COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Water Plan

Water Project Summary

Name of Applicant	Silverton, Town of
Name of Water Project	Project-01854 Kendall Mountain Alluvial Aquifer
Grant Request Amount	**$63,797.00**
Primary Category	$63,797.00
Water Storage & Supply	
Total Applicant Match	**$13,851.00**
Applicant Cash Match	$13,851.00
Applicant In-Kind Match	$0.00
Total Other Sources of Funding	**$75,549.00**
SWCD	$11,752.00
Southwest Basin Roundtable	$2,100.00
CWCB	$61,697.00
Total Project Cost	**$153,197.00**

Applicant & Grantee Information

Name of Grantee: Silverton, Town of
Mailing Address: 1360 Greene Street Silverton CO 81433
FEIN: 846,000,718

Organization Contact: John Sites
Position/Title: Public Works Director
Email: jsites@silverton.co.us
Phone: 19709466839

Organization Contact - Alternate: Gloria Kaasch-Buerger
Position/Title: Administrator
Email: gkaasch-buerger@silverton.co.us
Phone: 970.387.5522

Grant Management Contact: John Sites
Position/Title: Public Works Director
Email: jsites@silverton.co.us
Phone: 19709466839

Grant Management Contact - Alternate: Gloria Kaasch-Buerger
Position/Title: Administrator
Email: gkaasch-buerger@silverton.co.us
Phone: 970.387.5522

Engineering Contact: John Sites
Position/Title: Public Works Director
Email: jsites@silverton.co.us
Phone: 19709466839

Description of Grantee/Applicant

Municipality

Type of Eligible Entity

- ☐ Public (Government)
- ☐ Public (District)
- ■ Public (Municipality)
- ☐ Ditch Company
- ☐ Private Incorporated
- ☐ Private Individual, Partnership, or Sole Proprietor
- ☐ Non-governmental Organization
- ☐ Covered Entity
- ☐ Other

Category of Water Project

- ☐ Agricultural Projects
  Developing communications materials that specifically work with and educate the agricultural community on headwater restoration, identifying the state of the science of this type of work to assist agricultural users among others.
- ☐ Conservation & Land Use Planning
  Activities and projects that implement long-term strategies for conservation, land use, and drought planning.
- ☐ Engagement & Innovation Activities
  Activities and projects that support water education, outreach, and innovation efforts. Please fill out the Supplemental Application on the website.
- ☐ Watershed Restoration & Recreation
  Projects that promote watershed health, environmental health, and recreation.
- ■ Water Storage & Supply
  Projects that facilitate the development of additional storage, artificial aquifer recharge, and dredging existing reservoirs to restore the reservoirs' full decreed capacity and Multi-beneficial projects and those projects identified in basin implementation plans to address the water supply and demand gap.

Location of Water Project

Latitude	37.811900
Longitude	-107.664500
Lat Long Flag	Precise coordinates: Project coordinates are readily definable and precisely define the location of the project
Water Source	The Kendall Mountain Alluvial Aquifer is located within the drainage of the Animas River.
Basins	Southwest
Counties	San Juan
Districts	30-Animas River Basin

Water Project Overview

Major Water Use Type	Municipal
Subcategory	
Scheduled Start Date - Design	
Scheduled Start Date - Construction	10/3/2022

Description

This project is a test well drilling program to characterize the water quantity and quality of the Kendall Mountain Alluvial Aquifer. This project is part of a larger project to develop an alternative and redundant water supply for

municipal use. Silverton's current drinking water supply comes from two high elevation surface supplies, Boulder and Bear Creeks. Both of these supplies are vulnerable to drought, turbid runoff, avalanche, landslide and fires. Both intakes and diversions require significant upgrades from mining ere construction but cannot be taken off line for significant periods of time due to demand exceeding supply of either source.

Silverton conducted an engineering water resources study entitled the Silverton Water Security Plan to identify new and redundant physical and legal water supplies and / or storage. The report can be found in the Files section of this application.

The report identified the exploration of the Kendall Mountain Alluvial Aquifer as the most feasible alternative for a new supply. This test drilling program is the first step in a larger project to develop a municipal quality well field that will pump into the distribution system. A well house, chlorine contact basin and high service pumps will be required to complete the next phase of the project.

The project costs include the drilling of one 6" well approximately 200' deep. After the well is drilled, test pumping, drawdown and recovery tests will be performed to quantify the aquifer characteristics and production well capacity. Water quality tests will be taken to determine compliance with GWUDI and Safe drinking Water requirements.

A more detailed Scope and a map of the location of the test wells are provided in the Files section of this application.

This application is a re application for a Water Plan grant received in 2020. Due to unforeseen cost increases presumably caused by COVID 19, the Town decided to re apply for more funding to complete the project.

Measurable Results

	New Storage Created (acre-feet)
242	New Annual Water Supplies Developed or Conserved (acre-feet), Consumptive or Nonconsumptive
	Existing Storage Preserved or Enhanced (acre-feet)
	New Storage Created (acre-feet)
	Length of Stream Restored or Protected (linear feet)
	Efficiency Savings (dollars/year)
	Efficiency Savings (acre-feet/year)
	Area of Restored or Preserved Habitat (acres)
	Quantity of Water Shared through Alternative Transfer Mechanisms or water sharing agreement (acre-feet)
	Number of Coloradans Impacted by Incorporating Water-Saving Actions into Land Use Planning
	Number of Coloradans Impacted by Engagement Activity

Water Project Justification

Specific CWP goals met are as follows:
-Provide crucial water supply for a municipal water supplier.
-As a new water supply it will lead to reducing the GAP.
-Meets an identified need.
-Can be built within the next 15 years.
-By reducing the reliance on surface supplies, more than one need can be met.
-Protects existing water rights.
-Avoids adverse impacts and improves environmental and recreational interests by eliminating reliance on

surface supplies.
-Maximizes the use of water resources by using an existing water right as an alternative point of diversion.
-Firming the yield of existing supplies.
-The project is overall cost effective.
-The project demonstrates local investment and contribution.
-The project confirms technical and legal availability of water supplies.
-The project is ready to proceed.

Related Studies

The Town of Silverton Water Security Report prepared in 2019 / 2020 quantified existing water supplies and researched viable future physical and legal water supplies for long term municipal needs. The report can be found in the Files section of this application.

Taxpayer Bill of Rights

Silverton's Water Fund is an enterprise fund and is exempt from the Taxpayer Bill of Rights.

Budget and Schedule

This Statement of Work shall be accompanied by a combined Budget and Schedule that reflects the Tasks identified in the Statement of Work and shall be submitted to CWCB in excel format.

Reporting Requirements

Progress Reports: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of issuance of a purchase order, or the execution of a contract. The progress report shall describe the status of the tasks identified in the statement of work, including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Report: At completion of the project, the applicant shall provide the CWCB a Final Report on the applicant's letterhead that: (1) Summarizes the project and how the project was completed. (2) Describes any obstacles encountered, and how these obstacles were overcome. (3) Confirms that all matching commitments have been fulfilled. (4) Includes photographs, summaries of meetings and engineering reports/designs. The CWCB will pay out the last 10% of the budget when the Final Report is completed to the satisfaction of CWCB staff. Once the Final Report has been accepted, and final payment has been issued, the purchase order or grant will be closed without any further payment.

Payment

Payment will be made based on actual expenditures and must include invoices for all work completed. The request for payment must include a description of the work accomplished by task, an estimate of the percent completion for individual tasks and the entire Project in relation to the percentage of budget spent, identification of any major issues, and proposed or implemented corrective actions. Costs incurred prior to the effective date of this contract are not reimbursable. The last 10% of the entire grant will be paid out when the final deliverable has been received. All products, data and information developed as a result of this contract must be provided to as part of the project documentation.

Performance Measures

Performance measures for this contract shall include the following: (a) Performance standards and evaluation: Grantee will produce detailed deliverables for each task as specified. Grantee shall maintain receipts for all project expenses and documentation of the minimum in-kind contributions (if applicable) per the budget in the Budget & Schedule Exhibit B. Per Water Plan Grant Guidelines, the CWCB will pay out the last 10% of the budget when the Final Report is completed to the satisfaction of CWCB staff. Once the Final Report has been accepted, and final payment has been issued, the purchase order or grant will be closed without any further payment. (b) Accountability: Per Water Plan Grant Guidelines full documentation of project progress must be submitted with each invoice for reimbursement. Grantee must confirm that all grant conditions have been complied with on each invoice. In addition, per Water Plan Grant Guidelines, Progress Reports must be submitted at least once every 6 months. A Final Report must be submitted and approved before final project payment. (c) Monitoring Requirements: Grantee is responsible for ongoing monitoring of project progress per Exhibit A. Progress shall be detailed in each invoice and in each Progress Report, as detailed above. Additional inspections or field consultations will be arranged as may be necessary. (d) Noncompliance Resolution: Payment will be withheld if grantee is not current on all grant conditions. Flagrant disregard for grant conditions will result in a stop work order and cancellation of the Grant Agreement.

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Last Updated: May 2021

Colorado Water Conservation Board
Water Plan Grant – Statement of Work – Exhibit A

Statement Of Work	
Date:	**November 22, 2021**
Name of Grantee:	**Town of Silverton**
Name of Water Project:	**Kendall Mountain Alluvial Well Field Test Drilling Program**
Funding Source:	**Colorado Water Plan Grant; WSRF; Town Match; SWCD**

Water Project Overview:

The Town of Silverton studied multiple water supply alternatives for a more reliable physical and legal future water supply. The study, entitled Town of Silverton Water Security Study is attached to this application and was conducted by the Town and SGM in April 2020. Funding for this study was in part through the WSRA and Southwest Water Conservation District grant programs.

The alternatives studied included new supply sources, raw water reservoirs, wells, improvements to existing supply infrastructure and legal water right strategies including augmentation storage. The need for a more reliable physical supply was prompted in part by multiple natural hazards the Town has recently experienced including drought, fire, avalanche, landslide changing monthly water cycles caused by climate variability and winter freezing of intakes and transmission lines.
The Town's current supplies come from Bear and Boulder Creeks. The Boulder Creek supply infrastructure also includes the Galvin Creek supply. These supplies are high elevation "run of the river" supplies that are vulnerable to many natural hazards. The Town has no raw water storage for either supply. The drought of 2018 resulted in much lower flows in both watersheds that redefined dry year statistics. A warming climate has changed the hydrological cycle and monthly hydrographs with earlier spring runoff and peaks, and lower flows in the late season.
The drought of 2018 and 2020 in part resulted in extreme wildfire events including the adjacent 416 Fire in the San Juan National Forest, and the Ice Lakes Fire in 2020. The aftermath of these fires can cause erosion, ash debris, mud and debris flows that can cause intakes to become choked and spike significant raw water quality changes. These changes include negative effects on water chemistry, turbidity, pH, alkalinity, and organics. The water treatment processes are designed to remove particles with consistent anionic charge. Fire damage will affect these charges and disrupt processes.
The above average snowfall during the 2018-2019 winter caused avalanches in the Boulder Creek watershed. One avalanche completely covered and damaged the intake structure. The intake was buried in snow for months leaving the Town without access to the intake. Avalanche danger at both the Boulder and Bear Creek intakes prevents Town operator access during the avalanche season.
The Gold King Mine spill which occurred in 2015 raised awareness of the vulnerability of high mountain tributaries in the Silverton watersheds to the legacy of mining activity and associated acid rock mine drainage.
Finally, both supplies are vulnerable to legal calls during a drought condition from controlling senior water right holders on the lower Animas River.
New supply options were studied. Most new supply sources are impacted by historic mining water quality impacts from heavy metals and would require a new water treatment plant or replacement of

the existing water treatment plant which would cost millions of dollars in capital costs coupled with higher annual operation and maintenance costs.
The water security Plan recommendations for new water supply included the exploration of an alluvial well supply as noted in the Plan as follows.
"Silverton should undertake the planning and permitting to install a test well at the base of Kendall Mountain to determine water aquifer yield, quality and the geology to support a municipal quality well field. Of all the water supply options, we recommend this as the priority as a new and redundant source of supply. If the well is not under the influence of surface water (GWUDI) and does not contain high metal concentrations, expensive surface water treatment processes will not be required. Well water can be disinfected at the site and pumped directly into the distribution system."
This project would consist of drilling exploratory test wells for a new groundwater supply to supplement the current potable water supply of the Town. The goal of the exploratory drilling would be to locate a well that has sufficient yield of approximately 150 to 300 GPM. Water quality samples will be taken to determine water quality parameters and compliance with CDPHE GWUDI criteria. Wells drilled in the Kendall Mountain Alluvial Fan deposit and associated aquifer appears to be fed from a different tributary basin than existing wells. A supply with acceptable water quality would only require disinfection treatment with minimal capital cost. The exploratory well should be located a minimum distance 200 feet from the Animas River and have screened intervals at depths greater than 50 feet below the ground surface to avoid classification by CDPHE as GWUDI. The construction details consist of drilling and installing a 5 inch PVC test well casing between 100 to 200 feet deep. The wells would be pump tested for a minimum of 24 hours and tested for inorganics and general chemistry applicable to the "Colorado Minimum Drinking Water Standards".

Project Objectives:

The objective of the Kendall Mountain Alluvial Well Field Test Drilling Program is to locate and prove a new and legal municipal water supply for the Town of Silverton. This is the first construction phase of developing the supply. The subsequent phase would include installation of a permanent well, pump house, disinfection and detention appurtenances, pumps, piping to distribution and meeting all associated regulatory requirements.

Tasks

Task 1 – Bid solicitation

Description of Task:

The Town of Silverton will solicit bids from well drillers for one test well in the Kendall Mountain Alluvial Aquifer.
Method/Procedure:
Contact qualified drillers. Solicit bids for the drilling of the test well. Once a low qualified bidder is determined, Silverton will send a Notice of Award to the Low Bidder. Bidder will provide certificates of insurance to the Town. Agreements will be signed and then Town will issue notice to proceed to the well driller.
Deliverable:
The Town will have Bid Tabulations of bids received. Town will have contract documents including Notice of Award, Certificate of Insurance, executed agreements, and Notice of Award.

Tasks
Task 2 – Obtain Observation and Monitoring Well Permit from DNR (SEO).

Last Updated: May 2021

Description of Task:
Town will task Town Engineer, SGM, with obtaining an Observation and monitoring Well Permit from the State Engineer's Office.
Method/Procedure:
Submit Well Observation and monitoring Permit Application form to SEO.
Deliverable:
Well Permit Application and SEO approval permit.
Task 3 – Proceed with well drilling on site.

Last Updated: May 2021

Description of task: Well drilling contractor will proceed with drilling the well, 6" diameter approximately 200' deep SGM will take samples to characterize geology for underlying aquifer transmissivity and storage coefficients.
Method / procedure: Drill wells. Contractor will proceed with drilling wells. Engineer will take soil samples for classification and gradation.
Deliverable: One well drilled 6" in diameter to appropriate depth. Engineer will provide a log of soil geology.
Task 4 – Pump Testing
Description of task: Well driller will perform long term pump testing by inserting appropriately sized pump and performing step test well testing, followed by drawdown testing. Engineer will measure drawdown as function of time and drawdown depth. Data will be plotted on semi-logarithmic paper to determine aquifer characteristics. Recovery data will be collected to determine the time of well recovery.
Method / Procedure: See above – well drilling protocol for aquifer characterization. A well sounder to measure depth, meter flow for testing, and time will be used to plot well drawdown vs. time and flowrate. Data will be plotted on graph paper to determine aquifer characteristics.
Deliverable: Report summarizing data and well field characteristics will be prepared. Report will recommend production well sizing and capacity.

Last Updated: May 2021

Task 5 – Water Quality Laboratory Testing
Description of task: Water quality samples will be taken after the pump testing. Samples will be taken to a State approved lab to measure for all parameters required for Colorado Primary Drinking Water Regulations. Testing will also be taken during the pump testing on water quality from the well compared to water quality in the Animas River to determine GWUDI parameters. This will assist in locating production wells so that they are not influenced by surface water.
Method / Procedure: Send water samples into State approved water quality laboratory. GWUDI testing will be conducted at the well site and adjacent Animas River.
Deliverable: Laboratory and water quality tests will be provided.

Budget and Schedule

This Statement of Work shall be accompanied by a combined Budget and Schedule that reflects the Tasks identified in the Statement of Work and shall be submitted to CWCB in excel format.

Reporting Requirements

Progress Reports: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of issuance of a purchase order, or the execution of a contract. The progress report shall describe the status of the tasks identified in the statement of work, including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Report: At completion of the project, the applicant shall provide the CWCB a Final Report on the applicant's letterhead that:

- Summarizes the project and how the project was completed.
- Describes any obstacles encountered, and how these obstacles were overcome.
- Confirms that all matching commitments have been fulfilled.
- Includes photographs, summaries of meetings and engineering reports/designs.

The CWCB will pay out the last 10% of the budget when the Final Report is completed to the satisfaction of CWCB staff. Once the Final Report has been accepted, and final payment has been issued, the purchase order or grant will be closed without any further payment.

Payment

Payment will be made based on actual expenditures and must include invoices for all work completed. The request for payment must include a description of the work accomplished by task, an estimate of the percent completion for individual tasks and the entire Project in relation to the percentage of budget spent, identification of any major issues, and proposed or implemented corrective actions.

Costs incurred prior to the effective date of this contract are not reimbursable. The last 10% of the entire grant will be paid out when the final deliverable has been received. All products, data and information developed as a result of this contract must be provided to as part of the project documentation.

Performance Measures

Performance measures for this contract shall include the following:
(a) Performance standards and evaluation: Grantee will produce detailed deliverables for each task as specified. Grantee shall maintain receipts for all project expenses and documentation of the minimum in-kind contributions (if applicable) per the budget in Exhibit C. Per Grant Guidelines, the CWCB will pay out the last 10% of the budget when the Final Report is completed to the satisfaction of CWCB staff. Once the Final Report has been accepted, and final payment has been issued, the purchase order or grant will be closed without any further payment.
(b) Accountability: Per Grant Guidelines full documentation of project progress must be submitted with each invoice for reimbursement. Grantee must confirm that all grant conditions have been complied with on each invoice. In addition, per Grant Guidelines, Progress Reports must be submitted at least once every 6 months. A Final Report must be submitted and approved before final project payment.
(c) Monitoring Requirements: Grantee is responsible for ongoing monitoring of project progress per Exhibit A. Progress shall be detailed in each invoice and in each Progress Report, as detailed above. Additional inspections or field consultations will be arranged as may be necessary.
(d) Noncompliance Resolution: Payment will be withheld if grantee is not current on all grant conditions. Flagrant disregard for grant conditions will result in a stop work order and cancellation of the Grant Agreement.

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Water Plan Grant - Detailed Budget Estimate

Fair and Reasonable Estimate

Prepared Date: November 23, 2021

Name of Applicant: Town of Silverton

Name of Water Project: Kendall Mountain Alluvial Aquifer Test Drilling Program

Task Number	*Description*	Start date	End date	**Matching Funds**	**CWCB Funds**	**Total**
1	Exploratory well drilling			$ 15,730	$ 39,270	$ 55,000
2	Water quality lab tests			$ 858	$ 2,142	$ 3,000
3	Pumping tests			$ 5,148	$ 12,852	$ 18,000
4	Design engineering / prepare report			$ 572	$ 1,428	$ 2,000
5	Construction contingency			$ 3,295	$ 8,105	$ 11,400
TOTAL				$ 25,603.00	$ 63,797	$ 89,400


Silverton


Test Well #1

WATER SECURITY REPORT

TOWN OF SILVERTON

April 2020

Prepared by

SGM

555 RiverGate Ln, Suite B4-82
Durango, CO 81301
970.385.2340
970.385.2341 fax

WATER SECURITY REPORT

REVIEWED BY

SGM Project # 2015-513.001

P:\PROJECT FILES\2015-513-TOWNOFSILVERTON\007-WATERSECURITY\E-REPORTS\SGM\TOWNOFSILVERTONWATERSECURITYREPORT FINAL.DOCX

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 Introduction

1.1 Purpose

The purpose of the Town of Silverton (Town) Water Security Report is to study alternatives for a more reliable physical and legal future water supply. The alternatives will include new supply sources, raw water reservoirs, wells, improvements to existing supply infrastructure and legal water right strategies including augmentation storage. The need for a more reliable physical supply was prompted in part by multiple natural hazards the Town has recently experienced including droughts, fires, avalanches, changing monthly water cycles caused by climate variability and winter freezing challenges at intakes.

In the 2018-2019 winter, an above average snowpack caused avalanche danger in the tributary water supplies above the Town that prevented access to the intakes and caused damage to the infrastructure at the intake. These impacts were on display during the years 2017 through 2020 when both drought conditions and above average snowpack occurred in back to back years.

This report will provide qualitative and quantitative information for each alternative to allow the Town to select the most feasible alternative. Once an alternative is identified the Town will pursue financing options to implement further design, planning, regulatory compliance and construction implementation. This report can be used for the information and background required for most loans and grants applications from state, federal, and local financing sources.

The Town will have a blueprint or roadmap for a future water supply that is secure, redundant, less vulnerable to droughts, proof, and less vulnerable from curtailment from senior water right calls.

1.2 History

The Town's current supplies come from Bear and Boulder Creeks as shown in Figure 1-1. The Boulder Creek supply infrastructure also includes the Galvin Creek supply. These supplies are high elevation "run of the river" supplies that are vulnerable to many natural hazards. The Town has no raw water storage for either supply. Both supplies are at risk from extended droughts, fires, mud and debris flows, snow avalanches, rock fall, changing climate, and wintertime freezing. The drought of 2018 resulted in much lower flows in both watersheds that redefined dry year statistics. A warming climate has changed the hydrological cycle and monthly hydrographs with earlier spring runoff and peaks, and lower flows late in the season.

The drought of 2018 in part resulted in extreme wildfire events including the adjacent 416 Fire in the San Juan National Forest. The aftermath of these fires can cause erosion, ash debris in water supply, mud and debris flows that can cause intakes to be choked with debris and vegetation, and significant water quality changes. Water quality changes include water chemistry, turbidity, pH, alkalinity, and organics. The water treatment processes are designed to remove particles with consistent anionic charge. Fire damage will change these charges and disrupt processes.

The above average heavy snow fall during the 2018-2019 winter caused avalanches in the Boulder Creek watershed. One avalanche as shown in figures 1.2 and 1.3 completely covered and damaged the Boulder Creek Intake. The intake was buried in snow for months leaving the Town without access to the intake. Avalanche danger at both the Boulder and Bear Creek intakes prevents Town operators' access to the intakes during the avalanche season.

The Gold King mine spill which occurred in 2015 raised awareness of the vulnerability of high mountain tributaries in the Silverton watersheds to the legacy of mining activity and associated acid rock and mine drainage.

Finally, both supplies are vulnerable to legal calls during a drought conditions from controlling senior water right holders on the lower Animas River.

Figure 1-1 Location of Town Water Rights and Supply Infrastructure

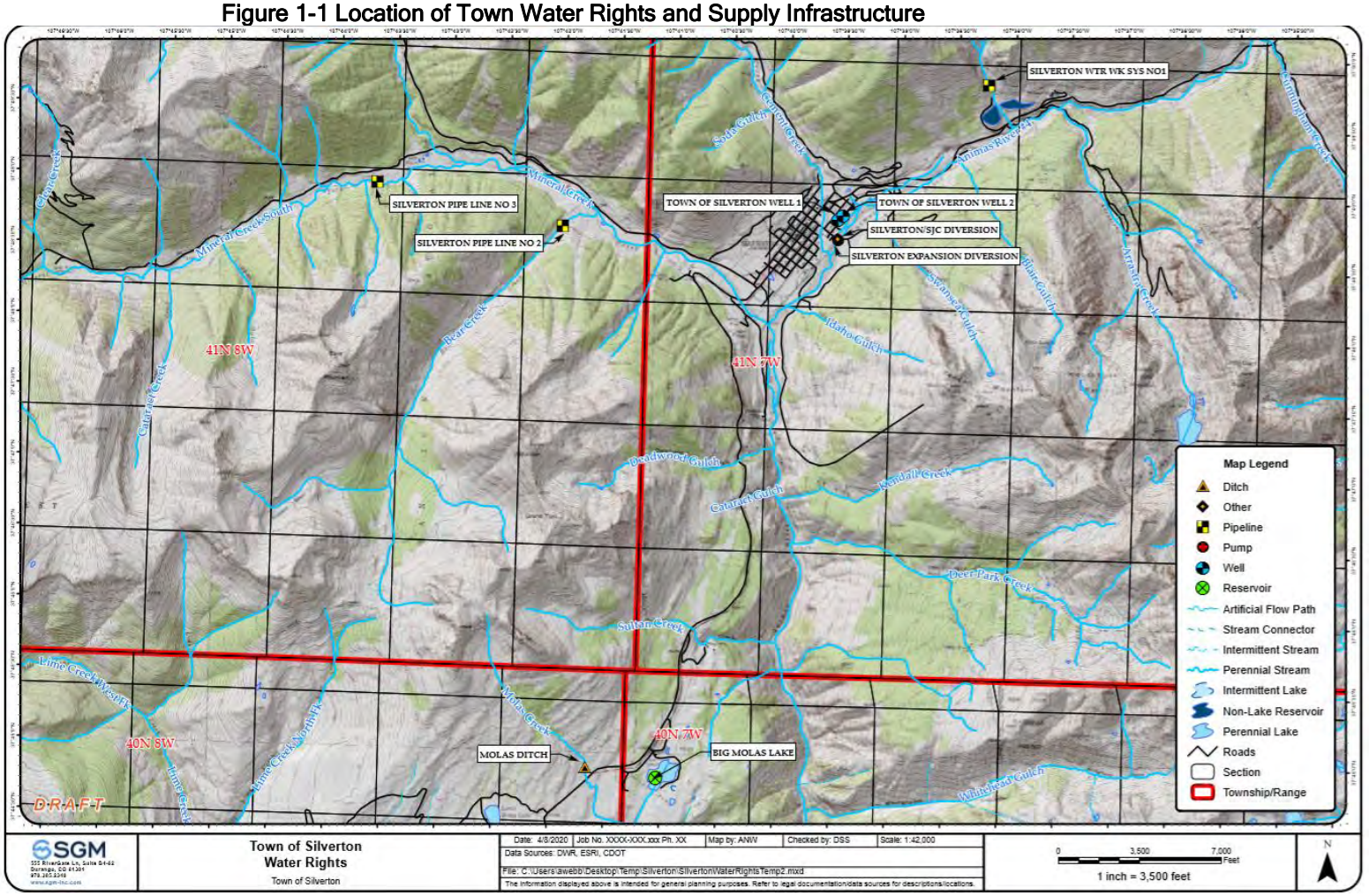
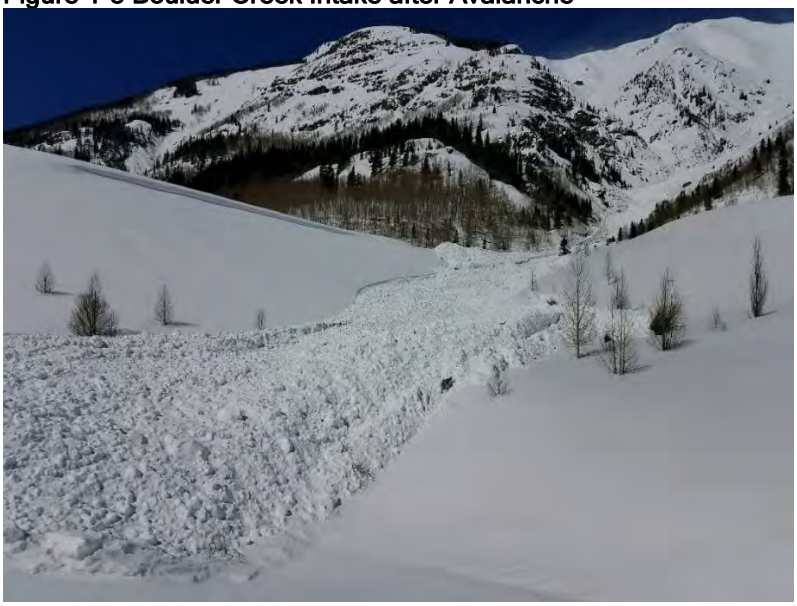


Figure 1-2 Boulder Creek Intake after Avalanche

Figure 1-3 Boulder Creek Intake after Avalanche



2.0 Conclusions and Recommendations

2.1 Colorado water providers face unprecedented water supply challenges from dwindling supplies and ever-increasing demands, extended droughts, climate change, increased population, and increased competition for long range water supplies. Further, water providers located high in basins known as headwater communities face ever more challenges because of "run-of-the-river" water supplies without upstream storage for physical and legal protections. Feasible reservoir locations are typically located on USFS or BLM ground with very difficult environmental permitting standards.

2.2 The Town of Silverton's water supply and supply infrastructure is vulnerable to physical natural hazards including, avalanches, droughts, climate change, rockfall, forest fires, and aging infrastructure.

2.3 The current Bear, Boulder and Galvin Creek supplies are vulnerable to a dry year senior water right call during extended droughts, and dry years during the months of August, September and October. We recommend strategies that will augment consumptive use with releases from either an existing reservoir or releases from a new reservoir.

2.4 If one of the existing supplies of Bear or Boulder Creek are taken offline for repairs or damage from natural hazards the remaining supply amount would not be able to supply Maximum Day Demand on a consistent basis in a dry year or an extended drought period.

2.5 The Bear, Boulder and Galvin Creek supplies do not have raw water storage above the intake or above the Water Treatment Plant that would supply water in case the other supply was shut down. All three supplies are known as "run of the river" supplies.

2.6 New supply options are numerous; however, most would require a new water treatment plant or replacement of the existing water treatment plant which would cost millions of dollars in capital costs coupled with higher annual operation and maintenance costs.

2.7 Silverton should undertake the planning and permitting to install a test well at the base of Kendall Mountain to determine water aquifer yield, water quality and the geology to support a municipal quality well field. Of all the water supply options we recommend this as the first priority as a new and redundant source of supply. If the well is not under the influence of surface water (GWUDI) and does not contain high metal concentrations expensive surface water treatment processes will not be required. Well water can be disinfected at the site and pumped directly into the distribution system.

2.8 Silverton should plan for the addition of a second water treatment plant train to serve as additional treatment plant capacity. The second train will provide additional capacity and redundancy to the existing 30-year-old packaged, pre-engineered WTP.

2.9 Silverton should pursue the planning, permitting and engineering for a small raw water reservoir that would be located on private land that is between the water treatment plant and the Boulder Creek intake.

2.10 As an alternative to the construction of a raw water reservoir to supply augmentation water, Silverton should undertake negotiations for a lease with Xcel Energy, the owner of Cascade Reservoir for an annual lease of augmentation water.

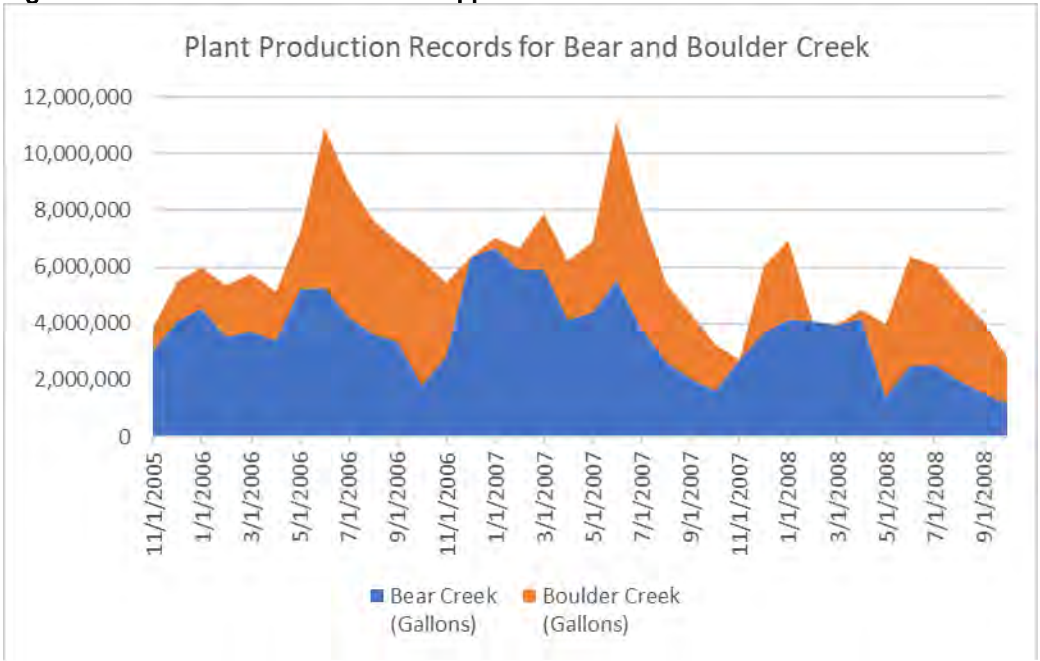
2.11 In order to help finance the wells and reservoir Silverton should plan on submitting grant request applications to the CWCB and the SWBRT both State agencies, The SWCD a regional agency and the USDA a Federal agency, to assist funding for the planning, permitting and construction of the well field and reservoir.

3.0 Existing Water Supply

The Town water sources include Bear and Boulder Creeks and a third supply, Galvin Creek which is adjacent to and part of the Boulder Creek supply. The diversions are run of the river intakes that supply the main Bear and Boulder water transmission lines that supply raw water to the Water Treatment Plant (WTP). More specific information on the watershed yield, vulnerabilities, condition of intakes and transmission lines are included in subsequent sections. The Town alternates use of both supplies depending upon the time of year, source water quality, and system demand.

Figure 3.1 shows the daily production of both supplies from the WTP for the years 2005 and 2008.

Figure 3-1 Bear and Boulder Creek Supplies



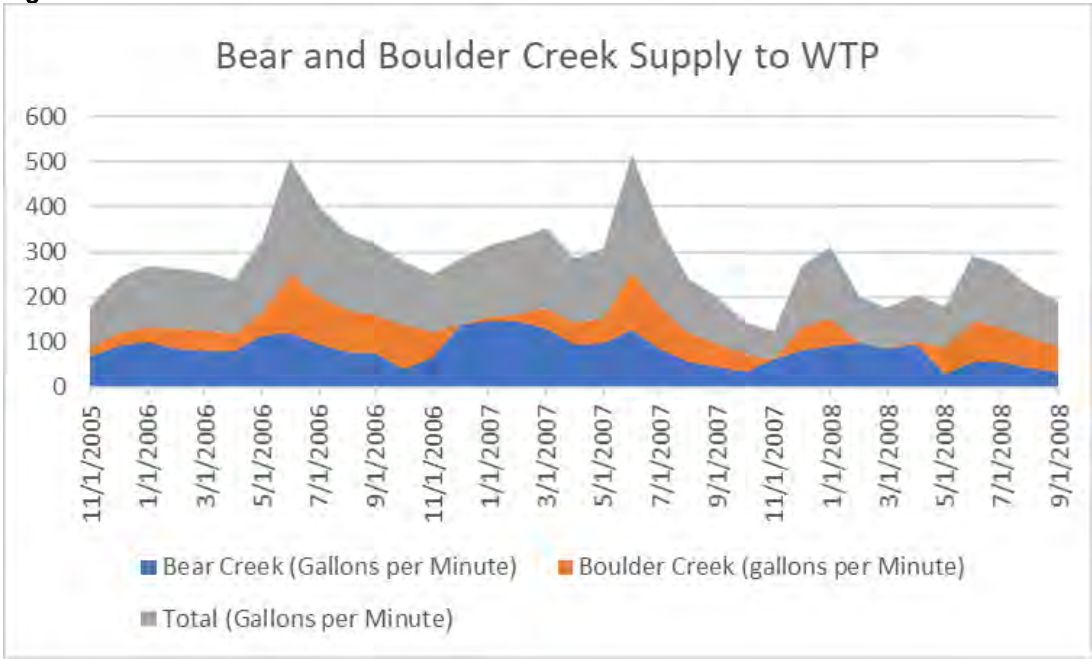
3.1 Physical Infrastructure

3.1.1 Boulder Creek

The Boulder Creek Intake facility is located north and east of the Town. The facility was installed in 1974 and upgraded in 2003-2004. The facility is located at the base of a waterfall in a steep gully. The location of this intake facility is prone to debris flow and avalanche events, which compromise its dependability. Access to the facility is provided by a two-track forest road where 4WD is generally needed. Photos as shown in Figures 3.3 – 3.10 show the Boulder Creek intake infrastructure.

Water quantity in gallons per minute (gpm) supplied from Boulder Creek to the WTP is shown in Figure 3.2. Water is delivered at a 100-psi residual pressure at the WTP. Boulder Creek is typically the primary source of supply to the Town because of the higher pressure, however, because of vulnerability issues, Bear Creek is relied upon as a secondary source.

Figure 3-2 Combined Water Sources to WTP



The intake is in a known avalanche run out zone. The avalanche that occurred in 2019 damaged some of the intake infrastructure. The slide prevented operations staff from site visits to the site. Costs were accrued to excavate the slide out of the intake area in order to gain access. The slide danger prevents winter maintenance at the intake.

Figure 3-3 Boulder Creek impoundment pool

Figure 3-4 Baffles in forebay

Figure 3-5 Shotcrete spillway and embankment

Figure 3-6 Boulder Creek spring box

Figure 3-7 Boulder Creek intake baffles and screen box

Figure 3-8 Boulder Creek water fall and stilling basin with Baffles

Figure 3-9 Boulder Creek raw water intake settling basin

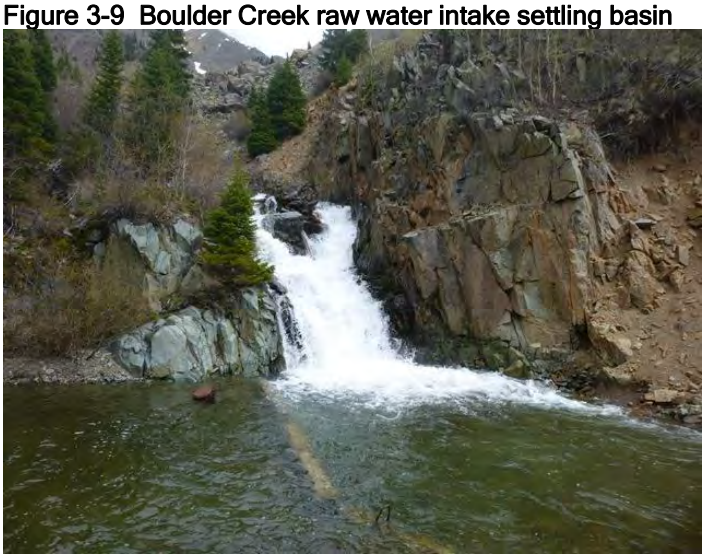


Figure 3-10 Boulder Creek raw water intake embankment dam

3.1.1.1 Legal Water Rights

The point of diversion for the Town's water rights in the Boulder Creek Pipeline are in the amount of 9.3 cfs. Said pipeline is decreed for 4.65 cfs of water from Boulder Creek and 4.65 cfs from Galvin Creek, with an appropriation date of December 31,1883, a decreed date of July 14th, 1920. The point of diversion on Boulder Creek, a tributary to the Animas River, is located in Section 9, T41N, R7W, of the NMPM at a point whence U.S. Mineral Monument "Evergreen" bears South 63 degrees 54' west a distance of 3391 feet.

3.1.1.2 Watershed Yield

This section includes a watershed analysis for the physical yield for the Boulder Creek watershed for a dry, average and wet year. The physical yield for a dry year of the watershed can inform the vulnerability to drought, climate change and a changing hydrograph.

A watershed yield analysis has been prepared using StreamStats, a service of the USGS for quantifying watershed yield. A printout of the input and results of the yield is contained in Exhibit A. The watershed area is 2.53 square miles and is shown in Figure 3.11. The mean annual precipitation is 47 inches and the mean basin elevation is 12,108 feet. The basin extends from 9,870 feet to 13,500 feet in elevation.

A prediction of the monthly flows at the point of diversion of Boulder Creek is shown in Table 3-1. The flow cycle is consistent with very high elevation runoff, ranging from a low of 1.17 cfs in February to 180 cfs in July. This variability would lend itself to storage during high runoff periods to increase water availability during periods of low yield. Dry year scenarios coupled with vulnerability from fire, avalanches, droughts and climate change pose Silverton's most critical water need.

Figure 3-11 Schematic of Watershed Extent

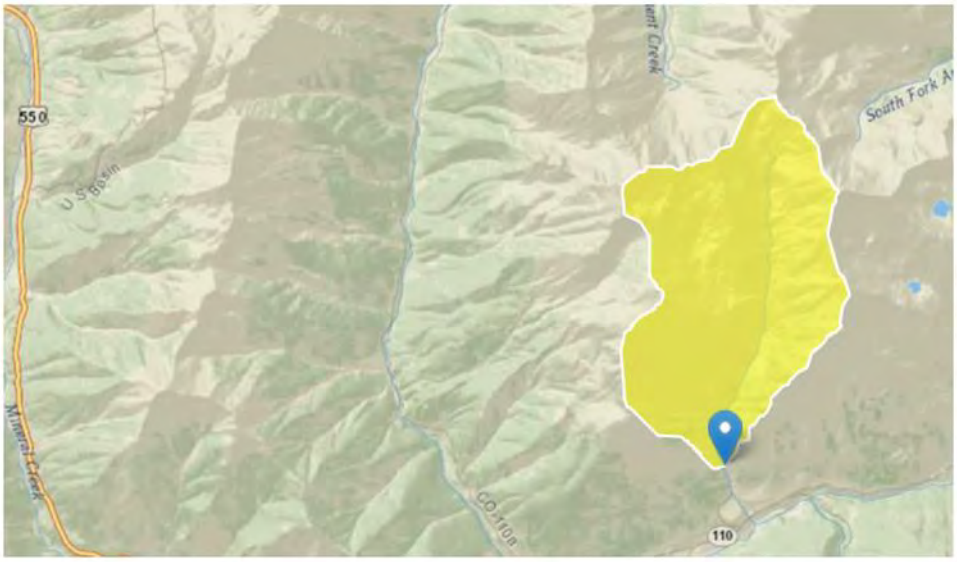


Table 3-1 Average Monthly Flows from Watershed Yield

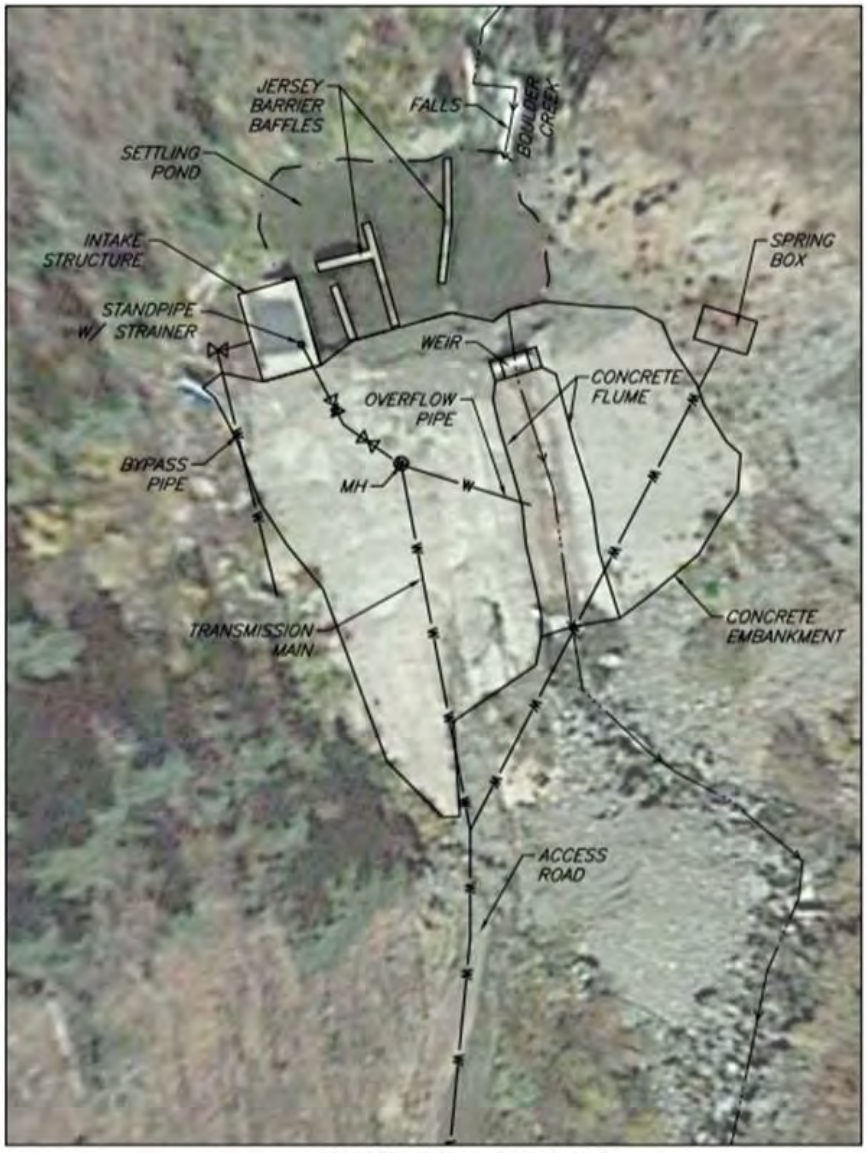
Statistic	Value	Unit	SEp
January Mean Flow	1.26	ft^3/s	77
February Mean Flow	1.17	ft^3/s	58
March Mean Flow	1.43	ft^3/s	47
April Mean Flow	4.67	ft^3/s	50
May Mean Flow	20.6	ft^3/s	62
June Mean Flow	30.2	ft^3/s	121
July Mean Flow	14.5	ft^3/s	180
August Mean Flow	5.12	ft^3/s	119
September Mean Flow	6.32	ft^3/s	120
October Mean Flow	2.71	ft^3/s	106
November Mean Flow	2.65	ft^3/s	80
December Mean Flow	1.74	ft^3/s	75

3.1.1.3 Vulnerabilities

The intake and diversion infrastructure consist of a settling pond with baffles, dam/embankment, intake structure, and outlet pipes/valves. The pipe from the outlet feeds the transmission main to the WTP. Overflow water from the settling pond goes over a weir to a shotcrete spillway, however significant water goes under the shotcrete and causes freeze thaw damage. There is also a spring box located on the east side of Boulder Creek which is connected to the transmission pipe system. (See Figure 3-12)

The vulnerabilities of the intake include avalanches, low flows during drought and dry low snowpack years, rockfall, inaccessibility during winter and winter freezing.

Figure 3-12 Schematic DWG of Boulder Diversion and Intake



3.1.1.4 Condition of Physical Intakes

The Boulder Creek intake is aging and has been damaged by avalanches and rockfall. The intake forebay is approximately 45 ft by 12 ft and 5 ft deep for a total of 53,900 gallons. The concrete baffles in the stilling well or forebay need replacement. The concrete embankment that dams up the creek has

cracks and allows water to flow under the concrete. The transition between the forebay and the concrete screened box requires better screening. Flow measurement on both the inlet and outlet is required to better quantify the flow as required by the State Engineers Office, Division of Water Resources. Improved flow measurement is also required for operational needs. The adjoining separate spring box should be evaluated to determine if it captures enough flow to warrant future capital improvements. If it is determined that it does capture adequate flow the box will need to be protected from rockfall and will require a retaining structure.

3.1.1.5 Condition of Boulder Creek Transmission line

The Boulder Creek transmission main is 6" or 8" dia. pipe (material/date of install unknown), which was partially video-inspected in 1997. The video-inspection showed multiple high spots and areas of potential cavitation. The video showed areas of low and high spots where water depths vary from empty to full. The diameter of the line is adequate based upon the history of flows to the WTP. At 100% of WTP capacity of 300 gpm, the velocity in the transmission main is less than 2 fps.

3.1.1.6 Proposed improvements

Recommended improvements include:

Improve Intake Structure
- Expand Reservoir
- Repair Shotcrete dam
- Flow measurement
- Replace baffles
- Improve screen system

Cost $250,000

Repair Spring Box

- Retaining wall to and above box
- Replumb spring box
- Flow measurement
- Piping and valving

Cost: $200,000

3.1.2 Bear Creek

The Bear Creek Raw Water Supply delivers water from the Bear Creek Drainage through a transmission line to the WTP. The intake is a run of the river surface supply located in the Bear Creek drainage south and west of Town. The intake consists of a boulder rock dam in in the channel that diverts water to a small pond impoundment that acts as a settling pond and an adjoining concrete walled open box.

The transmission line to the WTP begins at this box. The intake elevation is higher than the WTP and water flows by gravity to the WTP. The pressure to the WTP is much less than the Boulder Creek supply. This difference in elevation results in difficulty in blending and proportioning the Bear and Boulder Creek supplies accurately.

Access to this facility is difficult as it requires the crossing of South Mineral Creek. The access road is rough and requires 4WD vehicle and/or heavy equipment due to the crossing of South Mineral Creek.

Photos of the Bear Creek Intake and Pipeline are shown in Figures 3-14 through 3-18.

Figure 3-13 Schematic of Bear Creek Intake

Figure 3-14 Water Level in Bear Creek Intake

Figure 3-15 Water Level in Bear Creek Upstream of Intake

Figure 3-16 Bear Creek Settling Pond After Diversion from Creek

Figure 3-17 Low Water Level Below Intake During Drought of 2018

Figure 3-18 Settling Pond and Concrete Intake Box

Figure 3-19 Bear Creek Transmission Main Crossing Mineral Creek

3.1.2.1 Legal Water Rights

The legal water right structure name is Silverton Pipeline No. 2. The point of diversion for the Town's water right in the Bear Creek Pipeline is in the amount of 7 cfs, with an appropriation date of September 26 1904, a decreed date of July 14, 1920, and decreed special Appropriation Priority N. 1965-3 with a point of diversion on Bear Creek in Section 13, T41N, R8W, at a point from whence U.S. Mineral Monument No. 4937 bears North 67 degree 40' East, a distance of 3038 feet. In proceeding water right cases (W1289 and 89CW63) alternate points of diversion (Silverton Pipeline No. 3, Silverton Well Nos. 1 and 2) were added to the Bear Creek Diversion and the legal diversion rate currently totals 9.26 cfs.

3.1.2.2 Watershed Yield

The watershed for the Bear Creek supply is in the San Juan National Forest. The tributary area to the intake is a high elevation, steep, and well protected watershed. A watershed yield analysis through the StreamStats USGS software is contained in Appendix B and shown in Figure 3-20. The size of the drainage area is 5.55 square miles with a mean basin elevation of 11,593 feet. The watershed elevations extend from minimum base elevation 9,560 feet to the maximum base elevation of 13,400 feet. The mean annual precipitation is 40.08 inches.

Table 3-2 shows the predicted monthly flow statistics. The hydrograph exhibits a classic high elevation runoff curve with low flow in February of 1.79 cfs and a maximum monthly flow of 35 cfs in June. The 7-day 10-year low flow is 0.822 cfs. The Bear Creek intake does not have a flow measurement gauge. The stream below the intake in 2018 was dry and indicative of a drought period.

The current maximum day demand for the Town is approximately 0.67 cfs which compares to the dry year low flow of 0.822 cfs. The 20 year and 40 year predicted maximum day demands for the Town are 1.07 cfs and 1.6 cfs.

Figure 3-20 Extent of Watershed Tributary to the Bear Creek Intake

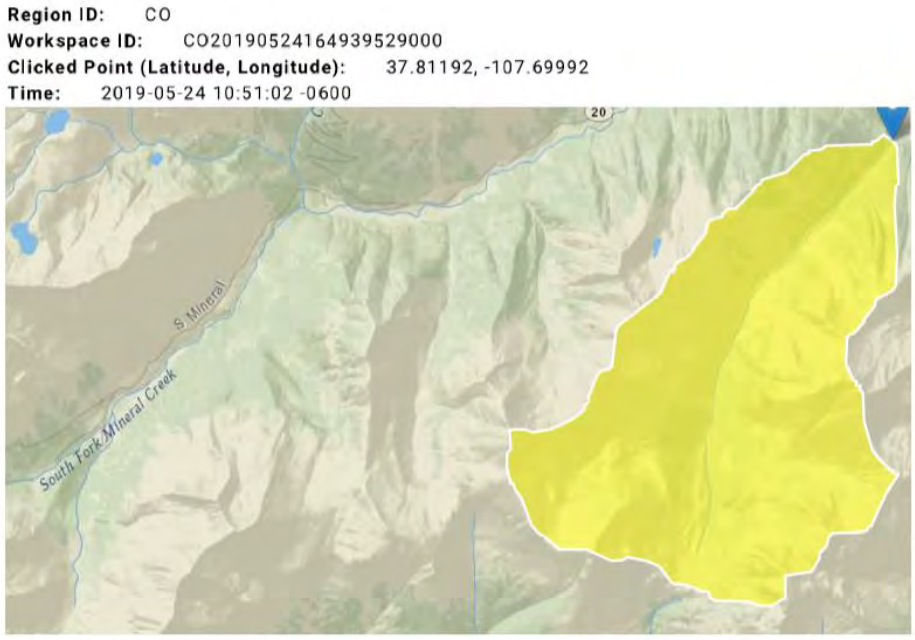


Table 3-2 Predicted monthly flow statistics

Statistic	Value	Unit	SEp
January Mean Flow	1.84	ft^3/s	77
February Mean Flow	1.79	ft^3/s	58
March Mean Flow	2.25	ft^3/s	47
April Mean Flow	6.9	ft^3/s	50
May Mean Flow	25.7	ft^3/s	62
June Mean Flow	35	ft^3/s	121
July Mean Flow	16.8	ft^3/s	180
August Mean Flow	6.73	ft^3/s	119
September Mean Flow	5.77	ft^3/s	120
October Mean Flow	3.77	ft^3/s	106
November Mean Flow	3.49	ft^3/s	80
December Mean Flow	2.42	ft^3/s	75

Monthly Flow Statistics Citations

3.1.2.3 Vulnerabilities

The Bear Creek water supply is vulnerable to both physical and legal water right conditions. The run-of-the-river intake is impacted by wintertime freezing, lack of upstream storage, drought conditions, fires, and avalanches. The rocky stream bed makes water diversion during drought and low flow conditions difficult because of the porous nature of the creek bottom.

The Bear Creek transmission line to the WTP has had a history of failures that interrupts water supply for up to weeks at a time. Failures have included freezing because the pipeline has a shallow bury above frost line. The transmission line is located on the surface of the bottom of Mineral Creek without any protective measures. The line should be buried below the scour depth of Mineral Creek. Large logs and debris can cause debris to build up and back up Mineral Creek.

The pressure head into the WTP from the Bear Creek Intake is only 49 feet or 21.23 psi. This pressure is lower than what is typically recommended by the manufacturer of the WTP. The elevation head is also much lower than Boulder Creek which makes blending water difficult.

The forebay of the intake slows flow from the creek diversion. The slower velocity causes sediment to deposit on the bottom. The forebay does not have any baffles which can cause short circuiting.

3.1.2.4 Condition of Intake

The Bear Creek intake consists of a rock dam in the on-channel creek bed that diverts water to a shallow forebay that is approximately 40 ft long and 15 ft wide. The forebay is subject to freezing in the wintertime. On the north side of the forebay, the walls transition to concrete. The end of the forebay has a gate and outlet pipe to the WTP.

Recommended improvements to the intake would include a more permanent run of the river diversion that does not require constant maintenance with heavy equipment in the creek. A measuring flume and flow control gate are necessary to comply with SEO regulations. A new screen system should be

installed to keep debris out of the transmission pipe. Flow regulation is required for proper flow control to the WTP.

The intake capacity is limited by the capacity of the pipeline from the intake to the WTP and is a function of the pipeline diameter, length, and elevation difference between intake and WTP.

3.1.2.5 Condition of Transmission Main

The transmission main consists of approximately 7,300 lineal feet of pipe. Pipe appears to be aging with sections of steel pipe and cast-iron pipe. The pipe is not buried as it crosses Mineral Creek. See Figures 3-21 and 3-22. The Town has experienced disruption of flow through freezing in the wintertime and build-up of sediment in the summer. The pipe has a very shallow bury depth. The exposure in the bottom of Mineral Creek creates vulnerability from high flows and logs and scour during spring runoff. We recommend a priority improvement is to plan for the excavation to bury the pipeline across the creek.

Figure 3-21 Mineral Creek Exposed Pipe

Figure 3-22 Mineral Creek Exposed Pipe

3.1.2.6 Proposed Improvements

Recommended improvements to the intake include increasing the capacity, adding flow measurement, larger forebay, and better creek intake. We recommend that a boulder Rosgen Structure intake inverted V or vortex weir replace the existing rock diversion dam. New screens and control gates are required for better control of the water.

Relocate Intake Structure 100' vertically and up to 1000' horizontally

USFS Permitting, Water Rights Permitting
Challenging construction
Cost: $278k (from 2009 CIP)

Replace 7,300 LF of 6" and 8" mains with 10" mains

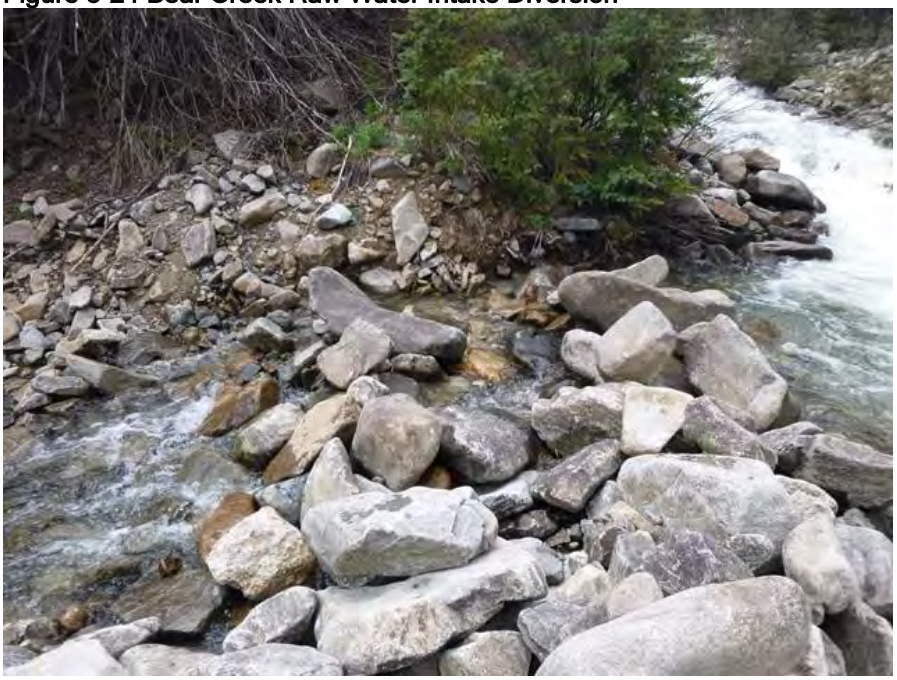
Cost: $803k (from CIP)

Improve Intake Structure

Expand Reservoir
Improve Screen system
Cost: $100k

Figure 3-23 Bear Creek Raw Water Intake Pond

Figure 3-24 Bear Creek Raw Water Intake Diversion



3.1.3 Galvin Creek

Galvin Creek is an infiltration gallery supply located between the Boulder Creek Intake and the WTP as shown in figure 3-22. The water from the infiltration gallery flows by gravity into the Boulder Creek

transmission main. The infiltration gallery box is accessed through the same Forest Service access road to Boulder Creek. The access is extremely steep and not accessible in the wintertime.

Flow from Galvin Creek is diverted into an infiltration box as shown in Figure 3-25. The box consists of an aging concrete sided box with an impervious membrane covered with gravel. The outlet pipe has an isolation valve at the spring box. This intake is not as vulnerable to natural hazards as Boulder and Bear Creek. The water quality is excellent and does not have the high turbidity during springs runoff that the other two supplies have. At the time of the site visit the flow was approximated at 50 to 100 gpm (0.25 cfs) with additional flow continuing down the drainage. That flow could be captured with additional work at the box.

The water rights for the Galvin intake is part of the Boulder Creek Pipeline decree, priority No. 231 and 226 on the Animas River, decreed for a total of 4.65 cfs, with a historic date of December 31, 1899 and a decree date of July 14, 1920. Galvin Creek is considered a second head-gate as part of the Silverton Water Works System No 1. The point of diversion on Galvin Creek is located at a point whence U.S Mineral Monument Evergreen bears North 58 degrees 26th east, a distance of 4,505 feet.

The water court and the State Engineer did not recognize the original decree, and the court therefor granted the Water Works Special Appropriation Priority No. 1965-1. (Footnote to memo, Maine's, Bradford, Shipps & Sheffield, January 23, 1998)

The Galvin Spring supply should be a priority water supply for the Town because of the high quality and the protection from other physical hazards. We recommend improvements to the spring box to capture additional water including a larger and deeper spring box with new gravel, along with a measuring meter and flow control valve.

Figure 3-25 Galvin Creek Raw Water Intake

3.1.4 Summary of Combined Supply

The combined decreed rights for Boulder Creek and Galvin Spring water rights (Silverton Water Works System No. 1) at 9.3 cfs and the Bear Creek water rights (Silverton Pipeline No. 2), of 9.23 cfs far exceeds current and future predicted demands. The existing water right decrees have more than enough flow, however the actual supply during dry years, and when physical hazards occur are less than secure or reliable.

The low flows of each from the StreamStats analysis for a dry period or 7-day 10-year low event of 0.822 cfs from Bear Creek and 0.562 from Boulder Creek, and 0.12 cfs from Galvin combine to have a dry year or drought year flow of 1.56 cfs or 700 gpm. This is more than double the current maximum day flow. However, the vulnerability of Bear and Boulder to physical hazards require that flow should exceed maximum day flows with one of the supplies out of service. With the highest flow supply from Bear Creek out of service the combined Boulder and Galvin Creek supply would equal 287 gpm or less than current max day demand.

3.1.5 Susceptibility to Drought Conditions

Silverton's two main sources of supply, Boulder and Bear Creek, are high elevation, run of the river intakes, with small watersheds. Both supplies do not have raw water storage above the intakes or between the intakes and the WTP. Both watersheds and intakes are vulnerable to natural hazards including avalanches, mud flows, rock fall, very low late season flows and a changing climate.

Silverton's water rights are junior to senior water right calls on the Animas River. A call was made in 1996, however the SEO office did not allow the call to be enforced because the senior rights infrastructure was not able to sweep the river.

The drought of 2018 also caused forest fires like the 416 fire which can cause severe water quality changes which are not treatable at the WTP. The aftermath of wildland fires can result in severe erosion, mud flows, and siltation at the intakes by filling in forebays and causing screens to foul.

The combination of all these conditions, result in water supplies that are not reliable, therefore, not up to the standards of a drinking water supply. A reliable water supply is a priority for Silverton's public and guests.

It is important for utilities to use scenario planning and consider scenarios that are critical to health and safety. Under the scenario of extended drought in combination with any other natural hazard, lack of storage, and a senior water right call, it is prudent for Silverton to plan for another more redundant and reliable supply. Further improvements to the existing supplies are necessary to insure more reliability and water security.

3.1.6 Water Treatment Plant

The Town has one Water Treatment Plant (WTP) that treats Boulder Creek, Galvin Creek and Bear Creek source water. This water security plan will focus on water supply and legal supply. Water infrastructure is discussed in more detail in an infrastructure assessment SGM prepared for the Town in 2016. Some WTP issues are discussed here because they have water security implications.

The WTP capacity is 300 gpm. Treatment plant capacity should be based upon meeting the demand from a maximum day demand (MDD). Previous periods of MDD have already exceeded that plant capacity. Water from storage tanks would have been drawn down during periods that MDD exceed WTP capacity.

Another key to reliability for the WTP is redundancy in critical processes. The WTP only has one treatment train. If the treatment train was disabled or taken offline for maintenance the town would have no ability to treat water. We recommend that Silverton plan to add a second and parallel treatment train to the WTP.

Further description of the WTP:

> The Town Silverton's water treatment plant (WTP) treats surface water from the Boulder Creek and Bear Creek sources using a pre-packaged filtration system from Water Technologies (Aquafloc 300TSA-HF filter system). The Aquafloc system consists of a single treatment train which functions as a converntioanl rapid rate gravity filtration plant. The system was

constructed in 1986 and has a labeled production capacity of 300 gpm. The Water Technologies product data sheet is provided in the Appendix.
Individual components of the Aquafloc treatment train include the following:

1. Coagulation: Raw water entering the plant is coagulated using Alum and a coagulant aid polymer. Chemicals are injected into an in-line mechanical mixer which homogenizes the resulting flow. The existing mechanical mixer runs off a 0.3 HP motor and supplies an average velocity gradient of 5,487 s^{-1}
2. Flocculation: Coagulated water enters a compartmentalized flocculation basin via a 6" inlet pipe. The flocculation basin contains three separate compartments which are separated by baffled walls and inter-connecting pipe weirs. At the plant's design flow of 300 gpm, the flocculation compartment has a wetted volume of approximately 2,990 gallons.
3. Settling/Clarification: Flocculated waters enters an up flow settling basin which utilizes a single rack of tube settlers to clarify suspended solids. The effective area of the tube settling rack is approximately 120 ft^2. Sludge is removed from the bottom of the flocculation and clarification basins via a sloped floor and waste drain. Sludge is sent to the WTP's nearby backwash ponds.
4. Filtration: Settled water enters the filtration basin via overflow effluent weir troughs. The filter is a mixed media gravity filter which utilizes 24' of anthracite coal and 8' of graded sand. The filter has a plan area of 60 ft^2 and is supported by a gravel underdrain system which utilizes perforated pipe laterals. Filter backwash is completed using potable water which is pumped from storage Tank No. 1. Used backwash is sent to the WTP's backwash pond and is not recycled to the head of the plant. Filter backwash events are initiated based on effluent turbidity levels (every 1 to 4 days). Additional filter cleaning is obtained via the use of a hydraulic surface wash system.
5. Disinfection: Filtered effluent from the Aquafloc system is disinfected via gaseous chlorine injection prior to entering Storage Tanks No. 1 and No. 2. Free chlorine residual is currently monitored for compliance using samples taken off the plant's house water line, which is pumped from Tank No. 1. The plant was designed with the ability to feed gaseous chlorine upstream of the Aquafloc filtration system so that additional contact time could be claimed if needed.

Evaluation of Existing Treatment Facility: Filtration
Principle design parameters of the Aquafloc filtration system are compared to updated CDPHE design criteria in Table 1.

Table 1 Aquafloc Design Parameter Summary

Unit Process	Value	CDPHE Design Criteria Requirement
Design Flow (gpm)	300	N/A
Rapid Mixer Velocity Gradient (S^{-1})	5487	≥500
Flocculation Detention Time (min)	10	≥30
Sedimentation Tube Settler Application Rate (gpm/ft^2)	2.5	≤2.5
Filtration Hydraulic Loading Rate (gpm/ft^2)	4.9	≤5
Filtration Backwash Rate (gpm/ft^2)	15	≥15

As shown in Table 1, the existing system meets the majority of CDPHE design criteria with the exception of flocculation detention time. Due to this discrepancy, it is likely that CDPHE will reclassify the WTP from a Conventional Filtration plant to a Direct Filtration plant. This would significantly reduce the amount of removal credit granted to the plant for filtration and increase its disinfection requirements.

3.2 Legal Water Rights

3.2.1 Water Rights Portfolio

The following Table 3-3 provides a summary of Silverton's water rights portfolio. Adjudicated water rights are an important element of the Town water security and constitute the legal water available to the Town. Figure 1-1 shows the general location and sources of Town water rights according to Colorado Division of Water Resources records. The Town owns 18.6 cfs of absolute water decreed for municipal purposes (this does not include water decreed at alternate points), and 8.8 cfs of conditional water.

The Silverton Water Works System No. 1 (aka Boulder Creek Diversion) is the Town's most senior water right and is decreed for 4.65 cfs at the Boulder Creek point of diversion and 4.65 cfs at the Galvin Creek point of diversion. The original filing included a 17.23 AF reservoir, which, based on historical aerial photography was likely located near the existing Water Treatment Plant.

The Silverton Pipeline No. 2 (aka Bear Creek Diversion) was originally decreed for 7.0 cfs in Case No. CA1751-B. In proceeding water right cases (W1289 and 89CW63) alternate points of diversion (Silverton Pipeline No. 3, Silverton Well Nos. 1 and 2) were added to the Bear Creek Diversion and the legal diversion rate currently totals 9.26 cfs. The Silverton Pipeline No. 3 which was located on Mineral Creek and the Silverton Well Nos. 1 and 2 were likely decreed alternate points of diversion due to water quality issues. The source water for these rights are not considered a good drinking water supply because of the high levels of heavy metals leaching from mining tailings and heavily mineralized rocks in each respective watershed.

Table 3-3 Town of Silverton Water Rights

Water Right	Case Number	Appropriation Date	Adjudication Date	Admin No.	Uses	Amount (cfs)		Structure	Comments
						Abs.	Cond.		
Silverton Water Works System No. 1	CA1751-B	12/31/1883	3/21/1966	26974.12418	1,2,7,8	4.65	-	Pipeline	Boulder Creek Diversion
Silverton Water Works System No. 1	CA1751-B	3/31/1899	3/21/1966	26974.17987	1,2,7,8	4.65	-	Pipeline	Galvin Creek Diversion, includes 17.23 AF Reservoir
Silverton Pipe Line No. 2	CA1751-B	9/26/1904	3/21/1966	26974.19992	2,7,8	7.0	-	Pipeline	Bear Creek Diversion
Silverton Pipe Line No. 2	W1289	8/24/1937	3/21/1966	32012.00000	2,8	1.6	-	Pipeline	Alternate Point to Silverton Pipe Line No. 3
Silverton Pipe Line No. 3	W1289	8/24/1937	3/21/1966	32012.00000	2,7,8	1.6	-	Pipeline	South Mineral Creek Diversion
Silverton Pipeline No. 2	89CW0063	8/7/1947	12/31/1972	44559.35647	2	0.33	-	Pipeline	Alternate Point of Diversion to Silverton Well No. 2
Silverton Well No. 2	W0959	8/7/1947	12/31/1972	44559.35647	2	0.33	-	Well	
Silverton Pipe Line No. 2	89CW0063	8/7/1964	12/31/1972	44559.41857	2	0.33	-	Pipeline	Alternate Point of Diversion to Silverton Well No. 1
Silverton Well No. 1	W0959	8/7/1964	12/31/1972	44559.41857	2	0.33	-	Well	
Big Molas Lake	04CW0050	5/31/1929	12/31/2004	56247.29005	5,6	113 AF	-	Reservoir	
		7/15/2004	12/31/2004	56247.29005	1,2,3,A, Q		113 AF	Reservoir	
Molas Ditch	04CW0050	5/31/1929	12/31/2004	56247.29005	5,6	2.2	-	Ditch	
		7/15/2004	12/31/2004	56247.29005	1,2,3,A, Q		2.2	Ditch	
Silverton Expansion Diversion	05CW0087	12/31/2000	12/31/2005	56613.55152	2	-	5.2	Pump	805 AF volumetirc limit
Silverton /SJC Diversion	05CW0088	12/31/2000	12/31/2005	56613.55152	3,4,6,7,8,9	-	0.9	Other	Non-mining related uses
					3,4		0.5	Other	Mining related uses
					Total	**23.02**	**8.8**		

Footnotes:

Use Codes: 0 = Storage, 1 = Irrigation, 2 = Municipal, 3 = Commercial, 4 = Industrial, 5 = Recreation, 6 = Fishery, 7 = Fire, 8 = Domestic, 9 = Stock, A = Augmentation, E = Evaporation, Q = Other

Abs = Absolute, Cond = Conditional, cfs = Cubic Feet per Second, AF = Acre Feet

The amount of the decreed water rights is more than adequate to meet the demands contemplated in for the 20 to 40-year planning period, however, during drought conditions yield of the Towns supplies does not match the decreed amounts. Further, during periods of drought not only will Silverton's water supply be minimal, other downstream senior water rights will have less and may place an administrative call on the Animas River to curtail junior rights, including Silverton's primary sources (Boulder and Bear Creek Diversions).

The filing for Molas Lake water rights occurred over concern of senior water rights call on the Animas River. A call was made in 1996, however the State did not honor the call because the stream could not be swept by the senior call and because of a rain event immediately after the call. Silverton's storage in Molas lake includes the top 5 feet. The remainder is owned by the CWCB. During the drought of 2018 it was evident that during drought conditions the 5 feet of water was not available. Further, the infrastructure is not in place to deliver water from the lake to the Animas River without significant losses.

3.2.2 Molas Lake

Silverton has decreed augmentation water in Molas Lake per Case No. 04CW50. The water right includes the Big Molas Lake and Molas Ditch structures. The rights in Big Molas Lake are for the water above 10,500 feet elevation. The source of the water is the natural drainage above Molas Ditch, both of which are tributary to the Animas River. The Big Molas Lake amount is 113 AF of storage. The Molas Ditch is decreed for 2.2 cfs. The water is decreed for exchange and augmentation for the Boulder Creek Pipeline, Bear Creek Pipeline, Mineral Creek Pipeline and Silverton Expansion Diversion at the 14th Street Bridge over the Animas River.

The follow photographs in Figures 3-26 and 3-27 show the low lake levels in 2018.

Figure 3-26 Low Lake Levels in 2018

Figure 3-27 Low Lake Levels in 2018

3.2.3 Vulnerability to Administrative Call

SGM reviewed all downstream water rights on the main stem of the Animas River and determined that there are approximately 123 water rights senior to the Town of Silverton's senior Boulder Creek and Bear Creek diversions. Approximately 258 cfs of water is needed in the Animas River to satisfy these senior water rights. Note that 258 cfs is not needed at any one location, because most of these senior water rights are decreed for irrigation use, which is efficient with irrigation return flow occurring to the Animas River satisfying downstream most downstream users. The water rights most likely to place a call on the Animas River are the Animas Consolidated Ditch (≈72 cfs) and the Reed Ditch (≈45 cfs). The Towns legal supply is most vulnerable during the irrigation season especially in the months of late July through early October, which also coincides with the summer tourist season and associated increased water demands.

3.2.4 Augmentation Requirement

Based on the WTP production in the year 2015 for the actual gallons produced per month, the average annual water demands in AF are shown in Table 3-4 for growth for varying growth rates.

Based on the demands shown in Table 3-4 and consumptive use of 5% for indoor uses, the daily depletion to the Animas River is approximately 0.050 AF (≈16,200 gallons). This assumes that drought restriction would be in place limiting irrigation demands. Assuming a call based upon a combination of drought and late season low surface water flows in the months of August, September and October (≈90 days), the Town would need approximately 4.47 AF of augmentation supply.

Estimated augmentation water needed at 20-year projection using a 1% to 3% growth rate range between 5.46 to 8.08 AF and at 40-year projection range between 6.66 and 14.59 AF. Augmentation supply could be met with constructing a new reservoir, purchasing senior irrigation rights, and/or leasing water from Cascade Reservoir (Electra Lake). Section 6.2 discusses these options.

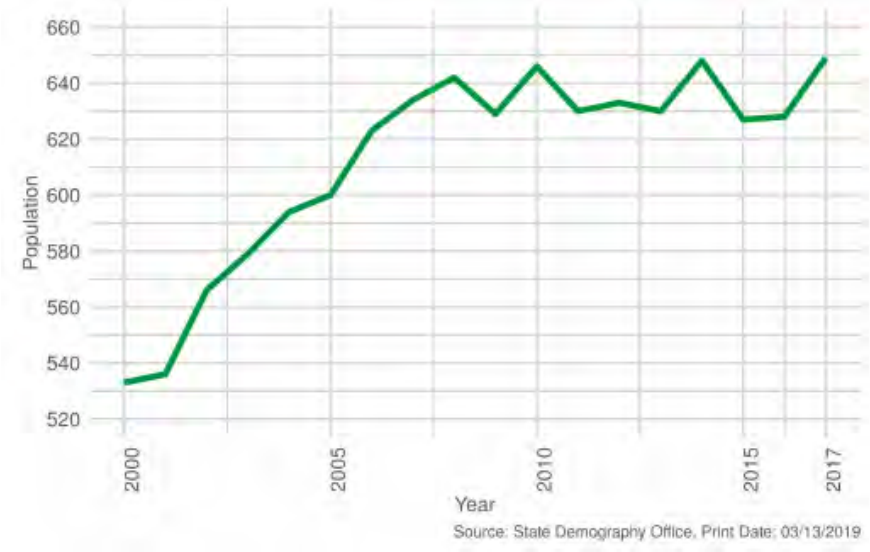
Table 3-4 Average Annual Projected Water Demands in AF and Augmentation Required

#	Year	Growth Rate Ave Annual 1% AF	2% AF	3% AF	Aug. water required 1% AF	2% AF	3% AF
	2,020	268	268	268	4.47	4.47	4.47
1	2,021	271	274	276	4.52	4.56	4.61
2	2,022	274	279	285	4.56	4.65	4.74
3	2,023	276	285	293	4.61	4.75	4.89
4	2,024	279	290	302	4.65	4.84	5.03
5	2,025	282	296	311	4.70	4.94	5.18
6	2,026	285	302	320	4.75	5.04	5.34
7	2,027	288	308	330	4.79	5.14	5.50
8	2,028	291	314	340	4.84	5.24	5.67
9	2,029	293	321	350	4.89	5.34	5.84
10	2,030	296	327	361	4.94	5.45	6.01
11	2,031	299	334	371	4.99	5.56	6.19
12	2,032	302	340	383	5.04	5.67	6.38
13	2,033	305	347	394	5.09	5.79	6.57
14	2,034	308	354	406	5.14	5.90	6.76
15	2,035	312	361	418	5.19	6.02	6.97
16	2,036	315	368	431	5.24	6.14	7.18
17	2,037	318	376	444	5.30	6.26	7.39
18	2,038	321	383	457	5.35	6.39	7.61
19	2,039	324	391	471	5.40	6.52	7.84
20	2,040	327	399	485	5.46	6.65	8.08
21	2,041	331	407	499	5.51	6.78	8.32
22	2,042	334	415	514	5.57	6.91	8.57
23	2,043	337	423	530	5.62	7.05	8.83
24	2,044	341	432	545	5.68	7.19	9.09
25	2,045	344	440	562	5.74	7.34	9.36
26	2,046	348	449	579	5.79	7.48	9.64
27	2,047	351	458	596	5.85	7.63	9.93
28	2,048	355	467	614	5.91	7.79	10.23
29	2,049	358	477	632	5.97	7.94	10.54
30	2,050	362	486	651	6.03	8.10	10.86
31	2,051	365	496	671	6.09	8.26	11.18
32	2,052	369	506	691	6.15	8.43	11.52
33	2,053	373	516	712	6.21	8.60	11.86
34	2,054	376	526	733	6.27	8.77	12.22
35	2,055	380	537	755	6.34	8.94	12.58
36	2,056	384	547	778	6.40	9.12	12.96
37	2,057	388	558	801	6.46	9.31	13.35
38	2,058	392	569	825	6.53	9.49	13.75
39	2,059	396	581	850	6.59	9.68	14.16
40	2,060	400	592	875	6.66	9.87	14.59

3.3 Population Estimates and Current and Future Demand

This section will discuss existing and future Silverton population and impacts to water demand and supply. Population data from the Colorado State Demography Office (SDO) shows a year-round population of 649 residents in Silverton in 2017, the most recent year available. According to the data, the Town's population has fluctuated over the past decade, but remained relatively stable around an average of 636. Silverton's population has been as high as 2,153 residents in 1910 at the peak of the mining activity. The average annual growth rate from 2010 to 2017 was slightly positive at 0.07%. As shown in Figure 3-28 the population has been increasing since 2015, with 2017 seeing an increase of 22 residents since then. The growth rate during this period was 1.7%.

Figure 3-28 Silverton Population 2000 - 2017



3.3.1 Current and Future Demand

The current demand for Silverton based upon water production at the WTP is shown in Table 3-5 for average day (ADD), Maximum Day Demand (MDD), and Peak Hour Demand (PHD). Water Supply must be able to provide MDD. The current MDD is 258 gpm. This compares to the WTP capacity of 300 gpm. Silverton's population has historically been sporadic and has large fluctuations of tourism in the summer months. Summer population can reach 3,500 people. Therefore, using population figures as a guide to future growth or using EQR metrics and per-capita use metrics is not a good indicator of future water demand. A better indicator is to use the WTP water production records.

The population increase from 2000-2017 was 1.7%. Table 3-6 shows the increase in water demand for maximum day demand with increases of 1%, 2% and 3% growth rate. Using the 2% growth rate the 20-year MDD is projected at 484 gpm (1.07 cfs). The 40-year MDD is projected at 720 gpm (1.6 cfs).

Infrastructure planning periods typically include a 20-year time frame, while water supply planning is typically 40 years or longer.

Table 3-5 Current Estimated Demands

Demand	Value (gpm)	Peaking Factor (Demand/ADD)
ADD	163	1.0
MMD	258	1.6
MDD	326	2.0
PHD	489	3.0

Table 3-6 Future Water Demands at Multiple Growth Rates

#	Year	Growth Rates (gpm)		
		1%	2%	3%
	2020	326	326	326
1	2021	329	333	336
2	2022	333	339	346
3	2023	336	346	356
4	2024	339	353	367
5	2025	343	360	378
6	2026	346	367	389
7	2027	350	374	401
8	2028	353	382	413
9	2029	357	390	425
10	2030	360	397	438
11	2031	364	405	451
12	2032	367	413	465
13	2033	371	422	479
14	2034	375	430	493
15	2035	378	439	508
16	2036	382	448	523
17	2037	386	456	539
18	2038	390	466	555
19	2039	394	475	572
20	2040	398	484	589
21	2041	402	494	606
22	2042	406	504	625
23	2043	410	514	643
24	2044	414	524	663
25	2045	418	535	683
26	2046	422	546	703
27	2047	426	556	724
28	2048	431	568	746
29	2049	435	579	768
30	2050	439	591	791
31	2051	444	602	815
32	2052	448	614	839
33	2053	453	627	865
34	2054	457	639	891
35	2055	462	652	917

36	2056	466	665	945
37	2057	471	678	973
38	2058	476	692	1002
39	2059	481	706	1032
40	2060	485	720	1063

3.3.2 Water Supply Peak Flow Requirements

Table 3-7 shows the dry year supply from Bear and Boulder Creeks compared to future demand for the 20-year and 40-year forecast. Bear and Boulder Creeks represent multiple supplies, however, with one of the supplies out of service, the remaining supply will not be able to meet the future water demands for Silverton. Both supplies have history of supply disruption. If Bear Creek which is the largest supply is offline, the Boulder Creek supply will not have adequate flow in a drought period to meet demands for the 20-year demand forecast. An additional supply or storage will be required.

It is also clear the 300 gpm current capacity of the WTP will not meet future demands and has been exceeded with even current demand. Therefore, Silverton should plan for adding an additional treatment train to the existing plant.

Table 3-7 Supply from Bear and Boulder Creek

Source	Mean flow winter cfs	7-day 2 year low flow cfs	Mean flow winter gpm	7-day 2 year low flow gpm
Bear Creek Dry year supply	1.79	0.88	803	393
Boulder Creek Dry year supply	1.26	0.55	565	245
Combined	3.05	1.42	1369	639
Water Treatment Plant Capacity	0.67	0.67	300	300
with largest source out of water			565	245
20-year projected MDD			484	
40-year projected MDD			720	

4.0 New Supply Alternatives

4.1 Existing Wells

Silverton has two wells as shown on Figure 1-1. Silverton Well No. 1 is located near 16th and Mineral Street. Silverton Well No. 2 is located near 16th and Cement Street. Only one of the two wells could be found in the field. The wells have not been in use because of water quality problems associated with heavy metals (Arsenic, Lead, Zinc, etc). This is likely caused by acid-mine and acid rock drainage of hydrothermally altered and mineralized source rocks in the Cement Creek and Animas River watersheds. The appurtenant well controls, disinfection and piping have been abandoned and would require completely new construction to bring them back in service. In addition, the well cap does not meet current CDPHE standards.

Well No. 1 has well permit number 6661-F. Well No. 2 has permit number 66662-F. The decreed right for the combined wells is 0.66 cfs or 0.33 cfs each (150 gpm).

In order to use the existing wells, a new water treatment plant would be required at the location of the wells. The existing WTP that treats Bear and Boulder Creeks Water does not have the processes to remove heavy metals.

Treatment processes appropriate for heavy metals removal would include activated carbon adsorption, ion exchange, reverse osmosis, and conventional processes of precipitation, oxidation, clarification and filtration. The metals of concern in sediments and wells in the Silverton area include Aluminum, Arsenic, Cobalt, Iron, Lead, Manganese, Uranium and Zinc.

Without specific data of which contaminants exists and at what levels capital costs could be in the millions of dollars along with significant annual O&M costs. Further water quality testing and treatment process testing, and evaluation would be necessary to identify processes in order to develop useful cost estimates. SGM recommends that the existing wells be abandoned.

4.2 New Wells

SGM recommends exploring for a new groundwater supply to supplement the current potable water supply of the Town. Based on the review geologic maps, historical mining records, existing well logs, and parcel ownership data, it is recommended that the Town drill one to two exploratory wells on the Kendall Mountain Parcel as shown on Figure 4-1. The goal of the exploration drilling would be to locate a well(s) site that has sufficient yield (150 to 300 gpm) and quality (low metals) and be sourced as a true groundwater source by the CDPHE.

It appears that the Kendall Mountain alluvial fan deposit and associated aquifer is fed from an different tributary basin than the existing wells. This type of supply would only require chlorination and minimal capital cost to add to the existing water distribution grid.

The exploratory well should be located a minimum of 200 feet from the Animas River, ponds and/or streams and have screed depths greater than 50 ft below the ground surface to avoid classification by the CDPHE as groundwater under the direct influence of surface water.

Improvement Plan

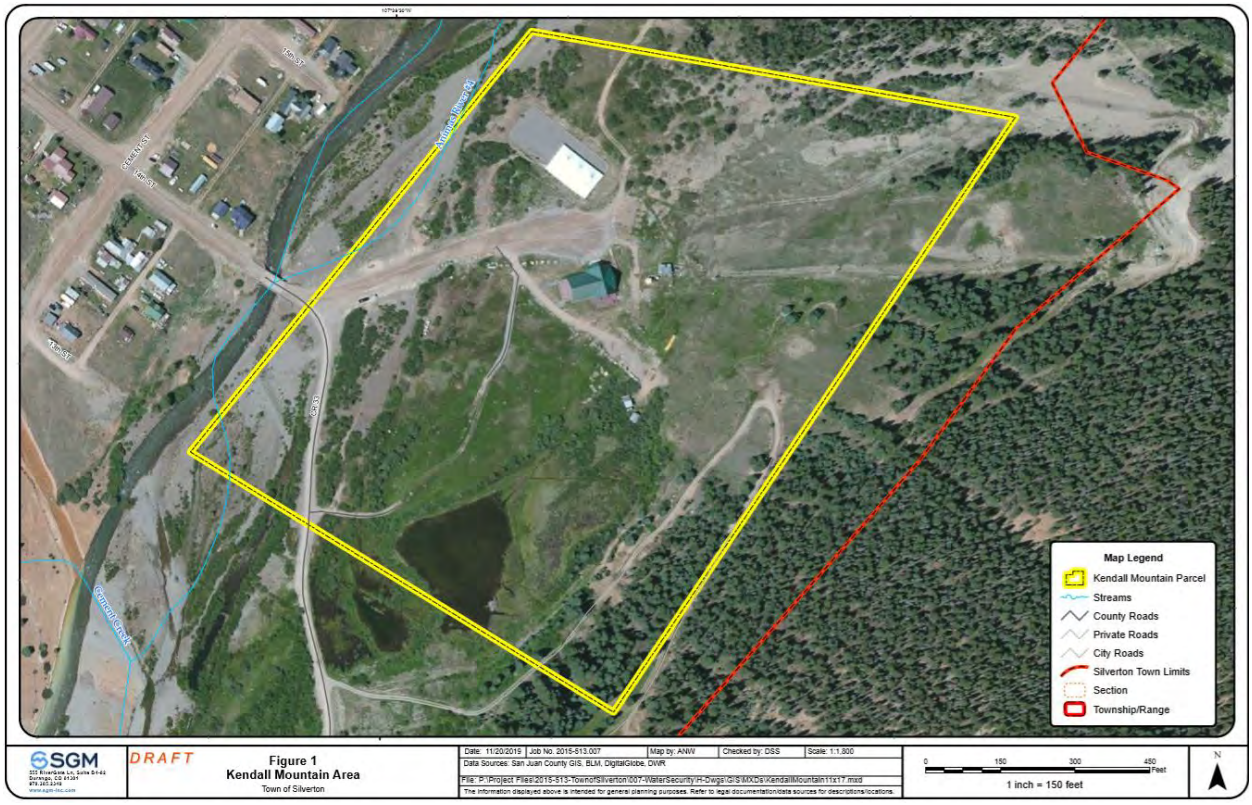
Drill Exploratory Well(s) – 5-inch PVC casing between 100 to 200 ft deep.
Aquifer Pumping Test for water quality and yield
Test for inorganics and general chemistry include RADs.
Cost = $20,000 per well

Municipal Production Well(s)

10 to 12-inch stainless steel casing 100 to 200 ft deep

Aquifer Test for water quality and yield
New Source Water Quality Testing
Chlorination System
Cost = $80,000

Figure 4-1 Kendell Mountain Proposed Well Field Area



4.3 New Surface Supplies

4.3.1 Silverton Expansion Diversion (14th Street Bridge Supply)

The town has a water right for 5.2 cfs on the Animas River at the 14th Street Bridge decreed for municipal uses. It was decreed as the Silverton Expansion Diversion and is very junior with a December 31, 2005 adjudication date. During this time the City of Durango was filing for a Recreation In Channel Diversion (RCID) right which would be senior to any future rights filed by Silverton. Silverton filed for this right to ensure that water was available in priority ahead of the RICD right.

The present WTP does not have adequate processes to treat Animas River water. The Animas River surface supply has documented metals from historic mining operations in the watershed. Additional processes such as ion exchange, membranes, activated carbon adsorption, modified precipitation, and clarification processes would be required. A new WTP could be constructed near the 14th street bridge. Treated water could then be pumped directly into the distribution system. A new WTP is projected to cost between $4 million and $7 million. Further the Town would have to operate two separate WTP's. We do not recommend further research and development of this surface water supply at this time.

4.3.2 Dewatering Wells for Ballfields

Silverton has dewatering wells for the Town Ballfields. These wells would be classified as GWUDI and would require filtration treatment to comply with the CDPHE Surface Water Treatment Rule. Water Quality data for this was is not available at this time. We do not recommend further planning for this water supply.

4.3.3 Swansea Gulch

Swansea Gulch is a small, steep, high elevation watershed just east of the Kendell Mountain Base Area. The Gulch drains to just north of the base area. The water quality appears to be good but could have dissolved heavy metals due to abundant fracture and mineralized vein systems mapped in the gulch. The surface water would require a surface water treatment plant at the site or would have to be pumped to the existing WTP. It is unclear if the water quality would be treatable at the existing WTP. We do not recommend that this source be considered because of the high cost of capital and long-term operation and maintenance of a second water plant and pumping to the existing WTP.

5.0 Water Efficiency as a Source of Supply

Water conservation can be used to limit Town water demands and limit the size of infrastructure necessary to meet MDD. High water conservation efforts have been adopted by the Southwest Basin Roundtable (SWBRT) as a method to insure adequate water in the future for the entire Colorado River Basin. Recent research by the Bureau of Reclamation has shown that existing demand in the entire Colorado Basin has exceeded supply and all the States that are part of the Colorado River Compact are overusing water. Lake Powell and Lake Mead reservoir supplies have dropped in part due to overuse in the basin. Levels have also dropped due to the current extended drought period.

Silverton should encourage high conservation efforts, including:

- future water smart land use
- voluntary water restrictions
- smart water conscious high elevation native landscaping
- aggressive leak detection.

These efforts, although in line with the entire Colorado Basin will not be adequate to provide future water security for the Town. Water supplies must be adequate for MDD, which occurs during the peak tourist season in June, July and August.

Silverton's net production at the WTP, by month, is shown in Figures 5-1. These figures are from two separate periods, with a gap between 2008 and 2014. The period from 2005 through 2018 shows the typical monthly spikes in usage during the irrigation and tourist season. Most of the increase in usage is attributable to tourism increases and not from outside irrigation, according to Town Staff. Silverton's outside irrigation is less than other Colorado municipalities because of its high elevation and smaller lot size. Meaningful water conservation efforts are targeted toward lessening the peak of outside irrigation. The domestic consumptive use of water is only between 5% and 10% because of return flows at the WWTF. Therefore, conservation efforts will not yield sufficient water savings that would negate the need to pursue additional water sources for water security.

Figure 5-2 for the years 2014-2015 show higher usage during the winter months, explained by excessive leakage which occurred during this era from ground movement in the wintertime. Silverton has aggressively pursued repairing leaks and has an ongoing program to decrease leakage.

We recommend that Silverton prepare a CWCB formatted Water Efficiency Plan so that the Town is eligible for CWCB grants in the future.

Figure 5-1 Net Production 2005 to 2008 gpd

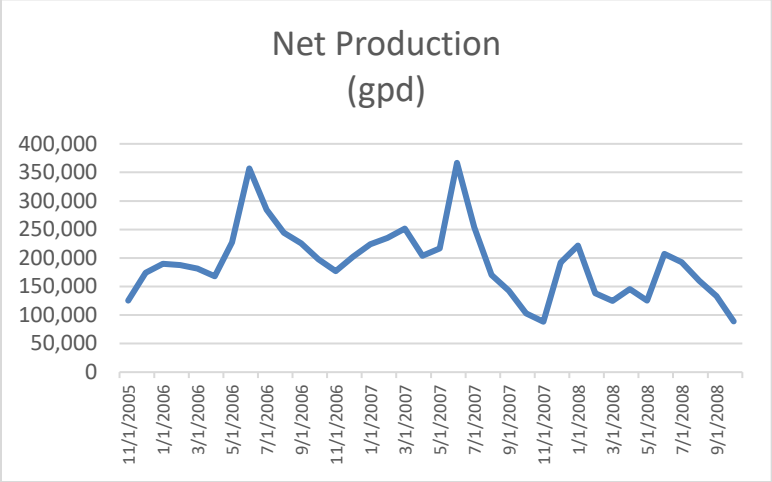


Figure 5-2 Net Production 2014 to 2015 gpd

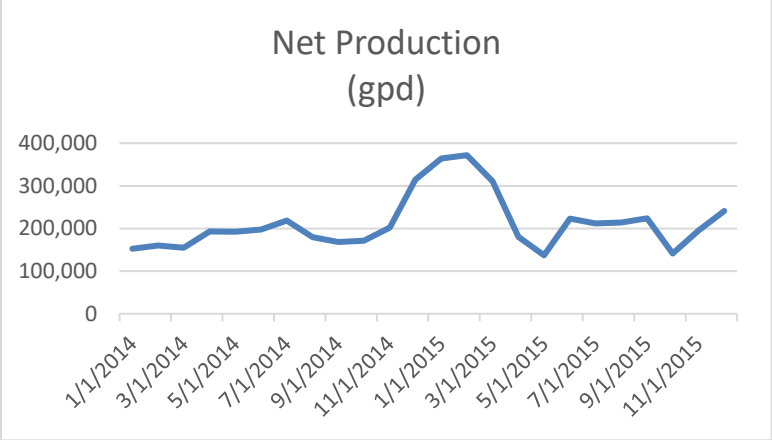
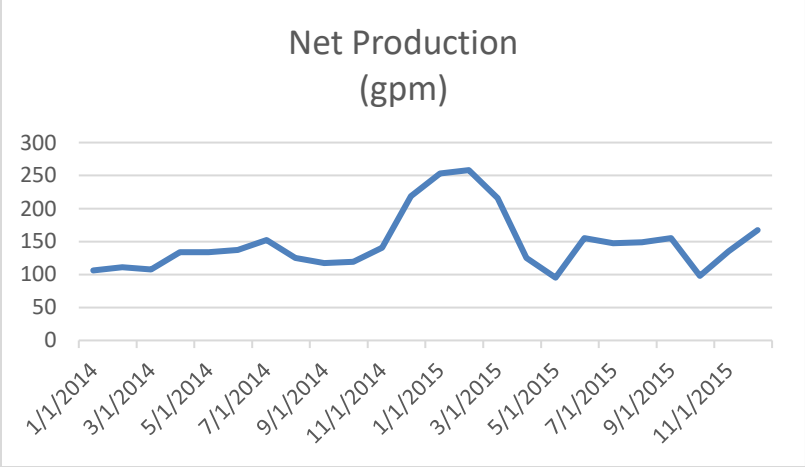


Figure 5-3 Net Production 2014 to 2015 gpm



6.0 Securing A More Reliable Water Right

Silverton's water rights are vulnerable to being curtailed during a drought year by downstream senior rights on the Animas River. Communication from Town Water Attorneys have stated that there has never been a call on the Animas River. The potential calling rights on the Animas River are the Animas Consolidated Ditch and the Reed Ditch, both of which have diversion structures just downstream of Bakers Bridge. Other historical information suggests the Town faced a call in 1996, however the SEO did not honor the call because the downstream right did not sweep the Animas River, and shortly thereafter rains increased the flow in the River.

Sources of supply will have different legal water right strategies to augment depletions from downstream calls.

One source of supply that can both supply physical water upstream of the WTP and provide augmentation water to satisfy a downstream call is the construction of a small reservoir. Other sources of augmentation would include water allotment contracts with existing reservoirs. The use of the Towns existing Lagoon system as a source of augmentation could be considered if the Town abandons the lagoons for a new mechanical treatment plant. The purchase of senior mining water rights was considered, however most mining rights are generally non-consumptive and have minimal value for augmentation because they do not have historical consumptive use that could be used to offset depletions from the Town. Of these options a small reservoir would provide both physical water and augmentation water.

6.1 Proposed New Reservoirs

A field trip with Town staff reviewed reservoir sites between the Bear and Boulder Creeks Water intakes and the WTP. The Bear Creek supply did not have any feasible sites that were off channel, relatively flat, and could provide the required water head conditions to the WTP.

The Boulder Creek supply however had a site on private land owned by Sunnyside Mine (Kinross Inc.) that meets many of the criteria for a small reservoir site. Locally this site is known as the Johnny Goff pasture. The site is shown in figure 1-1. The site is relatively flat and is off channel. The site is at an appropriate elevation to provide adequate head to the WTP. The site comprises around 2 acres. Upgradient of the site is extensive aspen forest on steeper slopes. Downgradient of the site are tailings ponds and tailings piles. The reservoir site is close to the Boulder Creek Transmission main and access road.

SGM has "engineers' opinion of probable costs" (EOPC) for small reservoirs. Attached in Appendix D is a recent estimate for a small reservoir with a volume of 5 AF for the Telluride area. The EOPC for a 5 AF reservoir construction was $646,000. When permitting, planning, and engineering are added, the cost increases to $860,000. This estimate does not include land purchase costs. This results in a projected cost of $172,000 per AF for a 5 AF reservoir. Table 6-1 shows the projected size of storage required for days of Town usage at the WTP, along with the projected order of magnitude cost based upon a per acre-foot unit basis.

Table 6-1 Costs for small reservoirs and days of storage

Days of Storage days	Volume AF	EOPC ($)
1	1.33	$227,383
2	2.65	$454,766
4	5.30	$909,533
5	6.63	$1,136,916
7	9.28	$1,591,683
30	39.78	$6,821,496

In addition to providing storage for several days of demand, the reservoir could take care of peak day flows and peak hour flows to the WTP. Further a small reservoir could provide augmentation storage. Assuming a maximum day of 300 gpm or 432,000 gallons per day, and a consumptive use of 5%, 1 AF of storage would result in 16 days of augmentation storage without any outside irrigation or ditch losses. Assuming a call based upon a combination of drought and late season low surface water flows in the months of August, September and October (90 days), a reservoir between 5 to 10 AF would be adequate for augmentation storage. The above analysis does not take into consideration conveyance losses from the Reservoir to the Animas or evaporative losses in the reservoir.

A minimum of 5 acres would be required to construct and maintain a 5 to 10 AF reservoir assuming a relatively level site. The Johnny Goff Pasture site would require additional engineering to determine the exact amount of storage. A reservoir on a flat site that is 200 ft square with 8 foot of water depth and 3:1 side slopes would have a capacity of 5.7 AF and would have a surface area of between 1 and 1.5 acres. Other benefits can be achieved with a reservoir including potential hydro power, environmental and recreational needs. Other consumptive water needs might benefit from the reservoir. The augmentation water would typically only be required during 3 months of year in August, September and a few days in October.

The CWCB, The SWCD and the Southwest Basin Roundtable fund known as the Water Supply Reserve Account (WSRA) are potential funding sources for loans and grants. The USDA Rural Water Fund is a potential funding source for federal loans and grants. CWCB and SWCD sponsored funds may be available through the small dam reconnaissance program.

Environmental permitting would be required for any wetland impacts, impacts to fens, and potential consultation between the Army Corps and the U.S. Fish and Wildlife Service regarding depletions to the Animas River.

Water Court approval would be required for a storage right. Other Town water rights could be transferred to the storage site.

6.2 Use of Existing Reservoirs for Augmentation Water

The controlling call on the Animas River is upstream from Durango near Hermosa. Existing reservoirs between Silverton and Durango would be able to make augmentation releases to satisfy the controlling calls. Silverton could lease the right to have releases made from these reservoirs. Often these rights require annual payment for the lease of water.

The reservoirs that have historically been considered include, Electra Lake, and Shalona Lake as potential opportunities. Other sites that have been mentioned include Henderson Lake, Smith Lake, and Bonner pond Highland Mary near Howardsville.

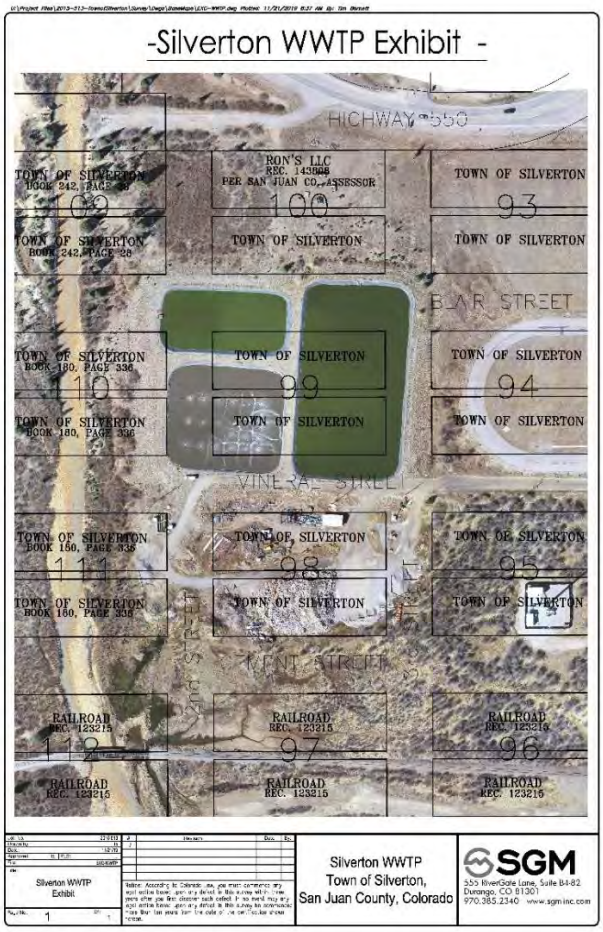
SGM contacted Xcel Energy regarding leasing augmentation water from Electra Lake (aka Cascade Reservoir). Cascade Reservoir is decreed to store approximately 22,000 AF for various uses including augmentation. The water is supplied from Cascade Creek and released to the Animas River at used to generate power at the Tacoma Plant. Xcel has sufficient water available to lease from Cascade Reservoir with a current cost of $764 per AF. Rates are adjusted every five years based on the Consumer Price Index, with the next rate adjustment occurring in 2021. If the Town were to purchase 6 AF (90 days of augmentation storage, see Section 3.4), the annual cost is approximately $4,700.

6.3 Existing Lagoons at the WWTF

Silverton has a three-cell aerated Lagoon Wastewater Treatment Facility at the confluence of Mineral Creek and the Animas River. See Figure 6-1. In the future, Silverton may elect to abandon the lagoons and build a new mechanical WWTF. New nutrient regulations are scheduled to be implemented in the 2027-time frame and the present lagoon treatment process would not meet the new discharge permit standards. If the town proceeds with a mechanical WWTF, the lagoons can be repurposed to act as augmentation ponds to make releases to lower controlling water rights on the Animas River.

The total volume of cells 1 and 2 is approximately 21 AF. The ponds have much of the infrastructure to release water to the Animas including liners, pipes, valving, and measuring devices. Full depth draw off pipes would be required to fully release water from the bottom of the lagoons, however not all 21 AF would be required. Existing Silverton surface water rights could be transferred to fill the lagoons.

Figure 6-1 Silverton WTF



7.0 Securing A More Reliable Water Right

The Town could buy a senior water right on the Animas River and apply to the Water Court to change the use of the water from irrigation and or mining, to augmentation. An example is the San Juan Historical Society for the Mayflower Mill. Details of the rights are as follows:

- Name: Mayflower Pipeline (2 rights under that name): 1.34 cfs (developed) and 0.89 cfs
- Source: Arrastra Creek
- Appropriated in Dec. 1930
- Adjudicated in Sept. 1971
- Current Owner: San Juan County Historical Society
- Original owner: Asarco?
- Use: originally Mining and Milling but converted to include Consumptive

SGM followed up on this right and did not find evidence of this right, however found another right known as the Power House Right that SJCHS owns called the Power House Pipeline. It was decreed in 02 CW121 for 1 cfs for irrigating 10 acres, and industrial, commercial uses. Historically mining rights for power are non-consumptive and used for hydroelectric power and would not have sufficient consumptive use to be able to transfer to a Town point of diversion or for augmentation purposes.

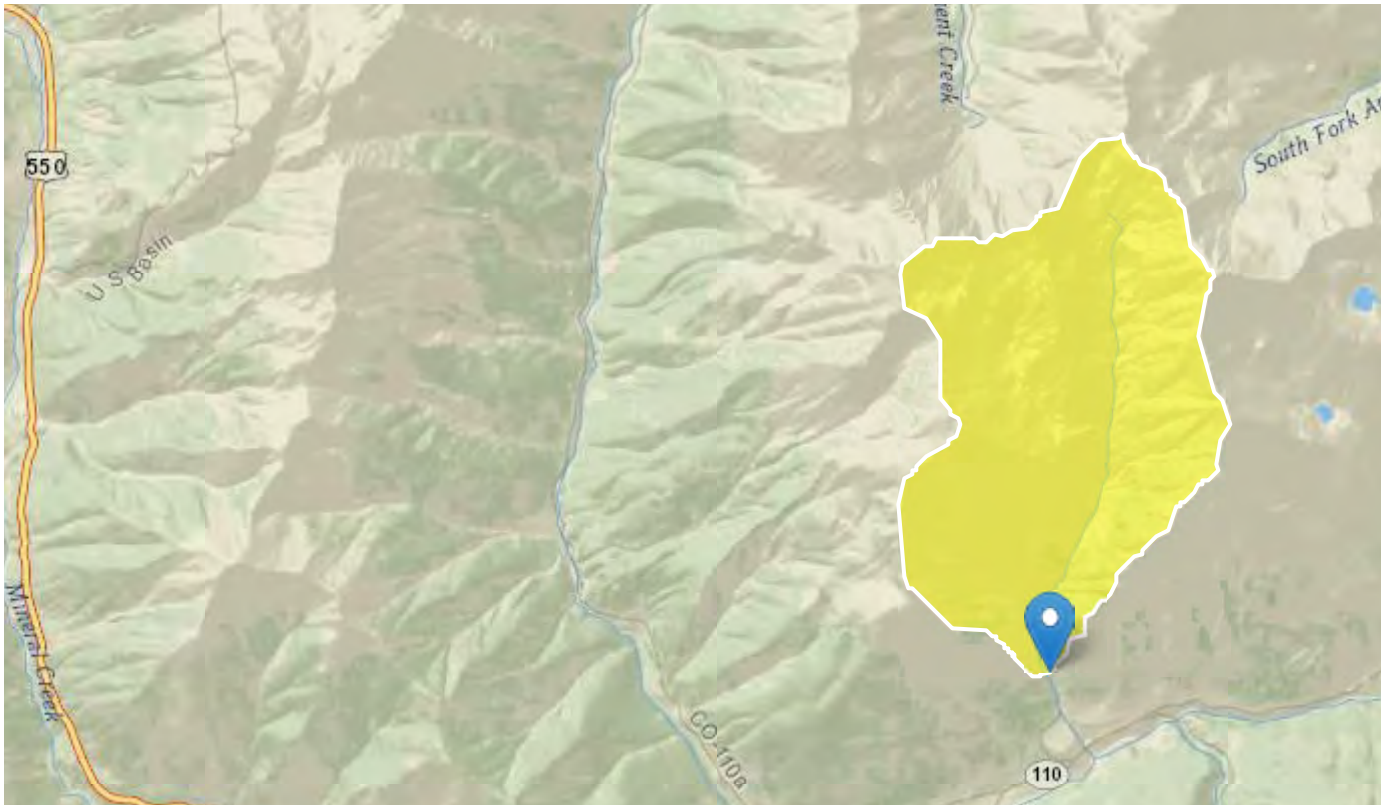
Appendix A

Stream Stats Report Boulder Gulch

APPENDIX A

StreamStats Report

Region ID: CO
Workspace ID: CO20190524164122274000
Clicked Point (Latitude, Longitude): 37.83036, -107.63756
Time: 2019-05-24 10:41:38 -0600



Boulder Gulch

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.53	square mile
PRECIP	Mean Annual Precipitation	46.92	inches
ELEV	Mean Basin Elevation	12108	feet
EL7500	Percent of area above 7500 ft	100	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	66.5	percent

APPENDIX A

Parameter Code	Parameter Description	Value	Unit
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	1039.7	feet per mi
ELEVMAX	Maximum basin elevation	13500	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	3.94	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	1.99	inches
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	2.39	inches
I6H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	1.08	inches
LAT_OUT	Latitude of Basin Outlet	4190275	degrees
LC11BARE	Percentage of barren from NLCD 2011 class 31	32.3	percent
LC11CRPHAY	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	0	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	10	percent
LC11GRASS	Percent of area covered by grassland/herbaceous using 2011 NLCD	56.4	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0	percent
LC11SHRUB	Percent of area covered by shrubland using 2011 NLCD	0	percent
LC11SNOIC	Percent snow and ice from NLCD 2011 class 12	0	percent
LC11WATER	Percent of open water, class 11, from NLCD 2011	0	percent
LC11WETLND	Percentage of wetlands, classes 90 and 95, from NLCD 2011	1.3	percent
LFPLENGTH	Length of longest flow path	2.91	miles
LONG_OUT	Longitude of Basin Outlet	267875	degrees
MINBELEV	Minimum basin elevation	9870	feet
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	9873	feet

APPENDIX A

Parameter Code	Parameter Description	Value	Unit
RCN	Runoff-curve number as defined by NRCS (http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17758.wba)	76.88	dimensionl
RUNCO_CO	Soil runoff coefficient as defined by Verdin and Gross (2017)	0.27	dimensionl
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	14.2	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	7.07	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	3.71	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	74.9	percent
STATSCLAY	Percentage of clay soils from STATSGO	17.74	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.2	percent
TOC	Time of concentration in hours	0.64	hours

Flow-Duration Statistics Parameters [Southwest Region Flow Duration]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.53	square miles	1	4390
PRECIP	Mean Annual Precipitation	46.92	inches	10	51

Flow-Duration Statistics Flow Report [Southwest Region Flow Duration]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
10 Percent Duration	20.2	ft^3/s	79
25 Percent Duration	6.54	ft^3/s	96
50 Percent Duration	2.22	ft^3/s	98
75 Percent Duration	1.13	ft^3/s	NaN
90 Percent Duration	0.947	ft^3/s	148

APPENDIX A

Flow-Duration Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Flood-Volume Statistics Parameters [Southwest Region Max Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.53	square miles	4	4390
PRECIP	Mean Annual Precipitation	46.92	inches	10	51

Flood-Volume Statistics Disclaimers [Southwest Region Max Flow]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Flood-Volume Statistics Flow Report [Southwest Region Max Flow]

Statistic	Value	Unit
7 Day 2 Year Maximum	32.4	ft^3/s
7 Day 10 Year Maximum	59.3	ft^3/s
7 Day 50 Year Maximum	77.9	ft^3/s

Flood-Volume Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Monthly Flow Statistics Parameters [Southwest Region Mean Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.53	square miles	1	4390
PRECIP	Mean Annual Precipitation	46.92	inches	10	51

Monthly Flow Statistics Flow Report [Southwest Region Mean Flow]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
January Mean Flow	1.26	ft^3/s	77
February Mean Flow	1.17	ft^3/s	58
March Mean Flow	1.43	ft^3/s	47
April Mean Flow	4.67	ft^3/s	50
May Mean Flow	20.6	ft^3/s	62
June Mean Flow	30.2	ft^3/s	121
July Mean Flow	14.5	ft^3/s	180
August Mean Flow	5.12	ft^3/s	119
September Mean Flow	6.32	ft^3/s	120
October Mean Flow	2.71	ft^3/s	106
November Mean Flow	2.65	ft^3/s	80
December Mean Flow	1.74	ft^3/s	75

Monthly Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Annual Flow Statistics Parameters [Southwest Region Mean Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.53	square miles	1	4390
PRECIP	Mean Annual Precipitation	46.92	inches	10	51

Annual Flow Statistics Flow Report [Southwest Region Mean Flow]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	9.49	ft^3/s	60

Annual Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Low-Flow Statistics Parameters [Southwest Region Min Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.53	square miles	4	4390
PRECIP	Mean Annual Precipitation	46.92	inches	10	51
ELEV	Mean Basin Elevation	12108	feet	792	9310

Low-Flow Statistics Disclaimers [Southwest Region Min Flow]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Low-Flow Statistics Flow Report [Southwest Region Min Flow]

Statistic	Value	Unit
7 Day 2 Year Low Flow	0.547	ft^3/s
7 Day 10 Year Low Flow	0.562	ft^3/s
7 Day 50 Year Low Flow	2.67	ft^3/s

Low-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Peak-Flow Statistics Parameters [Southwest Region Peak Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.53	square miles	1	4390
EL7500	Percent above 7500 ft	100	percent	0	99

Peak-Flow Statistics Disclaimers [Southwest Region Peak Flow]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report [Southwest Region Peak Flow]

Statistic	Value	Unit
2 Year Peak Flood	53.4	ft^3/s
5 Year Peak Flood	99.8	ft^3/s
10 Year Peak Flood	140	ft^3/s
25 Year Peak Flood	205	ft^3/s
50 Year Peak Flood	255	ft^3/s
100 Year Peak Flood	306	ft^3/s
200 Year Peak Flood	357	ft^3/s
500 Year Peak Flood	459	ft^3/s

Peak-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.3.0

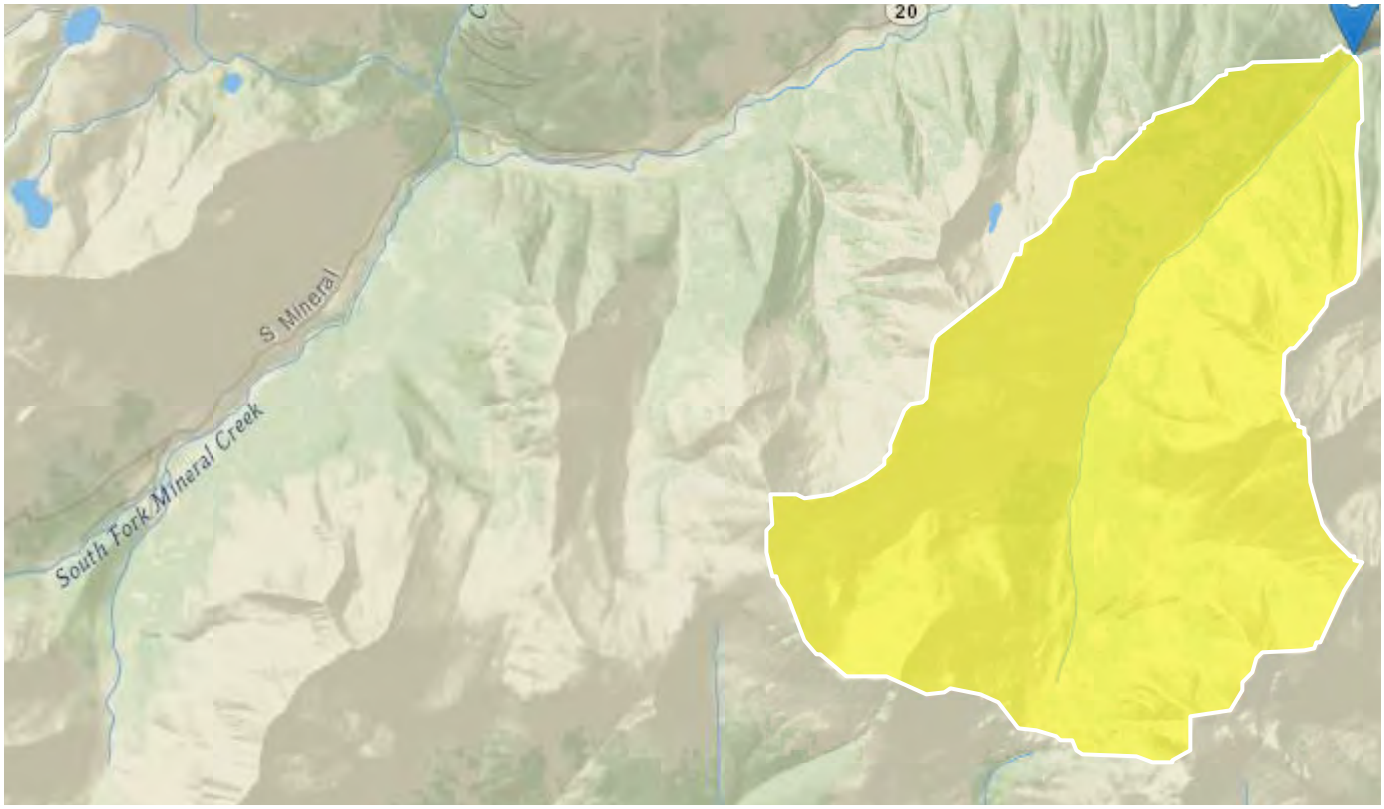
Appendix B

Stream Stats Report Bear Creek Gulch

APPENDIX B

StreamStats Report

Region ID: CO
Workspace ID: CO20190524164939529000
Clicked Point (Latitude, Longitude): 37.81192, -107.69992
Time: 2019-05-24 10:51:02 -0600



Bear Creek Gulch

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	5.55	square mile
PRECIP	Mean Annual Precipitation	40.08	inches
ELEV	Mean Basin Elevation	11593	feet
EL7500	Percent of area above 7500 ft	100	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	52	percent

Parameter Code	Parameter Description	Value	Unit
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	596.4	feet per mi
ELEVMAX	Maximum basin elevation	13400	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	3.75	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	1.88	inches
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	2.26	inches
I6H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	1	inches
LAT_OUT	Latitude of Basin Outlet	4188385	degrees
LC11BARE	Percentage of barren from NLCD 2011 class 31	27	percent
LC11CRPHAY	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	0	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	28.8	percent
LC11GRASS	Percent of area covered by grassland/herbaceous using 2011 NLCD	38.8	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0	percent
LC11SHRUB	Percent of area covered by shrubland using 2011 NLCD	0	percent
LC11SNOIC	Percent snow and ice from NLCD 2011 class 12	0	percent
LC11WATER	Percent of open water, class 11, from NLCD 2011	0	percent
LC11WETLND	Percentage of wetlands, classes 90 and 95, from NLCD 2011	5.1	percent
LFPLENGTH	Length of longest flow path	4.54	miles
LONG_OUT	Longitude of Basin Outlet	262325	degrees
MINBELEV	Minimum basin elevation	9560	feet
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	9556	feet

APPENDIX B

Parameter Code	Parameter Description	Value	Unit
RCN	Runoff-curve number as defined by NRCS (http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17758.wba)	68.17	dimensionl
RUNCO_CO	Soil runoff coefficient as defined by Verdin and Gross (2017)	0.32	dimensionl
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	16.2	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	35	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	11	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	36.6	percent
STATSCLAY	Percentage of clay soils from STATSGO	18.41	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0	percent
TOC	Time of concentration in hours	1.31	hours

Flow-Duration Statistics Parameters [Southwest Region Flow Duration]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.55	square miles	1	4390
PRECIP	Mean Annual Precipitation	40.08	inches	10	51

Flow-Duration Statistics Flow Report [Southwest Region Flow Duration]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
10 Percent Duration	24.8	ft^3/s	79
25 Percent Duration	8.4	ft^3/s	96
50 Percent Duration	2.98	ft^3/s	98
75 Percent Duration	1.48	ft^3/s	NaN
90 Percent Duration	1.1	ft^3/s	148

APPENDIX B

Flow-Duration Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Flood-Volume Statistics Parameters [Southwest Region Max Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.55	square miles	4	4390
PRECIP	Mean Annual Precipitation	40.08	inches	10	51

Flood-Volume Statistics Flow Report [Southwest Region Max Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
7 Day 2 Year Maximum	43.2	ft^3/s	64
7 Day 10 Year Maximum	83.8	ft^3/s	43
7 Day 50 Year Maximum	114	ft^3/s	33

Flood-Volume Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Monthly Flow Statistics Parameters [Southwest Region Mean Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.55	square miles	1	4390
PRECIP	Mean Annual Precipitation	40.08	inches	10	51

Monthly Flow Statistics Flow Report [Southwest Region Mean Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp

Statistic	Value	Unit	SEp
January Mean Flow	1.84	ft^3/s	77
February Mean Flow	1.79	ft^3/s	58
March Mean Flow	2.25	ft^3/s	47
April Mean Flow	6.9	ft^3/s	50
May Mean Flow	25.7	ft^3/s	62
June Mean Flow	35	ft^3/s	121
July Mean Flow	16.8	ft^3/s	180
August Mean Flow	6.73	ft^3/s	119
September Mean Flow	5.77	ft^3/s	120
October Mean Flow	3.77	ft^3/s	106
November Mean Flow	3.49	ft^3/s	80
December Mean Flow	2.42	ft^3/s	75

Monthly Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Annual Flow Statistics Parameters [Southwest Region Mean Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.55	square miles	1	4390
PRECIP	Mean Annual Precipitation	40.08	inches	10	51

Annual Flow Statistics Flow Report [Southwest Region Mean Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	12.1	ft^3/s	60

Annual Flow Statistics Citations

APPENDIX B

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Low-Flow Statistics Parameters [Southwest Region Min Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.55	square miles	4	4390
PRECIP	Mean Annual Precipitation	40.08	inches	10	51
ELEV	Mean Basin Elevation	11593	feet	792	9310

Low-Flow Statistics Disclaimers [Southwest Region Min Flow]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errorsOne or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Low-Flow Statistics Flow Report [Southwest Region Min Flow]

Statistic	Value	Unit
7 Day 2 Year Low Flow	0.876	ft^3/s
7 Day 10 Year Low Flow	0.822	ft^3/s
7 Day 50 Year Low Flow	2.92	ft^3/s

Low-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Peak-Flow Statistics Parameters [Southwest Region Peak Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.55	square miles	1	4390
EL7500	Percent above 7500 ft	100	percent	0	99

Peak-Flow Statistics Disclaimers [Southwest Region Peak Flow]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errorsOne or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report [Southwest Region Peak Flow]

Statistic	Value	Unit
2 Year Peak Flood	88.3	ft^3/s
5 Year Peak Flood	162	ft^3/s
10 Year Peak Flood	225	ft^3/s
25 Year Peak Flood	328	ft^3/s
50 Year Peak Flood	405	ft^3/s
100 Year Peak Flood	487	ft^3/s
200 Year Peak Flood	563	ft^3/s
500 Year Peak Flood	724	ft^3/s

Peak-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data for other purposes, nor on all computer systems, nor shall the act of distribution constitute any such warranty.

USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.3.0

APPENDIX B

Appendix C

Wilson Mesa Metro District Augmentation Pond EOPC (75% Design)

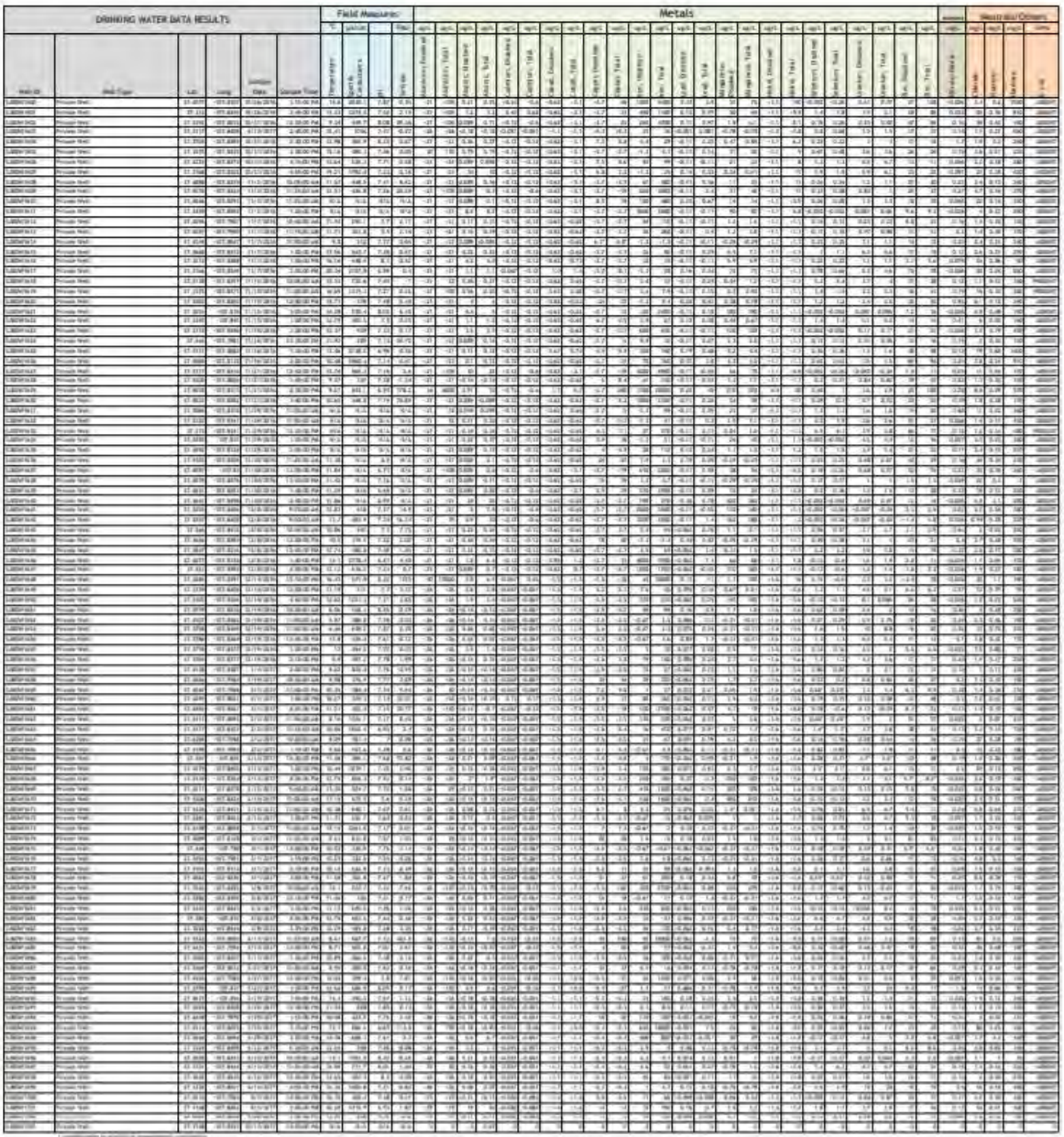
Wilson Mesa Metro District

Augmentation Pond EOPC (75% Design) 2/17/2020

Item	Unit	Qnty	Unit\$	Extension ($)	Notes:
Clear & Grub Site	AC	2.58	$ 10,000.00	$ 25,800.00	
Agridrain Structure	LS	1	$ 5,000.00	$ 5,000.00	
Excavation - Rock	CY	200	$ 40.00	$ 8,000.00	
Excavation - Native Soil Cut	CY	3365	$ 8.00	$ 26,920.00	
Import Fill Material	CY	3319	$ 14.00	$ 46,462.50	
Embankment Fill Construction	CY	6020	$ 20.00	$ 120,400.00	
Embankment Riprap	SY	685	$ 75.00	$ 51,375.00	
Embankment Crest Aggregate	SY	594	$ 30.00	$ 17,828.20	
Spillway Riprap	SY	260	$ 75.00	$ 19,500.00	
HDPE Liner w\ Vents	SF	48200	$ 1.50	$ 72,300.00	
Liner Ballast	SF	44400	$ 1.00	$ 44,400.00	
Reseeding	AC	1.47	$ 2,500.00	$ 3,675.00	
Stormwater Controls	LS	1	$ 5,000.00	$ 5,000.00	
Staff Gage	LS	1	$ 5,000.00	$ 5,000.00	
				$ -	
ConstSubTot				**$ 451,660.70**	
Mobilization	LS	1	$ 45,166.07	$ 45,166.07	
Survey	LS	1	$ 9,033.21	$ 9,033.21	
Materials Testing	LS	1	$ 4,516.61	$ 4,516.61	
Contingency (25%)	LS	1	$ 135,498.21	$ 135,498.21	
NonConstSubTot				**$ 194,214.10**	
ProjectTot				**$ 645,874.80**	

Appendix D

Private Well Water Quality Sampling from Gold King Mine


DRINKING WATER DATA RESULTS
Field Measures
Metals

Appendix E
Power House Pipeline

CENTRAL FILES

RECEIVED
NOV 16 2009
WATER RESOURCES
STATE ENGINEER
COLO.

DISTRICT COURT, WATER DIVISION 7, COLORADO Court Address: 1060 E. 2nd Ave., Suite 106 Durango, CO 81301-5157 **CONCERNING THE APPLICATION FOR WATER RIGHTS OF:** **SAN JUAN COUNTY HISTORICAL SOCIETY,** **IN SAN JUAN COUNTY.**	FILED IN DISTRICT COURT WATER DIVISION 7 NOV - 6 DURANGO COLORADO CLERK ▲ ▲ **COURT USE ONLY**
Attorney or Party Without Attorney (Name and Address): Phone Number: (520) 445-6804 E-mail: FAX Number: Atty. Reg.#:	**Case Number: 02CW121**
RULING OF THE REFEREE	

Application filed: December 24, 2002

APPLICANT: San Juan County Historical Society
P. O. Box 154
Silverton, CO 81433

NAME OF STRUCTURE: POWER HOUSE PIPELINE

LOCATION: On the right bank of the Animas River in the SW1/4SE1/4, Section 9, T41N, R7W, N.M.P.M. being 1975' West and 1300' North of the SE corner of said Section 9

SOURCE: Animas River

TYPE OF USE: Irrigation of 10 acres, Industrial, Commercial

AMOUNT OF WATER: 1.0 cfs Conditional

APPROPRIATION DATE: November 12, 2002

CONDITIONS:

THE APPLICANT SHALL COMPLY WITH THE ORDERS OF THE DIVISION ENGINEER TO INSTALL NECESSARY MEASURING DEVICES, AND SHALL KEEP RECORDS AND MAKE REPORTS AS REASONABLY REQUESTED BY THE DIVISION ENGINEER.

PP

The priority here awarded shall be junior to all priorities awarded in previous years. As between all rights adjudicated this calendar year, priorities shall be determined by historical dates of appropriation and not affected by the entry of this Ruling.

It is the Ruling of the Referee that the statements in the application are true and that the aforementioned water right is approved and granted the indicated priority.

Dated this 10th day of November 2003.

Gregory G. Lyman, Water Judge
Acting as Water Referee

cc: K. Beegles (certified mail)
H. Simpson (certified mail)
San Juan Historical Society (certified mail)

During the Month of December, 2009, and every six years thereafter until the right is decreed final, the owner or user thereof, if he desires to maintain the same, shall file an application for Finding of Reasonable Diligence with the Water Clerk of this Court.

No protest was filed in this matter. The foregoing Ruling is confirmed and approved, and is made the Judgment and Decree of this Court.

DATED this 10th day of December, 2003.

Gregory G. Lyman
Water Judge

cc: K. Beegles (3)
H. Simpson
San Juan Historical Society

RECEIVED
FEB 23 2004
WATER RESOURCES
STATE ENGINEER
COLO

DISTRICT COURT, WATER DIVISION 7, COLORADO Court Address: 1060 2nd Ave., P. O. Box 3340 Durango, CO 81302 **CONCERNING THE APPLICATION FOR WATER RIGHTS OF:** **SAN JUAN COUNTY HISTORICAL SOCIETY,** **IN SAN JUAN COUNTY.**	
	Case Number: 02CW121

JUDGMENT AND DECREE (AMENDED)

Application filed: December 24, 2002

APPLICANT: San Juan county Historical Society
P. O. Box 154
Silverton, CO 81433

NAME OF STRUCTURE: POWER HOUSE PIPELINE

POINT OF DIVERSION: On the right bank of the Animas River in the SW1/4SE1/4, Section 9, T41N, R7W, N.M.P.M. being **1875'** West and 1300' North of the SE corner of said Section 9

SOURCE: Animas River

TYPE OF USE: Irrigation of 10 acres, Industrial, Commercial

AMOUNT OF WATER: 1.0 cfs Conditional

APPROPRIATION DATE: November 12, 2002

CONDITIONS:

THE APPLICANT SHALL COMPLY WITH THE ORDERS OF THE DIVISION ENGINEER TO INSTALL NECESSARY MEASURING DEVICES, AND SHALL KEEP RECORDS AND MAKE REPORTS AS REASONABLY REQUESTED BY THE STATE OR DIVISION ENGINEER.

During the Month of **DECEMBER, 2009**, and every six years thereafter until the right is decreed final, the owner or user thereof, if he desires to maintain the same, shall file an application for finding of reasonable diligence with the Water Clerk of this Court.

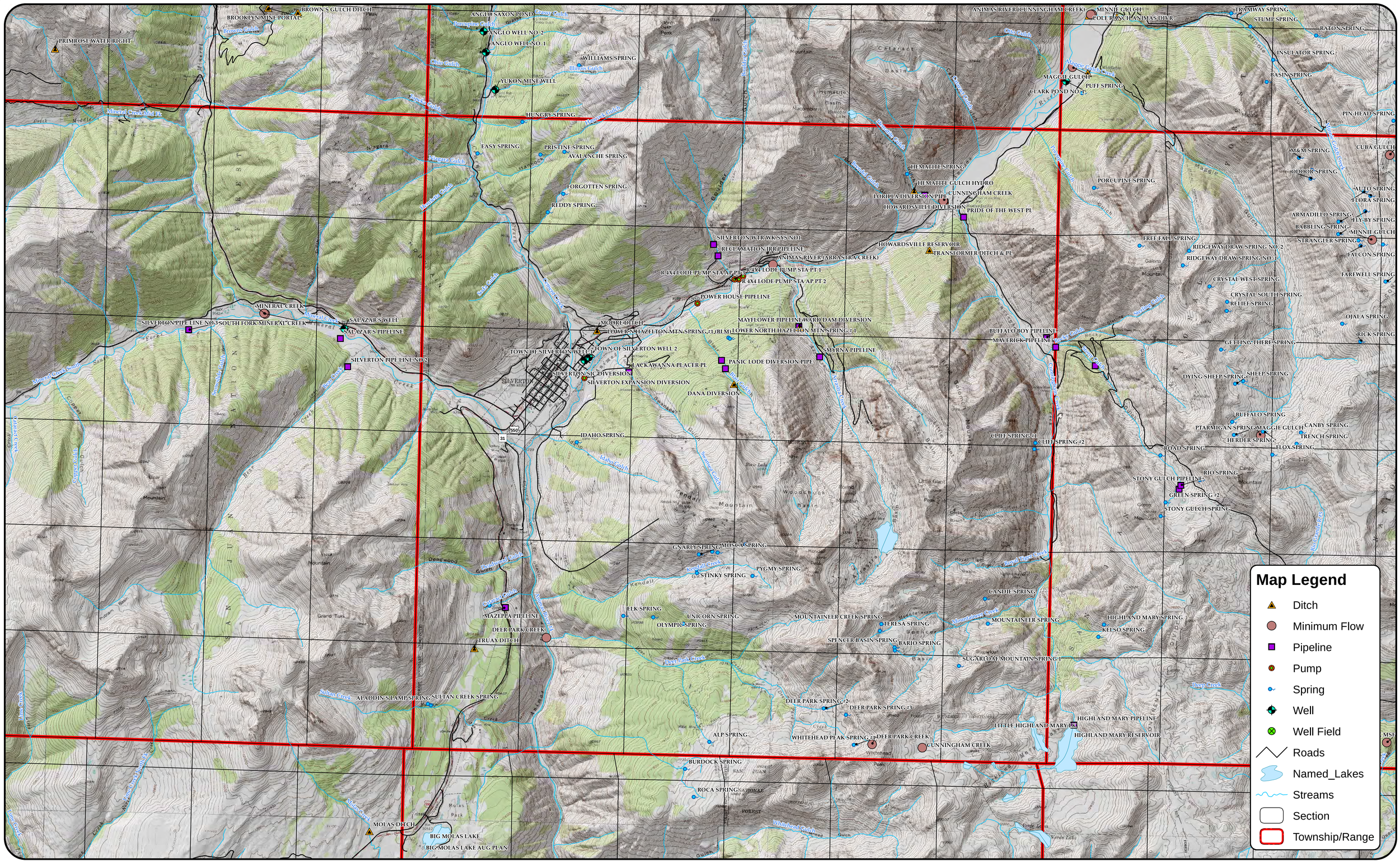
No protest was filed in this matter. The foregoing Ruling is confirmed and approved, and is made the Judgment and Decree (Amended) of this Court.

DATED this 18th day of February, 2004, nunc pro tunc to ~~December~~ December 10, 2003.

Gregory G. Lyman
Water Judge

cc: K. Beegles (3)
H. Simpson
SJ County Historical Society

Appendix F
Water Rights Map



SGM
555 RiverGate Ln, Suite B4-82
Durango, CO 81301
970.385.2340
www.sgm-inc.com

Draft

Exhibit F.
Water Rights

Town of Silverton

Date: 3/9/2020	Job No. 2015-513.001	Map by:ANW	Checked By: XXX	Scale: 1:24,000

Data Sources: CDWR, CDNR, CDOT, USGS, ESRI

File:R:\Project Files\2015-513-TownofSilverton\GIS\MXDs\2019\WaterRights2x3.mxd

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

0 2,500 5,000 7,500 10,000 12,500 15,000 Feet

1 inch = 2,000 feet

N W E S