration (ET), the amount of water evaporated/sublimated from the land surface and transpired by vegetation, was estimated by comparing OpenET (<https://etdata.org/>) data for non-growing season months to corresponding monthly PRISM precipitation depths. The remaining precipitation is an estimation of total recharge to the shallow groundwater systems in each watershed. This results in an estimation of the potential shallow groundwater present in each of the sub-basins where the Town's springs are located.

Additionally, the water levels in the spring collection structures were measured with continuously recording pressure transducers, and these data were used to estimate the discharge of each spring. Monthly yields for each spring were compared to the yields measured at the Upper Plant to evaluate how much of the collected spring water is delivered to the WTP. The Lower Plant and its contributing springs are not included in this investigation. The spring collection-system water balance evaluates the seasonality and relative proportions of shallow groundwater yields from each measured sub-basin.

5.2 Scope

This study is limited to selected major contributing drainage sub-basins in the Town's collection system feeding the Upper Plant: Lake Fork Minnesota Creek, German Creek, Reynolds Creek, and Lucas Creek, each of which have collection manholes (a.k.a. spring boxes) that collect shallow groundwater and transmit it to the WTP by gravity in pipelines (Figure 10). Discharge was measured at five springs, which are known as:

- Lake Fork Spring
- Upper German Creek Spring (German Creek Spring #1)
- Lower German Creek Spring (German Creek Spring #3)
- Reynolds Creek Spring
- Old Original Spring (tributary to Lucas Creek)

Data have not yet been obtained from the remote Spore and Pole Patch Springs because these sites are difficult for Town personnel to access, especially routinely. Additionally, these springs discharged to the Lower Plant, which is not evaluated in this report.

The Lake Fork Spring, Upper German Creek Spring, and Lower German Creek Spring flows are combined into a single, additional measurement point known as the German Creek Splitter Box. This structure, comprised of side-by-side rectangular weirs, splits the flow into two separate conveyances, which sends

80 percent of the combined flows to the Town and the other 20 percent to other users. Figure 9 shows a photograph of the 80/20 splitter box as taken from the aerial drone. Flows through the Splitter Box were measured for this study to estimate the proportion of water collected from the Lake Fork and German Creek Springs transmitted to the Upper Plant.



Figure 9. Aerial view of the Lake Fork and German Creek 80/20 splitter box.

Town personnel downloaded the pressure transducer data and emailed data files to WWE for archive and analysis. The Town also supplied data for the Upper Plant totalizers to WWE. Two separate flow totalizers discretely measure yields from 1) the German Creek and Lake Fork Springs and 2) Reynolds Creek and Old Original Springs. The Town provided additional detailed information pertaining to the operations of the Upper Plant, such as yields treated by each of its filtration skids. This study did not evaluate the balance of water distribution among filtration skids in the WTP.

WWE obtained historical discharge records for the Minnesota Creek at Paonia stream gage number 09134000 from the USGS Water Data for the Nation website (<https://waterdata.usgs.gov/nwis>). WWE obtained precipitation data from the PRISM™ (<https://prism.oregonstate.edu/>) gridded data sets for the periods of record that coincided with the streamflow data. ET data were obtained from the OpenET website (<https://etdata.org/>) in the ensemble mode.

5.3 Precipitation, Evapotranspiration, and Recharge

The topographical drainage areas for each watershed were delineated using a 1-m Digital Elevation Model (DEM) derived from 2015 Quantum Spatial LiDAR data. Small modifications were made to these DEM-

derived watersheds to incorporate additional areas that, following a review of the existing geologic mapping, WWE believed could be a part of the Springs' subsurface contributing drainage area, illustrated in Figure 10 (Noe, 2015). These drainage areas were merged with 4-km resolution PRISM™ data sets to estimate the total precipitation depths in each sub-basin during the period of August 1, 2024 to July 31, 2025, which is approximately the period of reliable flow-data collected from the springs. The PRISM data indicate that approximately 16.9 inches of precipitation fell across the watersheds during the period of record. Multiplying the average depths across the watershed areas results in the total precipitation yields listed in Table 1. The data indicate that the total amount of precipitation received by the combined spring sub-basins was approximately 3,104 acre-feet. It is important to note that these topographical drainage areas are not necessarily representative of the actual Spring drainage areas, due to the unknown extent of the subsurface drainage areas draining water to the Springs. Significant additional subsurface geologic investigations would be necessary to more accurately delineate the Springs' contributing drainage areas.

It is reasonable to estimate that approximately 30 to 50 percent of the 3,104 potential yield was lost to ET during the spring to fall and to sublimation during the winter in the montane environment (MacDonald and Stednick, 2003). Comparison of OpenET-estimated actual ET to the PRISM-estimated monthly precipitation depths during non-growing season during 2024 to 2025 (51 percent) resulted in an estimated median annual actual ET (Et_a) of approximately 8.62 inches.

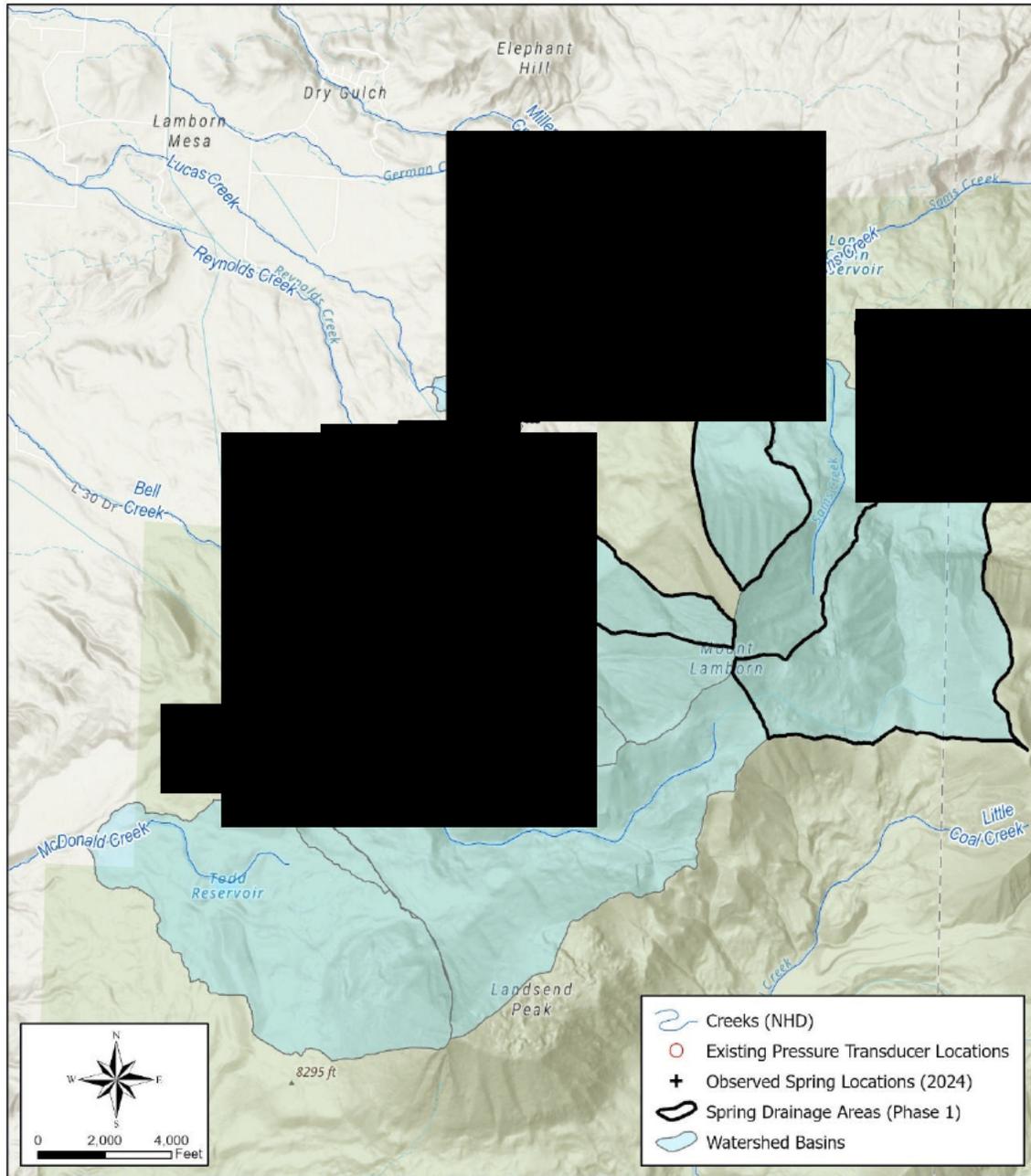


Figure 10. Locations of springs and existing pressure transducer monitoring locations, watershed basins for the spring systems, and drainage.

5.4 Estimation of Surface Water Runoff

There are no known surface-water gaging stations in the Town's collection-system watersheds. However, the Minnesota Creek drainage is considered hydrologically representative of the Lake Fork Minnesota Creek, German Creek, and Reynolds Creek, and Lucas Creek sub-basins for the purposes of this study. WWE computed annual yields from daily mean discharge data obtained from the USGS Water Data for the Nation website for the Minnesota Creek at Paonia gaging station 09134000 for the period of: 1987 to 2013. WWE excluded data for 2008-09, which had substantial missing record. Otherwise, missing values

were linearly interpolated from the measured data. The station was discontinued in 2014. Diversions that removed water from the river were not accounted for, but such diversions were not considered to be sufficiently large to adversely affect the calculations. Annual Runoff values normalized by the drainage area (26,688 acres) and then divided by annual PRISM-estimated annual precipitation depths resulted in a minimum runoff coefficient of 0.17 and a median runoff coefficient of 0.36 (Table 2). In other words, at least 17 – 36 percent of the precipitation yielded runoff in in the Minnesota Creek drainage during the most recent 25-years of available record. WWE considers this a reasonable expectation for runoff in the drainages feeding the Town's springs as well.

Table 1. Total precipitation, estimated actual evapotranspiration, and potential yields in each watershed sub-basin estimated from PRISM during August 1, 2024, to July 31, 2025.

[ET, evapotranspiration; Ppt, precipitation; OpenET data for 2024-25 from <https://etdata.org/>; AF, acre-feet]

Spring Sub-Basin						
Month-Year	German Creek	Lake Fork	Old Original	Reynolds Creek	OpenET Estimated ET (inches)	Average Percent Ppt Loss by ET
Aug-24	3.10	4.15	3.01	3.65	3.14	90
Sep-24	0.88	1.41	0.82	1.01	2.56	249
Oct-24	1.44	1.87	1.40	1.51	1.23	79
Nov-24	2.42	3.17	2.37	2.68	0.63	24
Dec-24	1.08	1.49	1.05	1.23	0.44	37
Jan-25	0.48	0.89	0.44	0.66	0.15	24
Feb-25	1.01	2.17	0.92	1.35	0.63	46
Mar-25	1.54	2.35	1.46	1.91	1.76	97
Apr-25	0.89	1.30	0.85	1.09	2.53	245
May-25	0.79	1.00	0.77	0.89	3.59	417
Jun-25	0.99	1.08	0.99	0.99	3.64	359
Jul-25	0.26	0.33	0.25	0.28	3.52	1,258
					Non-growing season	
Totals (inches)	14.90	21.21	14.32	17.24	23.82	Mean: 51%
Drainage Areas (acres)	460	1,052	79	404		
Potential Precipitation Yields for Each Watershed (AF)						
Month-Year	German Creek	Lake Fork	Old Original	Reynolds Creek		
Aug-24	119	364	20	123		
Sep-24	34	123	5	34		
Oct-24	55	164	9	51		
Nov-24	93	278	16	90		
Dec-24	42	130	7	41		
Jan-25	18	78	3	22		
Feb-25	39	190	6	45		
Mar-25	59	206	10	64		
Apr-25	34	114	6	37		
May-25	30	87	5	30		
Jun-25	38	95	7	33		
Jul-25	10	29	2	9	Sum Potential Yields	
Total Potential Yields (AF)	571	1,858	96	579	3,104 AF	

Table 2. Annual precipitation runoff yields for Minnesota Creek at Paonia and estimation of runoff coefficients, evapotranspiration, and shallow groundwater recharge rates.

Based on daily streamflow records from 1987 to 2013 (excluding 2008 to 2009), annual PRISM precipitation depths, and monthly OpenET-estimates of actual ET_a during non-growing season months 2024 to 2025.

[AF, acre-feet; PRISM data available from <https://prism.oregonstate.edu/>; OpenET data available from <https://etdata.org/>; nd, no data]

	Annual Runoff	Runoff Normalized to Drainage Area	Normalized Runoff	Annual PRISM Precipitation Depth	Runoff Coefficient	OpenET-Estimated ET_a	Estimated Shallow Groundwater Recharge (Ppt-Runoff- ET_a)
Water Year	(AF)	(feet)	(inches)	(inches)		(inches)	(inches)
1987	20,399	0.76	9.2	16.0	0.57	8.2	-1.3
1988	9,659	0.36	4.3	14.1	0.31	7.2	2.6
1989	9,441	0.35	4.2	11.5	0.37	5.9	1.4
1990	5,299	0.20	2.4	11.9	0.2	6.1	3.5
1991	12,886	0.48	5.8	14.2	0.41	7.3	1.2
1992	15,258	0.57	6.9	17.5	0.39	8.9	1.7
1993	33,794	1.3	15	19.9	0.76	10	-5.5
1994	12,093	0.45	5.4	13.5	0.40	6.9	1.2
1995	27,497	1.0	12	23.4	0.53	12	-0.9
1996	11,574	0.43	5.2	13.3	0.39	6.8	1.3
1997	25,932	0.97	12	22.0	0.53	11	-0.9
1998	17,691	0.66	8.0	13.1	0.61	6.7	-1.6
1999	8,984	0.34	4.0	18.2	0.22	9.3	4.9
2000	7,046	0.26	3.2	11.9	0.27	6.1	2.7
2001	6,974	0.26	3.1	12.6	0.25	6.4	3.0
2002	4,186	0.16	1.9	11.1	0.17	5.7	3.6
2003	11,284	0.42	5.1	14.0	0.36	7.1	1.8
2004	9,446	0.35	4.2	14.8	0.29	7.5	3.0
2005	20,672	0.77	9.3	17.8	0.52	9.1	-0.6
2006	11,809	0.44	5.3	14.8	0.36	7.5	1.9
2007	13,576	0.51	6.1	19.1	0.32	9.8	3.3
2008	19,079	nd	nd	14.5	nd	nd	nd
2009	16,397	nd	nd	12.8	nd	nd	nd
2010	11,468	0.43	5.2	14.9	0.35	7.6	2.1
2011	21,778	0.82	9.8	16.1	0.61	8.2	-1.9
2012	6,246	0.23	2.8	13.1	0.21	6.7	3.6
2013	8,066	0.30	3.6	15.4	0.24	7.9	3.9
			Minimum	11.1	0.17	5.7	-5.5
			Median	14.5	0.36	7.5	1.8
			Maximum	23.4	0.76	12	4.9

5.5 Spring Flow Data

5.5.1 Monitoring Plan Development

The springs systems are unique because the water supply is understood to be derived from recharge from snowpack and precipitation. The spring systems are within the Mount Lamborn and Landsend Peak basins (Figure 11). During certain times of the year, the flow reportedly exceeds the spring collection box capacity and results in “spilled” water while at other times of the year, the spring flow diminishes and can impact the raw water supply.

WWE worked with RESPEC to develop a preliminary spring systems monitoring plan. In developing the spring systems monitoring plan, WWE and RESPEC reviewed the Town's existing infrastructure for selection of flow measurement locations and methods. Each of the five springs evaluated in this investigation were instrumented with InSitu™ Rugged TROLL 100 pressure transducers to continuously measure and record water levels with respect to the discharge pipe inverts. Measurements of the instrumented spring collection infrastructure dimensions were taken to convert water level measurements into estimates of flow. A dry transducer was also installed at the Upper Plant to record atmospheric pressure, which was used to correct the wet transducers for changes in atmospheric pressure. Data missing from the Upper Plant atmospheric pressure record were replaced by correlated North Fork Valley Airport barometric pressure measurements (<https://www.wunderground.com/dashboard/pws/KCOPAONI16>). The Upper Plant atmospheric pressure data were adjusted to the land surface elevation at each monitoring location for site-specific correction of the wet transducer data at each monitoring location.

Based on the field measurements, RESPEC provided schematic drawings of each of the monitoring locations except for the Reynolds Creek Spring manhole, but sufficient data were available for all springs to estimate daily mean discharge and monthly yields for each measurement point. A summary of the spring collection system specifications is provided in Table (A-1) of the Appendix.

In addition to this preliminary springs monitoring plan for the hydrogeology investigation discussed here, RESPEC has designed a more sophisticated raw water flow monitoring system at four locations, illustrated in Figure 11. Once constructed and implemented, these additional monitoring points can be incorporated into the framework of the existing monitoring plan to improve upon the current raw water system water balance.

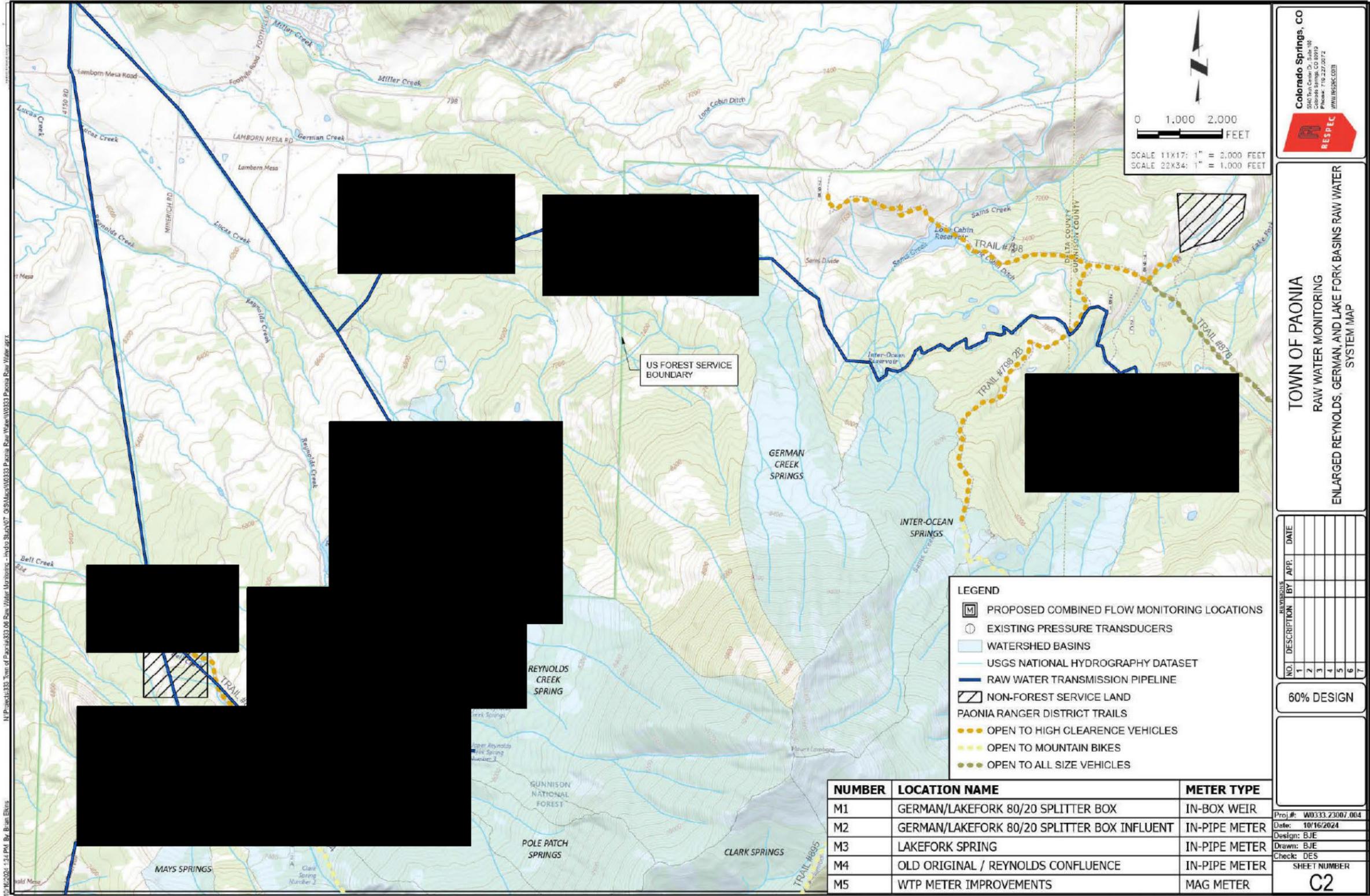


Figure 11. Enlarged Reynolds, German, and Lake Fork Basins Raw Water System Map (RESPEC, 2024).

5.5.2 Data Collection and Processing Methods

WWE received the pressure transducer data and Upper Plant flow totalizer data from the Town by email. Town personnel also verified and added to field measurements of flow-control structure dimensions and elevations collected by WWE and RESPEC, which were critical to converting the pressure transducer water levels into estimates of discharge. WWE also consulted with Town personnel on questions about characteristics, management, and performance of the spring collection system and how inflows are managed by the Upper Plant.

On approximately July 24, 2025, the Upper Plant dry transducer was accidentally removed from its monitoring location and might have been unknowingly damaged. This is suspected because the data from this transducer becomes wildly erratic after this date (Figure 12). Therefore, this limited the available spring discharge record to the period of August 1, 2024 to July 24, 2025. The remaining week of July 2025 was estimated by multiplying the measured record for July by 1.25 to include flow for the last week of July 2025 in the working record for the study.

The springs are primarily collected in manholes with discharge pipes slightly elevated from the bottoms of each manhole. When shallow groundwater rises above the inverts of each pipe, the water spills into the pipes and is gravity fed through the pipelines to the Upper Plant. WWE used Manning's equation to convert measured water depths on the pipe inverts in each manhole for Lake Fork, Upper German Creek, Lower German Creek, and Old Original Springs, assuming inlet-controlled conditions (Grant and Dawson, 1995). However, the Reynolds Spring data indicate that the manhole might be backwater affected during high flow periods, which violates the inlet control assumption. This is illustrated in Figure 12. Therefore, the average ratio of Reynolds Spring and Old Original discharges was computed for data collected during times when backwater affect was not suspected. Then, this ratio was applied to the Old Original record to estimate the Reynolds Spring discharge for the entire period.

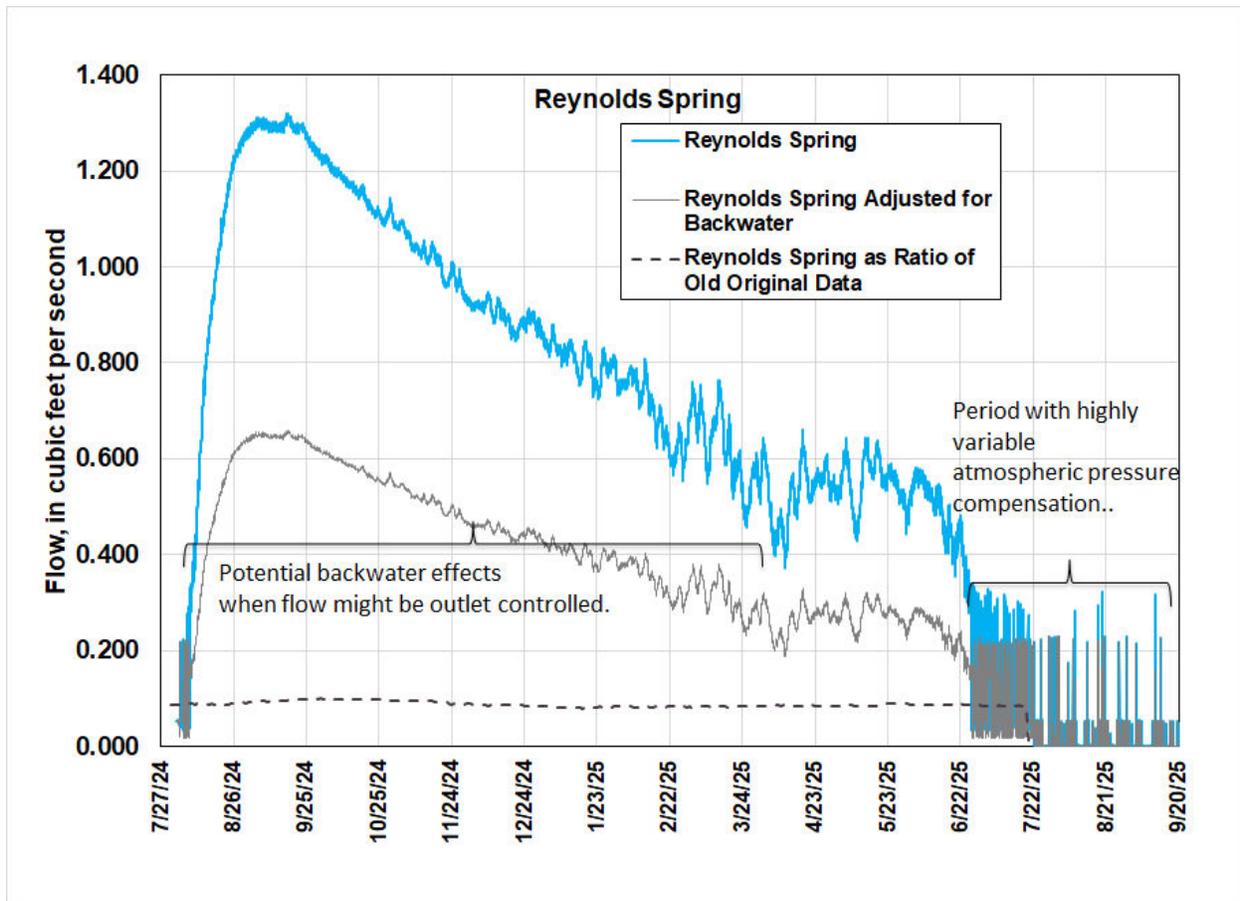


Figure 12. Reynolds Spring hydrograph based on Manning's equation calculations showing indications of possible backwater effects and erratic record due to faulty atmospheric pressure compensation.

The Upper Plant has separate flow totalizers on inflows from the Lake Fork/German Creek collection line and the Reynolds/Old Original collection line. Comparison of the yields from each Upper Plant line to the upstream measurements were useful for adjusting the upstream measurement parameters to achieve computations that are realistic. Nonetheless, the spring discharge data likely have an error of at least 15 percent and likely much higher. This is primarily because hydraulic parameters for the inlet pipes at the spring boxes are not precisely known, and frequent and routine manual measurements of water levels in the invert of each pipe were not logistically possible, which would have been useful to compensate for drift in the electronic pressure transducers. Improvements to the measurement systems are anticipated in the future. The structure with the lowest measurement error is likely the German Creek Splitter Box as this is a well-regulated rectangular weir structure with well-known physical dimensions and well-established flow-conversion formulas.

5.5.3 Discharge Records Assessment

The Lake Fork, Upper German Creek, and Lower German Creek Springs each discharge independently to a common pipeline that daylight to the German Creek Splitter Box (Splitter Box). The Splitter Box consists of two side-by-side concrete, rectangular weirs, with a 2-foot wide weir on the left (facing downstream) and a 0.5-foot weir on the right (Figure 13). The left weir is end contracted on the left side, and the right

weir is end contracted on the right side. These are known as the 80-percent and 20-percent weirs, respectively as the structure splits the flow and sends 80 percent to the Town and 20 percent to other users. Hydrographs for the German Creek collection system are shown in Figure 14 and Figure 15.

The apparent loss of water between the Lake Fork Spring and the Splitter Box is at least partly due to uncertainty in the Manning's equation inputs and associated error. For example, field measurements indicate that the pipeline transporting water from the Lake Fork collection structure is 14 inches in diameter, although previous reports document a 10-inch pipe. Using a pipe diameter of 10 inches versus 14 inches reduces calculated flows by approximately 30 percent. There is also a pipe tee at an unknown location along the Lake Fork pipeline that diverts water to Roeber Reservoir. The operations of this pipeline and the flow rate diverted are currently unknown. Leaks along the pipeline may be contributing to these losses further. The Upper and Lower German Creek springs hydrographs also indicate significant loss of water between their collection manholes and the Splitter Box. Again, measurement and computation error can explain some of this imbalance in flows, but even a 25 percent error would still lead to the conclusion of loss of water somewhere in transit between the springs and Splitter Box. If more accurate and precise measurements become available, these flow calculations can be updated to obtain better estimates of flow.



Figure 13. Photograph of German Creek Splitter Box.

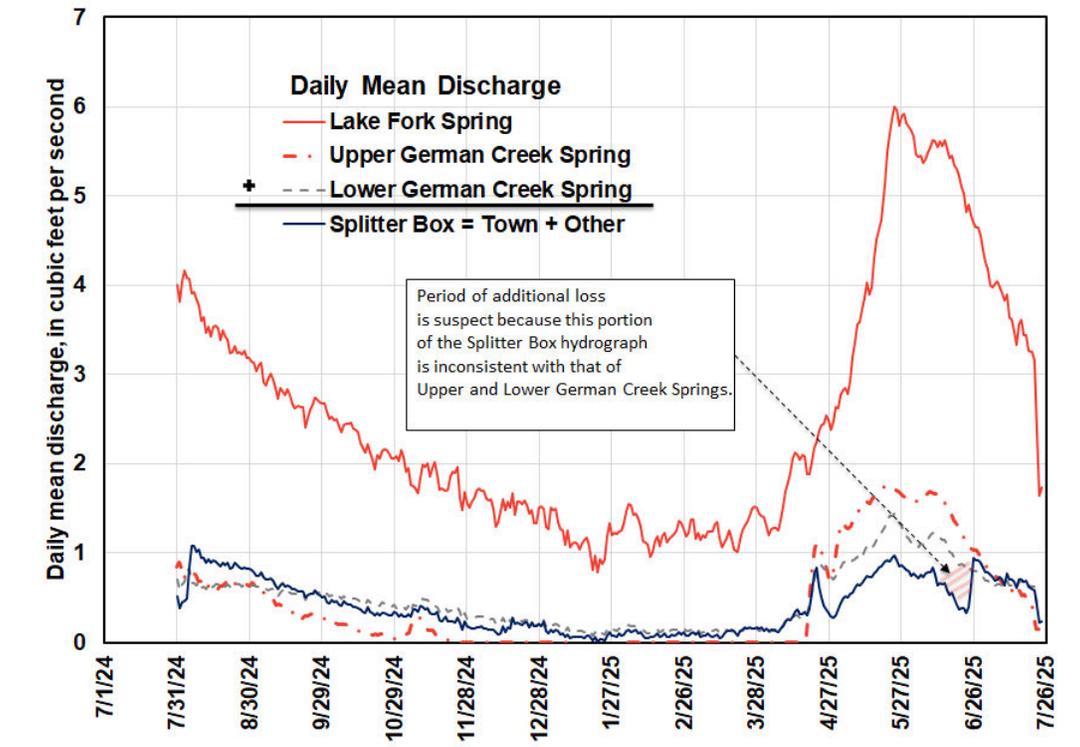


Figure 14. Hydrograph for spring collection in the Lake Fork and German Creek drainages.

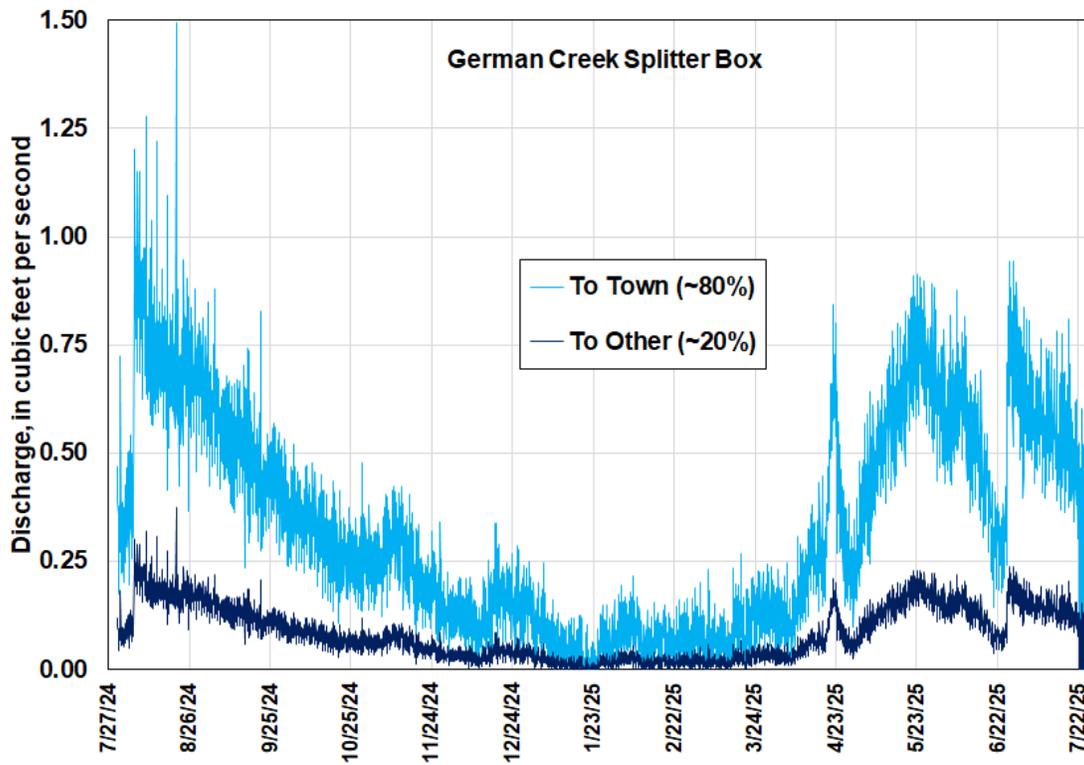


Figure 15. Hydrograph German Creek Splitter Box, August 2024 to July 2025.

The Upper Plant totalizer data indicates that approximately two-thirds of its inflow comes from the German Creek Splitter Box, and approximately one-third from the Reynolds Creek/Old Original Springs. The Old Original Spring contributes most of the water to the Reynolds Creek line. Hydrographs for the Old Original and Reynolds Creek Spring discharges to this line are shown in Figure 16.

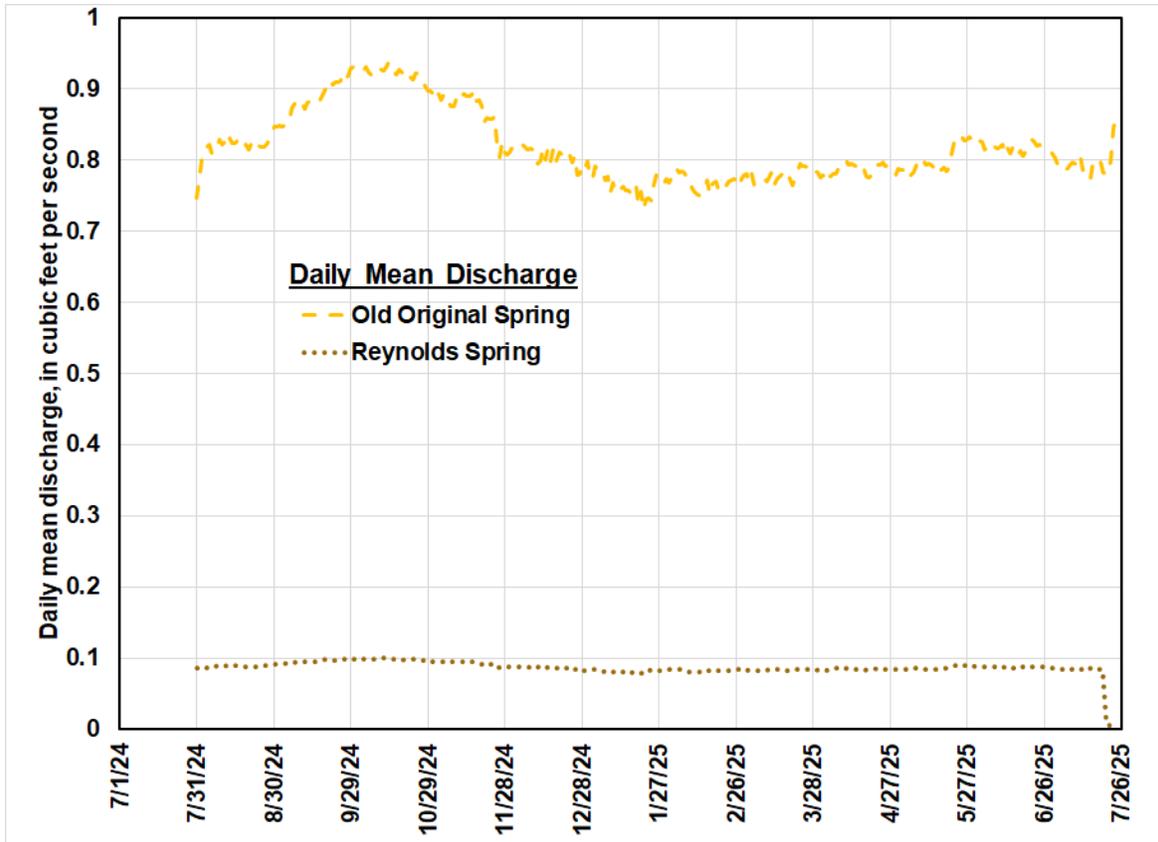


Figure 16. Hydrograph for spring collection in the Reynolds Creek drainage, August 2024 – July 2025.

The data for all measurement locations indicate seasonality of the flows that mirrors variations in flow observed in surface-water hydrographs, whereby more water is present during spring runoff periods and throughout the summer than during winter months (Figure 4). In fact, the data indicate that the Upper German Creek Spring was frozen from January 11 to February 4, 2025. The Reynolds Creek Spring flow record does not show the same seasonality as the other springs because ultimately its final record was based on a proportion of Old Original flow due to suspected backwater effects on Reynolds Creek Spring (Figure 12).

5.6 Water Treatment Plant Finished Water

WWE evaluated Upper Plant totalizer records to determine daily inflows from the Reynolds Creek/Old Original Springs and Lake Fork/German Creek Springs. The Reynolds Creek/Old Original Springs total yield was approximately 158.6 acre-feet, and the German Creek/Lake Fork Springs yield was approximately 333.6 acre-feet for the August 1, 2024 to July 31, 2025 period. Seasonality of the Upper Plant inflow data was consistent with that of the springs discharge data whereby inflows increase during spring and summer

months and are reduced by approximately 20 percent during winter months. The inflow yields are illustrated in Figure 17.

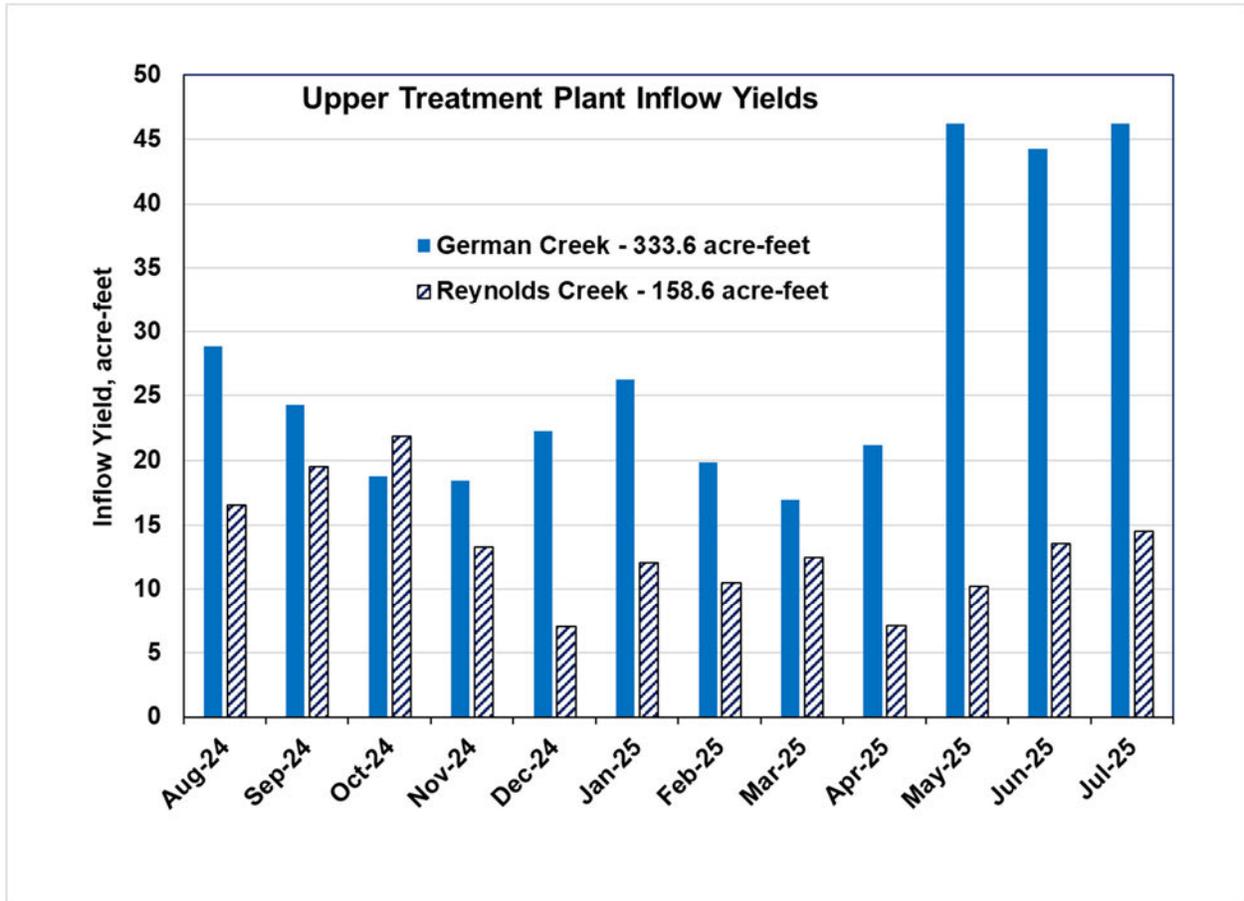


Figure 17. Upper Plant inflow yields calculated from totalizer data, August 2024 to July 2025.

5.7 Comparison of Spring Flows with Upper Plant Inflows

A critical part of evaluating the water balance model is a comparison of yields collected by the springs, on the upstream ends of the pipelines, with yields delivered to Upper Plant, on the downstream ends. Imbalances of estimated yields might indicate error in the flow measurements, pipeline leakage, diversions (a.k.a. “spill”) from the systems, or a combination of these factors. Comparison of estimated spring yields and the precipitation yields provides additional assessment of the accuracy and overall quality of the spring discharge records. Ultimately, important conclusions evolve from evaluation of the data by weighing each of the factors that could cause yield imbalances.

Monthly and total annual yields measured at the springs, Splitter Box, and Upper Plant locations are summarized in Table 3. The results lead to important conclusions about the Town’s spring-water collection system and simultaneously reveal large imbalances that are challenging to explain without critical additional information. For example, a *Paonia Water System Schematic* produced by WestWater Engineering, in January 2000, reveals that there are points in the Lake Fork Spring, German Creek Springs, and Reynolds Creek Springs pipelines where water can be “spilled”. The WestWater schematic also suggests that the Lake Fork Springs pipeline can spill to Roeber Reservoir, the Beaver Dam Ditch Pipeline

to Minnesota Creek, and to German Creek. Also, there is a point downstream from the connection of Reynolds Creek Spring and Old Original Spring pipelines where excess water can spill from the line. Documentation of the possible operations of these spill points was not provided to WWE; therefore they were not considered in the following analysis.

The following observations are provided starting from left to right in Table 3, which is essentially upstream to downstream in terms of the subsurface flow issuing into the system and flowing into the WTP.

- Total estimated precipitation yield in the Lake Fork drainage nearly matches the measured Lake Fork Spring yield. This is not possible or at best serendipitous because there is error in both the precipitation and spring yield estimations, and runoff of approximately 38 percent per the Minnesota Creek hydrologic analysis and ET at as much as 51 percent are not incorporated into this estimate. Therefore, the Lake Fork Spring discharge data might be overestimated by a significant percentage, or the excess water was spilled to Minnesota Creek or Roeber Reservoir. Improvements to the flow measurements are needed, including measured flows to Roeber Reservoir, Minnesota Creek, and German Creek. Alternatively, the sub-surface drainage area for Lake Fork Spring might be substantially larger than the topographic surface drainage area.
- The Upper German Creek Spring plus Lower German Creek Spring yields are 17 percent higher than the precipitation yields for the German Creek drainage area. Again, the same issues of measurement error are suspected for the German Creek Springs, and runoff (38 percent) and ET (51 percent) are not embodied in this estimate. Alternatively, the spill operations described above might explain the imbalance, or the sub-surface drainage area for the German Creek Springs might be substantially larger than the topographic surface drainage area.
- The German Creek Splitter Box yield, which is shown as the 80 percent that is routed to the WTP, is approximately 288 acre-feet, which is 57 percent less than the Upper and Lower German Creek Springs yields and 89 percent less than the combined yields of Lake Fork, Upper German Creek, and Lower German Creek springs (2,541 acre-feet). Yet, there is likely much lower measurement error in the Splitter Box measurement than in the springs' measurements. These differences in estimated yield could be explained by large leaks in the Lake Fork and German Creek collection lines that lose most of the collected water to the shallow groundwater, but this is not suspected. More than likely, water was spilled to German Creek. Additionally, the Splitter Box yield discharged to the WTP (240 acre-feet) is 28 percent less than the German Creek inflow yield at the WTP. If the WTP totalizer has a positive 10 percent bias and the Splitter Box data has a 10 percent negative bias, then these flows nearly match. However, there is still more water received at the WTP than is passing the Splitter Box even when these uncertainties are accounted for. This implies that the pipeline might be intercepting groundwater from leaks into the line, or additional unknown sources might be tied into this line.
- If the Reynolds Spring data are realistic, then that spring is intercepting a very small part of the available precipitation yield. On the other hand, the precipitation yield for the Reynolds Spring plus Old Original Spring drainage area is only 6 percent more than the combined yield of these two springs, indicating that the subsurface drainage areas of these two springs might be connected. Nonetheless, the yield measured for Old Original is 75 percent larger than the Reynolds Creek inflow yield to the WTP. Therefore, even if the measurement error for the Old Original data is hypothetically as high as 50 percent, the data strongly indicate that there is a very

large amount of leakage in this pipeline to the WTP or 75 percent of the flow was spilled prior to reaching the WTP.

- Overall, the flow data suggest that the springs have a distinct seasonality that mirrors the precipitation infiltration, much like surface-water hydrographs, and the same seasonality is observed in the WTP totalizer data.
- There appears to much more water to be captured in the Lake Fork and German Creek drainages than is currently developed.
- Comparison of measurements of the collected water in each of the spring monitoring locations to estimated precipitation yields for the topographical drainage areas suggests that the drainage areas for the springs are greater in extent than the topography indicates. Further investigation of the complex subsurface hydrogeology would be required to more closely delineate the actual extents of the sub-surface drainage areas and target areas where additional water might be developed for beneficial use.

Table 3. Monthly and annual yields for Reynolds Creek and German Creek Springs and Lamborn Water Treatment Plant and comparison with estimated precipitation yields for each spring sub-basin, August 1, 2024 – July 31, 2025.

[AF, acre-feet; %, percent; red bold type indicates large discrepancies between precipitation and spring yields]

Monthly Spring Collection Yields									Lamborn Water Treatment Plant Totalizer Yields	
Month-Year	Lake Fork-LF (AF)	Upper German-UG (AF)	Lower German-LG (AF)	Splitter Box 80% (AF)	Sum LF+UG+LG x 80% (AF)	Old Original (AF)	Reynolds as Ratio of Old Original (AF)	Reynolds + Old Original (AF)	Inflow Source	
									German Creek (AF)	Reynolds Creek (AF)
Aug-24										
Sep-24										
Oct-24										
Nov-24										
Dec-24										
Jan-25										
Feb-25										
Mar-25										
Apr-25										
May-25										
Jun-25										
Jul-25										
Spring Totals (AF)	1872	316	353	240	2033	593.7	39.2	632.9	333.6	158.6
Precipitation Totals (AF)	1858	571			1943	96	579	675	2429	675

5.8 Suggestions for Improved Monitoring and Other Data Collection

Opportunities exist to improve the spring-water data-collection system. In addition to installation of new, more accurate instrumentation on the spring manhole outlets designed by RESPEC, the following actions are suggested.

5.8.1 Town Water-Collection System Investigations

1. Improve the water monitoring program.
 - a. Implement a more routine data-collection program. At least monthly data downloads would be helpful, and measurements of water levels inside the pipe inverts are critical.
 - b. Refine current design drawings of each spring monitoring location to make sure all dimensions are included and accurate.
 - c. Obtain and analyze the continuous water level records collected in the Spore Spring and Pole Patch Spring measurement locations.
2. Document and evaluate the raw water collection system conditions.
 - a. Incorporate the measurements from new instrumentation designed by RESPEC to the raw water collection system water balance. These measurements will improve the current water balance by providing more accurate flow measurements at existing monitoring locations and can help to identify potential spill locations or other transmission losses.
 - b. Measure and obtain accurate records of water spilled from the pipelines to various receiving waters.
 - c. If resources are sufficient, perform camera surveys of insides of pipeline sections believed to be leaking to find places for limiting transmission losses.

5.8.2 Continuing Hydrogeological Characterization

1. Install meteorological instrumentation for barometric pressure, temperature, and precipitation depth monitoring wherever possible in each spring's drainage area.
2. Conduct more geophysical and surface geological investigation to more accurately determine the sub-surface drainage areas for each spring.
3. Consider conducting stream gaging to gain knowledge of actual runoff and groundwater-surface water interaction.
4. Additionally, consider conducting conservative tracer injection studies (e.g. sodium bromide, sodium chloride) on surface waters suspected to be lost to the sub-surface and captured by the spring-water collection system. This requires specialized expertise using scientists accessible to WWE who have expertise with these techniques.

6.0 GEOPHYSICAL SURVEY AND ANALYSIS

The shallow hydrogeologic conditions of the site are complicated because they involve the underlying bedrock structure, including fracture zones, and depositional processes related to bedrock erosion and downslope movement of erosional materials. Although the mechanics that form these bedrock features and depositional processes are complex, techniques and methodologies such as geophysics, remote sensing, and geomorphic modeling improve the interpretation with respect to water-bearing features. Electrical resistivity has been used extensively in groundwater exploration and is commonly used to determine preferred locations for development of groundwater supplies, including both wells and shallow springs. For this evaluation, WWE utilized the 2DR method.

6.1 Basics of the 2DR Geophysical Survey

The 2DR geophysical survey is performed by measuring electrical resistivity between various locations (or stainless-steel stakes) oriented in selected configurations or arrays. This arrangement and data collection is performed along various lines or traverses as selected by previous site visits to assess the most ideal location for data acquisition. To obtain this information, stainless steel stakes are driven into the ground at equal length intervals and connected by an electrode cable to a receiver. The receiver is a computer system known as a SuperSting Earth Resistivity System (SuperSting) manufactured by Advanced Geosciences, Inc. (AGI). The SuperSting is connected to a switch box which is connected to sealed lead acid batteries to provide current injection to the subsurface using the programmed configurations. The SuperSting automatically measures and records hundreds of earth resistivity values. The resistivity measurements are typically performed using three standard arrays: Dipole-Dipole, Schlumberger and Wenner configurations. These three configurations have different advantages regarding horizontal and vertical resolution and susceptibility to outside electrical noise. Data was first analyzed separately for each configuration to evaluate the presence of subsurface features that are in common. Subsequently, the data for all three configurations were merged to provide a more detailed analysis for each traverse. Prior to analysis, a terrain file was created to provide topographic correction of the resistivity measurements. Topographic elevations were obtained in the field by WWE at each stake using a high-resolution GPS-based system.

6.2 2DR Survey at Mount Lamborn

WWE mobilized and conducted the 2DR geophysical survey during a ten-day period spanning from July 21, 2025, to July 30, 2025. WWE conducted this geophysical survey analysis along six pre-selected traverses within the Town's spring collection system [REDACTED]. Traverse locations were determined based on previous geologic field and mapping observations, the relative importance of the springs in terms of current estimated water diversions, accessibility of the springs, and the potential for capturing additional supplies from unused/under-used water rights. [REDACTED]

[REDACTED] had been planned but could not be performed due to inaccessibility at the time of the survey. All 2DR surveys were conducted using either two- or three-meter spacing and 56 electrodes, providing traverse lengths between 110 meters (361 feet) and 165 meters (541 feet). Depth of resolution ranged from 16 meters (52 feet) to 38 meters (125 feet). Processing of the data using proprietary software from AGI produces a virtual resistivity vertical section that is color-contoured to assist with interpretation of site hydrogeologic conditions.

Interpretation of hydrogeologic conditions from the 2DR survey is based on contrasts in resistivity values and observations of potential structural features associated with those contrasts. For example, a dense, unfractured, igneous rock such as granite has a very high resistivity value greater than 1,000 ohm-m. However, the presence of water-bearing fracture zones locally reduces the bulk resistivity from thousands of ohm-m to hundreds or even tens of ohm-m. These local zones of low-resistivity can often show structure that supports the interpretation of a water-bearing zone, such as a steeply-dipping fracture or zone that projects to a known spring location. Shallow-dipping fracture zones, such as bedding-plane fractures, can also be detected but are sometimes less distinct when combined with near-horizontal layering of geologic units. As another example, lenticular, near-horizontal zones of low resistivity materials overlying more highly resistive zones can indicate water-bearing zones consisting of sand, gravel, or cobbles associated with paleochannels and/or contact springs.

6.2.1 German Creek

[REDACTED] The traverse locations were offset slightly from the originally planned locations, because the access was not adequate. Upper German Creek was not accessible.

[REDACTED] It appears that flow from both the fracture zone and the shallow flow combines to emerge near the land surface at approximately 78 meters on the traverse.

[REDACTED] unless power is available for a well pump or unless there is sufficient artesian head to allow the well to flow on the surface, further exploration by means of drilling is not likely to be of value.

[REDACTED] A water-bearing fracture zone is suggested by the abrupt transition from high to low resistivity at about 34 meters on the traverse. Low resistivity near the land surface between approximately 39 and 54 meters on the traverse suggests a potential location to intersect near-surface groundwater with a track excavator. Given that it is unlikely that a drilling rig could be mobilized to this location and given the limitation of a well as noted above, further exploration by drilling of the potential fracture zone is not likely to be of value.

6.2.2 Reynolds Creek

[REDACTED] A near-horizontal zone of low resistivity between

depths of approximately 13 and 20 meters (42 and 66 feet)

Approximately 15 gallons per minute of flow was estimated to bypass the spring box. After the flow surfaces, it follows the topography downslope as a small stream. The stream does not appear to gain additional flow along its path, suggesting that it provides some recharge to the overburden along its path. At approximately 82 meters on the traverse, the shallow bedrock appears to force the subsurface flow to emerge again, creating a second contact spring. The flow then appears to infiltrate into the overburden.

It is possible that this flow, which is bypassing the spring box, could be better captured by improving the surface structure. However, given the contact nature of the spring and the depth of the saturated zone upstream of the spring box, it is unlikely that significant additional capture could be achieved with a deeper excavation.

6.2.3 Old Original

It had been planned to orient one traverse along the stream drainage, crossing the spring box at the bottom, and orient the other traverse perpendicular to the stream, near the head of the drainage where the original spring structures are located. However, neither traverse was accessible. Therefore, an alternative

Neither of these features appear to directly feed the spring box. It is also postulated that the southeastern feature could be associated with flow along low-angle bedrock fractures, as there is indication of near-horizontal layering. In addition, there is a potential, near-vertical fracture indicated at approximately 48 meters on the traverse. While this feature underlies the spring box, it does not appear to be directly feeding the spring box. Rather, it appears that the topography itself is fracture controlled and that the flow at the spring box is nearly all in the streambed, rather than groundwater emerging at the spring box location. It is postulated that stream might be largely fed at the original spring locations closer to the head of the drainage, perhaps receiving water from an underlying fracture zone. However, this could not be verified without better access to those locations. More persistent flows later into the summer at Old Original potentially support the interpretation of fracture flow, particularly considering the small drainage area compared to the other spring locations. It might be possible to better capture the surface flow in the spring box by improving the existing surface structures; however, it appears unlikely that more deeply excavated structures would significantly improve the capture of water at this location.

6.2.4 Lake Fork

, lenticular-shaped zones of low resistivity are observed at depths between approximately 7 and 23 meters (23 and 75 feet). These zones are suggestive of paleochannels within the overburden that might contain coarse-

grained, water-bearing materials. These materials do not appear to be in direct hydraulic connection with the spring box. Further to the east, between approximately 89 and 119 meters on the traverse, are a series of conductive features that are interpreted as a potential zone of intersecting, water-bearing bedrock fractures. These features, which are at depths of approximately 27 meters (89 feet), appear to be in hydraulic communication with the potential paleochannels, which might be feeding the deeper fracture system, but do not appear to be in hydraulic connection with the overlying spring box.

[REDACTED] This saturated zone appears to be perched on a high-resistivity layer, likely representing shallow bedrock, and is likely the zone feeding the spring box. Shallow water can be heard percolating through the rocks just upslope of the spring box. WWE interprets this zone as a minor contact spring, and the observation of Mancos Shale fragments in the stream at the start of the traverse support the conclusion of a contact spring.

[REDACTED] (46 to 92 feet). These near-vertical zones are interpreted to be water-bearing fractures within the bedrock, and they do not appear to be contributing water to the spring box.

It is our opinion that the spring box at Lake Fork is intersecting a minor contact spring and that there is little opportunity to increase flow collected at the spring box location. The western-most potential paleochannel might possibly be further explored with a large track excavator that could reach a depth in excess of 25 feet. A drilling rig would be required to reach the potential fracture zones underlying the spring box location, but further exploration by drilling is unlikely to be of value given the previously discussed limitations of wells on this site.

6.3 Summary of Results

The 2DR geophysical survey performed at selected spring sites demonstrates the complexity of the underlying hydrogeologic conditions on Mount Lamborn. WWE's interpretation of the geophysical data indicates the presence of the three major types of springs (gravity, contact and fracture) as well as some combinations of these spring types. At German Creek, both gravity and fracture springs are interpreted. At Reynolds Creek, the spring appears to be a classic contact spring. At Old Original, a fracture source is postulated. At Lake Fork, a contact spring is interpreted.

Existing collection systems sometimes appear to have been constructed at locations based on observed surface expressions of the springs. The subsurface information provided by the geophysical surveys indicates that there are additional areas nearby that may contain greater yields of shallow subsurface flow. For example, the Lower German Creek collection box appears to be approximately 130 feet south of a much larger area of saturated overburden that is potentially combined with fracture flow. This is not surprising, as the technology to better image the hydrogeologic conditions is relatively new compared to the age of the spring collection systems.

Further verification to determine the nature of the features identified by the surface geophysical survey and further exploration to determine the extent of those features are important next steps. Access to the sites by either excavation equipment or drilling rigs is a significant limiting factor with respect to such efforts. In addition, drilling for the purpose of exploring and verifying the deeper potential fracture features (such as at Lake Fork and Old Original) may not have value if power cannot be provided for

pumping equipment or if sufficient artesian pressure does not exist to bring water to the surface without pumps. However, opportunities do exist for using track excavation equipment to verify and explore some of these locations, such as Middle German Creek, Lower German Creek, and perhaps Lake Fork. Alternatively, some locations could potentially benefit by improving existing collection structures, such as at Old Original and Reynolds Creek. More detailed evaluations of those structures and the ability to improve them should be contemplated as part of future phases in planning for further spring collection and/or development.

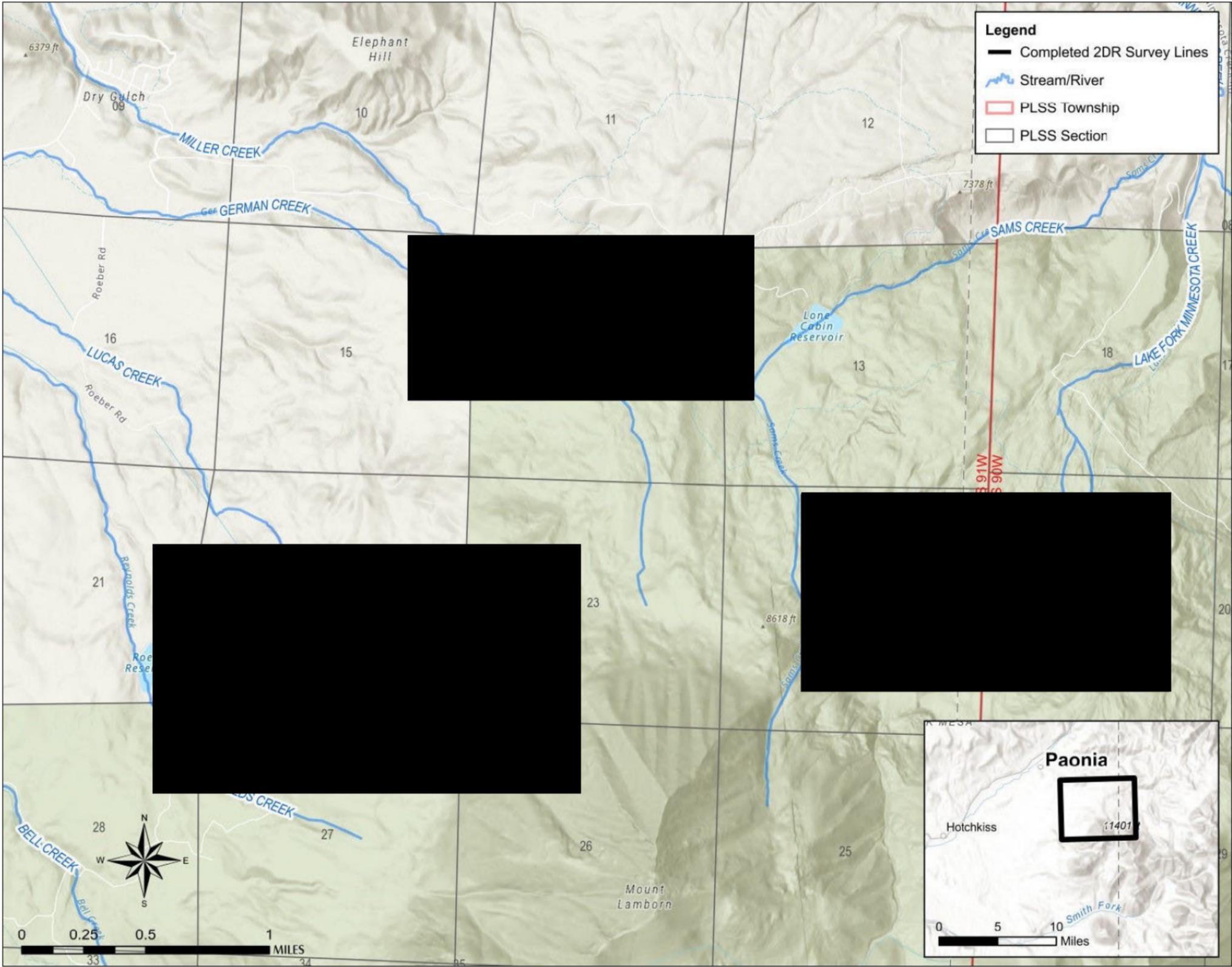


Figure 18. Geophysics Overview of 2DR Section Lines.

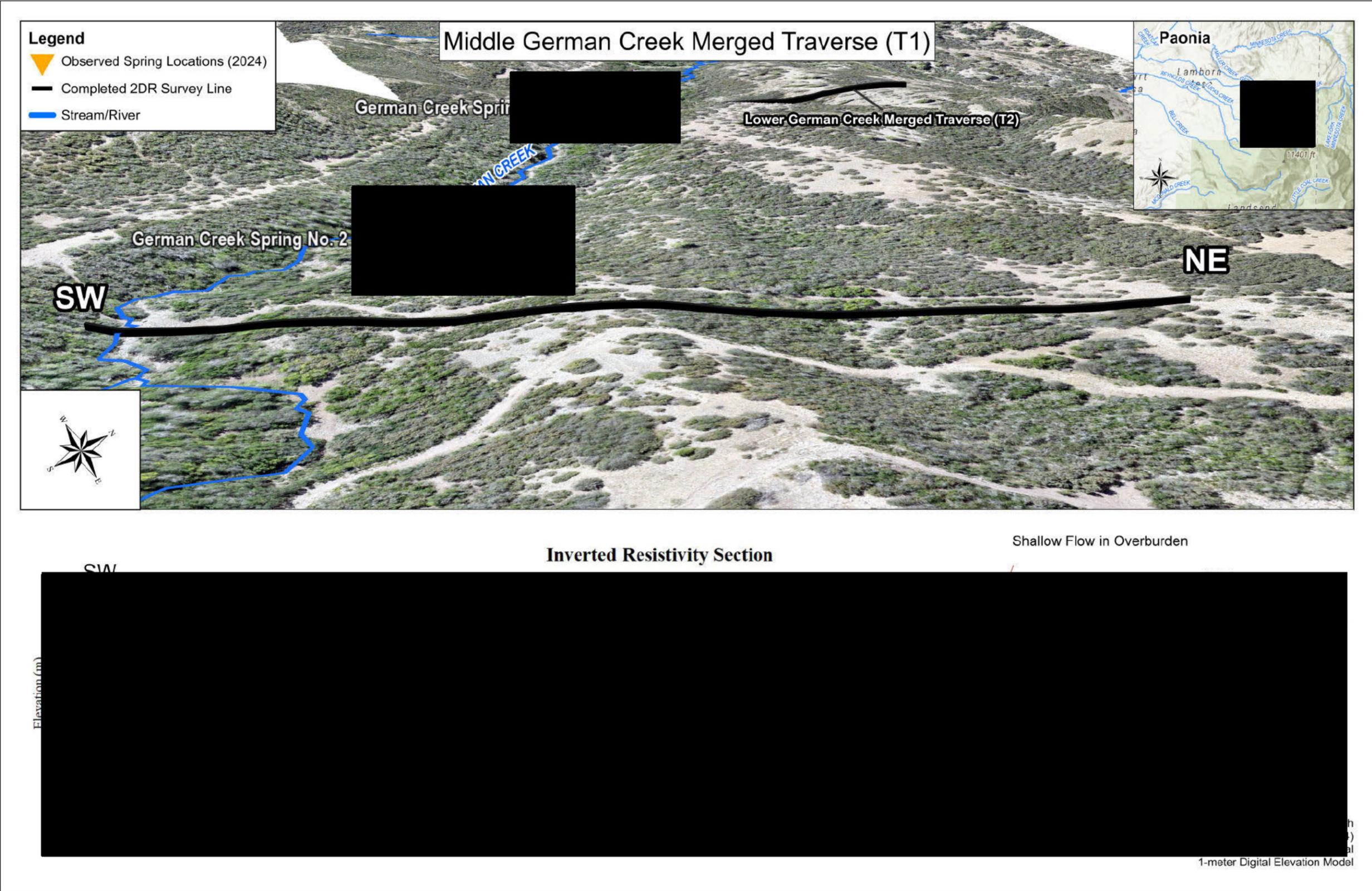


Figure 19. Middle German Creek Merged Traverse (T1).

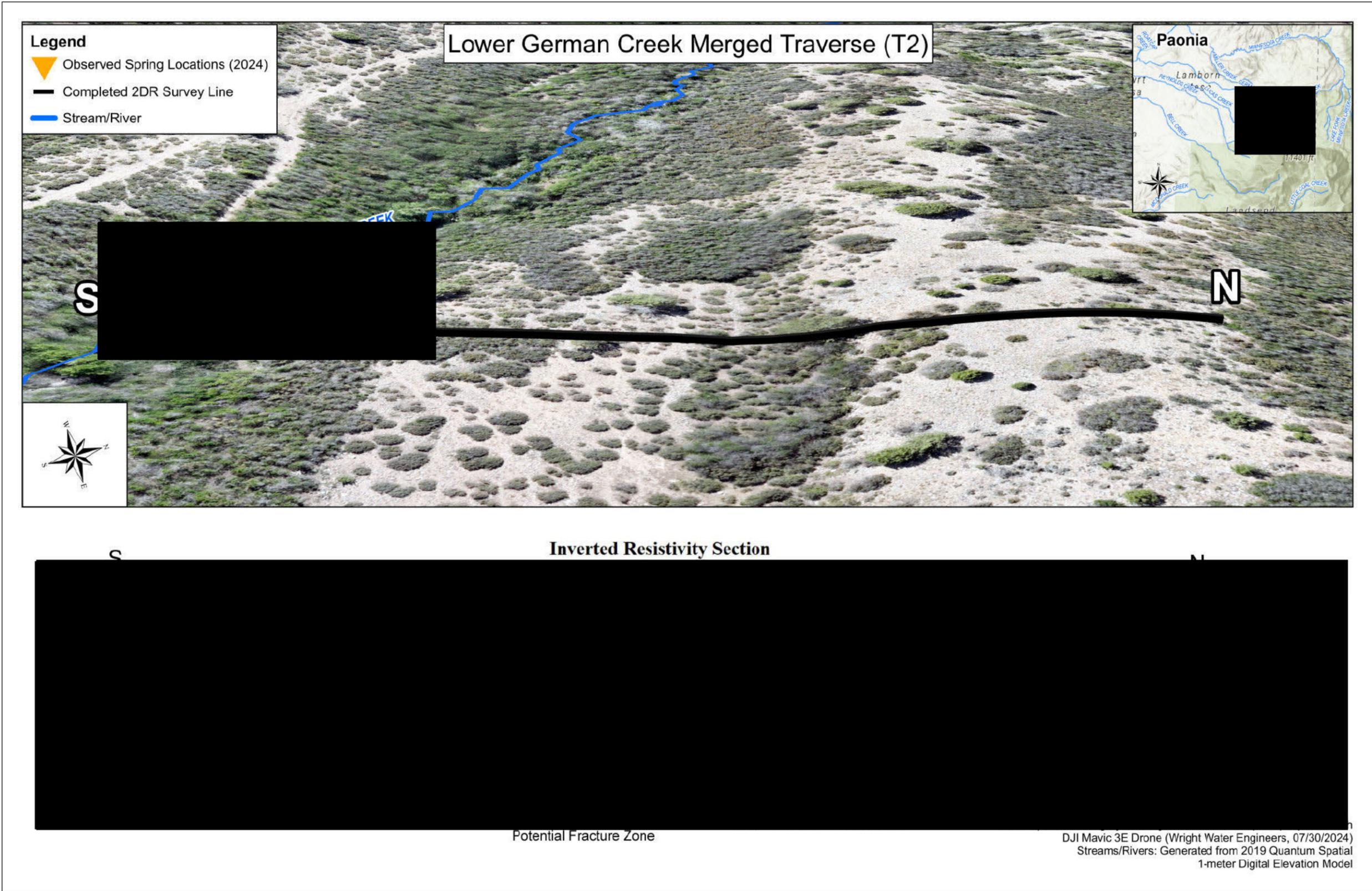


Figure 20. Lower German Creek Merged Traverse (T2).



Figure 21. Reynolds Creek Traverse (T3).

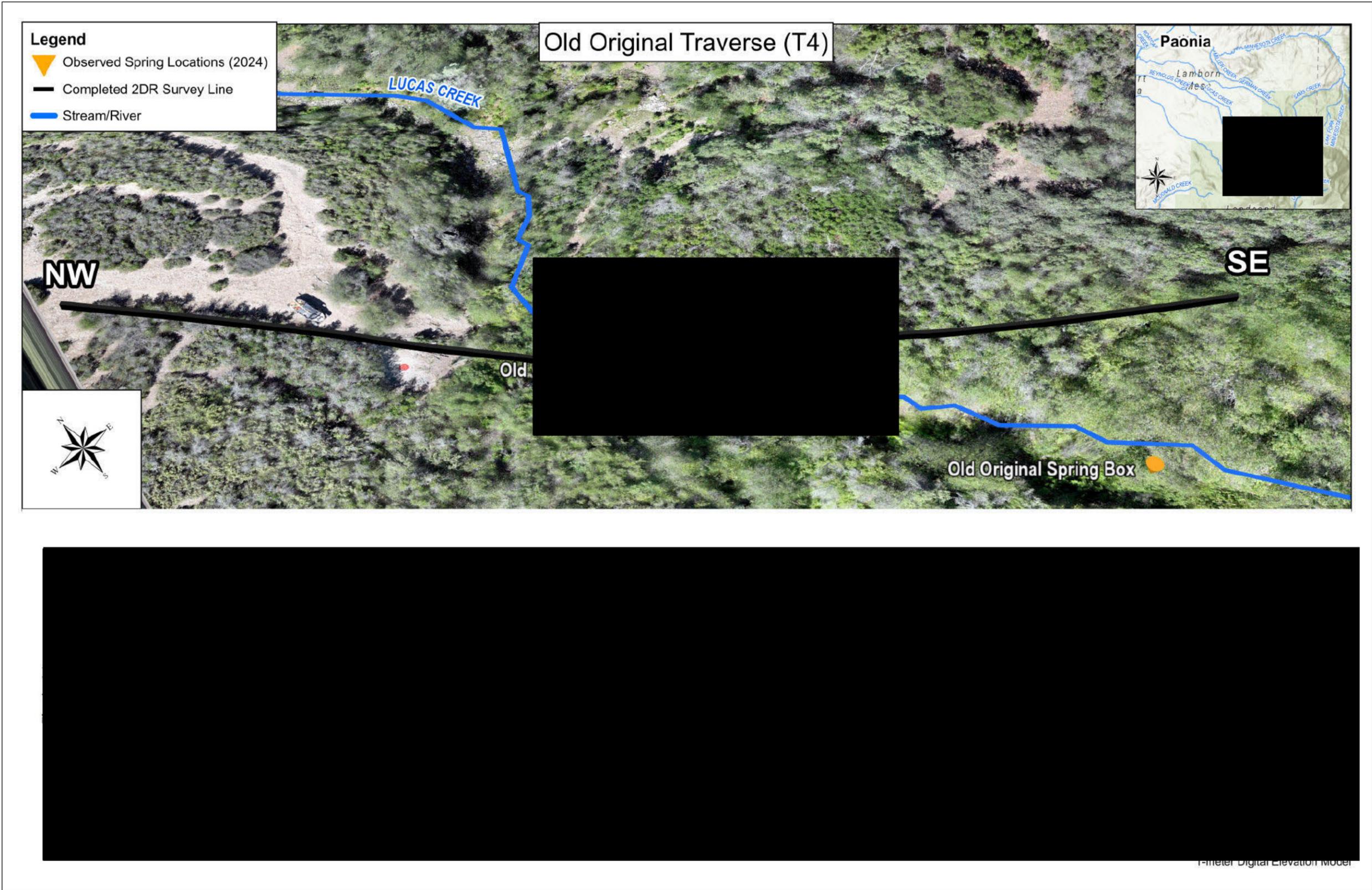


Figure 22. Old Original Traverse (T4).



Figure 23. Lake Fork Perpendicular Traverse (T5).

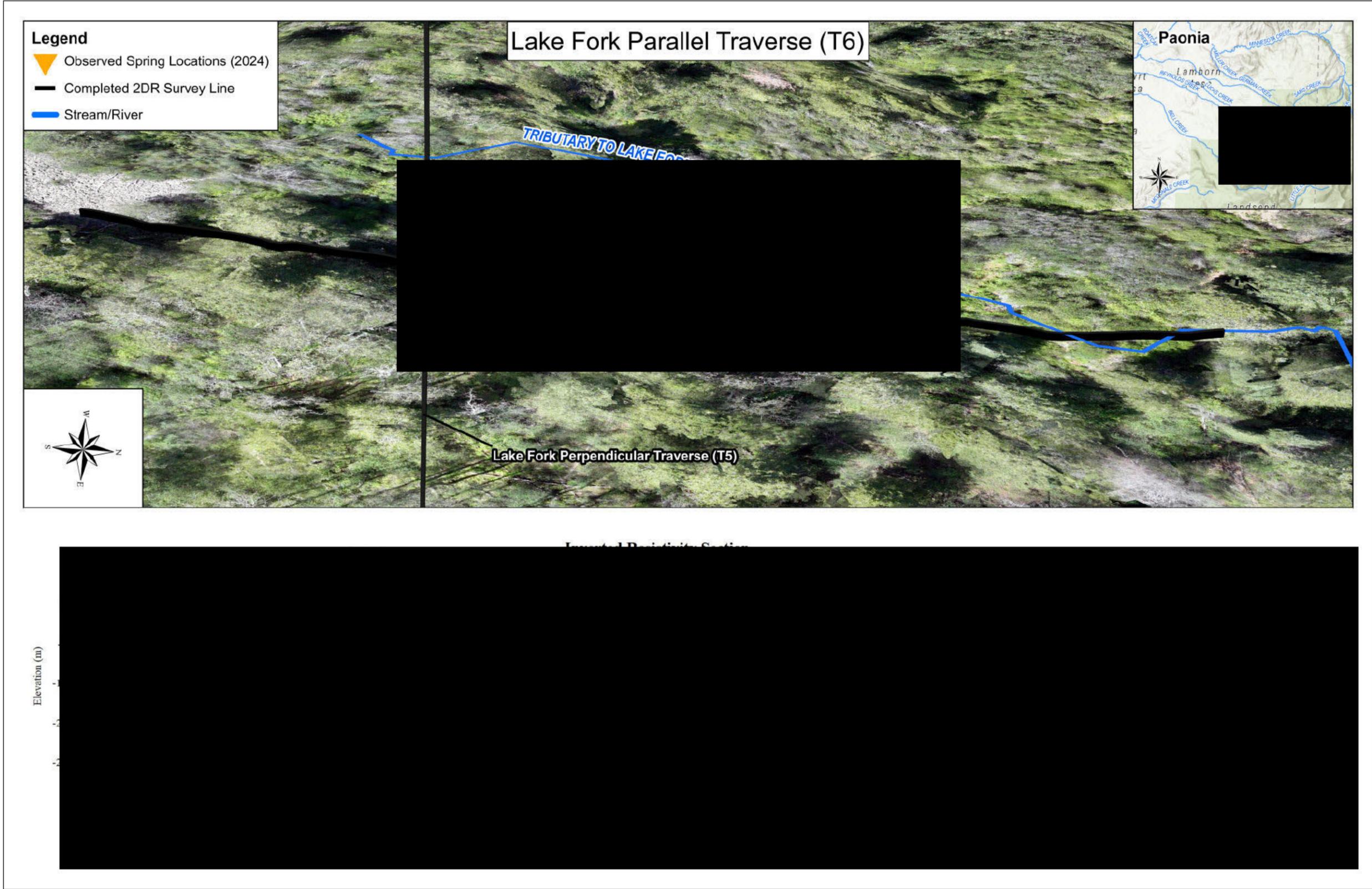


Figure 24. Lake Fork Parallel Traverse (T6).

7.0 WATER RIGHTS

The springs that feed the Town's domestic water supply are all located within the North Fork Gunnison River (North Fork) drainage basin. The North Fork is an over-appropriated drainage basin, meaning that, at least during certain times of year, there are more decreed water rights than flow available to satisfy the rights. In the North Fork basin, as in most drainages, the river is controlled by senior (older) irrigation water rights that often date back to the 1880s.

During times of shortage, senior water rights have the ability to place a "call" on the river and ask that the Division 4 Engineer of the Division of Water Resources (DWR) administer the stream. During a call, the Division Engineer begins by curtailing any unadjudicated water rights first, followed by the most junior water rights. Only those water rights located above (upstream) the calling right are affected by a call, but that includes rights on tributaries whose confluence is above the calling right.

As discussed earlier, the Town's water supply is divided into two areas. The springs that feed the collection system that delivers water to the Lower Plant and those that feed into the collection system for the Upper Plant. We will summarize the water rights for both areas, but the focus of the water rights discussion will be on those springs feeding the Upper Plant (Figure 25).

Water rights administration in Division 4 has historically been viewed to be at a more relaxed level than other divisions. WWE recommends that any water supply development plan be based on the assumption of strict administration in the future.

Additional development of water supplies needs to be in line with the water court decreed locations for the senior rights. For surface water diversions, locations that are found to be within 500 feet of their decreed location are considered to be in compliance with the decree. Proposed locations for further development of the spring water rights should be confirmed with a legal interpretation of the decree by the Town's water attorney.

WWE mapped the Town's water rights that deliver water to the Upper Treatment Plant to show the legal description compared to the features observed in the field (Figure 26, Figure 27, and Figure 28). WWE also included the 500-foot buffer around the decreed location to indicate the area within which further spring development might occur without triggering a change in water right.

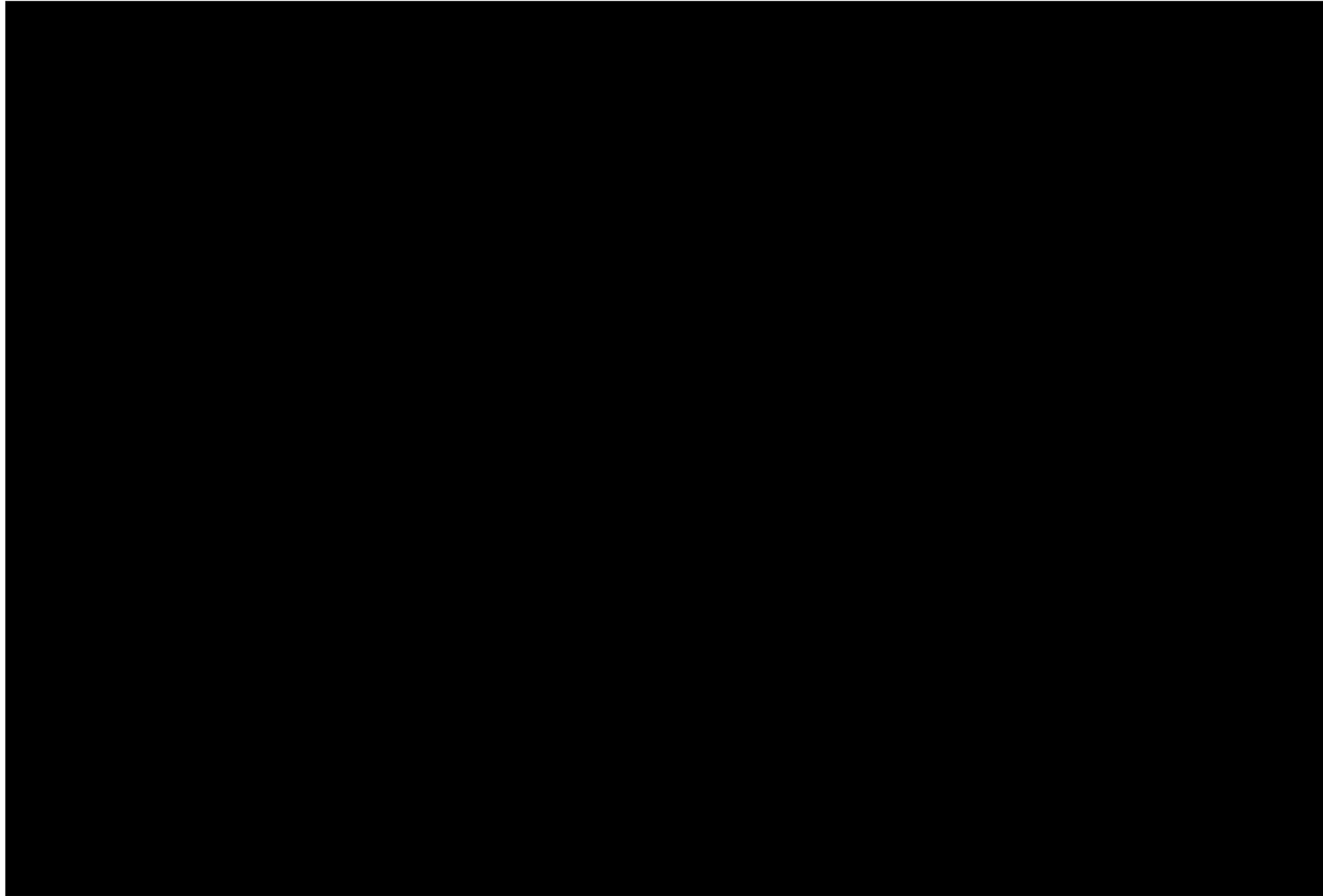
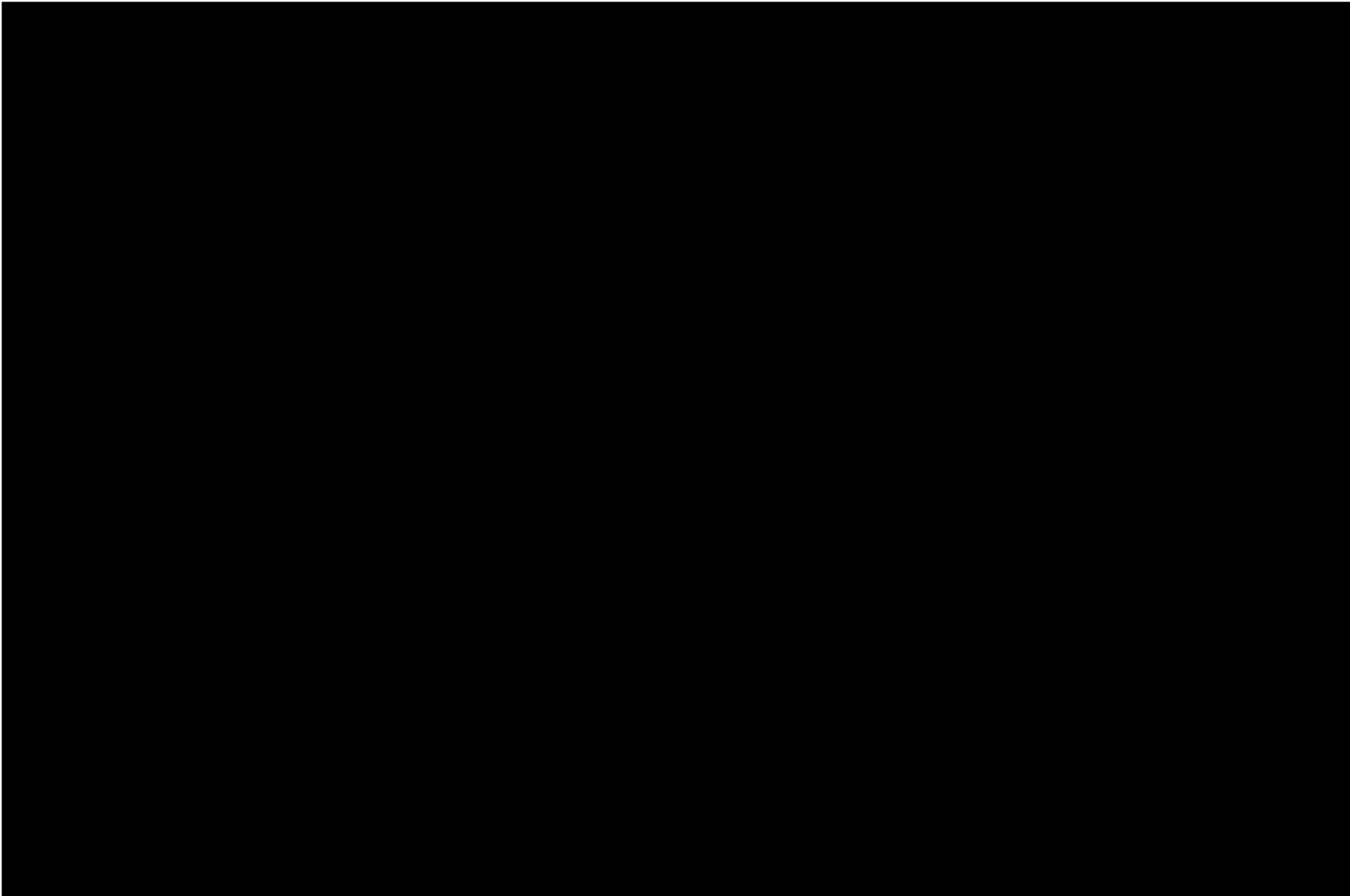
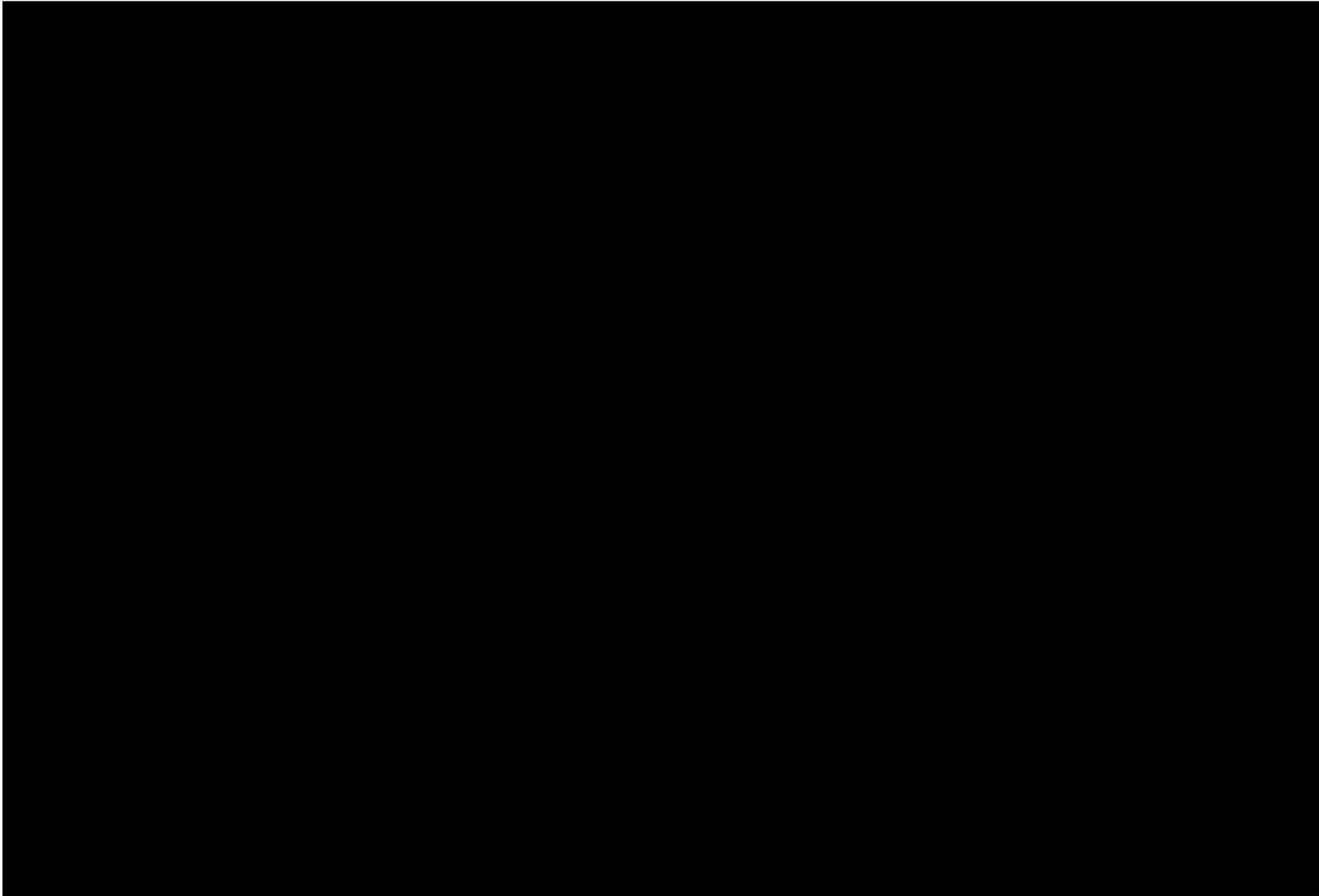
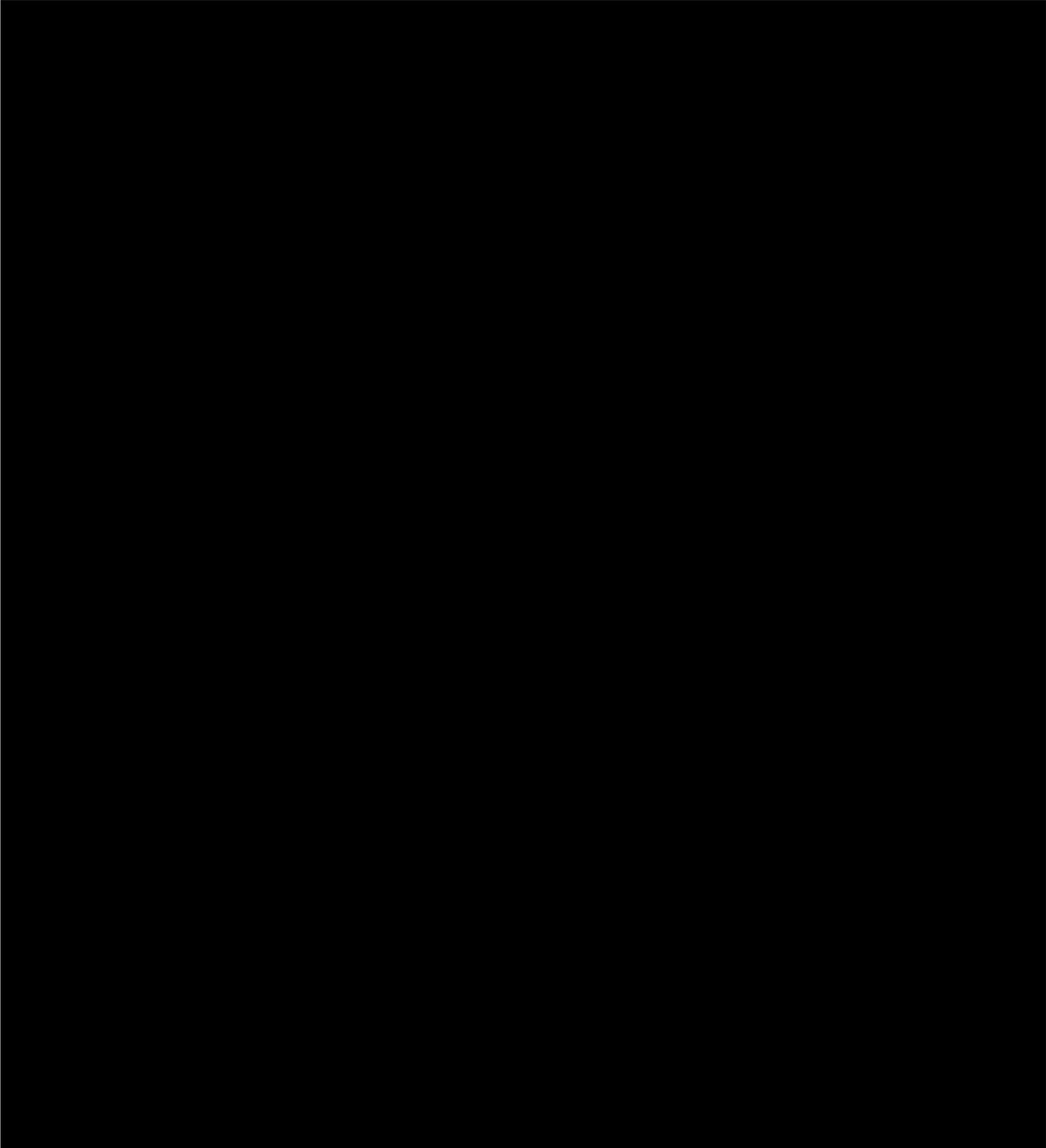


Figure 25. Paonia Water System Schematic (WestWater Engineering, 2000)







7.1 Previous Water Rights Reports

Minion Hydrologic (1994), WestWater Engineering (2000), and W.W. Wheeler & Associates (2004) have completed previous studies that have at least included documentation of the water rights associated with the Town's springs and the associated collection system. The Minion Hydrologic report was the most comprehensive and is included (without the appendices) as Appendix B.

The Town's previous water attorney, Sherry Caloia, prepared a water rights table in 2023, included here as Table 4. Table 4 represents Ms. Caloia's research of previous engineering reports obtained by the Town, the Division Engineer's tabulation of water rights, review of the decrees, conversation with the Water Commissioner for District 40, and review of contractual agreements involving the Town.

For the purposes of this report, Table 4 represents the extent of the investigation regarding the springs delivering water to the Lower Treatment Plant. WWE made some observations regarding some of the water rights associated with the Upper Treatment Plant that will be discussed below.

Table 4. Town of Paonia Water Rights Table 2023

Name	Decree	Priority	Amt in cfs	Use	Dates	Notes	Water Treatment Plant
Beaver Dam Ditch or Lake Fork Springs	567 (W3216) See 14CW3004 14CW3004			I M	Irrigation season only Nov 1 – March 31		Upper Plant
German Creek Sp Collection	423 3503 W-3188 (80CW100) W-3188			M M M	1883/1889 1883/1889 1882/1954 1974/1977		Upper Plant
Meyer & Orth	38 CA0423 3503			M M M	1882/1889		Upper Plant
Lucas Ditch	CA0038 + CA00475			M	1884/ 1889 1905		Upper Plant Old Original Spring Reynolds Creek Spring
Bell Creek Pipeline (Decreed Name)	W-3279 + 80CW81 3503			M M	1883/1889 1930/1936		Lower Plant
Paonia Pipeline (Decreed Name)	2574 80CW81			M	1883/1889		Lower Plant
Clark Springs							Lower Plant
Corral Sp 1	4808 + W-3279			M			Lower Plant
Corral Sp 2	4808 + W-3279			M			Lower Plant
Gelwicks Sp Pipeline	5625			M	1885/1889 1885/1920		Lower Plant
Kauer Springs	3964 + 5			M			Lower Plant
Lambs Gulch Spring	3694 and 5						Lower Plant
Mays Sp							Lower Plant

Legend for Table of Water Rights Town of Paonia

1. Beaver Dam Ditch. The Clark and Wade ditch right (C&W) was transferred to this ditch. Decree states that the Town owns 12.5% or .50 cfs. This is the first priority. This amount is decreed for irrigation use only so it is limited to the irrigation season. The Town adjudicated an additional .5 cfs in 2014 which is limited by decree to the non-irrigation season November 1 to March 31.
2. German Creek Springs Collection. These springs were originally adjudicated for 4.0 cfs by the Town in 1977 for municipal uses. In 1980 the Town moved the Meyer and Orth Ditch rights it acquired from Mott and all other owners in a change/augmentation plan. The maximum diversions under these senior priorities of the M & O is 80% of the amount of the decrees (#1+9 3.16 and #J-2 .40 cfs). The Town could also divert its own 4 cfs but this right is probably never in priority when needed.
3. Kauer Spring. The Kauer Spring is only adjudicated as a part of the Mount Lambert Ditch decree along with the Spore Spring and the Upper Reynolds. The Upper Reynolds has its own decree in addition to Mount Lambert Ditch. Spore and Kauer springs have no separate decree. The Town has .25 cfs of the Mount Lambert and the balance of the Mount Lambert (.50) is abandoned.
4. Lamb's Gulch Spring. Lamb's Gulch Spring is mentioned in testimony of 84CW288 and presumably is part of the springs mentioned in Case No. 3695 as connected to the Spore, Kauer, and Upper Reynolds collection of springs. There is no separate decree.
5. Mount Lambert Ditch. There was an agreement with the Simeos referenced in Case No. 3279 that the Town owned the first .25 cfs and that the Simeos own the balance or .50 cfs. Thus, the flow of Spore Springs, Lamb Gulch, Upper Reynolds, and Kauer were all included in this .25 cfs. (The town could not call out the Spore Spring as against Simeo.) However, in 01CW282 the State abandoned .50 cfs of Mount Lambert saying that this amount was not used. Since the Town diverted the flow, I believe that this was the Simeo's .50 cfs and not the Town's.
6. Spore Spring. This spring has not been adjudicated under the name Spore Spring. However, it is included as a source for Mount Lambert Ditch. The State Engineer has separately measured and recorded the diversions from the Spore saying that it was not decreed. The Division engineer has not altered its position and is recording the Spore Spring as Mount Lambert. But the Kauer and Upper Reynolds and Lamb Gulch are also to be included in the diversion amount.
7. T + M Springs. The T+M springs do not appear to be adjudicated under this name. In 3279 the Applicant moved the AA Smith Ditch down to the T & M springs 1-3. Spring #4 was found to be a source for the Town's Mays Spring. However, a few years later Sunrise Ranch went to Court and undid that change moving the AA Smith back to its original location. T + M Springs appear to be unadjudicated otherwise.

7.2 German Creek Springs Collection System

The Town owns a junior right for 4.0 cfs decreed in Case No. W-3188 for municipal use (Figure 26). Because this junior right is typically not in priority during the irrigation season, a change of water right and plan for augmentation was also decreed in Water Court in Case No. W-2693. The Court decreed the senior priorities in the Meyer and Orth Ditch (a downstream ditch on German Creek) to be changed and/or used for augmentation for the German Creek Springs Collection System during the irrigation season.

Priorities 1 and 9 in the ditch for 1.7 and 2.25 cfs, respectively, were changed to municipal use. However, the Court only allowed the consumptive use portion (80 percent) to be changed, while the other 20 percent—representing historical return flows—must be allowed to pass downstream to the historical headgate on German Creek. Even with this limitation, the legal supply associated with the senior rights is 3.16 cfs (80% of 1.7 and 2.25 cfs).

When the junior municipal right goes out of priority, the Town must cease irrigation diversions at the Meyer and Orth Ditch and use the senior rights as an augmentation supply for the diversions under the German Creek Springs Collection System.

7.3 Beaver Dam Ditch (Lake Fork Springs)

The senior irrigation water right in the Clark and Wade Ditch was previously transferred to the Beaver Dam Ditch before the Town sought to change its use in Case No. 14CW3004 (Figure 28). The Town owns a 12.5% interest in the first 4.0 cfs, or 0.5 cfs, as specified in W-3216. The Court only allowed the historical

consumptive use (HCU) portion of the right to be changed to municipal use due to the historical return flows returning to Reynolds Creek and the North Fork bypassing intervening water rights.

Therefore, the ability to use the changed water right for municipal use was limited to the average HCU over the prior 10 years (2003 through 2012). These monthly rates range from 0.017 to 0.2 cfs during the months of April through October, significantly reducing the 0.5 cfs value during the irrigation season as shown in Table 5, below. It is unclear whether these rates would only be available if/when the full 4.0 cfs was physically and legally available given the 12.5% ownership.

Table 5. Table 1 from 14CW3004 Decree: Historical Consumptive Use of Town of Paonia Interest in Beaver Dam Ditch (AF)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003	0	0	0	2.14	5.12	9.58	13.14	11.45	4.37	3.11	0	0	48.91
2004	0	0	0	0.29	7.08	10.07	12.69	9.53	3.12	1.82	0	0	44.59
2005	0	0	0	1.00	5.54	7.17	13.14	8.51	3.73	1.53	0	0	40.62
2006	0	0	0	2.42	7.74	11.00	9.69	9.74	2.98	0.00	0	0	43.56
2007	0	0	0	1.73	5.60	9.37	12.90	10.62	3.62	1.73	0	0	45.57
2008	0	0	0	0.45	4.98	8.92	13.01	8.41	6.12	2.50	0	0	44.38
2009	0	0	0	0.00	4.39	8.43	12.86	10.24	6.91	0.91	0	0	43.74
2010	0	0	0	13.4	3.33	9.90	11.10	7.85	6.04	1.81	0	0	41.37
2011	0	0	0	0.78	3.46	9.20	11.79	10.28	5.09	1.81	0	0	42.40
2012	0	0	0	0.27	7.80	12.15	11.87	8.45	6.04	2.01	0	0	48.58
Ave (AF)	0	0	0	1.04	5.50	9.58	12.22	9.51	4.80	1.72	0	0	44.37
(cfs)	0	0	0	0.017	0.09	0.16	0.2	0.15	0.08	0.028	0	0	

During the non-irrigation season the Town can exercise its junior water right, when in priority, for up to 0.5 cfs without further limitations.

8.0 CONCLUSIONS AND AREAS OF FUTURE STUDY

WWE's investigation of the hydrogeology of the Town's water supply has provided and improved understanding of the physical and legal yield of the springs comprising the domestic water supply. The hydrogeology of the study area—comprised primarily of the springs and tributary basins supplying water to the Upper Treatment Plant—is complex beyond what has historically been understood based on the spring surface expressions. WWE found that the subsurface drainage basins do not match the surface topography, with some of the better-producing springs appearing to have some of the smaller tributary areas.

The inherent challenge with the water supply is that the springs generally have a seasonal hydrograph similar to a surface water source. When the spring flows drop off in the late season, the supply can struggle to meet demand. With only operational storage in the system, there is no mechanism to store the higher raw water flows for delivery later in the season. As a result, WWE prioritized spring complexes that maintained higher flows in the late season as resources to explore for further development.

The initial hydrologic modeling was based on regional values for key parameters such as precipitation and evapotranspiration and relied upon recently installed pressure transducers to collect data at key locations to estimate flows being collected at the springs. WWE was receiving pressure transducer data through September 2025 from Town staff that we processed to estimate flows using hydraulic analysis of the collection systems with schematics and dimensions provided by RESPEC. WWE was able to draw broad conclusions from our modeling efforts. There is generally more water that is available than is currently being captured at the collection systems. This conclusion matches the fact that during high runoff, significant water is bypassed at the spring boxes due to the flows exceeding system capacity. In addition, there appears to be significant losses in the conveyance system delivering the water to the Upper Treatment Plant. The Town and RESPEC are planning on installing permanent flow measurement stations at key locations in the collection system. WWE proposed to use the structure of the hydrologic model developed in this investigation combined with the improved accuracy and consistency of the proposed flow data to refine the modeling and enable the results and conclusions to be more quantitative.

WWE's initial evaluation of the water rights associated with the Town's springs found that there were limitations to some of the supplies that should be factored in when prioritizing potential spring development projects. These initial findings lead us to prioritize the Old Original, German Creek Springs, and, to a lesser extent, Lake Fork (Beaver Dam Ditch) supplies with our investigation.

The geophysical surveys provided valuable insight into where there might be additional flow at the locations identified as having senior water rights that had not fully developed the decreed water rights. The results of the 2DR survey showed that the German Creek Springs and Old Original locations showed good potential for further field exploration. Due to access limitations, exploration and potential development should be focused on shallow resources that can be developed without requiring drilling rigs and pumping.

WWE has identified the following areas of future study and next steps the Town may take.

1. The Town has implemented an expanded and improved monitoring program to collect flow data at key locations within the spring collection system. These data should be integrated into the hydrologic model to better understand the water balance and where there should be additional water supplies for development.
2. Document the infrastructure comprising the raw water collection system, including the delivery pipelines from the spring boxes to the Upper Treatment Plant. Hydraulically evaluate the capacity of the pipelines to understand where limitations exist. Additionally, the condition of the infrastructure needs to be evaluated to identify where significant system losses occur.
3. Develop a thorough understanding of the water rights associated with the Town's springs to help the Town prioritize additional physical supplies associated with water rights that will remain in priority even in dry years.
4. Field investigation of locations identified by the geophysics survey to verify the presence of water and better understand the development potential.

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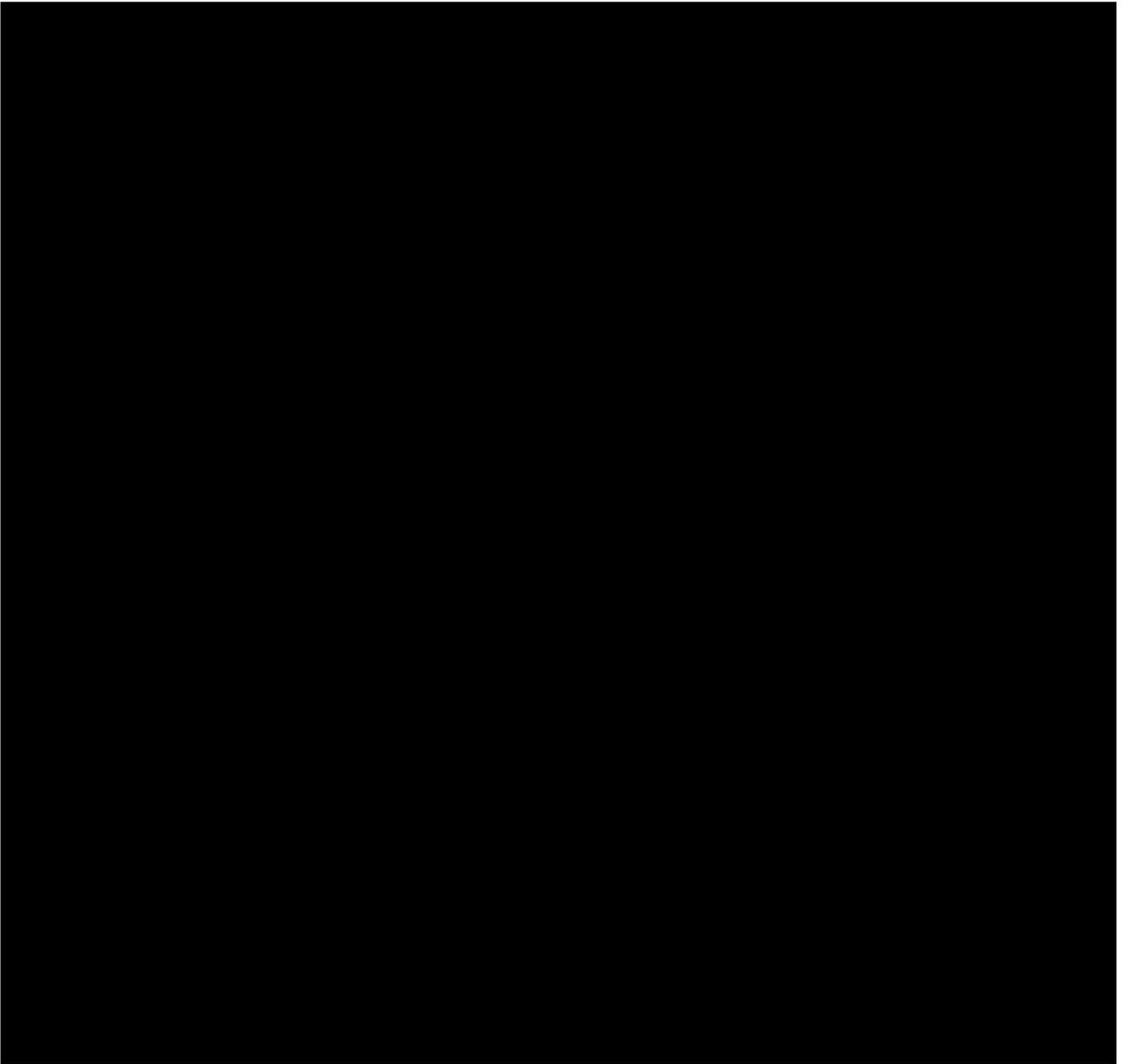
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ATTACHMENTS

Appendix A. Section 4.0 Water Balance

PRISM Data Collection and Computation Protocol

- Downloaded monthly 4 km resolution grids for period of record (August 2024 through July 2025)
 - Data are provisional and subject to revision for March 2025 through August 2025.
 - From PRISM: “PRISM grids are modeled multiple times after a month has ended to accommodate data reporting and quality control schedules from various station networks. The first model run for a particular month is made on the first day of the following month. The second through seventh runs, which include visual inspection of the maps and data quality assessment by a trained analyst, are completed by about the 15th of each month, out to six months. After six months, most stations have reported and undergone quality control checks. The seventh model run is therefore considered "final," until the time series dataset undergoes a major revision.”
<https://prism.oregonstate.edu/calendar/>
 - Total PRISM data in each watershed for PHASE 1 Springs calculated by averaging PRISM precipitation grid values within each drainage area
 - Monthly volume of precipitation calculated by multiplying precipitation depth by drainage area
-







Appendix B. Minion Hydrologic Report



MINION HYDROLOGIC

61006 Jay Jay Road
Montrose, CO 81401
(303) 240-8078

8 December 1994

Mr. James Briscoe
Briscoe Stanway & Harper, P.C.
104 W. Bridge Street
P.O. Box 120
Hotchkiss, CO 81419

Re: Town of Paonia - Water Rights

Dear Jim:

At your request, Minion Hydrologic has performed an analysis of the water rights associated with the Town of Paonia. The study has included review of the State Engineer's Office (SEO) water rights alpha list for Division 4, District 40; review of applicable water right decrees; and review of previous file information and reports regarding the raw water sources utilized for the Town's water supply. The water rights analysis is based upon the raw water sources presently used by the Town of Paonia. This report summarizes the results of the initial water rights study for the Town of Paonia.

Water rights data in this report is presented as follows:

- 1) Individual water rights analyses of each particular raw water source utilized by the Town of Paonia.
- 2) A summary of the water rights associated with the Town utilizing data presented in the individual water right analyses.
- 3) Other issues and concerns associated with the Town's existing water rights.

The individual water rights analyses are presented in alphabetical order for ease of reference. The order of presentation is not related to water rights priority in terms of appropriation or adjudication dates. The decreed locations of the water rights owned (or believed to be owned) by the Town of Paonia, and other relevant water rights, are shown on attached figure 1 (pocket).

BEAVER DAM DITCH

The Beaver Dam Ditch water rights associated with the Town of Paonia are commonly known as the "Lake Fork Springs". Review of the Beaver Dam Ditch decrees did not reveal the particular water

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rights in the ditch which are owned by the Town. A total of 3.12 cfs is decreed to the Beaver Dam Ditch (diverting from Minnesota Creek). Of this amount, 0.62 cfs is senior water rights transferred to the ditch from the Clark and Wade Ditch. The remaining 2.5 cfs was decreed in Case Nos. 617 (1.2 cfs) and 2030 (1.3 cfs).

Copies of the SEO water rights alpha list and pertinent decrees for the Beaver Dam Ditch and Clark and Wade Ditch are shown in attached Appendix A. A summary of the water rights decreed to the Beaver Dam Ditch is as follows:

BEAVER DAM DITCH

- WATER RIGHTS SUMMARY -

NOTES:

- (1) cfs = cubic feet per second.
- (2) TF = transferred from
- (3) P- = priority no.

The 0.62 cfs water right transfer to the Beaver Dam Ditch from the Clark and Wade Ditch is described in Case No. W-3216. Review of this decree indicates a total of 8.23 cfs of priorities 1, 2, 7

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and 8 decreed to the Clark and Wade Ditch was divided-up between the Turner Ditch, Beaver Dam Ditch, Sweezy and Turner Ditch, Minnesota Ditch and the Clough Ditch. In Case W-3216, the Beaver Dam Ditch apportionment was described as 0.5 cfs of the initial 4 cfs of priority 1, and 3% of all water available above the initial 4 cfs amount. This equates to 0.12 cfs (3% of 4.23 cfs) + 0.5 cfs, which totals the transferred amount of 0.62 cfs.

Review of the Clark and Wade Ditch decrees (Appendix A), indicates a total of 8.46 cfs was adjudicated in this ditch under priorities 1, 2, 7 and 8. The original decree (Case 38) was decreed for 5.6 cfs absolute and 1.4 cfs conditional. These amounts represent priorities nos. 1 and 2. The 1.4 cfs conditional amount was later abandoned in Case CW74/48. The Clark and Wade Ditch was later decreed for 1.86 cfs (priority 7) and 1.0 cfs (priority 8) in Case 228. Thus, the total decreed to the Clark and Wade Ditch equalled $5.6 \text{ cfs} + 1.86 \text{ cfs} + 1.0 \text{ cfs} = 8.46 \text{ cfs}$.

Of the 8.46 cfs amount decreed to the Clark and Wade Ditch, 4.0 cfs was transferred to the Turner Ditch and the Beaver Dam Ditch in Case 567 (App. A). Review of Case 567 did not indicate the specific amounts of each priority transferred to each ditch. The transferred amounts and priorities (e.g. 3.5 cfs priority 1 to Turner Ditch and 0.5 cfs priority 1 to Beaver Dam Ditch) are stated in Case W-3216.

In Case 886, 4.23 cfs of the remaining water rights in the Clark and Wade Ditch were transferred to the Clough Ditch (1.4 cfs), Sweezy and Turner Ditch (1.83 cfs), and the Turner and Beaver Dam Ditch (1.0 cfs). The 1.83 cfs of Clark and Wade Ditch rights transferred to the Sweezy and Turner Ditch ended up split between the Sweezy and Turner Ditch (0.915 cfs) and the Minnesota Ditch (0.915 cfs), as described in W-3216. It is not clear where the extra water originally decreed to the Clark and Wade Ditch is apportioned (eg. $8.46 \text{ cfs} - 8.23 \text{ cfs} = 0.23 \text{ cfs}$ of undeclared water rights). This amount could be the "very small portion of priorities 1, 2 and 7 still remaining in W. A. Clark's original appropriation" as discussed on page 2 of Case 567.

Based on the SEO water rights alpha list, the Beaver Dam Ditch is decreed for a total of 3.12 cfs. Of this amount, 0.54 cfs is priority 1 transferred from the Clark and Wade Ditch, 0.08 cfs is priority 2 transferred from the Clark and Wade Ditch, 1.20 cfs was decreed in Case 617, and 1.3 cfs was decreed in Case 2030. The determination of the 0.54 cfs priority 1 consists of: 1) 0.50 cfs priority 1 transferred in Case 567, and 2) 0.04 cfs of the

remaining portion of priority 1 (5.6 cfs - 4.0 cfs = 1.6 cfs x 3% = 0.048 cfs). The origin of the 0.08 cfs priority 2 amount is a little unclear. All the water in the Beaver Dam Ditch is decreed for irrigation use.

The amount of ownership of Beaver Dam Ditch rights by the Town of Paonia is not known, based on review of the decrees. It will be necessary to clarify which priorities are owned by the Town based on chain-of-title ownership (possibly purchased from the Roebbers?). It will also be necessary to change the decreed use of the Beaver Dam Ditch water rights to include municipal uses in order to cover the non-irrigation season municipal diversions.

The decreed location of the Beaver Dam Ditch is described in Case W-3216 as being in the SW $\frac{1}{4}$ of Section 19, Township 14 South, Range 90 West, N.M.P.M. Previous decreed location description in Case 567 placed the diversion point further north in Section 18 of the same Township and Range. The SEO water rights tabulation shows the location as the SE $\frac{1}{4}$, NW $\frac{1}{4}$, SW $\frac{1}{4}$ of Section 19 (figure 1). It would be prudent to provide an accurate location description of the diversion point (or reach) for the Beaver Dam Ditch in any change cases filed with the Water Court.

BELL CREEK PIPELINE

The Bell Creek Pipeline was decreed in Case 3503 for 0.75 cfs for municipal use. The applicant in this case was the Town of Paonia. Copies of the SEO water rights tabulation for the Bell Creek Pipeline and Case 3503 are shown in attached Appendix B. A summary of the water rights associated with the Bell Creek Pipeline is as follows:

BELL CREEK PIPELINE

WATER RIGHTS SUMMARY

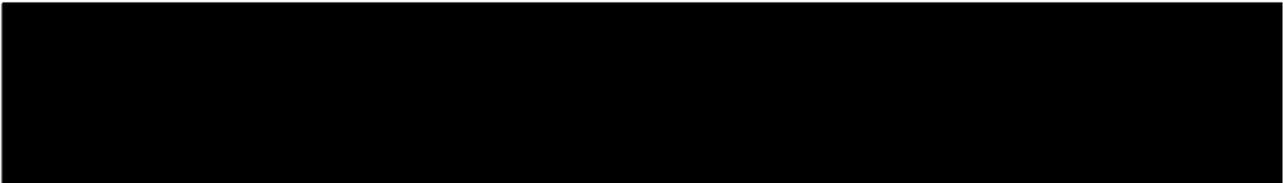
(1) cfs = cubic feet per second

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The location of the Bell Creek Pipeline, as described in Case 3503, is the same location as the Mayes Spring (fig. 1). In Case 3503, it is stated that the Bell Creek Pipeline already carries decreed water in the amount of 1.0 cfs. This amount is assumed to be the 1.0 cfs decreed to the Paonia Pipeline (Mayes and Pole Patch Springs for 0.5 cfs each). The 0.75 cfs decreed to the Bell Creek Pipeline in Case 3503 is additional to the 1.0 cfs already decreed to the Paonia Pipeline.

CORRAL SPRINGS NOS. 1 AND 2

The Corral Springs Nos. 1 and 2 were decreed for 0.50 cfs each in Case 4808. The applicant in the case was the Town of Paonia. The decreed uses for the Corral Springs are irrigation, domestic, manufacturing, fishing, recreational, power, and other beneficial uses. Copies of the SEO water rights alpha list and Case 4808 are shown in attached Appendix C. A summary of the water rights associated with the Corral Springs Nos. 1 and 2 are shown below.



CORRAL SPRINGS NOS. 1 & 2



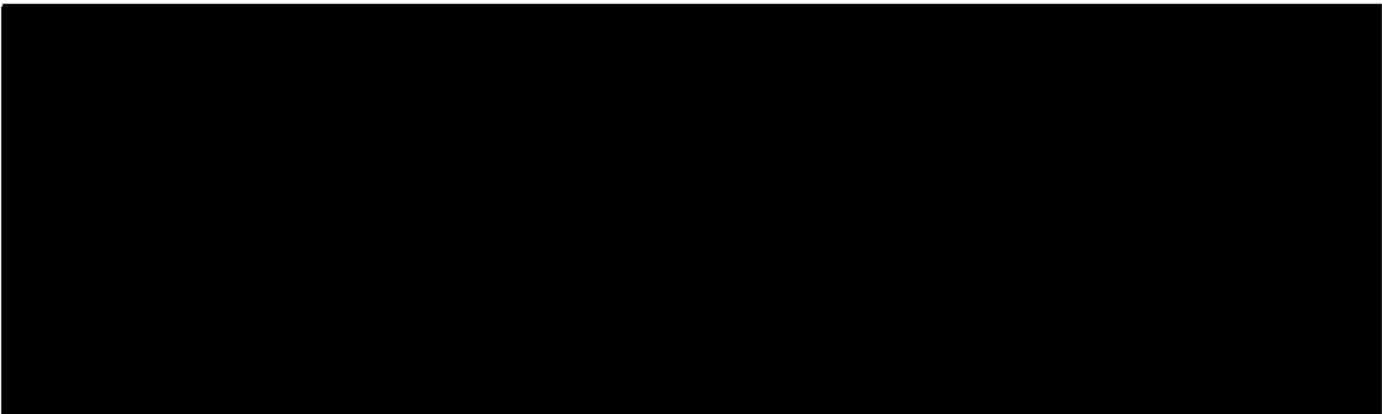
(1) cfs = cubic feet per second

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GELWICKS SPRING PIPELINE

A summary of the water rights associated with the Gelwicks Spring Pipeline is as follows:

GELWICKS SPRINGS PIPELINE



- (1) cfs = cubic feet per second
- (2) TF = transferred from

Water rights dedicated to the Gelwick Springs Pipeline were transferred from the Gelwicks Ditch in Case 5625. The petitioner in this case was the Town of Paonia. Use of the 1.85 cfs water right amount transferred in Case 5625 was changed in the decree from irrigation to domestic, irrigation and municipal purposes.

Review of decrees associated with the Gelwicks Ditch indicates the ditch was decreed for 0.6 cfs absolute and 1.4 cfs conditional in Case 38. The ditch was decreed for an additional 1.25 cfs in Case 1424. The 1.4 cfs conditional amount decreed in Case 38 was abandoned in Case CW74/79. The 0.6 cfs amount decreed in Case 38 and the 1.25 cfs amount decreed in Case 1424 totals the 1.85 cfs of Gelwicks Ditch water rights transferred to the Gelwicks Spring Pipeline in Case 5625.

Copies of the SEO water rights alpha list and decrees associated with the Gelwicks Springs Pipeline and Gelwicks Ditch are shown in attached Appendix D.



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Review of the SEO water rights alpha list indicates the Gelwicks Spring Pipeline is incorrectly located in the water rights tabulation. The SEO records show the Gelwicks Spring Pipeline as being located in the NE $\frac{1}{4}$, Section 5, Township 15 South, Range 92 West, 6th P.M. - the Range location should be 91 West.

GERMAN CREEK SPRINGS COLLECTION SYSTEM

[REDACTED] In Case 85CW100, the German Creek Springs Collection System was decreed absolute for diversion from Spring No. 1, Spring No. 2, Spring No. 3, and a surface water diversion from German Creek. Decreed uses include municipal, irrigation and commercial. Case 85CW100 made absolute conditional decrees and diligence awarded in previous Cases W-3188 and 80CW415. Copies of the SEO water rights alpha list and relevant decrees for the German Creek Springs Collection System and the Meyer and Orth Ditch are shown in attached Appendix E.

In Case W-2693, the Town of Paonia filed for a change of water rights and plan for augmentation to transfer senior priorities in the Meyer and Orth Ditch to the German Creek Springs Collection System. In the decree, it is stated that the Town is the owner of 3 priorities in the Meyer and Orth Ditch as follows:

- 1) priority 1 for 1.7 cfs decreed in Case Not Available *
- 2) priority 9 for 2.25 cfs decreed in Case 423 **
- 3) priority J-2 for 0.5 cfs decreed in Case 3503

* 1.7 cfs amount decreed in Case 38

** The priority 9 - 2.25 cfs water right for the Meyer and Orth Ditch was decreed in Case 228; Case 423 discusses ownership amounts of the Meyer & Orth Ditch by the various parties

[REDACTED]
when the priority awarded in case 85CW100 is being called, the Town will cease irrigation under the Meyer and Orth decrees and will divert these priorities at the GCSCS alternate point. The alternate point diversion at the German Creek System is limited to 80% of the volume available for diversion at the Meyer & Orth headgate, based on the assumption that 80% of the water

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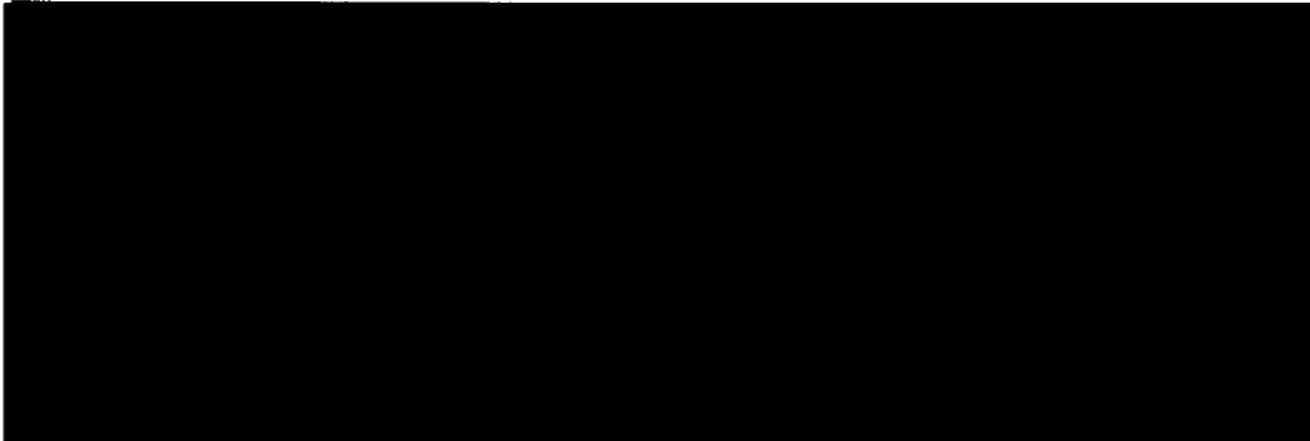
historically diverted at the Meyer and Orth Ditch was consumptively used for irrigation purposes.

In the decree, priority J-2 for 0.5 cfs was transferred to the municipal system. The remaining priorities were to be transferred on an "as needed" basis as described in the augmentation plan (alternate point), or used for continued irrigation of land under the Meyer and Orth Ditch. The Meyer and Orth augmentation water is available during the time period of May 15 through September 15 of any given year. Outside these dates the Town is diverting under the priority awarded in Case 85CW100 (W-3188), except the 0.50 cfs under priority J-2, which was previously decreed for year-round uses of domestic and stock water.

The uses decreed in Case W-2693 include municipal, domestic, irrigation, mechanical, manufacturing, etc. The applicant in this case, and the other German Creek System decrees, is the Town of Paonia. A summary of the German Creek Springs water rights are as follows:

GERMAN CREEK SPRINGS COLLECTION SYSTEM

- WATER RIGHTS SUMMARY -



- (1) cfs = cubic feet per second
- (2) TF = transferred from
- (3) abs. = absolute

The overflow, or waste water, from the German Creek Springs Collection System is ordered to be returned to the stream at the

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decreed headgate location on the north bank of German Creek (W-2693). The decreed locations of the GCSCS headgate, springs 1-3, and the surface water diversion point are shown on figure 1. The decreed GCSCS headgate location is the same as the decreed location of the Meyer and Orth Ditch headgate.

In Case 85CW100, it is stated "A manifold system below Spring No. 1 allows full control of water from the Lake Fork Spring to be joined with Spring No. 1 ..." Water from the Lake Fork Spring is diverted water from the Beaver Dam Ditch, which as previously mentioned is not decreed for municipal use.

Review of the Meyer and Orth Ditch decrees shows the ditch was awarded 1.7 cfs absolute and 2.3 cfs conditional (both priority 1) in Case 38. Of the 2.3 cfs conditional amount, 0.05 cfs was abandoned in Case CW74/63 and 2.25 cfs was left. In Case 228, the Meyer and Orth Ditch was awarded an additional 2.25 cfs (priority 9), all of which was theoretically transferred to the German Creek Springs Collection System in the augmentation plan (W-2693). Finally, in Case 3503 the Meyer and Orth Ditch was awarded 0.50 cfs (priority J-2), again all of which was transferred to the GCSCS in Case W-2693. The J-2 priority was transferred for municipal use entirely in W-2693, as the decree awarded in Case 3503 was for year-round uses of domestic and stockwater.

Analysis of the Court records in Case CW74/63 (abandonment) indicates the 2.30 cfs priority 1 water right was intended to be abandoned, however the 2.30 cfs amount was reduced to 0.05 cfs. In the Minute Order Correcting Clerical Mistake for Case CW74/63 it is stated, "This decree was originally for 1.7 cfs absolute, 2.3 cfs conditional. In 1901, the Water Court made 2.25 cfs of the conditional into absolute. That leaves .05 cfs of water, which is the amount abandoned in this Action". The Water Court may have confused the 2.25 cfs priority 9 adjudication with the 2.30 cfs conditional amount decreed to priority 1.

Case 423 discusses ownership of the Meyer & Orth Ditch decrees among the various water right owners. In Case 423, the 1.7 cfs absolute priority 1 water right awarded in Case 38 was combined with the 2.25 cfs water right awarded in "decree bearing" date 12 April 1901. In this decree, the 3.95 cfs total (1.7 + 2.25) is divided amongst the following parties:

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Gonner (?)	-	0.71 cfs
Wilcox	-	1.50 cfs
Vogel	-	1.62 cfs
Koehne	-	0.12 cfs

TOTAL	-	3.95 cfs
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It is mentioned towards the end of Case 423 (App. E) that Julie Koehne objected to the ruling because the amount awarded to her was too small, and that in dividing the water the 2 decrees should not have been aggregated. Ms. Koehne stated her "interest should have been taken out of the first decree entirely, and the first decree held to be superior to the second". There were also other objectors listed, however the parties agreed "that pending said appeal the waters of said Meyers & Orth Ditch shall be divided in accordance with the decree rendered herein and that this appeal shall not act as a suspension of said decree". No record of a decision regarding the appeal(s) to Case 423 was found in the SEO records.

Review of Case 423 suggests the 2.25 cfs priority with a "decree bearing" date of 12 April 1901 is the priority 9 water right awarded in Case 228. The SEO water rights tabulation for the Meyer & Orth Ditch indicates the 3.95 cfs transfer to the GCSCS consists of 1.7 cfs of priority 1 water right and 2.25 cfs of priority 9 water right.

The remaining 2.25 cfs of priority 1 water right in the Meyer & Orth Ditch was not abandoned by the Court, and apparently was not transferred to the German Creek Springs Collection System in Case W-2693. It is not clear who owns the remaining 2.25 cfs priority 1 water right in the Meyer and Orth Ditch. It does not appear this right has been transferred to an alternate point of diversion. The potential availability of this right for use by the Town should be determined.

PAONIA PIPELINE

The Paonia Pipeline was decreed in Cases 2574 and 80CW81. In both cases the applicant was the Town of Paonia. In Case 2574, 1.0 cfs was transferred from the North Fork Orchard Ditch to both the Mayes Spring and the Pole Patch Spring (0.50 cfs each). Municipal use for the 2 springs was added in Case 80CW81. Copies of the SEO

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water rights alpha list and pertinent decrees associated with the Paonia Pipeline, Quackenbush Ditch, North Fork Orchard Company Ditch and the Burkhart Ditch (Bone Mesa Pipeline) are shown in attached Appendix F.

A summary of the water rights associated with the Paonia Pipeline is as follows:

PAONIA PIPELINE
- WATER RIGHTS SUMMARY -

Amount (cfs)	Adjudication Date	Appropriation Date	Case Number	Comments
0.50	06/17/1889	05/01/1883	2574	TF North Fork Orchard D. to Mayes Spr.; add munic. use in 80CW81
0.50	06/17/1889	05/01/1883	2574	TF North Fork Orchard D. to Pole Patch Spr; add munic. use in 80CW81

NOTES:

(1) cfs = cubic feet per second

(2) TF = transferred from



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the Quackenbush Ditch, which was later transferred to the North Fork Orchard Co. Ditch and the Burkhart Ditch.

The Quackenbush Ditch was originally decreed for 3 cfs absolute and 5 cfs conditional in Case 38. The 5.0 cfs conditional amount was later abandoned in Case CW74/47. Of the remaining 3.0 cfs amount, 2.25 cfs was transferred to the North Fork Orchard Co. Ditch and 0.75 cfs was transferred to the Burkhart Ditch in Case 582.

In Case W-3279, the Town of Paonia was a protestant in regard to water rights owned by Theodore and Madeline Simineo in the Bell Creek drainage. In Case W-3279 it is stated, "that the Town of Paonia, Colorado is entitled to the first 1.0 cfs of water from Priority #1 on Bell Creek, on a year-round basis, for the uses of irrigation, municipal and domestic, and is entitled to the changes it seeks in Case No. 80CW81, in this Court, and that the facts set forth in its application in that case are accurate and correct".

Schedule A attached to Case W-3279 is a description and ranking of each of the water rights owned by the parties to Case W-3279. Schedule A was presented to show the relationship of each right in Bell Creek to the other so far as the interests of the parties in Case W-3279 (App. F). In Schedule A, the Town of Paonia's right in Bell Creek under the Paonia Pipeline decree is described as follows:

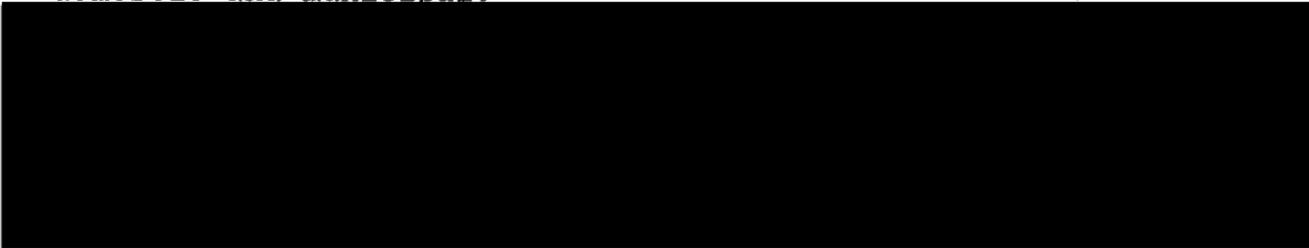
First Rank: To the Quackenbush Ditch, Priority #1 out of Bell Creek, appropriation date May 1, 1883, decree date June 17, 1889, for 3.0 cfs, absolute, for irrigation purposes. Said water is presently claimed and used by:

A. Town of Paonia: The first 1.0 cfs out of a $\frac{3}{4}$ interest in said Priority #1, with the right to divert the same as follows: $\frac{1}{2}$ of said first 1.0 cfs at the Mays Spring, and $\frac{1}{2}$ of said first 1.0 cfs at the Pole Patch Spring. Waters from these 2 springs are diverted by pipelines to a concrete division box....., which box separates the water of the Town of Paonia and the Bone Mesa Domestic Water District respectively.

The remaining 2.0 cfs of priority #1 in Bell Creek is described as being owned by the Bone Mesa Domestic Water District (BMDWD) - 0.75 cfs, and Columbine Ranch - 1.25 cfs. The Columbine Ranch water right is subject to the Town of Paonia's right to divert the first 1.0 cfs of priority #1.

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In Case 2576, the BMDWD was decreed an alternate diversion point for their 0.75 cfs priority #1 water right in Bell Creek from the Burkhardt Ditch to the same decreed location as the Mays Spring (Paonia Pipeline). The BMDWD can divert the 0.75 cfs amount at one or both diversion points. In the decree it is mentioned that if the full 3 cfs decreed amount of priority #1 is not available, the right of the BMDWD to divert shall be diminished in proportion with other ownerships in said Decree No. 1. In Case 3725 the usage of the BMDWD 0.75 cfs right was expanded from irrigation to include domestic and municipal.



In schedule A of Case W-3279, the Bell Creek Pipeline is described as follows:



REYNOLDS SPRING PIPELINE

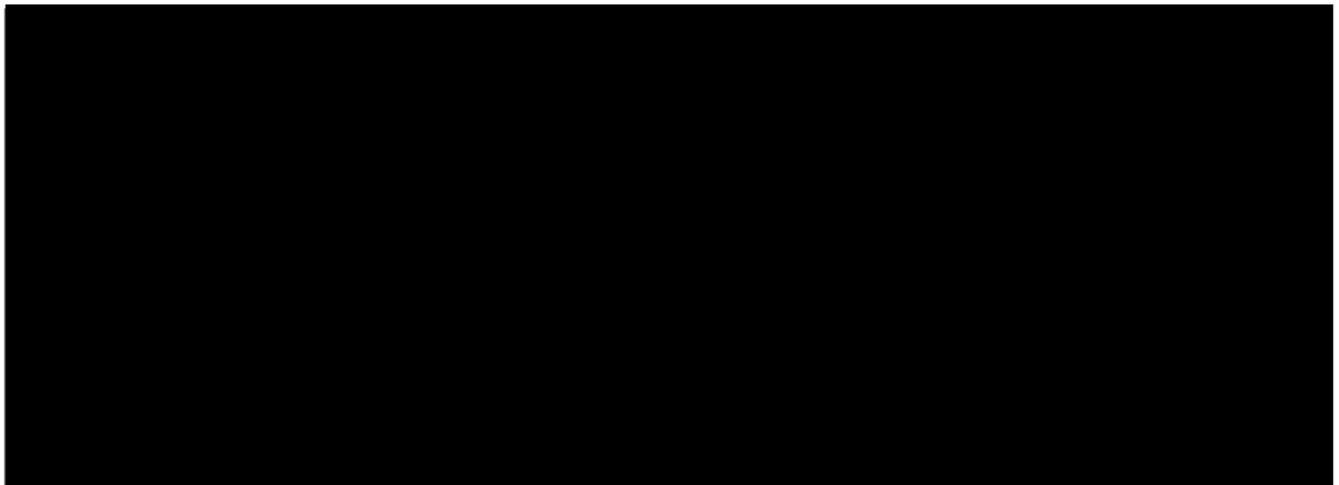
The Reynolds Spring Pipeline is decreed for a total of 4.5 cfs. Of the 4.5 cfs total, 4.0 cfs was transferred from the Lucas Ditch and 0.5 cfs was transferred from the Reynolds Ditch. Copies of the SEO water rights tabulation and applicable decrees for the Reynolds Spring Pipeline, Lucas Ditch, Reynolds Ditch and Mount Lambert Ditch are shown in attached Appendix G. A summary of the water rights decreed to the Reynolds Spring Pipeline is shown on page 14.

The Lucas Ditch was decreed for 0.9 cfs absolute and 3.1 cfs conditional in Case 38. Both of these rights, totalling 4.0 cfs, were transferred to the Reynolds Spring Pipeline in Case 475. These rights were "for and to the use of the Town of Paonia according to the rights decreed to the Lucas Ditch..." The new headgate location is described as "the intake or proposed point of diversion of the Supply line of the Public Water Works System".

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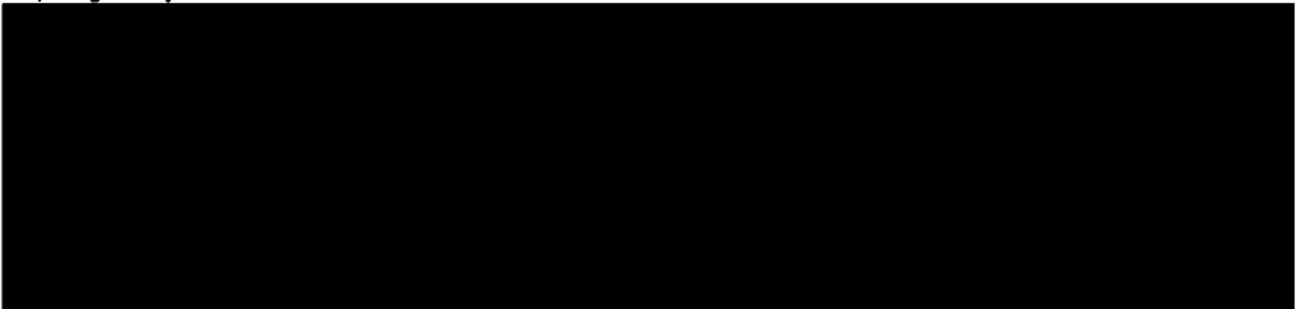
In the decree the change in use from irrigation to municipal is never specifically mentioned. The SEO water rights alpha list does show municipal use under the use codes for the Reynolds Spring Pipeline. It is unclear whether the municipal use for the Reynolds Spring Pipeline, under the Lucas Ditch transfer in Case 475, is a year-round right or only an irrigation season right. The decree language "for and to the use of the Town.... according to the rights decreed to the Lucas Ditch" suggests it is for use only during the typical irrigation season. The water rights previously decreed to the Lucas Ditch were for irrigation use.

REYNOLDS SPRING PIPELINE



- (1) cfs = cubic feet per second
- (2) TF = transferred from

The decreed location of the Reynolds Spring Pipeline, as described in Case 475, appears to be 300 feet distant from the spring location shown on the 1979 photorevised USGS Paonia Quadrangle (fig. 1).

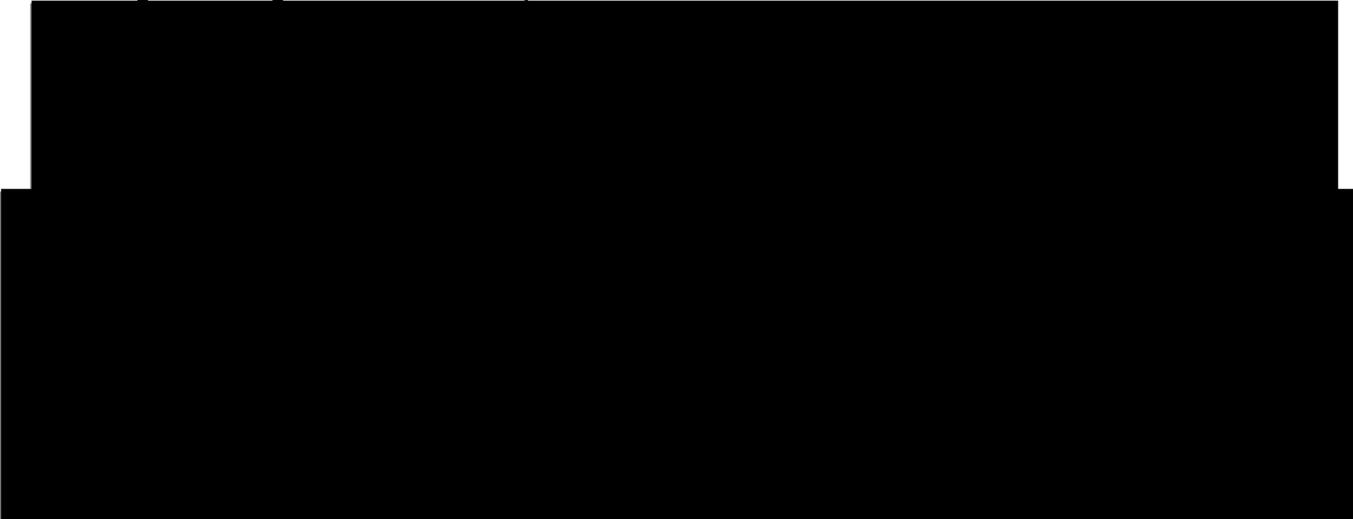


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A headgate was to be installed at the Mt. Lambert headgate, and the first 1/4 cfs of Mt. Lambert Ditch priority (A-85) could be diverted to the Reynolds Creek watershed (at the Reynolds Creek Springs for the Town), or run down Bell Creek. In the event the water was run down Bell Creek, the first 0.25 cfs, less shrinkage, could be taken by the Town of Paonia. This diversion amount was to be measured at Kauer Springs. It is also mentioned that any water above the 0.75 cfs decreed to the Mt. Lambert Ditch may be turned to Reynolds Creek as a portion of priority no. 13 owned by the Town and by Clinton Roeber.

The decree stated the source of supply of Reynolds Creek and source of supply of the Mt. Lambert Ditch are in part the same, and for a considerable period of time the Spore's, and their grantors, have intercepted and used the surface flow from the springs arising at the head of Reynolds Creek. Thus, the stipulation described above. Later in the decree it is mentioned the Town has stipulated to divert the first 0.25 cfs acquired from L.E. and Margery W. Spore at the Kauer Springs No. 1. The Town is also able to divert the first 0.50 cfs of priority no. 13 in the Reynolds Ditch at the Reynolds Creek Springs.

In summary, it appears the decree in Case 3695 awards the Town and/or Clinton Roeber 0.25 cfs from the Kauer Springs, under the Mt. Lambert decree - priority A-85, and 0.50 cfs from the Reynolds Creek Springs, under the Reynolds Ditch decree - priority 13. Apparently the Town can divert the first 0.25 cfs of collected water with the next 0.50 cfs being diverted to the Mt. Lambert Ditch. Any amount over the 0.75 cfs described can also be diverted by the Town, up to an additional 0.50 cfs (the decreed amount under the priority 13 transfer).



In regard to beneficial use, the Reply of Simineo, Inc. in Case 84CW288 states, "In approximately 1961, the Town of Paonia constructed a pipeline to bring all the water decreed the Mt. Lambert Ditch from its source of out of Reynolds Creek into the watershed of Bell Creek and from the Kauer Spring downstream to the "dog house". For several years the Town of Paonia... released to the Simineos approximately 0.5 cfs of water at the "dog house". Thereafter, the diversion facility at that diversion point became broken, and water commenced to be released at that point without any particular measurement".

In regard to diversion regards, the Reply of Simineo, Inc. in Case 84CW288 states, "Under ¶ 3rd at page 3 of the Decree numbered 3694 & 3695, Paonia was required to install pipe of sufficient capacity to carry the water decreed to the Mt. Lambert Ditch, and it complied with this requirement. As a practical matter, if the water had been diverted at Kauer Spring, the Simineo's second 0.5 cfs of water under said priority would on many occasions not reach Bell Creek in sufficient quantity to be of use to them. Therefore, by tacit agreement of the parties the water was continued to flow downstream to the "dog house" so its quantity was not diminished... This practice was instituted and continued in lieu of cleaning the ditch leading from Lambs Gulch Spring and treating it with an impervious matter".

"The Engineer in describing the source of supply of the Lambs Gulch Ditch omits mention of Lambs Gulch Spring. This spring produces approximately 0.25 cfs of water which is introduced into the subject pipeline. This flow augments the water decreed to the Mt. Lambert Ditch..... The (SEO) statement that Paonia takes the entire spring source of water of the Mt. Lambert Ditch, and that it has not released any water from its pipeline, is inaccurate."

Copies of the SEO's Factual Data and Interpretation in Support of Abandonment (of the Mt. Lambert Ditch) in Case 84CW288, and the Reply of Simineo, Inc. to the Engineer's Report in Case 84CW288 are shown in attached Appendix G.

In Case W-3279 (App. F), in regard to the Mt. Lambert Ditch it is stated, "The parties stipulated that the waters decreed to the Mt. Lamborn (?) Ditch out of Reynolds Creek under Priority No. A-85 are presently owned by the Town of Paonia, Colorado, as to the first 0.25 cfs of water and by the Applicants (Simineo) as to the remaining 0.50 cfs of water".

Schedule A of Case W-3279 describes the Mount Lambert Ditch, priority A-85, as follows:

Third Rank: To the Mt. Lambert Ditch, priority #A-85 in the Bell Creek area, appropriation date April 1, 1906, decree date June 23, 1914. This water right is claimed by the Town of Paonia, and derives water from those springs designated "The Upper Reynolds Creek Springs", "The Kauer Springs" and "The Spore Springs" which are located in the west half of Section 27 and the southeast quarter of Section 28. (See stipulation..... regarding the parties agreement as to ownership of this priority).

The Mt. Lambert Ditch was decreed for 0.75 cfs for irrigation purposes in Case 617. Review of the Mt. Lambert Ditch decree no. 617 (priority A-85) does not indicate a transfer of a portion of this water right to the Reynolds Springs, Kauer Springs or the Spore Springs. The transfer is also not mentioned in the SEO water rights alpha list. This discrepancy should be corrected in the SEO records.

The decreed location for the Town of Paonia's diversion point, as described in Case 3695, is shown on figure 1. Based on the lengthy dialogue presented in Case 84CW288, it appears there are several sources for the water decreed to the Town of Paonia in Case 3695 (including the Upper Reynolds Creek Springs, Kauer Springs, Spore Springs and the Lambs Gulch Spring). The actual spring sources associated with this portion of the Reynolds Spring Pipeline decree should be accurately located and the correct locations and/or reaches should be supplied to clarify the Court records.

TODD RESERVOIR/SPRINGS

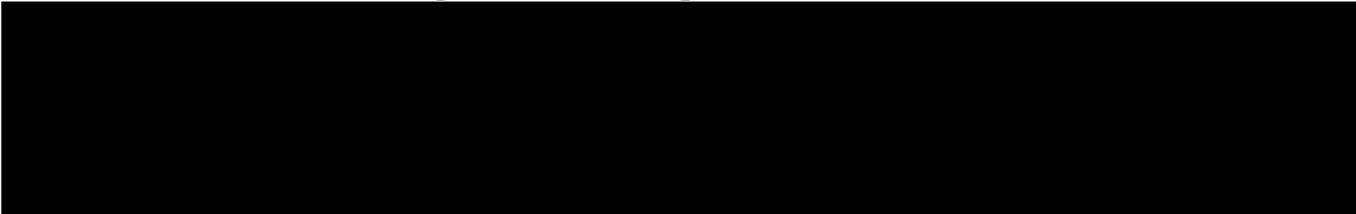
Review of the SEO water rights data indicates Todd Reservoir is currently decreed for 244.55 acre-feet (AF) for storage and irrigation uses (Case 1424). The storage amounts of 244 AF and 156 AF decreed in Case 2563 were subsequently abandoned in Case CW74/162.

Testimony regarding the Todd Reservoir suggests the prior owners intended to fill the reservoir from available discharge in the watershed and from several springs in the area. Other water supply sources contemplated included the Gove Ditch, which diverts from Little Coal Creek, and the Todd Reservoir Feeder Ditch. The Todd Reservoir Feeder Ditch was to consist as a carrier of Gove Ditch

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water to the Todd Reservoir. In the testimony, the prior owners indicate the upper 1/4 mile of the Todd Reservoir Feeder Ditch was constructed.

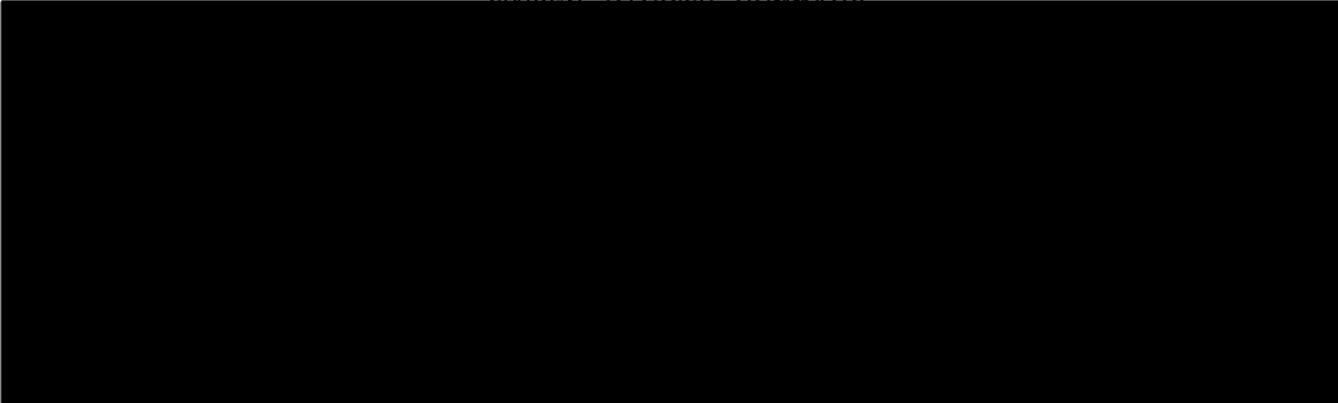
The SEO Division 4 District Engineer Analysis Of Testimony And Decrees in Cases 84CW241 and 84CW289, concerning abandonment of a portion of Todd Reservoir, states (re: Case 2563) "the claim appears to be for the Gove Ditch and the Todd Reservoir Feeder Ditch as both structures relate to the reservoir. On the subsequent pages..... the claim appears to be for conditional water rights for the above ditches and for an absolute right for the reservoir. No award was granted to either of the above mentioned ditches in the so-called 'H' adjudication, however the Gove Ditch had previously been awarded two priorities in the so-called 'A' adjudication decreed on June 23, 1914, namely Pri. No. A-77 for 5.17 cfs, and Pri. No. A-115 for 8.5 cfs. This information was not addressed in the subject testimony."



Water rights decreed to Todd Reservoir are as follows:

TODD RESERVOIR

WATER RIGHTS SUMMARY



NOTES:

(1) AF = acre-feet

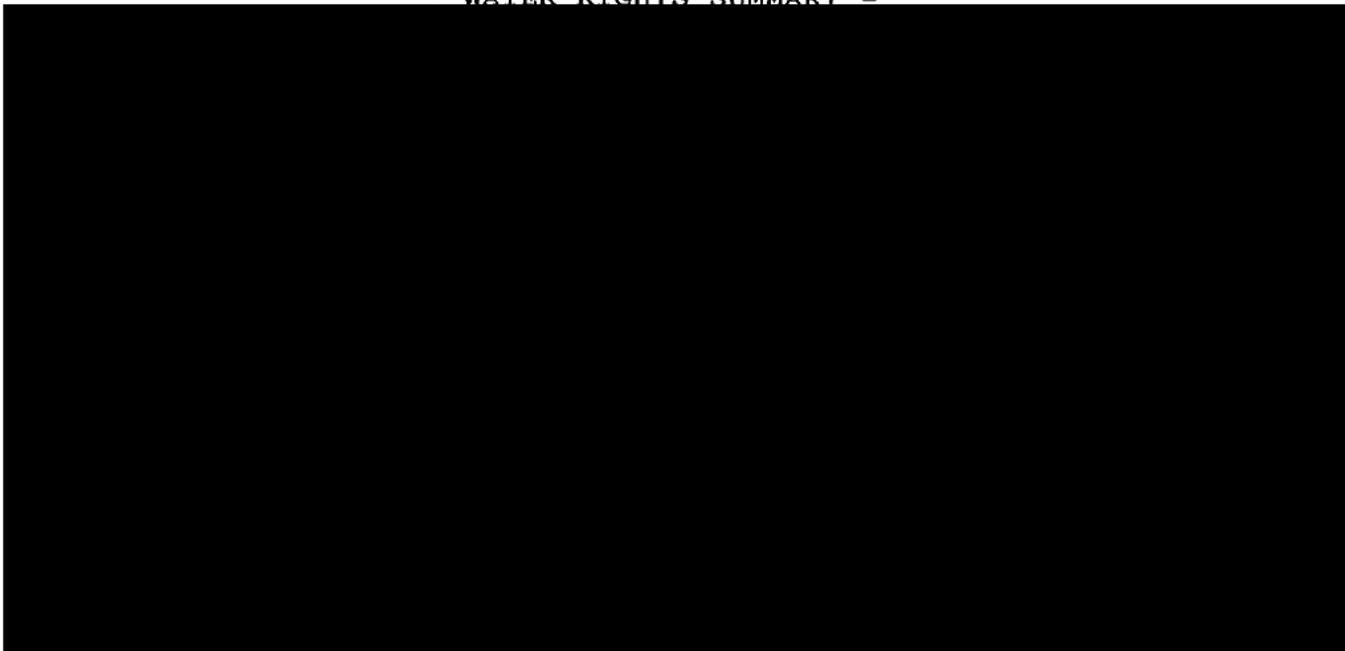
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Copies of the SEO water rights tabulation and decrees relevant to the Todd Reservoir and Todd Reservoir Springs are shown in attached Appendix H. Copies of pertinent SEO and legal correspondence are also shown in Appendix H.

The Todd Reservoir Springs Nos. 2, 3 and 4 were decreed in Case W-2305 for 0.11 cfs, 0.03 cfs and 0.01 cfs, respectively. A summary of the Todd Reservoir Springs water rights is as follows:

TODD RESERVOIR SPRINGS

- WATER RIGHTS SUMMARY -



NOTES:

- (1) cfs = cubic feet per second
- (2) dom. = domestic
- (3) abnd. = abandoned

The 3 springs were granted an absolute decree for storage and irrigation purposes, and a conditional decree for domestic purposes. Diligence on the springs was awarded in Case 79CW17. The conditional decree for domestic use for all 3 springs was cancelled (abandoned) in Case 83CW161.

The decreed locations for the Todd Reservoir Springs Nos. 2-4 are shown on figure 1. Review of figure 1 indicates all 3 springs are located within the Reservoir.

The current decreed uses for the Todd Reservoir and Todd Reservoir Springs include storage and irrigation. A change in use (expanded use) for these water rights to include municipal, commercial, domestic and augmentation uses should be filed with the Water Court.

TOWN OF PAONIA - WATER RIGHTS SUMMARY

Based on the water rights study to date, it appears the Town of Paonia owns the decreed water rights and associated amounts shown on the summary table at the end of this report.

The following decreed water rights appear to be correlated with the associated listed diversion points. The diversion points were the structure names used in the previous raw water supply analysis (17 August 1994 report).

<u>Decreed Water Right</u>	<u>Associated Diversion Point</u>
Beaver Dam Ditch	Beaver Dam Ditch
Bell Creek Pipeline	Paonia Pipeline
Corral Springs	Corral Springs
Gelwicks Spring PL	Gelwicks Spring PL
Paonia Pipeline (Mays and Pole Patch)	Paonia Pipeline
Reynolds Spring PL (Case 475)	Reynolds Spring PL
Reynolds Spring PL (Case 3695)	Spore Spring PL
Todd Reservoir	Todd Reservoir
Todd Springs	No Data - in future will be recorded under Gelwicks Spring Pipeline

It should be noted that the decreed location of the water right may not correspond with the actual location of the associated diversion point. Current SEO diversion records for water rights owned by the

Town of Paonia are listed under the names shown in the Associated Diversion Point column.

OTHER ISSUES

Other issues which could effect either the water right amounts owned by the Town, or the manner in which the rights are used, include contractual agreements with other water users in the area, SEO water rights administration, and any minimum stream flow rights decreed to the Colorado Water Conservation Board (CWCB) in the area.

Based on information supplied by Town personnel during previous studies, the Town of Paonia is party to the following agreements:

- 1) Supplying 11.7 gallons per minute (one miners inch) to Mr. George Tracy out of the Gelwicks Spring Pipeline.
- 2) An agreement with the Bone Mesa Domestic Water District (BMDWD) which involves water rights decreed to the Paonia Pipeline (Pole Patch and Mays Springs), the Bell Creek Pipeline, and the Corral Springs. These spring flows combine in the "Mays Sump" and are split by the Town of Paonia and the BMDWD in the following manner:

From April 1 to November 1 - Paonia diverts 75% and BMDWD 25%
From November 1 to April 1 - BMDWD diverts 100%

These agreements, and any other contractual agreements the Town of Paonia may have with other parties regarding water rights, water supply and distribution, need to be incorporated with the water rights information presented in this report.

Prior to filing any applications for water rights (augmentation, alternate point, etc.) the Town should consider the potential for impact to existing water rights in the effected drainage(s). Analysis of water right priorities in specific drainage basins is beyond the scope of this report. For future planning purposes, copies of the SEO water right tabulations, indexed by stream name for Bell Creek, German Creek, McDonald Creek, Minnesota Creek and Reynolds Creek are shown in attached Appendix I.

Review of existing CWCB minimum stream flow decrees in the area indicates the only minimum stream flow (MSF) section in the immediate vicinity is on a reach of the North Fork Gunnison River. The reach decreed to the CWCB in Case 84CW400 is described as "the natural stream channel from the confluence with Coal Creek in the

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NW $\frac{1}{4}$, NE $\frac{1}{4}$, Section 8, Township 13 South, Range 89 West, 6th P.M. as the upstream terminus and the confluence with Elk Creek in the NW $\frac{1}{4}$, NE $\frac{1}{4}$, Section 17, Township 13 South, Range 90 West, 6th P.M. as the downstream terminus, being a distance of approximately 6.2 miles. A copy of Case 84CW400 is shown in attached Appendix K.

The MSF amounts decreed to the CWCB in Case 84CW400 are 60.0 cfs from March through November and 30.0 cfs from December through February. The decreed MSF reach of the North Fork Gunnison River would not be effected by any water right diversions by the Town of Paonia.

Other issues the Town should consider, in terms of water rights and supply, include decreed diversion points for the German Creek Springs Collection System (GCSCS) and decreed storage amounts for the Todd Reservoir.

The GCSCS is decreed for diversion from the 3 springs and a surface water diversion out of German Creek. The potential for obtaining additional water at the decreed surface water diversion point should be investigated. If it would be feasible to increase the Town's supply at another diversion point in the German Creek drainage, an alternate diversion point for the decreed surface diversion point should be considered.

Discussion with SEO personnel indicates the Town is currently involved with engineering studies regarding rehabilitation of the Todd Reservoir. If the reservoir is designed to store an amount less than the full decreed amount of 244.55 acre-feet, the Town could lose the "unstored" portion of the decreed water right during a subsequent abandonment procedure. It is currently not known whether there is adequate discharge in the drainage basin to fill the reservoir to the full decreed amount.

CONCLUSIONS AND RECOMMENDATIONS

Specific conclusions for each individual water right are listed in the section of the report in which that water right is discussed. The following recommendations are more general in nature, with the more important specific items of concern being included. The following recommendations are based on the initial water rights study for the Town of Paonia to date:

- 1) The Town needs to clarify ownership amounts, and associated priorities, for water rights diverted in the Beaver Dam Ditch.
- 2) Water rights associated with the Beaver Dam Ditch and the Todd Reservoir rights should be changed to include municipal, commercial, domestic and augmentation uses. An augmentation strategy should be formulated prior to filing for a change in use for these water rights in order to maintain a senior priority for these "expanded" uses. A direct change in use application would likely precipitate a ruling from the Water Court with a junior adjudication date for the new uses. It is unlikely the Town would obtain a ruling as favorable, in terms of maintaining senior adjudication dates, as the ruling obtained with the change in use case filed for the Paonia Pipeline in 80CW81.
The potential for a call on junior municipal water rights during the non-irrigation season is currently not known. If this potential exists, the "new" non-irrigation season municipal rights for the Todd Reservoir rights and the Beaver Dam Ditch would need to be augmented. Since the Town does not currently have the means to release augmentation water, perhaps the best non-irrigation season augmentation option would be to transfer portions of existing decreed year-round municipal water rights to the "new" municipal water rights.
- 3) It is unclear whether the municipal use for the Reynolds Spring Pipeline is a year-round right, or only for use during the typical irrigation season. In regard to item 2) above, the time period of decreed municipal usage for the Reynolds Spring Pipeline should be determined.
- 4) There are location errors associated with some of the Town's water rights. The location errors include incorrect location of specific diversion points, and poor descriptions of diversion "reaches". For example, review of figure 1 indicates there are no adjudicated water rights located in the vicinity of the "Upper Reynolds Springs" (west $\frac{1}{2}$ of Section 27). It is believed the spring flows captured in this area constitute the discharge of the Spore Spring Pipeline as described in the SEO diversion summaries. The Spore Springs are believed to be decreed under the Reynolds Spring Pipeline.
The location of a decreed water right needs to be within 200 feet of the actual location of the water resource. In some cases it may be better to file on a spring reach versus a specific point due to potential migration over time of spring source areas.

Accurate field locations of the raw water sources and diversion points for the municipal system should be obtained and compared with the existing decreed location descriptions for each individual water right. Any location corrections for the decreed water rights, in terms of specific diversion points or described diversion reaches, should be supplied to clarify the Court records.

The Water Court has become much more sensitive to proper decreed locations than occurred in the past. As an example, in Case 80CW81 (App. F), the Town of Paonia requested to add to their existing points of diversion - "additional alternate points of diversion... at the points of all known sources of water and springs, and at such point of such sources which may be discovered in the future." The response to this request was "The Court cannot grant alternate points of diversion until the same are specified, so this request should be denied."

- 5) Based on review of the decrees and the USGS Paonia Quadrangle (figure 1), it appears there are diversions of technically unadjudicated water resources into the Town's distribution system. In other words, there appears to be diversion of other unadjudicated sources to decreed diversion points. These unadjudicated sources are then diverted under the decreed water right. For example, data on the USGS mapping suggests the Clark Springs are diverted to the Mays Spring, then diverted at the decreed Mays Spring location on to the Town's distribution system. Filing a "corrected location" for a spring reach, or diversion reach, may be the best approach for "adjudication", under existing senior priorities, of the undecreed water sources (e.g. the Clark Springs could be described as the historic diversion point for the Bell Creek Pipeline, etc.).
- 6) The potential availability of the 2.25 cfs priority 1 water right decreed to the Meyer & Orth Ditch should be investigated. It may be prudent to research any available testimony related to Case 423, and the other Meyer & Orth decrees, to aid in this determination. If the water right is not currently used or claimed by another party, the potential for the Town to claim this water right should be determined.
- 7) The transfer to the Town of the first 0.25 cfs of the 0.75 cfs priority A-85 decreed to the Mt. Lambert Ditch in Case 617 should be clarified in the SEO water rights tabulation (see Reynolds Spring Pipeline section - Case 3695). In regard to this right, the location of the Kauer Spring No. 1, as shown in

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Case 3695, is incorrectly located in Range 95 West (should be Range 91 West).
The incorrect SEO water rights tabulation location of the Gelwicks Spring Pipeline should also be corrected.

Jim, it would be advantageous to discuss the Town's water rights, in terms of existing rights and future water rights planning, after your review and analysis of this report. Future "legal" water for the Town of Paonia would probably be better supplied from transfers of previously decreed senior year-round municipal water rights to alternate points than by purchasing senior water rights which are only valid during the typical irrigation season.

If you have any questions or comments please call.

Very Truly Yours,

MINION HYDROLOGIC

by



Wayne E. Goin
Hydrogeologist

94-09

cc: Town of Paonia

TOWN OF PAONIA - WATER RIGHTS SUMMARY

WATER RIGHT	AMOUNT (cfs)	ADJUDICATION DATE	COMMENTS
Beaver Dam Ditch	----	-----	Use - irrig.; Ownership amount not currently known
Bell Creek Pipeline	0.75	03/20/1954	Case 3503; Decreed use - municipal
Corral Springs No. 1 No. 2	0.50 0.50	01/31/1964	Case 4808; Decreed use - irrig., domestic, manuf., fishing, recreation, power and other beneficial uses
Gelwicks Springs PL	0.60 1.25	06/17/1889 08/28/1920	Case 5625; Decreed use - domestic, irrig. & munic.
German Creek Springs Collection System	4.00 0.50 3.95	12/31/1977 03/20/1954 06/17/1889	Case 85CW100 (W-3188); decreed use - municipal, irrig. & commercial Case W-2693; TF Meyer & Orth D.; use - municipal Case W-2693; TF Meyer & Orth D.; use - irrig. or augmentation for municipal May 15 - Sept. 15
Paonia PL Mayes Spr. Pole Patch	0.50 0.50	06/17/1889	Case 2574; use - irrig.; decreed use of municipal added in 80CW81
Reynolds Spring Pipeline	4.00 0.50 0.25	06/17/1889 04/12/1901 06/23/1914	Case 475; TF Lucas Ditch; use - irrig. (munic. during irrigation season) Case 3695; TF Reynolds D.; use - irrig. (munic. during irrigation season) Case 3695; TF Mt. Lambert D.; use - irrig. (munic. during irrigation season)
Todd Reservoir	244.55 AF	08/20/1920	Case 1424; use - storage, irrigation
Todd Res. Springs Spring #2 Spring #3 Spring #4	0.11 0.03 0.01	12/31/1974	Case W-2305; use - irrig. and storage. Domestic use abandoned in 83CW161

NOTES:

- (1) cfs = cubic feet per second
- (2) AF = acre-feet
- (3) TF = transferred from
- (4) PL = pipeline

Hydrogeological Investigation of the Town of Paonia's Water Supply

PREPARED FOR

TOWN OF PAONIA



October 2025

241-019.000

WWE

WRIGHT WATER ENGINEERS, INC.