Eagle River Water and Sanitation District
Gore Creek Watershed
Source Water Protection Plan

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[Cover photo: East Vail Golf Course near the Vail municipal well field. Photo from Vail Recreation District]

Acknowledgments

ERWSD would like to thank all community members who provided input to this plan, as well as staff from town of Vail, Eagle County, Colorado Department of Public Health and Environment, and the Eagle River Watershed Council who provided feedback essential to providing a good result.

Signatures

This plan was developed using materials, guidance, and language provided by Colorado Department of Public Health and Environment and the Colorado Rural Water Association's Source Water Protection Plan programs, modified by local partners where needed to address concerns and characteristics unique to the Gore Creek watershed and upper Eagle Valley. This is a planning document and there is no legal requirement for any party to implement the recommendations herein. Actions on public lands will be subject to federal, state, and county policies and procedures. Action on private land may require compliance with county land use codes, building codes, local covenants, and permission from the landowner.

This is intended as a living document Potential Sources of Contamination (PSOC) inventories were based on information available to staff and stakeholders at the time of this planning process and should not be seen as a definitive or unchanging characterization of drinking water threats and concerns in the Gore Creek Watershed. New concerns may emerge and the relative risk associated with an individual PSOC or group of PSOCs may be subject to continual change.

Table of Contents

Figures and Tables

Common Abbreviations and Definitions

Abbreviation	Definition
BMP	Best Management Practice
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CDWR	Colorado Division of Water Resources
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (i.e., "Superfund)
CORA	Colorado Open Records Request
CPW	Colorado Parks and Wildlife
CRWA	Colorado Rural Water Users Association
ECO	Eagle County
EPA, USEPA	Environmental Protection Agency, United States Environmental Protection Agency
ERSWD	Eagle River Water and Sanitation District
ERWC	Eagle River Watershed Council
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GVDWF	Gore Valley Drinking Water Facility
GW	Groundwater
GWUDI	Groundwater Under Direct Influence (of surface water)
HAZMAT	Hazardous Materials
ISDS	Individual Sewage Disposal System
LPG	Liquified Petroleum Gas
LUST	Leaky Underground Storage Tank
MGD	Million Gallons Per Day
MS4	Municipal Separate Storm Sewer System
NO HARM	National Hazard and Risk Model (computer wildfire behavior model)
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OWTS	Onsite Waste Treatment System
PFAS, PFOA	Per- and Polyfluoroalkyl Substances
PSOC	Potential Sources of Contamination
RCRA	Resource Conservation and Recovery Act
SCADA	Supervisory Control and Data Acquisition
SCAP	Sediment Control and Action Plan
SDS	Safety Data Sheet
SDWA	Safe Drinking Water Act
SWAP	Source Water Assessment and Protection
SWPP	Source Water Protection Plan
TOV	Town of Vail
UERWA	Upper Eagle Regional Water Authority
USFS	United States Forest Service
USGS	United States Geological Survey
VFD	Vail Fire Department
VOC	Volatile Organic Chemical
VRD	Vail Recreation District
WQIP	Water Quality Improvement Plan

ERWSD SOURCE WATER PROTECTION PLAN

Last update: February 2022

EXECUTIVE SUMMARY

Source water protection is a vital component to ensure Eagle River Water and Sanitation District (ERWSD or "the District") meets its mission to provide efficient, effective, and reliable water and wastewater utility services in a manner that respects the natural environment. The District is located at the top of the Rocky Mountains in Vail, Colorado, where the source water originates from snow that accumulates throughout the winter. The District serves up to 60,000 residents and visitors in Eagle County. The District strives to deliver high quality drinking water to its customers and has voluntarily taken on a community effort to help prevent contamination of the source water that supplies its public water system.

Preventing contaminants from entering a public water system supply benefits the community by minimizing the problems that can occur from contaminants in the water supply such as increased health risks to the public, expanded drinking water requirements, additional water treatment requirements, and expensive environmental cleanup activities. The District chose to prepare its first Source Water Protection Plan (SWPP) for the Gore Creek Watershed. This effort will be used as template for future SWPPs for the District's other water sources. This SWPP was developed by a Steering Committee and stakeholders from the watershed to identify potential sources of contamination (PSOCs) and help weigh in on overall risk levels and categories.

To ensure community involvement in development of the SWPP, the District reached out to many different entities. These entities include stakeholders from Colorado Department of Public Health and Environment (CDPHE), Colorado Department of Transportation (CDOT), Colorado Parks and Wildlife (CPW), Colorado Rural Water Association (CRWA), Eagle County (EC), Eagle River Watershed Council (ERWC), Vail Fire District (VFD), Town of Vail (TOV), Vail Health (VH), Vail Recreation District (VRD), Vail Resorts (VR), and U.S. Forest Service (USFS). Best management practices will be implemented to maintain high quality water and reduce the need for additional water treatment costs in the future.

The SWPP will be released to the public for comment. This Plan is a living document that is meant to be updated to address any changes that will inevitably come. The Steering Committee will review this Plan once every 3-5 years or if circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

1 INTRODUCTION

1.1 PURPOSE AND NEED

Contamination of drinking water sources constitutes a serious threat to the health of local residents and visitors, as well as the community's tourist-driven economic engine. The District is conducting Source Water Assessment and Protection (SWAP) planning for the Gore Creek watershed, which serves drinking water to multiple communities in western Eagle County. This planning exercise delineates a community's source water contribution areas, identifies potential contaminants and threats, and contemplates actions to address them via structural or programmatic Best Management Practices (BMPs). The District, in conjunction with the Upper Eagle Regional Water Authority (UERWA), maintains and operates an interconnected system of wellfields and surface intakes in the Gore Creek and Upper Eagle River watersheds that serves Vail, Avon, Edwards, and associated unincorporated communities like EagleVail, Beaver Creek, and Cordillera. This plan's primary focus is on the Gore Creek ground and surface water collection systems.

Pre-empting drinking water source contamination through sound planning and land use decision making provides a more prudent, sustainable, and cost-effective solution to protection than reactive post-contamination event correction and mitigation efforts.

Through source water planning, the District strives to:

- Increase community awareness, water literacy, and social capital networking relationships for drinking water protection,
- Reduce risks of existing drinking water contamination and costly water source replacement,
- Reduce future treatment costs,
- Reduce threats from emerging contaminants,
- Encourage voluntary solutions to mitigate pollution risks, and
- Cultivate smart growth relationships between development and water resources.

Desired outcomes of the planning effort include:

- Increased stakeholder water fluency,
- Improved communication channels between watershed stakeholders who impact drinking water sources,
- Creation of prioritized Best Management Practices (BMPs) and recommended actions to improve or create new source water protections,
- Identification of funding sources or local support for funding sources for source water BMPs, and
- Ongoing periodic dialogue assessing progress on source water BMP implementation and new or changing potential sources of contamination.

1.2 SWAP PROGRAM

CDPHE provides a collection of resources for SWAP planning at https://cdphe.colorado.gov/swap. The following background information on the SWAP process is provided directly from the state's template available online.

SWAP came into existence in 1996 as a result of Congressional reauthorization and amendment of the Safe Drinking Water Act. The 1996 amendments required each state to develop a SWAP program. The Water Quality Control Division, an agency of the CDPHE, assumed the responsibility of developing Colorado's SWAP program. The SWAP program was integrated with the existing Colorado Wellhead Protection Program that was established in amendments made to the federal Safe Drinking Water Act (SDWA, Section 1428) in 1986. Wellhead protection is a preventative concept that aims to protect public groundwater wells from contamination. The Wellhead Protection Program and the SWAP program have similar goals and combine protection efforts in one merged program plan.

Colorado's SWAP program is an iterative, two-phased process (Figure 1) designed to assist public water systems in preventing potential contamination of their untreated drinking water supplies. The two phases include the Assessment Phase and the Protection Phase as depicted in the upper and lower portions of Figure 1, respectively.

Figure 1. Colorado SWAP program cycles show how the ongoing assessment and protection phases work together. Graphic from CDPHE.

Source Water Assessment Phase

As depicted in the upper cycle of Figure 1, the Assessment Phase for all public water systems consists of four primary elements.

1. Delineating the source water assessment area for each drinking water source;

2. Conducting a contaminant source inventory to identify potential sources of contamination within each of the source water assessment areas;
3. Conducting a susceptibility analysis to determine the potential susceptibility of each public drinking water source to the different sources of contamination; and
4. Reporting the results of the source water assessment to the public water systems and the general public.

The Assessment Phase involves understanding where Vail's source water comes from, what contaminant sources potentially threaten the water source(s), and how susceptible each water source is to potential contamination. The susceptibility of an individual water source is analyzed by examining the properties of its physical setting and potential contaminant source threats. The resulting analysis calculations are used to report an estimate of how susceptible each water source is to potential contamination.

Source Water Protection Phase

The Protection Phase is a voluntary, ongoing process in which the District and local partners are encouraged to voluntarily employ preventive measures to protect their water supply from the potential sources of contamination to which it may be most susceptible. The Protection Phase can be used to take action to avoid unnecessary treatment or replacement costs associated with potential contamination of the untreated water supply. Source water protection begins when local decision-makers use the source water assessment results and other pertinent information as a starting point to develop a protection plan. As depicted in the lower portion of Figure 1, the source water protection phase for all public water systems consists of four primary elements.

1. Involving local stakeholders in the planning process;
2. Developing a comprehensive protection plan for all drinking water sources;
3. Implementing the protection plan on a continuous basis to reduce the risk of potential contamination of the drinking water sources; and
4. Monitoring the effectiveness of the protection plan and updating it accordingly as future assessment results indicate.

The District and the community recognize that the Safe Drinking Water Act grants no statutory authority to CDPHE or to any other state or federal agency to force the adoption or implementation of source water protection measures. This authority rests solely with local communities and governments. Since the source water protection phase is an iterative process, ongoing evolutions of the SWAP program will aim to incorporate any new assessment information provided by the public water supply systems over time and update protection plans accordingly.

1.3 STAKEHOLDER AND PUBLIC PARTICIPATION

The District initiated a stakeholder process during preliminary plan development to provide local partners with an understanding of the purposes and goals of SWAP and solicit input and feedback. Due to the unexpected impact of the COVID-19 pandemic on businesses and governments during 2020, meeting schedules required shifts online formats, cancellations, or postponement, reducing or altering stakeholder interactions from the levels and occasions originally anticipated. Table 1 describes milestones in the process.

Date	Meeting Subject
03/2020	Steering committee planning
06/2020	Stakeholder introduction and PSOC inventories
09/2020	Stakeholder PSOC review
12/2020	Steering committee draft plan review and comments/feedback
05/2021	Stakeholder draft plan review and comments/feedback
10/2021	Final plan release to public

Table 1. Stakeholder participation timeline for SWAP planning.

Source Water Protection Steering Committee

The District is the primary drinking water provider for Vail. The District is also the contract provider to the UERWA for water operations and management services to communities in eastern Eagle County including EagleVail, Avon, Edwards, Arrowhead, Cordillera, Berry Creek/Singletree, and Beaver Creek/Bachelor Gulch. ERWSD is undertaking source water protection planning for Vail and the Gore Creek Watershed in order to proactively safeguard local water supplies. TOV, ERWC, and Lotic Hydrological are participating in the District's steering committee to organize the process and collect stakeholder feedback, prepare inventories, and publish and promote the final plan (Table 2). Additional stakeholder participants who have attended one or more program meetings and provided feedback and potential sources of contamination (PSOC) inventories are listed in Table 3.

Name	Organization
Leah Cribari	Eagle River Water & Sanitation District
Kailey Rosema	Eagle River Water & Sanitation District
Peter Wadden	Town of Vail
Bill Hoblitzell	Lotic Hydrological (project consultant), ERWC Liaison

Table 2. SWPP steering committee.

Name	Organization
John Duggan	Colorado Department of Public Health and Environment
Kristen Hughes	Colorado Department of Public Health and Environment
Jenn Klaetsch	Colorado Department of Transportation
Karen Berdoulay	Colorado Department of Transportation
Devin Duval	Colorado Parks and Wildlife
Kendall Bakich	Colorado Parks and Wildlife
Paul Hempel	Colorado Rural Water Association
Eric Lovegren	Eagle County
Maureen Mulcahy	Eagle County
Morgan Hill	Eagle County
Andrew Kirsch	Eagle River Water & Sanitation District
Brad Zachman	Eagle River Water & Sanitation District
Kailey Rosema	Eagle River Water & Sanitation District
Leah Cribari	Eagle River Water & Sanitation District
Siri Roman	Eagle River Water & Sanitation District
Travis Young	Eagle River Water & Sanitation District
Kate Isaacson	Eagle River Watershed Council
Bill Hoblitzell	Lotic Hydrological
Mark Novak	Vail Fire & Emergency Services
Paul Cada	Vail Fire & Emergency Services
Peter Wadden	Town of Vail
Timothy Ivancich	Vail Health
Scott Todd	Vail Recreation District
Doug Workman	Vail Resorts
Jeff Babb	Vail Resorts
Melvin Woody	White River National Forest

Table 3. SWPP community stakeholder list.

1.4 EXISTING PLANS AND RELATION TO SOURCE WATER PROTECTION

A number of prior plans for the Gore Creek watershed have a significant nexus with this plan. However, each has differing goals and purposes. Table 4 provides a brief summary of local planning efforts that are relevant to the SWAP context:

Plan	Summary
2013 Gore Creek Water Quality Improvement Plan	Gore Creek was provisionally placed on the 303(d) list and designated with impaired water quality by CDPHE. The Gore Creek Water Quality Improvement Plan (WQIP) conducted new water quality investigations and summarized existing research detailing the probable causes of impairments to aquatic macroinvertebrates in Gore Creek. The plan concluded that riparian buffer degradation, runoff from urban impervious surfaces, and land use practices are the primary drivers of aquatic life stress in Vail. Corrective actions are proposed This plan is focused on improving instream water quality for aquatic life such as macroinvertebrates and cold water fisheries.
2014 Gore Creek Strategic Action Plan	The action plan developed a toolbox of actions and roadmap for the Town of Vail to address the causes of water quality impairment identified by the WQIP. Actions included a suite of BMPs, regulatory options, education/outreach, research, and restoration projects to improve in-stream conditions. This plan is focused on improving instream water quality for aquatic life such as macroinvertebrates and cold water fisheries.
2019 Wellhead Protection Plan	ERWSD created a Gore Creek Watershed wellhead protection plan to identify contributing areas to its municipal groundwater wells. The outputs of this plan provide a component of the source water protection area delineation for this plan. This plan is focused on protecting human drinking water sources.
Vail Community Wildfire Protection Plan	This plan was developed to guide the Town of Vail in efforts to increase community resiliency to catastrophic forest fires. The plan created goals, strategies, and actions including fuels reduction in the urban-wildlands interface.
I-70 Spill Response Plan	This plan provides direction for coordinated actions by CDOT, Colorado State Patrol, Town of Vail, Vail Fire, and ERWSD in the event of a hazardous spill incident on the highway.

Table 4. Recent area plans with a significant nexus to source water protection planning.

2 SOURCE WATER SETTING

2.1 HYDROLOGIC SETTING

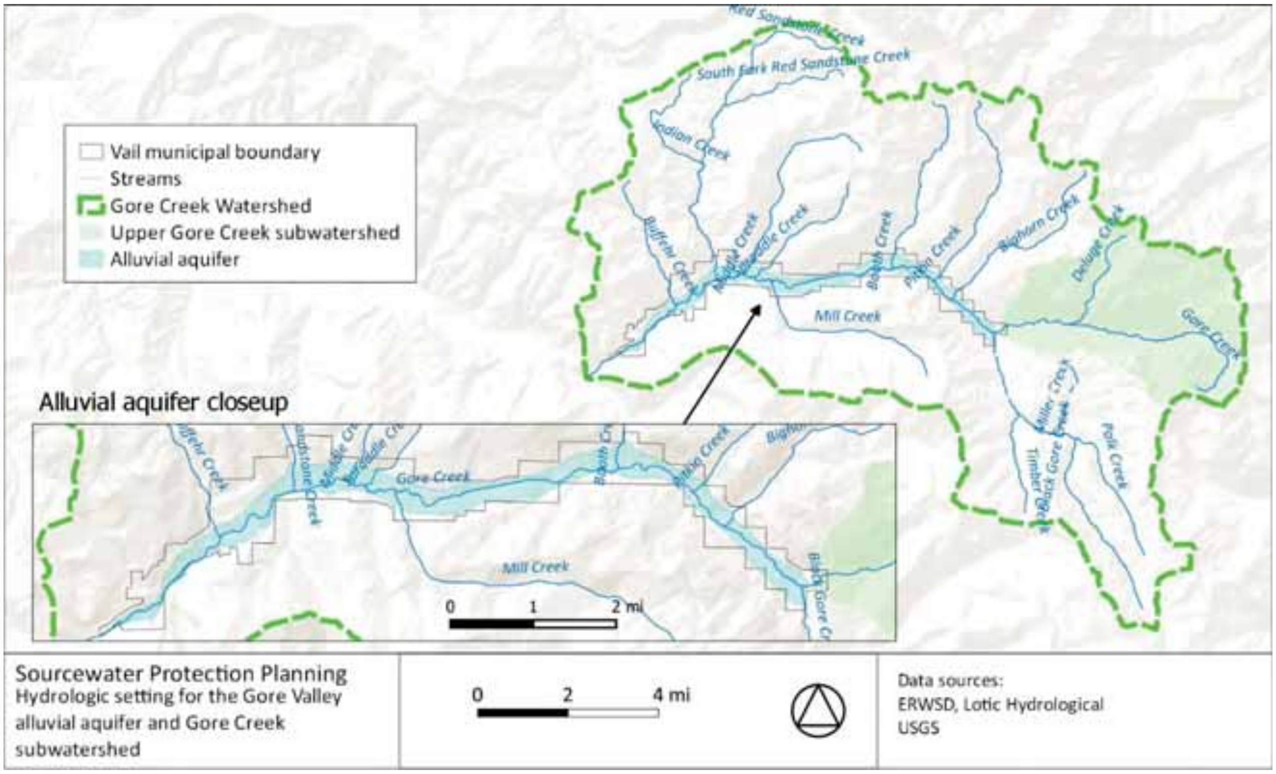

Figure 2. Hydrogeologic setting of the Gore Creek watershed.

Within the greater Gore Creek Watershed, the Town of Vail and US I-70 fill the lower Gore Valley. It is a narrow subalpine valley on the southwest slope of the Gore Range mountains. The valley was scoured out by glacial activity to approximately the eastern edge of the current Vail Village area near Ford Park, then the valley bottom was filled with outwash alluvium and the valley margins were subsequently overlain with additional colluvial landslide and alluvial fan deposits (Figure 2, Figure 3, Figure 4). Municipal wells in Vail source their water in this valley-fill quaternary alluvium, comprised of coarse sand and gravel deposits. The aquifer is unconfined and may range from 100-200 feet in thickness near the East Vail wellfield, and 50-100 feet in West Vail. ERWSD also maintains surface diversion rights at the mouth of the upper Gore Creek subwatershed. This subwatershed drains steep high-elevation zones from 9,000-13,000 feet with a combination of forested, tundra, and barren land cover. Geologies are dominated by crystalline/granitic formations with low weathering rates that produce surface runoff of high quality and low dissolved solids. Runoff is often turbid during spring snowmelt for a period of several weeks.

Alluvial aquifer properties in the Gore Valley are heterogeneous, with interbedded formations of unconsolidated sediments from the various periods of glacial outflow and retreat, and more recent depositionary events. The migration of Gore Creek's channel laterally across the valley bottom over time likely added further complexity, depositing localized zones of sand, clay, and gravel that may variously increase or impeded groundwater movement within the valley floor. Buried paleo channels may create preferential flow paths that increase or decrease subsurface flow rates in some locations and create localized zones of increased base flow recharge or groundwater infiltration to and from Gore Creek surface flows. Hillslope bases and alluvial fans of low order perennial tributaries (i.e., Booth, Bighorn, Pitkin, Spraddle, Middle, Red Sandstone, and Mill Creeks) and other smaller lateral drainages (i.e., East Vail Chutes) may provide local zones of increased recharge rates and increased aquifer thickness where the unconsolidated fan formations overlay the valley bottom alluvium.

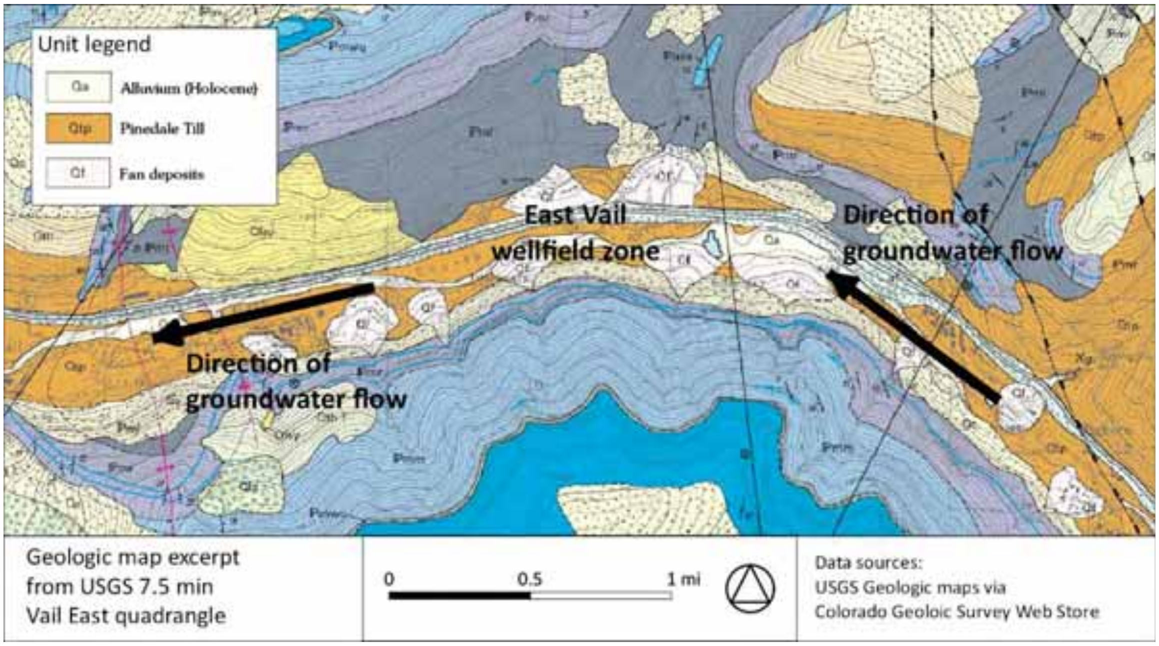

Figure 3. Geologic setting for East Vail well field.

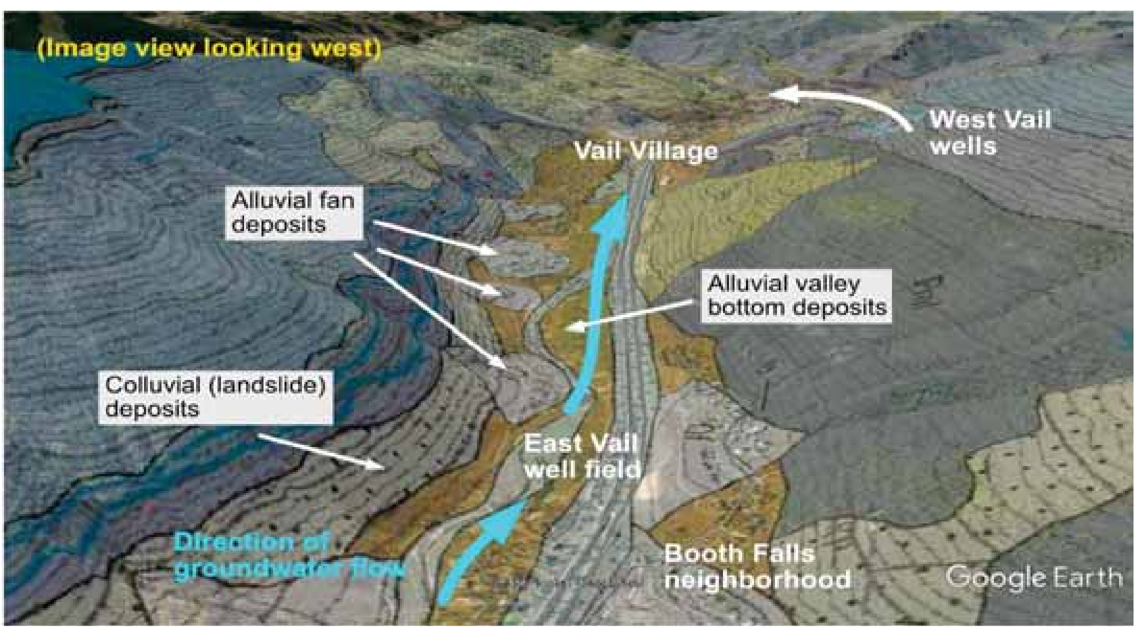

Figure 4. Conceptual view of groundwater flow in Gore Creek Valley. Tilted oblique aerial view for East Vail well field geologic setting, looking west.

2.2 GROUNDWATER FLOW CHARACTERISTICS

Aquifer recharge occurs through direct precipitation and surface water infiltration from Gore Creek mainstem during spring runoff, hillslope runoff, and tributary alluvial fans. Upper elevations of the Gore Valley receive around 40 inches of precipitation each year, mostly in the form of snow between October and April, with the valley floor receiving significantly less. During snowmelt runoff from April to July, swollen creeks reach bankfull levels and may overtop locally unconfined floodplains, raising local water tables and seasonally reversing groundwater head gradients from the stream channel laterally towards the floodplain in localized areas. During the majority of the year including baseflow periods, Gore Creek is understood to be a gaining stream, with groundwater head gradients moving towards the creek and down-valley. Valley slopes in the vicinity of the well fields are westward, ranging from 1.1% to 4% based on measurements between index contours on the USGS 7.5 minute East Vail quadrangle. Groundwater flow is assumed to follow a subdued contour of the land surface. In the Gore Creek alluvium, flow follows both a dominant westward trend with valley slope, with localized flows also trending towards the open stream channel during periods of elevated water tables in the spring.

A modelling study analyzing the potential for aquifer recharge to augment Gore Creek baseflows found that 80 to 90% of well-injected water volumes in East Vail during baseflow periods were likely reach the stream in a little over 3 weeks.[1] This does not imply that the reverse travel time from surface water to the well is equally likely, rather, it just provides context to understand that hydraulic conductivities in the Gore Valley alluvium are relatively high, and the potential for relatively rapid contaminant transport (weeks to months) in the aquifer exists. A very particular set of hypothetical hydrologic circumstances would need to occur to strongly promote rapid surface water transport from Gore Creek towards wellheads (i.e., very high pumping rates during very low baseflow conditions), and even in these circumstances, total contaminant load is likely to minimal, as most surface water will rapidly flush downstream. Additional more-recent work to understand whether municipal well sources should be classified as Groundwater Under the Direct Influence (GWUDI) of surface found that the municipal wells were not directly under the influence of Gore Creek surface waters. CDPHE-required GWUDI studies aim specifically to understand whether well locations are susceptible to contamination from water-borne pathogens and turbidity, which has important bearing for the type of treatment processes a water provider will then need to apply to raw well water. The timeframes for well water connections to surface water considered in GWUDI studies (days to weeks) establish a much different assessment context timeframe than what is considered a short term risk in the SWPP context (months to several years).

Little data exists regarding static groundwater elevation levels in the wellfield zone across seasons, years, and valley locations. ERWSD has records from recent periods that could be compiled and organized into an analytical dataset in the future. CDWR's Colorado Decision Support System maintains online database records including water levels in some wells. Water level measurements from July of 2003 were available for wells R7, R6, R1, WV7, and WV8. Water level depths below land surface varied between 7 and 20 feet, with a mean depth of 14 feet in East Vail and 12.7 feet in the West Vail well zone. The shallow water table

[1] Hydrosphere Resource Consultants. 1997. Aquifer Storage and Recharge Feasibility Study. Memorandum from Bob Weaver/Hydrosphere Consultants to L Schorr and J McNeil/Alpine Engineering regarding study resorts.

depths and unconfined nature of the alluvial aquifer indicate that risks from direct surface contamination for the Gore Valley are present.

2.3 Surface water characteristics

Gore Creek drains a high elevation watershed of approximately 100 square miles on the western side of the Continental Divide. Approximately 55-60% of the watershed area is potential tributary recharge to the alluvial zone around the District's primary municipal wellfield in East Vail. The District's auxiliary surface water intake near the Gore/Black Gore Creeks confluence receives surface flows only from the upper Gore Creek subwatershed above the USFS campground in East Vail, draining 15 square miles or approximately 14% of the total Gore Creek Watershed. Interstate 70 parallels Black Gore Creek and Gore Creek for its entire length through the Gore Valley, at times running within tens of meters of Gore Creek.

USGS station 09065500 "*Gore Creek at Upper Station Near Minturn"* has reported real time data since 1986 and annual statistics beginning in 1948. For the period of record at this site, annual mean flow is 29.6 cubic feet per second (cfs), with annual mean flow range of 13.7 to 29.6 cfs. In low flow years, base flows (as characterized by the lowest daily mean and annual 7-day minimum) may reach as low as 1.10 and 1.22 cfs respectively.

Gore Creek is a snowmelt-driven system, typical of the southern Rocky Mountain physiographic province. Snow accumulates in high elevation storage from October until May most years, then runs off during late spring and early summer in a pronounced peak flood period. High flows at station 09065500 usually hit 100-500 cfs and typically occur in early to mid-June, receding throughout the summer into early fall. Base flows occur in fall and winter and are commonly < 10 cfs. The lowest monthly mean flow at this USGS site (3.01 cfs) for the period of record is in February. Stream areas near the District's surface diversion intake may completely ice over during mid-winter periods.

2.4 Current and anticipated population demographics, growth, and demand

The Town of Vail's estimated residential population from the 2018 U.S. Census is approximately 5,400 residents within its 4.5 square mile municipal boundary. Daily worker influx by western commuters arriving from Avon to Gypsum swells this by several thousand. During peak tourism occupancy periods, local population is estimated to approach 29,000 at times, creating widely varying needs for water and sanitation services. Full time residences combine with second homes for an estimated service demand of 10,500 Single Family Equivalents (SFE). Current projected buildout totals are near 13,600 SFEs. Drinking water supply services for Town of Vail are closely interconnected with additional system infrastructure of the Upper Eagle Regional Water Authority (UERWA) serving the western valley communities including EagleVail, Avon, and Edwards. Average District demand in the 2018-2020 period has been 2.4 million gallons per day (MGD) with a peak demand reaching 5.3 MGD (Figure). As valley buildout continues, average system demand is projected to rise to 3.6 MGD and peak demand to 8.2 MGD.

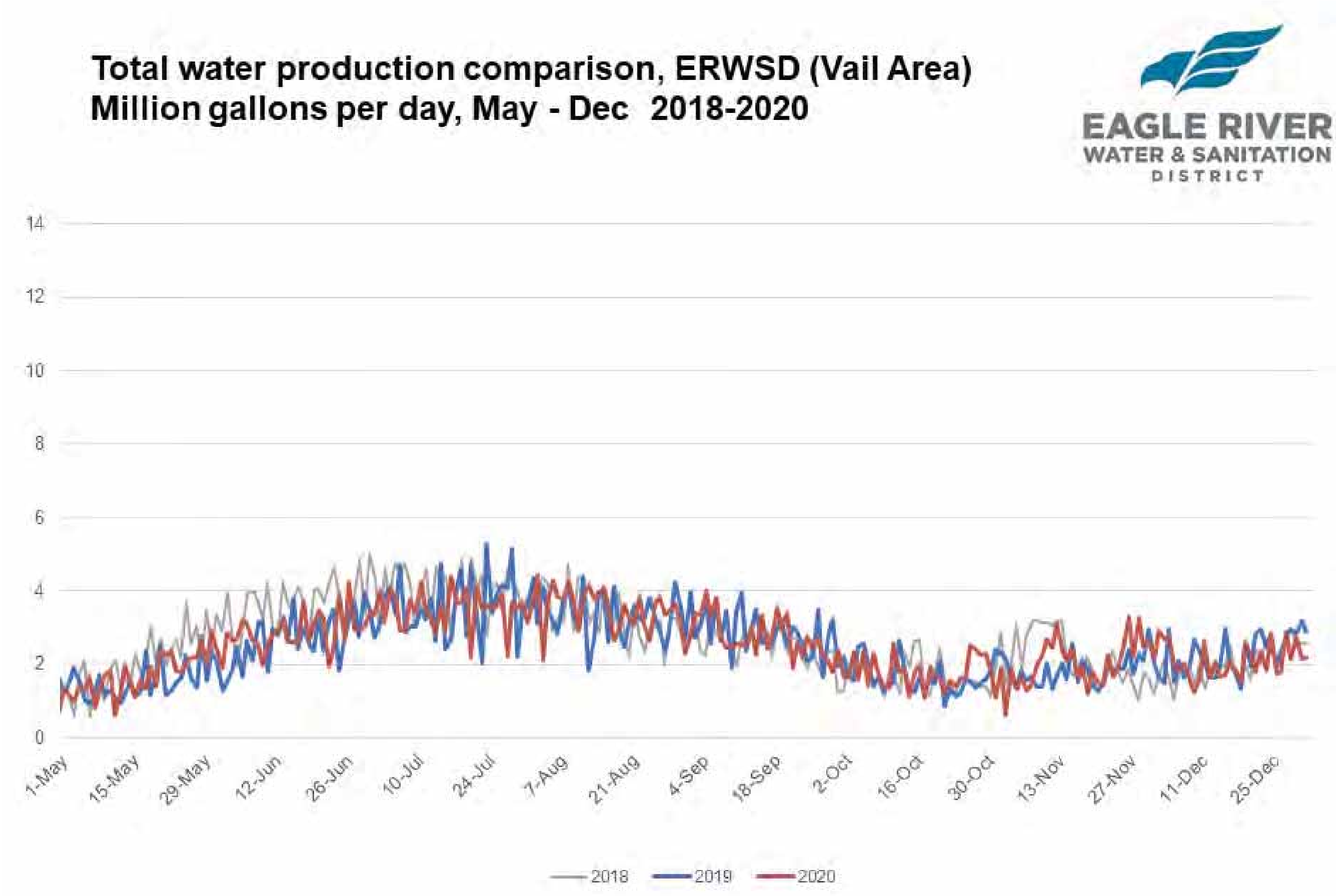

Figure 5. Typical water production volumes for ERWSD service area, 2018-2010.

2.5 DRINKING WATER SYSTEM

The Gore Valley component of source water for ERWSD's drinking water system is primarily comprised of two dispersed wellfields east and west of the urban core. Both wellfields lie in relatively shallow (50-200 feet) deposits of glacial alluvium adjacent to Gore Creek. Water quality at groundwater well sources is very good, requiring little additional treatment. Disinfection, fluoridation, and corrosion control chemicals are added prior to distribution. Water is pumped to a series of reservoir tanks above the valley floor where it is then gravity fed to the service area. Individual well characteristics can be found in Table 5. ERWSD groundwater infrastructure information. The District also maintains an additional surface water right and diversion structure on Gore Creek above the confluence of the Black Gore Creek that is capable of diverting to the East Vail treatment facility (See surface water rights information in Table 6). Gore Creek is a third order (Strahler) stream draining from Vail Pass and the southwest slopes of the Gore Range. The entire ERWSD drinking water distribution system is connected to the UERWA distribution system near Gore Creek's mouth at Dowd Junction. Water sourced in the Gore Valley may be utilized downstream in western communities like Avon and Edwards. Treated water may also be pumped in reverse from the Avon area upgradient into the Vail area distribution system.

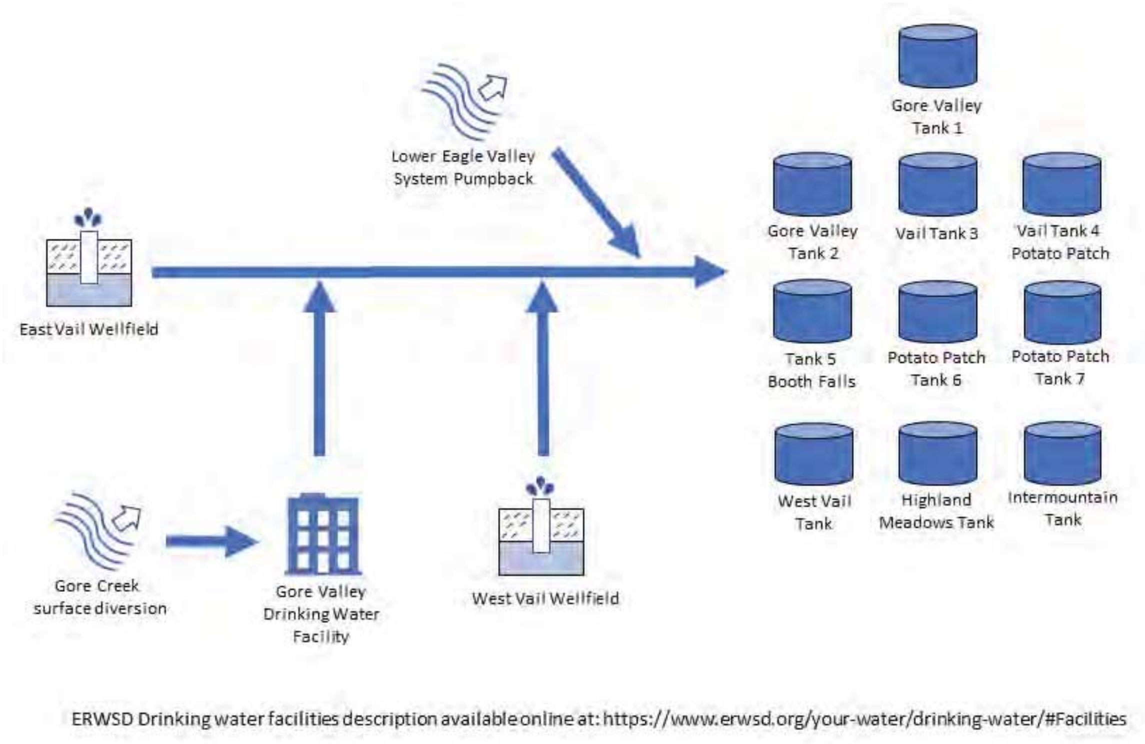

Figure 6. ERWSD drinking water facility and distribution system schematic.

Figure not Included in Public Version of Document

Figure 7. Source water infrastructure in the Gore Valley including wells, diversion structures, and major storage locations.

CDWR Structure	Well	Drilled	Depth	Casing (in)	Permitted Flow rate (gpm)	Current Production Capacity (gpm)
VVCWD WELL NO R-1	R1	Jan-79	103	9	700	475
VVCWD WELL NO R-2	R2	Nov-94	150.5	18	1800	2300*
VVCWD WELL NO R-4	R4	Jun-92	202	16	800	725
VVCWD WELL NO R-6	R6	Mar-83	125	12	650	2300*
VVCWD WELL NO R-7	R7	May-86	180	16	2400	2100
WEST WELL 7	WV7	Sep-96	68	12	400	400
WEST WELL 8	WV8	Dec-07	68	12	120	115

*Current production capacity for wells R2 and R6 is combined.

Table 5. ERWSD groundwater infrastructure information.

CDWR Structure	Absolute Rate, cfs	Conditional Rate, cfs
VAIL WTR & SAN GORE INTK	2	2

Table 6. Surface water rights held by ERWSD for Vail municipal source water.

2.6 SURFACE WATER REGULATORY STATUS

Several stream segments in Vail's source water basin are currently identified with water quality impairments. Segment COUCEA06_H, Black Gore Creek from Black Lakes to Miller Creek, is impaired for arsenic and aquatic life use (macroinvertebrates) and Segment COUCEA06_G from Miller Creek to the confluence with mainstem Gore Creek for arsenic and sediment. Ambient arsenic levels are likely driven by natural geologic weathering and soils sources, while sediment impacts stem from I-70 winter maintenance and traction sand application. Segment COUCEA08_A, the mainstem of Gore Creek between the confluence with Black Gore Creek and the Eagle River, is classified as impaired for arsenic and provisionally impaired for aquatic life use. Investigations into factors impacting aquatic life on this reach have identified urban runoff, loss of riparian vegetation buffers, and landscaping practices and treatments as primary drivers of community stress to aquatic bugs.[2] Sediment and salinity impacts from I-70 and the Black Gore watershed may play an additional role. Tributary segments to Gore Creek in assessment unit COUCEA06_E including Mill Creek and Red Sandstone Creek have also been listed for arsenic, presumably from natural background sources. A map of these stream segments can be found in Figure 8. Town of Vail has invested significant financial resources in cooperation with the District and Eagle River Watershed Council in recent years via the *Restore the Gore*[3] program to address impairments to Gore Creek including restoration of riparian areas, stormwater system improvements, resident and business outreach/education campaigns, and continued macroinvertebrate monitoring.

[2] Leonard Rice. 2018. Gore Creek Water Quality Improvement Plan. Prepared for Eagle River Watershed Council. http://www.erwc.org/research/gore-creek-water-quality-improvement-plan-wqip/

[3] https://lovevail.org/programs/gore-creek/

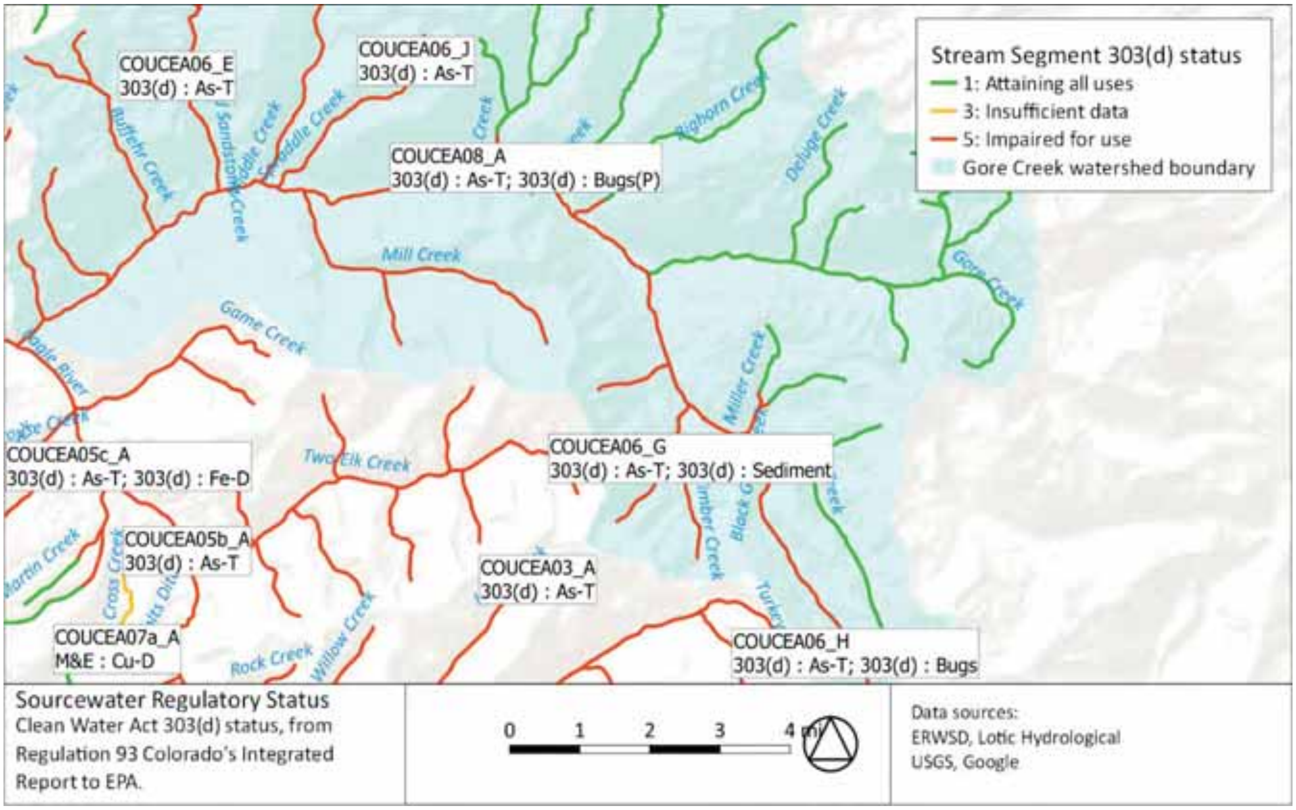

Figure 8. Clean Water Act sections 305(b) and 303(d) regulatory status.

3 SOURCE WATER RISK ASSESSMENT

3.1 SOURCE WATER PROTECTION AREA

ERWSD relies primarily on the East Vail alluvial wellfield for municipal drinking water supply in Town of Vail. Additional smaller wellfields in West Vail and the ability to pump from the UERWA system at Dowd Junction provide auxiliary supplies and system redundancy. A surface diversion intake on Gore Creek above the East Vail neighborhood provides a seldom-used backup source in the event that primary supplies are compromised, or emergency demand is needed. After reviewing protection delineation methods described by the state in its SWAP program as well as existing plans for neighboring communities and peer communities elsewhere in Colorado, a hybrid method was chosen to delineate protection areas for both the wellheads and the surface water intakes.

Wellheads received a three-zone protection overlay, while surface water intakes received a two-zone protection overlay (Table 7, Figure 9).

Sensitivity zones

Zone	Groundwater	Surface Water
1: Very Sensitive	500' radius around wellheads	75' buffer on either side of Gore Creek from diversion location to Eagle's Nest Wilderness boundary
2: Sensitive	2.5 year estimated travel distance in alluvial aquifer	Upper Gore Creek watershed, excepting portions in zone 1, from diversion location to watershed divide
3: Less Sensitive	5 year estimated travel distance in alluvial aquifer	--

Table 7. Source water protection sensitivity zone definitions.

GW Zone 1: Very sensitive. 500' buffer around wellhead; considered very sensitive due to unconfined aquifer conditions.

GW Zone 2: Sensitive. Approximate 2.5-year time of travel (TOT). Considered less sensitive, but significant risk for contamination by recalcitrant or persistent groundwater pollutants such as fuels or organochlorine chemicals. Travel time distances were conservatively modeled during wellhead protection planning using the Environmental Protection Agency's (EPA) WhAEM software and a variety of aquifer conductivity scenarios.[4] Groundwater in this zone generally moves from the valley margins and hillslopes towards the Gore Creek centerline, and from east to west downslope on the Gore Valley axis. Although groundwater is assumed to follow a subdued replica of surface topography in alluvial deposits, subsurface preferential flow paths from paleo channels and other geomorphic forms are likely to exist, making accurate mapping and travel time estimation difficult.

GW Zone 3: Less sensitive. Approximate 5-year time of travel (TOT). Considered even less sensitive, but some risk may still exist for contamination by recalcitrant or persistent groundwater pollutants. Travel time distances were conservatively modeled during Wellhead Protection Planning using EPA's WhAEM software and a variety of aquifer conductivity scenarios. Groundwater in this zone generally moves from the valley margins and hillslopes towards the Gore Creek centerline, and from east to west downslope on the Gore Valley axis. Although groundwater is assumed to follow a subdued replica of surface topography in alluvial deposits, subsurface preferential flow paths from paleo channels and other geomorphic forms are likely to exist, making accurate mapping and travel time estimation difficult.

SW Zone 1: Sensitive. 75' buffer on either side of Gore Creek extending from the surface intake to the Eagles Nest Wilderness boundary.

SW Zone 2: Less sensitive. Gore Creek subwatershed upstream of surface intake to watershed boundary.

[4] Kraemer SR and Haitjema HM. 2018. Working with WhAEM. Demonstration of Capture Zone Delineation for a City Wellfield in a Valley Fill Glacial Outwash Aquifer for Wellhead Protection. EPA/600/B-18/089

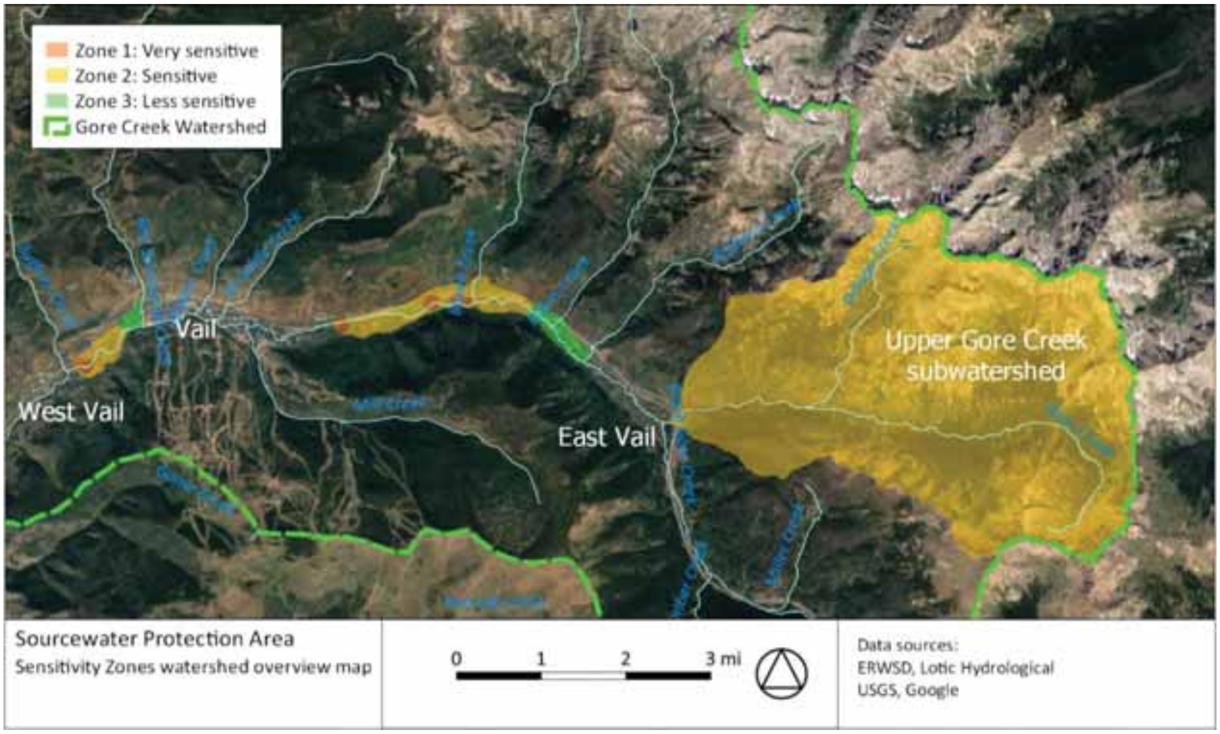

Figure 9. Source water protection sensitivity zone overview.

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Figure 10. Groundwater sensitivity zones closeup map.

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Figure 11. Surface water sensitivity zone closeup map.

3.2 Potential sources of contamination

As part of statewide SWPP reporting outputs, CDPHE compiled an initial list of potential sources of contamination (PSOCs) for Vail's public water supplies using GIS systems and available statewide datasets. CDPHE also created a SWAP toolkit including planning templates to help small and medium sized public water providers.[5] The steering committee opted to develop a more detailed local inventory in lieu of the state's preliminary findings. The inventory is not intended to supplant or replace the state's work, rather, it augments the earlier report with more detailed local knowledge of potential contamination sources and other watershed issues with a significant nexus to source water protection. Gore Valley PSOCs were first considered through the lens of the major discrete and dispersed contaminant source types provided in the CDPHE's planning template. Because of its recent urbanization history as a resort community, lack of hardrock mining activity, and lack of intensive agricultural past, very few classically 'polluting' land uses occurred in the Gore watershed. Major contemporary source water threats center largely around

[5] https://cdphe.colorado.gov/swap-protection-phase

urbanization impacts, unpredictable natural events like wildfire, and the highway transportation corridor that bisects the valley.

Discrete contaminant source type	Present in source water watershed	Reviewed
EPA Superfund sites (NPL)	No (Present in Eagle but not Gore)	No
EPA Abandoned Contaminated sites (CERCLA)	No	No
EPA hazardous waste generators (RCRA)	Yes; all small, conditionally exempt	Yes; RCRA database query
EPA Chemical Inventory Storage Sites (SARA/TRI)	No	Yes; TRI database query
Permitted Wastewater Discharge Sites	Yes; ERWSD outfall downstream of EV wells	No
Storage tanks; AST, UST, LUST	Yes	Yes; state database
Solid waste sites	No	No
Existing/Abandoned Mine Sites	Yes	No; no active/significant sites
Concentrated Animal Feeding Operations	No	No

Table 8**. Discrete (point source) contaminant source categories for source water assessments.**

Dispersed contaminant source type	Present in source water watershed	Reviewed
Commercial/industrial/transportation	Yes	Yes (I-70)
High intensity residential	Yes	Yes (dispersed chem use)
Low intensity residential	Yes	Yes (dispersed chem. use)
Urban recreational grasses	Yes	Yes (golf courses)
Quarries/strip mines/gravel pits	No	No
Agriculture	No	No
Forest	Yes	Yes (wildfire/forest health)
Septic systems	Yes	Yes (very few present)
Oil and gas/energy development	No	No

Table 9. Dispersed (non-point source) contaminant categories for source water protection.

Major PSOC concerns in the Gore Valley are tied to forest fires, transportation corridors, or lighter intensity land use practices. A small number of larger facilities including the hospital, Vail Public Works department shop, and selected hotels, are small producers of hazardous wastes. However, these facilities typically have low potential for source water contamination due either to their geographic location relative to source water infrastructure, or their existing/required institutional waste handling and disposal practices.

The complete PSOC inventory is included as **Appendix 1**. The inventory is also available as a spatial dataset for viewing and manipulation in GIS software.

Stakeholder inventories identified close to 100 PSOCs in the source water planning area (Figure 12). PSOC data collection is an ongoing effort, and this dataset represents a living document that will be updated over time as conditions change or additional information is gathered by ERWSD. The most common class of PSOCs in the Zone 1 and 2 Sensitivity areas is assumed to be small quantity household chemicals and fuel due to the preponderance of low and medium density residential areas near and upstream of the municipal wellfields. It is infeasible to complete a full inventory of individual households, therefore these PSOCs were aggregated together as a single risk category. Although they are geographically prevalent, their typical small quantities and unlikelihood for a simultaneous release event make them low risk overall. Transportation impacts comprise a serious yet difficult-to-predict risk to both the wellfield area (direct spill over an unconfined aquifer) and to upgradient tributary surface waters in the Black Gore subwatershed. Based on state data, another large reporting class is fuel storage tanks. State tank inventories list over 100 registered tank locations within the watershed, with approximately 50 of those currently active. Fuel tank sizes range from a few dozen or hundred gallons up to over 10,000 gallons. Tanks typically store diesel, gasoline, or motor/machine oils that are used for operational purposes by the entities that maintain them. Locations with significant storage in the valley bottom include the town maintenance shop, the Vail Resorts maintenance yard in Lionshead village, and the service stations in West Vail. Other significant storage depots exist on Vail Mountain Resort and for backup generator use at the hospital and larger hotels. Registered tanks are already regulated at the state level and have required spill prevention BMPs that typically include double wall construction, secondary spill containment (berms, basins, etc.), and leak detection capabilities.

Figure not Included in Public Version of Document

Figure 12. Potential Sources of Contamination in the Gore Valley.

3.3 CONTAMINANT PRIORITIZATION

The Colorado Rural Water Association (CRWA) developed a SWAP Risk Assessment Matrix to help water providers characterize the relative risks posed by various PSOC types. Town of Eagle recently used this approach in its plan with help from the CRWA's Source Water Specialist to rank source water risks, and this approach is also used here. The CRWA SWAP matrix characterizes risk in terms of the *probability* and anticipated *level* (severity) of impact. The *probability of impact* describes the likelihood of damage or losses from a contaminant source within a 1 to 10-year time period using the overall number of sources, a source's migration potential, and the frequency of occurrence based on any available historical data. The *level of impact* describes the severity with which a contaminant source can impact drinking water supplies based on its known danger to human health and potential release volume. The combination of probability and severity level characterize the total exposure to risk from a given PSOC. Probability of impact and level of impact tiers are described in Tables 10-15 below.

Prioritization schema: Risk Exposure Matrix scoring definitions

Tables 10 through 15 describe the rationale behind PSOC risk rating and are reproduced or adapted from materials provided by CDPHE and CRWA.

Rating	Key	Risk exposure scoring
Certain	> 95% probability of Impact	5
Likely	70-95% probability of impact	4
Possible	30 to 70% probability of impact	3
Unlikely	5 to 30% probability of impact	2
Rare	< 5% probability	1

Table 10. Probability of impact tiers describe the likelihood or frequency that a PSOC could impact water sources within a 1 to 10-year time period.

Rating	Key	Risk exposure scoring
Catastrophic	Irreversible damage to the water source(s). This could include the need for new treatment technologies and/or the replacement of existing water sources	5
Major	Substantial damage to the water source(s). This could include a loss of use for an extended period of time and/or the need for new treatment technologies	4
Significant	Moderate damage to the water source(s). This could include a loss of use for an extended period of time and/or the need for increased monitoring and/or maintenance activities	3
Minor	Minor damage resulting in minimal, recoverable, or localized efforts. This could include temporarily shutting off an intake or well and/or the issuance of a boil order.	2
Insignificant	Damage that may be too small or unimportant to be worth consideration but may need to be observed for worsening conditions. This could include the development of administrative procedures to maintain awareness of changing conditions.	1

Table 11. Severity level tiers describe how strongly a PSOC can impact drinking water sources.

Direct Control	The water system can take direct measures to prevent.
Indirect Control	The water system cannot directly control the issue but can work with another person or entity to take measures to prevent.
No Control	The PSOC or issue of concern is outside the control of the public water system and other entities.

Table 12. Control levels describe the legal or technical ability of a water provider to address a PSOC.

Risk rating matrix	Risk = Probability x Impact Level					
Probability of impact:						
Certain	*5*	5	10	15	20	25
Likely	*4*	4	8	12	16	20
Possible	*3*	3	6	9	12	15
Unlikely	*2*	2	4	6	8	10
Rare	*1*	1	2	3	4	5
	Score	*1*	*2*	*3*	*4*	*5*
	Impact level:	**Insignificant**	**Minor**	**Significant**	**Major**	**Catastrophic**

Table 13. Risk exposure scoring matrix.

Risk Score	Risk Rating
1-2	Very Low
3-5	Low
6-10	Moderate
12-16	High
20+	Very High

Table 14. Risk scoring levels.

Probability of impact:

Certain	5	Low	Moderate	High	Very High	Very High
Likely	4	Low	Moderate	High	High	Very High
Possible	3	Low	Moderate	Moderate	High	High
Unlikely	2	Very Low	Low	Moderate	Moderate	Moderate
Rare	1	Very Low	Very Low	Low	Low	Low
	Score	1	2	3	4	5
Impact level:		Insignificant	Minor	Significant	Major	Catastrophic

Table 15. Risk exposure levels matrix.

Risk exposure summary

Individual PSOCs were scored for probability and level of impact using a combination of watershed location and sensitivity zone proximity, contaminant amount, control level, and other criteria based on local stakeholder knowledge. Overall *Risk Exposure* in this context is defined as the *Probability of impact x Impact Level.* An event that has a catastrophic impact but only occurs on a rare frequency will receive a lesser risk rating than an event that has minor impacts but occurs regularly within a 10-year time frame. Scoring for sources can be found in the full PSOC table in Appendix 1. Table 16 below aggregates PSOCs by contamination risk categories and displays the range of risk levels and maximum risk level estimated for each category. Many PSOC such as storage tanks occur multiple times in the valley but due to location or size, constitute low total risk. Low probability but high consequence events like wildfire or transportation spills are not specific point source PSOCs but provide relatively higher risks in the Gore Creek Watershed.

This is intended as a living document PSOC inventories were based on information available to staff at the time of this planning process and should not be seen as a definitive or unchanging characterization of drinking water threats and concerns in the Gore Valley. New concerns may emerge and the relative risk relatively associated with an individual PSOC or group of PSOCs is subject to constant change.

Contamination Risk Category	PSOC occurrence count, grouped by risk rating category Very Low	Low	Mod.	PSOC Total	Proximity (Sensitivity Zone)	Control Level	Overall Risk Level
Operational storage tanks	79	1		80	--	2	Low
Non-residential land use practices	1	3		4	GW1, 2, 3	2	Low
OWTS/Septic	2			2	SW2, GW2	2	Very Low
Recreation, pets	2			2	GW2, 3	2	Very Low
Flooding, water infrastructure		1		1	GW1	3	Low
Residential practices	1			1	GW2, 3	2	Very Low
Security		1		1	GW1	1	Low
Transportation/roads			*Dispersed*	1	GW1, 2, 3	3	Moderate
Wildfire			*Dispersed*	1	SW1, 2	2-3	Moderate
PSOC Occurrence Count Total	85	6	2	93			

Table 16. ERWSD drinking water sources risk ratings, aggregated by contaminant category and risk level.

4 THREATS AND CONTAMINANTS REVIEW

4.1 INTERSTATE 70

Federal Interstate 70 traverses Colorado from the Kansas to the Utah state borders and provides the main east-west travel and commercial shipping route across the southern Rocky Mountains between Denver, the intermountain region, and the western slope. Due to the mountainous terrain, steep grades, substandard curve geometry of Vail Pass, and frequently inclement weather conditions, vehicle crashes are common and occasionally may involve transport of fuel or other hazardous materials. Due to constant proximity to Gore Creek and the difficulties associated with winter road maintenance, I-70 also provides other unique challenges to maintaining surface water quality in the watershed. Large amounts of traction sand are applied during winter to help vehicles maintain control on steep grades and curves. Fine sediments then move with stormwater runoff into Black Gore Creek or Gore Creek where they are transported downstream over time and may impact stream health and infrastructure. Solid and liquid salt and other deicer chemical applications are also frequently used. These compounds are readily soluble in water and transport downstream into surface and groundwater reservoirs during runoff. Over time, increases to salinity of surface waters have been detected by USGS at monitoring sites near the watershed mouth.[6] Nationwide studies of water quality in regions with prevalent salt use for road maintenance have detected increasing reservoirs of salinity in surface waters even in non-winter seasons, indicating the potential for shallow groundwater systems to accumulate and release reservoirs of salinity[7]. It is unclear to what potential this low-level contamination issue may exist in the Gore Valley.

In case of a highway spill involving hazardous materials, ERWSD maintains a spill response plan (Appendix 2) and coordinates with the Colorado Department of Transportation (CDOT), Colorado State Patrol, town of Vail, and Vail Fire to quickly identify potential threats to water infrastructure. CDPHE also has spill response reporting and control requirements for CDOT. Contamination potential is highly variable, and the probability of an event is very low and difficult to assess, but not absent. A worst-case scenario may be represented by a truck transporting a recalcitrant toxic compound overturning and completely spilling its contents on the south side of the interstate in the golf course area just west of Booth Creek. This would present the rapid introduction of a significant volume of contaminant directly into the unconfined alluvial aquifer within the 500’ Zone 1 sensitivity area of the East Vail wellfield. Fuels, Volatile Organic Compounds (VOCs), or other organochlorine compounds could require sediment remediation or the complete shutdown of one or more municipal wells for an unknown time frame. Serious contamination might result in the need for complete relocation of a wellhead due to contaminated soils.

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[6] Williams, C.A., Moore, J.L., and Richards, R.J., 2011, Assessment of surface-water quantity and quality, Eagle River watershed, Colorado, 1947–2007: U.S. Geological Survey, Scientific Investigation Report 2011–5075, 139 p.

[7] Corsi SR, Di Cicco LA, Lutz MA, and Hirsch RM. 2015. River chloride trends in snow-affected urban watersheds: increasing concentrations outpace urban growth rate and common among all seasons. Science of the Total Environment. 508 p 488-497. https://www.sciencedirect.com/science/article/pii/S0048969714017148 Accessed Oct 2020.

In addition to coordinated spill response, USGS has previously conducted travel time studies[8] to understand the rate of contaminant transport in Gore Creek from different watershed locations at a variety of streamflow volumes. Due to the valley's topography, Gore Creek is generally a gaining stream throughout the year, meaning groundwater gradients are towards the stream and little surface-to-groundwater recharge occurs laterally from streambanks. Under very specific hydrologic circumstances, such as an extremely dry period with low streamflows coupled with very high pumping demand from the from wells, some theoretical potential may exist for localized and short-lived reversal of groundwater gradients in the golf course area that induce some amount of stream water to enter the alluvium and transport laterally towards well influence areas. However, surface pulses of spill contaminants in Gore Creek are likely to rapidly transport downstream and experience localized dilution on a fast enough time scale that the potential for significant groundwater contamination appears negligibly low.

To understand the relative probability of a surface spill event to impact the various source water sensitive zones, transportation data provided by CDOT was reviewed. CDOT maintains a crash data information database for recorded traffic incidents including the location, type of vehicle involved, and type of incident. A CDOT Colorado Open Records Act (CORA) request included the most recent 5 years of data for I-70 between mile markers 171 (Dowd Junction) and 190 (Vail Pass summit), as displayed in Figure 13. Although the vast majority of incident types are non-critical in terms of likely water quality impacts, the general location and frequency of all incidents provides a usable overall characterization of the higher risk zones for transportation incidents in the watershed. Several regions in the corridor stand out for higher incident risk. Zones of increased crash frequency are evident in the Vail Pass Narrows (miles 182-184 above Polk and Miller Creeks), on the steepened grade above the Gore Creek/Black Gore confluence zone (miles 182-183), and near the top of the pass. Additional zones of increased incident frequency occur at the East Vail and Main Vail interchanges, and at the East Vail chain lanes. It should be noted that the chain lane zone includes many non-critical incident types such as side swipes, rear-ends, etc. This analysis is not suggesting that zone is a location of higher catastrophic crash types such as truck rollovers that are likely to have greater water quality implications. However, because this location is where a truck spill could place a pollutant load directly on the unconfined aquifer within the Zone 1 sensitivity area, it is worth noting. A more-probable scenario for a transportation incident to impact source water is for a significant accident to deliver pollutants direct to Black Gore Creek either in the Narrows or in the 182-183 mile marker segment (the steep curves near the last runaway truck ramp above East Vail). Once in Black Gore Creek surface waters, the pollutant would travel towards Vail. However, as noted above, the possibility for significant long-term pollutant loading to the Gore Valley alluvial aquifer in the wellfield zone is relatively low via this scenario, and the surface water intake in East Vail on main Gore Creek is typically only auxiliary supply.

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[8] Gurdak JJ, Spahr NE,and Szmajter R. 2002. Traveltime Characteristics of Gore Creek and Black Gore Creek, Upper Colorado River Basin, Colorado. USGS Water Resources Investigations Report 0-4037. https://pubs.usgs.gov/wri/wri02-4037/pdf/wrir4037.pdf. Accessed October 2020.

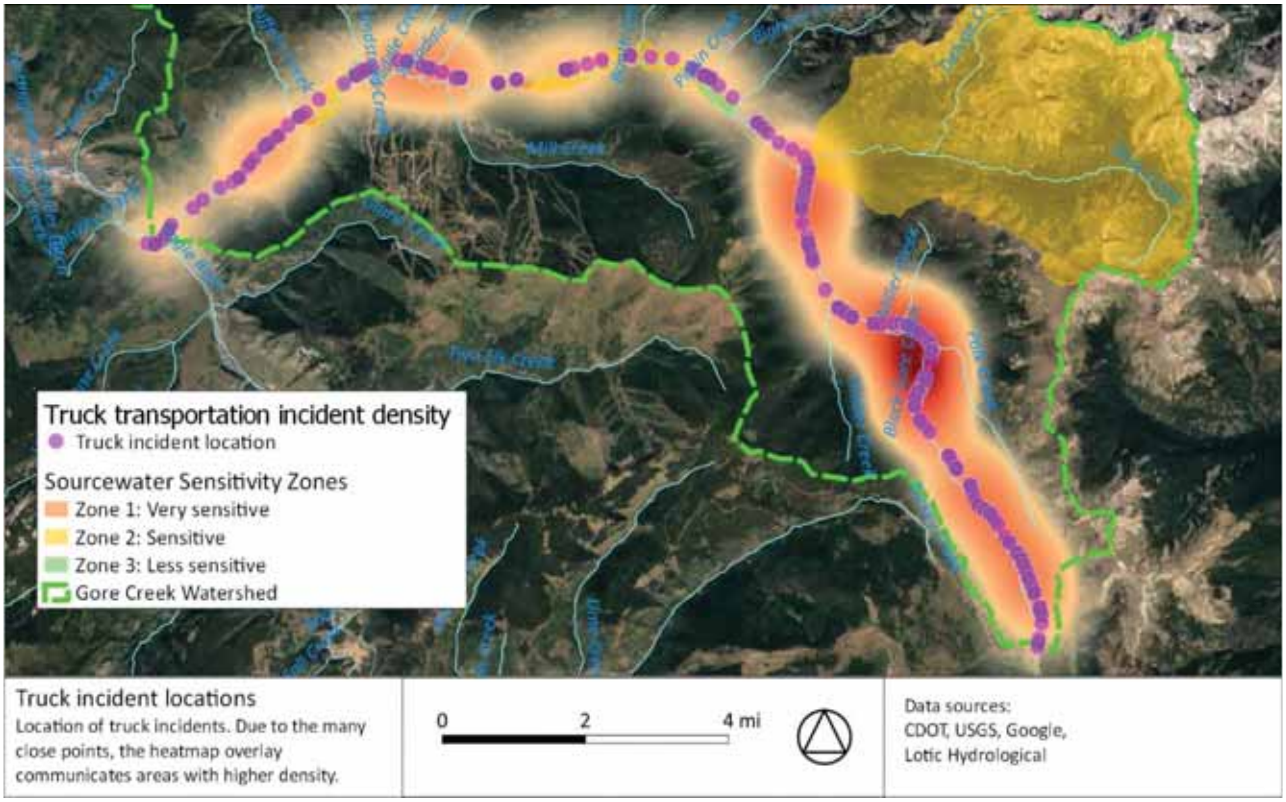

Figure 13. Truck incident heatmap. Red colors indicate a higher frequency of incidents in that location.

4.2 Wildfire

Wildfires have serious implications for drinking water sources. Post-fire watershed impacts include increased risk of topsoil loss, flooding and sedimentation events, and debris flows in the first several years due to the lack of stabilizing vegetation and decreased soil infiltration in burn zones. Burn severity may affect the degree to which any of these occur. Hillslopes denuded of soil-stabilizing vegetation pose high erosional risk during downpours and may completely fail in catastrophic debris flows that clog streams, reservoirs, or municipal surface water intakes. Because the District relies primarily on wellfields and the surface water intake on Gore Creek is auxiliary, the direct risk from wildfires may be relatively short-lived in the post-fire event time period. Intakes downstream on the mainstem Eagle River above Avon may however be more susceptible to sedimentation and turbidity issues. Steep gradient stream channels and high spring flows are capable of moving excess sediment and debris out of the watershed over time but may require several years after a large fire event to self-clean. Surface water intakes and transport/treatment infrastructure are susceptible to sedimentation or short-term flooding damage, but the impact to the wellfield in the golf course vicinity is likely to be small. The upper Gore Creek subwatershed supplies the auxiliary surface water intake for the municipal supply. Eagle County utilizes a fire behavior model called NO HARM to characterize the likely risk of a wildfire burning at a particular location combined with the probable severity based on fuels type and topography. Fire hazard in upper Gore Creek is variable; at the mouth of the watershed several of the NO HARM computer model firesheds in the county's hazard model are rated as 'wildland high' but the majority of the watershed is rated 'wildland moderate' or 'wildland low'. North facing conifer forests on the south side of Gore Creek cover steep drainages and are prone to strong west winds. Both lodgepole pine stands and higher elevation spruce stands are experiencing prolonged attack and mortality episodes from the mountain pine beetle and the spruce beetle respectively, leading to increased downed and standing fuel loads. While fuels reduction projects are identified below the wilderness boundary near the Gore Creek Campground, it is unlikely that additional significant active fuels management can occur within the designated wilderness area.

Storage and distribution infrastructure

EC and TOV have conducted fire risk planning in the Gore Valley, and ERWSD has been a stakeholder of these processes. These efforts produced mapping outputs and action plans for agencies and community residents to address fire risk and responses. Due to their suburban setting within golf course open space and residential parks, Vail's municipal wellfields have significant defensible space and buffering from wildlands fires. Portions of the supply and distribution infrastructure in town other than wellheads and surface intakes may face relatively higher risks. In particular, distribution reservoir tanks above the town core and various neighborhoods lie on the urban-wildland interface in zones of increased wildlands fire hazard. Most ERWSD storage tanks are fully or partially buried, constructed of concrete, and backed by earthen berms or other fire-resistant materials, and have maintained defensible spaces. ERWSD staff identified damage to storage tank infrastructure including the supervisory control and data acquisition (SCADA) monitoring and electrical systems on the tanks as well as external telemetry equipment as the primary risk from wildfire, with direct tank damage unlikely or low risk. Damage to monitoring and communications systems may trigger a short term shut down of the tank system until field checks can be made, but all systems may be operated manually, and general redundancy of distribution systems makes service disturbances to residences of more than a few days unlikely.

Black Lakes Reservoirs

In some recent instances of wildfire in Colorado, drinking water reservoirs suffered from severe sedimentation and loss of capacity. ERWSD operates Black Lakes Reservoirs 1 and 2 for storage capacity and instream flows at the headwaters of Black Gore Creek. Because of the landscape position of these lakes–high in the headwaters with relatively little overall surface stream input—a major sedimentation or debris flow that impacts reservoir storage volume significantly is unlikely. However, a catastrophic wildfire event on the west side of the reservoirs that denudes soils could theoretically release enough sediment or contribute to landslides into the Black Lakes during a heavy rain event to impact storage volumes. Eagle County's fire risk model currently characterizes this hillside as either moderate or low for wildfire risk—likely due in part to its higher elevation, which experiences more precipitation and higher soil moistures throughout the year than elsewhere in the watershed.

Existing Fire Plans with a SWAP nexus

Eagle River Phase 1 Wildfire Assessment (2010): This study rated the vulnerability of subwatersheds in the Eagle basin based on wildfire hazard, flooding/debris flow hazard, and soil erodibility. Composite rating maps identified the lower Gore Creek watershed as the most vulnerable in the planning area for post-wildfire watershed hazard, helping to guide fuels treatment decisions.

Eagle County Community Wildfire Protection Plan (2011): The county's plan identified areas of higher fire risk and sought to create prescriptive mitigation recommendations including fuels reduction and public engagement. Similar to the 2019 Vail plan that it preceded, the primary focus is on property damage and human life risk, source water protection is only indirectly addressed.

Vail Community Wildfire Protection Plan (2019): This plan focuses on the intersection between wildfire risk and locations of high community. The plan is primarily focused on risks to life and property, including residential neighborhood risk, rather than watershed impacts or drinking water risk. It identifies education/outreach, fuels reduction, and defensible spaces as primary methods to reduce risk.

Gore Valley Watershed Wellhead Protection Plan (2019): This plan served as a precursor to this SWPP by using EPA-provided software to estimate approximate groundwater travel times and delineate wellhead protection zones. These zones are directly incorporated in the groundwater sensitivity zones in this plan.

Fire exposure risk maps

Eagle County's utilizes the NO HARM fire behavior model to characterize the likely risk of a wildfire burning at a particular location combined with the probable severity based on fuels type and topography. Overlaying the current (as of 2020) NO HARM model for the Vail Area with locations of critical source water infrastructure as well as fuels reduction layers (Figures 14 and 15) helps provide an understanding of which infrastructure faces relatively higher risk and where source water protection may be a benefit when conducting future fuels mitigation activities.

Figure not Included in Public Version of Document

Figure 14. Eagle County NO HARM Fireshed hazard ratings near Vail urban core.

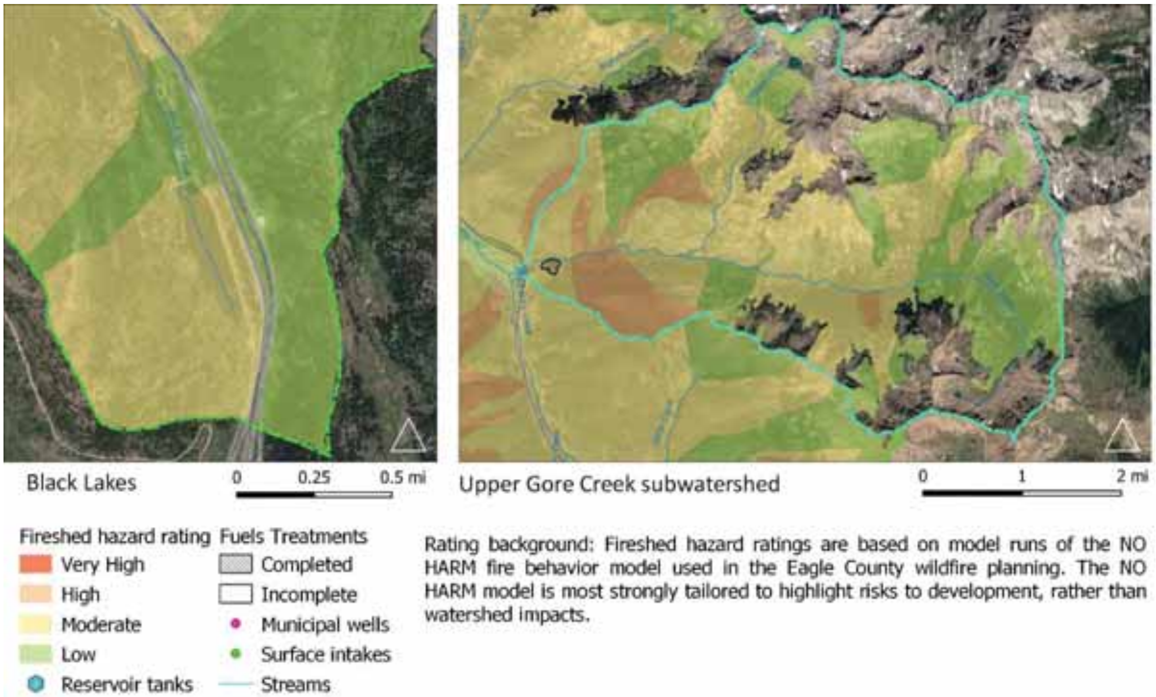

Figure 15. Eagle County NO HARM fireshed hazard ratings for Black Lakes and upper Gore Creek.

4.3 DISPERSED RESIDENTIAL CHEMICALS USE

Herbicides, pesticides, fertilizers, paints, oils, detergents, and other solvents constitute household hazardous waste according to US EPA. Previous work by USGS[9], Leonard Rice Engineers[10], and others have identified application of and runoff of landscape care chemicals at dispersed residential and commercial sites in the Gore Valley as a contributor to water quality declines that impact aquatic macroinvertebrate populations in Gore Creek and tributaries. Macroinvertebrate sampling sites in East Vail and near the urban core of Vail Village display increasingly impaired macroinvertebrate community conditions with downstream distance, indicating a cumulative downstream effect. Although these pollutant sources are typically small in amount—perhaps in the range of one to ten gallons total of fuel, fertilizers, pesticides, herbicides, and other outdoor care chemicals at a typical residence or small business—their use is widespread and regular in most suburban environments. A significant portion of Vail's 5000 residents and residential units occur upgradient of the golf course well field, indicating there is at least slight potential for residential chemical use to impact the alluvial aquifer via runoff, instream transport, and aquifer recharge processes.

[9] Zuellig, R.E., Bruce, J.F., Healy, B.D., Williams, C.A., 2010, Macroinvertebrate-based assessment of biological condition at selected sites in the Eagle River watershed, Colorado, 2000–07: U.S. Geological Survey Scientific Investigations Report 2010–5148, 19 p.

[10] Leonard Rice Engineers. 2013. Gore Creek Water Quality Improvement Plan. Prepared for Town of Vail and available upon request. Executive summary available at http://www.erwc.org/wp-content/uploads/2014/01/ExecutiveSummary.pdf,. Accessed Nov 2020.

In 2016, the TOV launched its "Restore the Gore" campaign to improve stream conditions via education of streamside landowners, improved municipal code, and revamped stormwater treatment systems. The District has worked closely with the town on this campaign and is likely to continue doing so in the future. Reducing surface use of these chemicals, especially in riparian areas and on impervious surfaces likely to runoff during precipitation events, can slow the rate of stream loading and aquifer recharge. Although some level of use is likely to persist, educating homeowners and promoting functional natural buffer systems may provide the best strategy to ensure loading from regular usage or localized small volume spills can be naturally attenuated by dilution or biological and physical processes in soils and riparian zones.

4.4 Operational fuels and chemical storage

Fuel storage and used fluids storage for motor and machine oils constitute one of the most regularly reported small to medium sized PSOC categories in the watershed. A smaller number of sites also report storage of light industrial chemicals and solvents or firefighting foams. Nearly 60% of the approximately 100 individually inventoried discrete/point-source PSOCs are fuel or combustible oil tanks. The most typical storage capacities reported by the Colorado Division of Oil and Public Safety, which registers and tracks storage tanks, range from 500 to 30,000 gallons[11]. Larger sites include the TOV public works yard and several equipment facilities operated by VR on the ski resort and near the confluence of Gore Creek and Red Sandstone Creek. Locations for all of the identified storage tanks are shown in Figure 16. It is sometimes cited in EPA materials and other water quality outreach materials that one gallon of motor oil or diesel fuel can potentially contaminate up to 1 million gallons of freshwater to levels unsuitable for drinking water use. Regardless of the exact amount, depending on the porosity of aquifer storage in the Gore Valley alluvium, the potential for contamination of very large volumes of groundwater storage from relatively small fuel storage sites remains a serious consideration.

No fuel storage facilities were identified upgradient of the East Vail wellfield or surface water intake, but over a dozen occur upgradient of the auxiliary wellfield in West Vail. These storage facilities, including the commercial gas stations in West Vail, are also upgradient of UERWA's Avon and Edwards surface water intakes on the mainstem Eagle River below the Gore Creek confluence. Fuel storage at the TOV maintenance facility and Vail Golf Course are within one half mile of municipal well R4. Due to the predominantly west-trending groundwater movement gradients, major fuel spills at either of these locations are unlikely to have high migration potential towards the wellhead and sensitive Zone 1 protection area. Approximately half of the reported tanks occur within the Gore Valley alluvial valley floor and several are within 500 feet of Gore Creek, including tanks at the VR maintenance facility near Red Sandstone Creek and at the West Vail gas stations. Spills from these locations have a greater risk of localized aquifer contamination and migration towards surface waters, and potential entry to and downstream transport by surface waters via stormwater surface pathways. Hydrocarbons in groundwaters may migrate at variable rates dependent on the weight fraction of the various constituent species. Fuel molecules are not water soluble and may have a strong upward vertical migration tendency or tendency to 'float' on the surface of an unconfined water table such as the Gore Valley alluvium as well.

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[11] The Colorado Division of Oil and Public Saftey provides a searchable statewide storage tank database at https://ops.colorado.gov/Petroleum/DataDocuments. Accessed October 2020 for this report.

Overall spread and attenuation potential is dependent on the alluvium characteristics of the site, and well oxygenated soils and sediments may provide opportunities for relatively rapid biodegradation by microbial pathways, whereas spills in less oxygenated soils or shallow water tables may degrade much more slowly.

Non-fuel or non-petroleum hydrocarbon storage accounts for a much smaller percentage of tank sites. A small amount of firefighting foam is stored and used by Vail Fire and at the helicopter landing site operated by VH and Flight for Life. This class of chemicals, which may include per- and polyfluorinated compounds known as PFOAs or PFASs, is currently under scrutiny at the state level for their impacts to drinking water and human health and may be discontinued in the future. Inventoried storage amounts in the Gore watershed are relatively small, ranging from 50 to 100 gallons. However, these classes of chemicals are known as 'forever chemicals' due to their resistance to natural or artificial biodegradation pathways and have proven to be extremely recalcitrant in natural environments. Even at small amounts, the persistent nature creates a level of concern for localized surface and groundwater contamination as the health advisory level for these contaminants is currently set at 70 parts per trillion (ppt). Other commonly reported non-fuel chemical types include water treatment chemicals used either for water disinfection such as various halogen salts, sodium fluoride for drinking water fluoridation, or phosphorous-based corrosion inhibitors used to treat the District's municipal water. These are typically stored in small quantities directly onsite at the District's entry point treatment facilities throughout the valley. These compounds are stored in dry form, above ground in locked facilities on concrete pads, creating little spill likelihood or contamination potential.

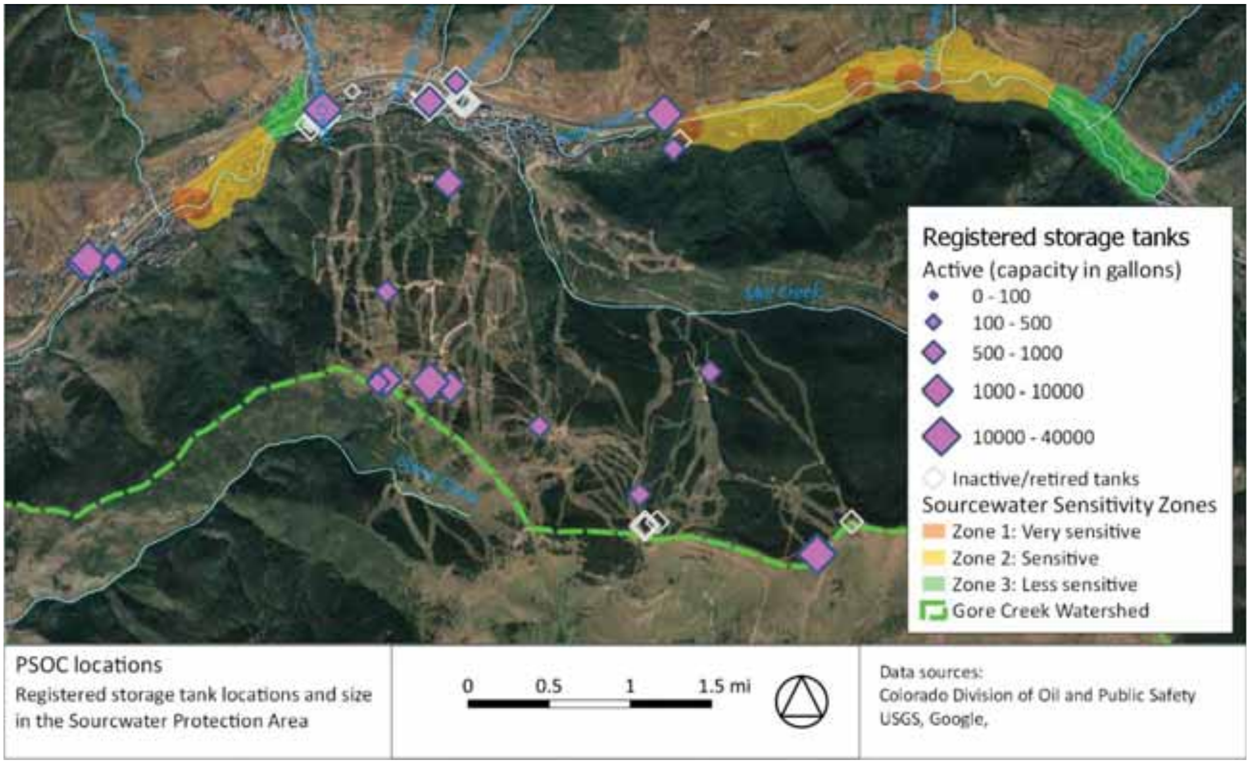

Figure 16. Locations of registered storage tanks.

EPA's hazardous waste generator inventory web tool[12] was queried for Vail zip codes to identify known hazardous waste generators for further screening as needed. The query returned 15 sites (Table 17), many of which were already known via the SWAP stakeholder input sessions for this effort. Most listings were for businesses or government entities capable of producing small quantities of hazardous wastes such as spent fuels or chemical solvents and were conditionally exempt from further permitting or regulation. None of the sites dispose of wastes directly onsite; all are removed for further processing, recycling, or appropriate landfill disposal.

[12] https://enviro.epa.gov/facts/rcrainfo/search.html accessed 2020

EAGLE RIVER WATER & SANITATION DISTRICT

Site ID	Site Name	Address	City, State	Last update	Activities	Waste types
COD983776626	ALPINE STANDARD #1	28 S FRT RD	VAIL, CO	2004		Ignitable waste, corrosive, BTEX
COD983787607	BP AMOCO OIL	934 S FRONTAGE RD	VAIL, CO	2004	Conditionally-exempt small quantity generator	Ignitable waste, benzene
COD983785643	CHEMICAL HANDLING - VAIL CLEANUP	TRUCK RAMP W OF VAIL ON I-70	VAIL, CO	1991	Defunct/NA	Truck ramp clean up potential
COD983773490	COLORADO DEPT OF HWYS - VAIL PAS	I-70 MP 190.00	VAIL, CO	2007		Ignitable, corrosive, lead, MEK, various halogenated solvents
COD983773508	COLORADO DEPT OF HWYS - VAIL PAS	I-70 MP 189.50	VAIL, CO	2007		Ignitable, corrosive, lead, MEK, various halogenated solvents
COD983794298	HOTEL TALISA - VAIL	1300 WESTHAVEN DR	VAIL, CO	2018	Conditionally-exempt small quantity generator	Ignitable, various spent solvents
COD983772070	NATIONAL VELVET	2151 N FRONTAGE RD W	VAIL, CO	2011		Dry cleaning solvents
COR000234377	SAFEWAY STORE #631	2131 N FRONTAGE RD W	VAIL, CO	2014	Conditionally-exempt small quantity generator	Ignitable waste, corrosive waste
COR000016972	SHARPSHOOTER SPECTRUM IMAGING	600 E LIONSHEAD CIR	VAIL, CO		Defunct/NA	Photography development chemicals
COR000226068	SPILL #2011-0791	I-70 AT MILE MARKER 183	NEAR VAIL	2011	Hazardous spill @ mm 186	Methanol-based mixture, 5,000 gal
COR000200790	TOWN OF VAIL	1289 ELKHORN DR	VAIL, CO	2008	Conditionally-exempt small quantity generator	Solvents
COD981544752	U S DEA	75 S FRONTAGE RD	VAIL, CO	1996	Defunct/NA	
COD982590606	VAIL ASSOCIATES INC	862 S FRONTAGE RD W	VAIL, CO	2010	Conditionally-exempt small quantity generator	Hotel wastes; ignitable, corrosive
CO0001017037	VAIL RECREATION DISTRICT	292 W MEADOW DR	VAIL, CO	1995	Conditionally-exempt small quantity generator	
COR000247353	VAIL VALLEY SURGERY CENTER	181 W MEADOW DR STE 3R	VAIL, CO	2018	Conditionally-exempt small quantity generator	Pharmaceutical wastes

Table 17. Resource Conservation and Recovery Act (RCRA) registered sites.

4.5 Riparian Areas

The Gore Creek Water Quality Improvement Plan identified loss or degradation of streamside riparian areas as a primary driver of declining aquatic life conditions. Healthy riparian buffers also protect drinking water quality by reducing fine sediment inputs to streams, stabilizing banks and infrastructure, and attenuating pollutants from impervious surfaces or landscaping practices that are otherwise carried to streams in stormwater runoff. Although some localized disturbance exists in Gore Creek campground from human recreational use, vegetation conditions are native, intact, and robust for a large portion of the upper watershed. Riparian communities are naturalized and protected from development above the surface water intake in East Vail from the public land boundary upstream but have experienced some degradation including reduction of woody species and sediment accumulation below the I-70 bridges, and limited suburban encroachment directly near the intake. Riparian conditions in East Vail neighborhoods along the mainstem of Gore Creek upstream of the municipal wellfield and in the golf course itself exist in various health conditions. Some segments of stream continue to have robust vegetation while others have experienced loss of natural vegetation types, complete clearing and mowing, or hardening and bank armoring. More so than water quality benefits, riparian vegetation communities in the neighborhood and golf course zone surrounding the wellfield serve to protect well infrastructure through bank stabilization and increased channel resilience to flood flows. Wells R7, R4, and R1 in particular may be vulnerable in the event of catastrophic bank loss from extreme flooding events. Ensuring the existence, growth and robust health of naturalized woody vegetation communities (native willow, alder, spruce) in these areas will help guard against this.

TOV has moved assertively to improve riparian conditions throughout the community as part of its Restore the Gore campaign and based on recommended actions in the Gore Creek Strategic Action Plan. Numerous education and outreach programs have targeted private homeowners, landscaping contractors, and town staff to encourage riparian friendly practices for streamside landscaping. Project Rewild is a public assistance program that provides funding for landowners to restore vegetative buffers. Because much of the riparian zone near the wellfields both at the golf course and Donovan Park occurs on municipally owned or managed land (in conjunction with the VRD), the ability to implement vegetation improvement projects is greatly streamlined.

4.6 Golf courses

The Vail Golf Club, a facility managed by the VRD on behalf of the TOV, provides a setting of special consideration due to the land use activities associated with golf course maintenance and its proximity to the primary wellheads for the District's water supply. Co-location of the wellfields and golf course provide both an opportunity to protect the wellheads from residential or urban development and the associated contamination risks with those land uses, while at the same time potentially exposing the wells to surface practices and potential contaminants inherent in golf course operation such as fertilizers and pesticides. The main fuel and chemical storage shop for the course is south and east of the wellfield, contributing very low risk to the aquifer. However, due to the shallow nature of the groundwater wells and surfaces practices required to maintain quality turf, some concern exists from other surface practices. The District's municipal wells range in depth from 70 to 200 feet and are screened at relatively shallow depths. Chemicals applied to the surface including fertilizer, herbicides, and pesticides have some potential for migration beyond the unsaturated vadose zone to the shallow water table and enter the wellfield's radius of influence. Fertilizers frequently contain nitrogen, phosphorus, and potassium, all of which occur in soluble forms capable of moving through groundwater relatively quickly. Nitrates in particular may cause human health effects in drinking water, but all nutrients are capable of amplifying unwanted algal growth or other biologic activity in surface waters or potentially in nuisance biofilm forms within well infrastructure. Pesticides and herbicides common in turf care may contain recalcitrant organochlorines or other compounds which strongly resist natural biodegradation and have potentially high solubilities. In addition to a localized spill event or improper surface storage/mixing/disposal practices, poor turf management practices such as overirrigation can increase the possibility of leaching surface applications beyond the turf and organic horizons of the soil deeper into the unsaturated soil zone and potentially through this zone to the water table below.

4.7 WELLFIELD FLOODING

Flooding of wellhead locations may threaten water sources by damaging infrastructure such as pumps and electrical equipment. Flooding may also contaminate the well bore at the top of the screen, requiring temporary disabling of the source. Vail's municipal wells are located in the valley bottom where alluvial deposits of adequate depth provide suitable well locations. Well locations were compared against the flood Zone AE in currently available National Flood Hazard GIS datasets from either FEMA or Eagle County. Zone AE designates a high-risk zone where the annual flood probability is a 1% chance, often referred to as the 100-year floodplain. This zone is frequently believed to mean that a flood occurs only once in 100 years, however this is an incorrect understanding of statistical descriptors used in flood mapping. Due to cumulative probabilities over an extended time period, a flood flow with a 1% chance in any single year has approximately a 26% (~1 in 4) chance of occurring during a 30-year period (such as the term of a residential mortgage) and a 50% (~ 1 in 2) chance to occur during an average person's lifespan of 70-80 years. Well R4 is in the delineated AE zone, while the other wells range between 25' to 150' linear feet away.

Delineated flood zones are based on computer-modeled static inundation depths only. Dynamic conditions that may occur during a large flood event such as a bank failure or an uprooted tree lodging under a pedestrian or motor bridge may raise localized flood heights beyond model estimates, increasing risk. The majority of the golf course zone, because it is in low-lying alluvium deposits atop which Gore Creek formerly meandered back and forth, is subject to a variety of fluvial hazards during large flood flows. These may include unexpected inundation, avulsions, or other sudden stream channel process changes that could threaten wellheads. Because Gore Creek's peak flows occur during snowmelt rather than warm season precipitation events, peak flows are somewhat predictable based on annual snowpack and localized weather conditions in late spring and early summer. Conditions that may drive very large flood flows include a combination of large snowpack and a block of very warm days, potentially exacerbated by a rain-on-snow episode. While flooding is unlikely to permanently disable a well, temporary issues with access, operation, or sanitary conditions may occur. In the event of likely flooding, the District has the capacity to disable all or portions of the wellfield and draw on integrated supplies from lower on the Eagle River.

Figure not Included in Public Version of Document

Figure 17. Flooding risk to municipal wellfields as characterized by wellhead location relative to the flooding extent of the 1% annual return probability flood.

4.8 PERMITTED AND UNPERMITTED DISCHARGERS

CDPHE provides permits to permitted discharges. Permitted dischargers are regulated and usually have discharge limits associated with the permit. Permitted dischargers include

- Municipal wastewater treatment facilities,
- Pretreatment,
- Drinking water treatment facilities,
- Structures with groundwater dewatering,
- Stormwater discharges from construction activities with disturbance of one or more acres,
- Municipal separate storm sewer system (MS4), and

- Industrial stormwater.

Table 18 contains current permitted dischargers.

Permit Sector	General Permit Type	Permit ID	Permit Status	Issue Date	Effective Date	Expiration Date
Public and private utilities	CO-Individual permit	CO0024431	Admin continued	12/30/2010	2/1/2011	1/31/2016
Public and private utilities	COG641000-Water treatment plant wastewater discharge	COG641058	Admin continued	1/9/2006	2/1/2006	10/31/2010
Commerce and industry	COR900000-Industrial stormwater	COR901387	Admin continued	11/28/2017	11/28/2017	6/30/2020
Construction	COR400000-Stormwater discharge associated with construction activities	COR405415	Effective	5/13/2019	5/13/2019	3/31/2024
Public and private utilities	CO-Individual permit	CO0037311	Effective	1/29/2021	3/1/2021	2/28/2026
Public and private utilities	COG641000-Water treatment plant wastewater discharge	COG641105	Admin continued	1/19/2006	2/1/2006	10/31/2010
Construction	COR400000-Stormwater discharge associated with construction activities	COR404383	Effective	4/1/2019	4/1/2019	3/31/2024
Commerce and industry	COR900000-Industrial stormwater	COR901386	Admin continued	11/28/2017	11/28/2017	6/30/2020
Public and private utilities	CO-Individual permit	CO0021369	Effective	1/29/2021	3/1/2021	2/28/2026
Construction	COG317000-Short-Term Remediation Activities	COG318043	Effective	1/4/2021	2/1/2021	5/31/2025
Construction	COG318000-Long-Term Remediation Activities	COG318062	Effective	4/2/2021	5/1/2021	5/31/2025
Construction	COG318000-Long-Term Remediation Activities	COG318064	Effective	4/7/2021	5/1/2021	5/31/2025
Construction	COG318000-Long-Term Remediation Activities	COG318079	Effective	6/3/2021	8/1/2021	5/31/2025
Construction	COR400000-Stormwater discharge associated with construction activities	COR402127	Effective	4/1/2019	4/1/2019	3/31/2024
Commerce and industry	COR900000-Industrial stormwater	COR901384	Admin continued	11/28/2017	11/28/2017	6/30/2020
Construction	COG318000-Long-Term Remediation Activities	COG318065	Effective	4/15/2021	6/1/2021	5/31/2025
Construction	COR400000-Stormwater discharge associated with construction activities	COR404840	Effective	4/1/2019	4/1/2019	3/31/2024
Construction	COR400000-Stormwater discharge associated with construction activities	COR404841	Effective	4/1/2019	4/1/2019	3/31/2024

Table 18. Permitted Dischargers

Unpermitted discharges mean the discharge of pollutants from a point source into waters of the United States or the State which is not authorized by a National Pollutant Discharge Elimination System (NPDES) Permit. Unpermitted discharges include but are not limited to the following discharges.

- Stormwater,
- Paint, oil, antifreeze, other chemicals, trash or debris poured into a storm drainage system
- Chlorinated swimming pools and hot tubs,
- Snowmaking operations,

- Sanitary sewer overflows,

In Vail, stormwater is not regulated under MS4. Stormwater runoff has the potential to carry contaminants into Gore Creek which can adversely affect source water quality. Town of Vail has installed BMPs to help filter out pollutants before entering Gore Creek.

While water we use in our homes and businesses drain to a treatment plant, stormwater and anything else dumped or spilled outside flows into the storm drain system and directly to our waterways. Stormwater pollution has many sources. One of the most common is illegal dumping or spilling of wastes directly into storm drains, like pouring used motor oil or paint directly into a storm drain. Pollutants also enter storm drains when it rains or snows: rain runs off roofs, streets, parking lots and other paved surfaces and flows directly into nearest storm drain picking up pollutants along the way. Rain, as well as waters from hoses and sprinklers, carries detergent from car washings as well as pesticides, and fertilizers to the storm drain. From the storm drain, water flows (directly) to the nearest waterway – garbage, dirt, toxins and all.

If swimming pool or hot tub water has chlorine in it, then that water can be extremely harmful to aquatic life. Discharging chlorinated pool water is considered an illicit discharge. Discharges from swimming pools can be directed to the storm drain, provided the water does not have a harmful impact on the environment. Therefore, pool water must be dechlorinated and tested for chlorine prior to discharge to the storm drain system. ERWSD allows swimming pools and hot tubs to be discharged into the sanitary sewer as long as they are notified prior to the discharge and the water has been dechlorinated.

Snowmaking water contains an algaecide that may be harmful to fish and other aquatic life. It is likely that the types of impacts to benthic macroinvertebrates included mortality (particularly among sensitive taxa) and displacement (some species 'drift' downstream when confronted by changes in water quality).

Occasionally, sanitary sewers will release raw sewage. These types of releases are called sanitary sewer overflows (SSOs). SSOs can contaminate our waters, causing serious water quality problems, and back-up into homes, causing property damage and threatening public health. SSOs that reach waters of the U.S. are point source discharges. Like other point source discharges from municipal sanitary sewer systems, SSOs are prohibited unless authorized by a NPDES permit. Moreover, SSOs, including those that do not reach waters of the U.S., may be indicative of improper operation and maintenance of the sewer systems, and may violate NPDES permit conditions.

5 EXISTING AND RECOMMENDED BEST MANAGEMENT PRACTICES

The Gore Creek watershed is host to a variety of drinking water concerns and threats. While small-scale fuel and chemical storage is prevalent, the location, total volume, and potential for migration to raw water collection infrastructure is relatively low and reduces concern. The primary concerns of stakeholders consist of the low-probability/high-consequence threats created by transportation activities and catastrophic wildfire. Because transportation incidents are difficult to predict and highly variable in their ability to impact water infrastructure, individual BMPs are difficult to identify. Stakeholder efforts in this topic area may be best focused in supporting CDOT when periodic opportunities for safety improvements to the travel corridor arise and participating in robust planning and training for spill response actions with partner entities like CDOT, TOV, VFD, Colorado State Patrol, and EC. Mitigating wildlife risks is an extremely difficult task given the geographic scale of issues, the multi-jurisdictional nature of public lands management, and difficulties inherent in predicting occurrence and severity. ERWSD is fortunate that groundwater sources in developed urban areas are relatively robust against wildfire impacts, however it remains highly important to support collaborative local efforts to plan, approve, and fund wildfire mitigation on neighboring public lands.

The following table (Table 19) describes the major issues identified in the assessment process as well as existing or potential capital and programmatic Best Management Practices (BMPs) that target each particular issue. It is not an exhaustive list, and the intention is for it to serve as a living/aspirational document to help identify and prioritize funding and implementation for SWAP-related actions. Best Management Practices are the set of actions that may be implemented in the source water protection area to mitigate or reduce risks posed by Potential Sources of Contaminants. BMPs may be structural (tangible/physical engineering solutions such as stormwater infrastructure or forest thinning), or programmatic (policy actions such as designating a setback from wellheads for application of chemicals).

BMPs and actions have been identified through a variety of methods including expert knowledge of ERSWD staff or local government staff, knowledge or review of industry best practices, and stakeholder/partner elicitation and discussion. Priorities and rankings may change over time based on new information or changing contaminant threats.

Issue	Sub-issue	Priority Ranking	Best Management Practices	Responsible Entity	Status (Incomplete/ Partial/ Complete)	Estimated Costs (if project development has occurred)	Potential Funding Sources
Transportation corridors	Stormwater runoff: sediment and salinity		Engage CDOT planning processes for SCAP update/implementation sediment capture, salinity and aquatic life monitoring. Identify zones of especially high sediment load generation or sensitive areas for targeted protections.	CDOT, TOV, ERWSD, ERWC, CDPHE	In-progress		
	Spill release		Maintain and update spill response plan. Participate in joint incident scenarios with CDOT/Colorado State Patrol/TOV.	ERWSD, TOV, CDOT, EC, Colorado State Patrol	Complete		
			Support WVP safety improvements (curve realignment, etc.) to reduce incident frequency.	CDOT	In-progress		
			Outreach to first responders to understand water impacts of spill incidents and rapid notification.	TOV, Colorado State Patrol, EC			
			Characterize surface-groundwater connections (groundwater movement rates) in the wellfield area.	ERWSD	Complete (GWUDI study by Leonard Rice Engineers)		

EAGLE RIVER WATER & SANITATION DISTRICT

Issue	Sub-issue	Priority Ranking	Best Management Practices	Responsible Entity	Status (Incomplete/ Partial/ Complete)	Estimated Costs (if project development has occurred)	Potential Funding Sources
Wildfire/Forest health	Fuels reduction and forest health projects (thinning, critical breaks)		Participate in ongoing county (ECO), municipal (TOV) and/or federal (USFS) processes for forest health planning, wildfire assessment, and mitigation. Participate in funding and implementation decisions to help prioritize fuels reduction near reservoir infrastructure.	USFS, TOV, ECO, Colorado State Forest Service, ERWSD	Partial		
	Reservoir safety and remote monitoring equipment integrity		Define vegetation setback targets for critical water resource infrastructure. Promote fuels reduction projects near reservoirs as a priority.	TOV, ERWSD	Partial		
			Ensure access is prepared and ready for critical events.	TOV, ERWSD	Complete		
Dispersed land use practices/ chemical use			Support TOV education outreach campaigns (Restore The Gore; Project Re-Wild, Creekside Landscaping outreach).	TOV	Partial		
Operational fuels and chemical storage	Incomplete understanding of current BMP status		Catalog existing BMPs or update BMP records.	TOV, VR, private			
	Location near sensitive resources		Contemplate location/relocation as needed if proximity to water resources	Various			

Issue	Sub-issue	Priority Ranking	Best Management Practices	Responsible Entity	Status (Incomplete/ Partial/ Complete)	Estimated Costs (if project development has occurred)	Potential Funding Sources
			is considered problematic.				
Riparian management	Water quality protection/ runoff attenuation		Support TOV Project Re-Wild goals and implementation.	TOV	Partial		
	Hydrogeo-morphic issues (bank stability)		Promote robust woody vegetation preservation/restoration/enhancement near wellheads. Consider green/soft armoring techniques when necessary.	TOV, ERWSD, VRD			
Golf Course	Chemical applications in wellhead Sensitivity Zone 1		Understand/work with VRD to calibrate application rates for fertilizers and pesticides to reduce movement beyond the vadose zone into water tables. Establish sensitive wellhead protection zones that may have additional restrictions or prohibitions such as a 'no-spray zone' on certain chemical uses.	VRD, ERWSD, TOV			
	Near-surface groundwater monitoring		Conduct ongoing near-surface groundwater monitoring for nutrients and selected organic chemicals (pesticide/herbicide) in Sensitivity Zone 1.	VRD, ERWSD			

Issue	Sub-issue	Priority Ranking	Best Management Practices	Responsible Entity	Status (Incomplete/ Partial/ Complete)	Estimated Costs (if project development has occurred)	Potential Funding Sources
	Riparian conditions for geomorphic stability and protection of wellhead infrastructure		Support TOV work on riparian vegetation conditions near wellfield.	TOV, VRD, ERWSD			
Wellfield flooding	Wellheads in Zone AE (100-year floodplain) or in Fluvial Hazard Zone		Protect floodplain extent from development and redevelopment. Consider re-location of R4 outside of FEMA zone AE at end-of-lifecycle. Consider an elevated wellhead facility.	ERWSD, TOV, VRD			

Table 19. Existing and recommended Best Management Practices (BMPs).

EAGLE RIVER WATER & SANITATION DISTRICT

6 APPENDICES

1. Full Potential Sources of Contamination Inventory

Appendix 1. Potential Sources of Contamination Inventory

(Last updated 11/2020. Available as spreadsheet)

Entity	Contaminant	Contaminant type	Contaminant Risk Category	Contaminant Type	Location Description	Address	Quantity	Units	SDS Available	Data Source	Tank FacID	SWP Zone	Probability of Impact	Probability Score	Impact Level	Impact Score	Risk Score	Risk	Control Level	Existing BMP	Recommended BMP
Public	Wildfire	Infrastructure damage, sediment, pollutants	Wildfire	Dispersed/non-point	Watershed wide					Community wildfire plan and TOV datasets		SW2	possible	3	significant	3	9	Moderate	none	Fuels reduction plan implementation in progress	
Public	Highway chemical spill	Chemicals, non-fuel	Transportation/roads	Dispersed/non-point	Any in vicinity of R4, R2/R6, or R7							GW1, GW2, GW3	unlikely	2	significant	3	6	Moderate	none	ERWSD Highway spill response plan, spill response/HAZMAT plan and training Vail Fire Dept, spill response CDOT	
Private	ISDS; pathogens in surface and groundwater from leaky/old/inappropriate systems	Pathogens	OWTS	Dispersed/non-point	unknown number and location in TOV							GW2	rare	1	insignificant	1	1	Very Low	none		
CDOT	Diesel	Fuel	Operational storage	Discrete/point	CDOT Vail Pass		6000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	1760		rare	1	insignificant	1	1	Very Low	indirect		
ERWSD	Sodium Hypochlorite NACIO	Chemicals, non-fuel	Operational storage	Discrete/point	GVDWF				Y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct		
ERWSD	Carus 4200	Chemicals, non-fuel	Operational storage	Discrete/point	GVDWF		90	gal	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on a secondary containment pallet- low risk of dispersal	
ERWSD	Calcium Hypochlorite Tablets (Ca(ClO)2)	Chemicals, non-fuel	Operational storage	Discrete/point	R7		240	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored in locked buckets. Low risk of dispersal	
ERWSD	Sodium Fluoride (NaF)	Chemicals, non-fuel	Operational storage	Discrete/point	R7		300	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on a secondary containment pallet- dry bags. Low risk of dispersal	
ERWSD	Carus 4200	Chemicals, non-fuel	Operational storage	Discrete/point	R7		90	gal	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on a secondary containment pallet. Low risk of dispersal	
ERWSD	Calcium Hypochlorite (Ca(ClO)2)	Chemicals, non-fuel	Operational storage	Discrete/point	R1		180	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored in locked buckets. Low risk of dispersal	
ERWSD	Sodium Fluoride (NaF)	Chemicals, non-fuel	Operational storage	Discrete/point	R1		200	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on an elevated pallet, dry bags. Low risk of dispersal	
ERWSD	Carus 4200	Chemicals, non-fuel	Operational storage	Discrete/point	R1		60	gal	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on a secondary containment pallet. Low risk of dispersal	
ERWSD	Calcium Hypochlorite (Ca(ClO)2)	Chemicals, non-fuel	Operational storage	Discrete/point	R2/R6		720	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored in locked buckets and placed on a secondary containment pallet. Low risk of dispersal	
ERWSD	Sodium Fluoride (NaF)	Chemicals, non-fuel	Operational storage	Discrete/point	R2/R6		300	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Dry bags- Stored on an elevated pallet- low risk of dispersal	
ERWSD	Carus 4200	Chemicals, non-fuel	Operational storage	Discrete/point	R2/R6		90	gal	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on a secondary containment pallet. Low risk of dispersal	
ERWSD	Calcium Hypochlorite (Ca(ClO)2)	Chemicals, non-fuel	Operational storage	Discrete/point	R4		240	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored in locked buckets. Low risk of dispersal	
ERWSD	Sodium Fluoride (NaF)	Chemicals, non-fuel	Operational storage	Discrete/point	R4		250	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Dry bags stored on an elevated pallet- low risk of dispersal	
ERWSD	Carus 4200	Chemicals, non-fuel	Operational storage	Discrete/point	R4		90	gal	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	stored on a secondary containment pallet- low risk of dispersal	
ERWSD	Calcium Hypochlorite (Ca(ClO)2)	Chemicals, non-fuel	Operational storage	Discrete/point	WV7/WV8		120	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored in locked buckets	
ERWSD	Sodium Fluoride (NaF)	Chemicals, non-fuel	Operational storage	Discrete/point	WV7/WV8		200	lbs	y	self inventory		GW1	rare	1	minor	2	2	Very Low	direct	Stored on an elevated pallet	
ERWSD	Security/vandalizm/damage to source water infrastructure	Infrastructure damage	Security	Dispersed/non-point	all					self inventory		GW1	rare	1	major	4	4	Low	direct		
Private	LPG	Fuel	Operational storage	Discrete/point	West Vail Conoco	2154 S Frontage Rd	500	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	3298		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	West Vail Conoco	2154 S Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	3298		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Premium (PUL)	Fuel	Operational storage	Discrete/point	West Vail Conoco	2154 S Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	3298		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	West Vail Conoco	2154 S Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	3298		rare	1	minor	2	2	Very Low	indirect		

Entity	Contaminant	Contaminant type	Contaminant Risk Category	Contaminant Type	Location Description	Address	Quantity	Units	SDS Available	Data Source	Tank FacID	SWP Zone	Probability of Impact	Probability Score	Impact Level	Impact Score	Risk Score	Risk	Control Level	Existing BMP	Recommended BMP
Private	Diesel	Fuel	Operational storage	Discrete/point	West Vail Conoco	2154 S Frontage Rd	10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	3298		rare	1	minor	2	2	Very Low	indirect		
Private	Waste Oil	Chemicals, combustible	Operational storage	Discrete/point	West Vail Conoco		550	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	3298		rare	1	insignificant	1	1	Very Low	indirect		
Private	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	Vail 66 Service		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	1945		rare	1	minor	2	2	Very Low	indirect		
Private	Diesel	Fuel	Operational storage	Discrete/point	Vail 66 Service		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	1945		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Premium (PUL)	Fuel	Operational storage	Discrete/point	Vail 66 Service		12000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	1945		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Premium (PUL)	Fuel	Operational storage	Discrete/point	West Vail Shell	2313 N Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10133		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	West Vail Shell	2313 N Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10133		rare	1	minor	2	2	Very Low	indirect		
Private	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	West Vail Shell	2313 N Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10133		rare	1	minor	2	2	Very Low	indirect		
Private	Diesel	Fuel	Operational storage	Discrete/point	West Vail Shell	2313 N Frontage Rd	8000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10133		rare	1	insignificant	1	1	Very Low	indirect		
Town of Vail	Magnesium chloride tank	Chemicals, non-fuel	Operational storage	Discrete/point	Public works	1309 Elkhorn Dr	10,000	gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Double walled tank	
Town of Vail	Gas	Fuel	Operational storage	Discrete/point	Public works	1309 Elkhorn Dr	12000	gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Double-walled underground tanks with leak sensors in interstitial space. Curb containment for spills on surface	
Town of Vail	Diesel	Fuel	Operational storage	Discrete/point	Public works	1309 Elkhorn Dr	12000	gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect		
Town of Vail	Used oil, indoor tank	Fuel	Operational storage	Discrete/point	Public works	1309 Elkhorn Dr	300	gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Double-walled tanks	
Town of Vail	Used oil, outdoor tank	Fuel	Operational storage	Discrete/point	Public works	1309 Elkhorn Dr	500	gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect		
Town of Vail	Bulk oil storage, diesel and 5w30	Chemicals, combustible	Operational storage	Discrete/point	Indoors at public works	1309 Elkhorn Dr	375	gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Sit in a room with a containment pit and barrier at the door	
Town of Vail	Diesel exhaust fluid	Fuel	Operational storage	Discrete/point	Near fuel island at Public Works	1309 Elkhorn Dr	1000	gal	Urea	self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Tank sits inside separate plastic containment tub	
Town of Vail	Flammable/ caustic chemical cabinets	Chemicals, non-fuel	Operational storage	Discrete/point	20 separate cabinets in carpenter bay, sign shop, fleet bay, landscaping bay and streets bay			gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Closed and locked cabinets	
Town of Vail	Propane cage	Fuel	Operational storage	Discrete/point	Locked cage			gal		self-inventory			rare	1	insignificant	1	1	Very Low	indirect	Closed and locked cage	
Town of Vail	Diesel	Fuel	Operational storage	Discrete/point	Vail Central Office		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	9527		rare	1	minor	2	2	Very Low	indirect		
Vail Fire Department	Class B firefighting foams with PFAS	Chemicals, non-fuel	Operational storage	Discrete/point	Station 2		50	gal		self inventory			rare	1	insignificant	1	1	Very Low	indirect		
Vail Fire Department	Class B firefighting foams with PFAS	Chemicals, non-fuel	Operational storage	Discrete/point	Station 1		50	gal		self inventory			rare	1	insignificant	1	1	Very Low	indirect		
Vail Fire Department	Class B firefighting foams with PFAS	Chemicals, non-fuel	Operational storage	Discrete/point	Station 3		50	gal		self inventory			rare	1	insignificant	1	1	Very Low	indirect		
Vail Health	Diesel - #2	Fuel	Operational storage	Discrete/point	Vail Valley Medical Center		6000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	2478		rare	1	insignificant	1	1	Very Low	indirect		
Vail Health	Diesel	Fuel	Operational storage	Discrete/point	Underground storage tank		22000	gal		self inventory			rare	1	insignificant	1	1	Very Low	indirect		
Vail Health	Diesel	Fuel	Operational storage	Discrete/point	Above Ground storage tank		6000	gal		self inventory			rare	1	insignificant	1	1	Very Low	indirect		
Vail Health	Firefighting foam, non-PFAS	Chemicals, non-fuel	Operational storage	Discrete/point	Heli pad		100	gal		self inventory			rare	1	minor	2	2	Very Low	indirect		
Vail Recreation District	Fertilizers, various formulations of both granular and liquid	Chemicals, non-fuel	Non-residential land use practices	Discrete/point	Storage garage and chemical storage building at 1278 Vail Valley Drive			gal	y	self inventory			unlikely	2	minor	2	4	Low	indirect	Storage garage and chemical storage building at 1278 Vail Valley Drive	

Entity	Contaminant	Contaminant type	Contaminant Risk Category	Contaminant Type	Location Description	Address	Quantity	Units	SDS Available	Data Source	Tank FacID	SWP Zone	Probability of Impact	Probability Score	Impact Level	Impact Score	Risk Score	Risk	Control Level	Existing BMP	Recommended BMP
Vail Recreation District	Herbicides, Fungicides, Growth regulators, Wetting Agents	Chemicals, non-fuel	Non-residential land use practices	Discrete/point	Chemical Storage building at 1278 Vail Valley Drive	1278 Vail Valley Drive		gal	y	self inventory			unlikely	2	minor	2	4	Low	indirect	Chemical Storage building at 1278 Vail Valley Drive	
Vail Recreation District	Golf course maintenance products; various. Oil, solvents, engine coolant etc	Chemicals, non-fuel	Non-residential land use practices	Discrete/point	Equipment Manager shop of Maintenance Facility at 1278 Vail Valley Drive	1278 Vail Valley Drive		gal	y	self inventory			unlikely	2	minor	2	4	Low	indirect	Equipment Manager shop of Maintenance Facility at 1278 Vail Valley Drive	
Vail Recreation District	Fuel, unleaded and diesel	Fuel	Operational storage	Discrete/point	Fuel station at maintenance facility at 1278 Vail Valley Drive	1278 Vail Valley Drive	500	gal	y	self inventory			unlikely	2	minor	2	4	Low	indirect	Fuel station at maintenance facility at 1278 Vail Valley Drive	
Vail Recreation District	Diesel/Gasoline (Multi-Comp)	Fuel	Operational storage	Discrete/point	Vail Recreation Golf Course Maintenance Facility		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	2545		rare	1	minor	2	2	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Ski Patrol PHQ - Collett		20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7633		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Ski Patrol PHQ - Collett		20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7633		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	Vail Ski Patrol PHQ - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7633		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Ski Patrol Far East- Collett		20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	18468		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Ski Patrol Far East- Collett		20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	18468		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Riva Bahn Chair 6		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	17607		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	Town Of Vail		12000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	6184		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel	Fuel	Operational storage	Discrete/point	Town Of Vail		12000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	6184		rare	1	minor	2	2	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel	Fuel	Operational storage	Discrete/point	Vail Game Creek Chair 7		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	17608		rare	1	minor	2	2	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel	Fuel	Operational storage	Discrete/point	Vail Mountain Gondola #1		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	19322		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel	Fuel	Operational storage	Discrete/point	Vail Mountain Gondola #1		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	19322		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Snow Summit - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7070		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	Vail Snow Summit - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7070		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	Vail Snow Central - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7074		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Snow Central - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7074		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Snow Central - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7074		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Mountain Ledges - Collett		30000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	16110		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Mountain Ledges - Collett		30000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	16110		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Mountain Ledges - Collett		30000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	16110		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	

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Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Mountain Ledges - Collett		30000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	16110		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Mountain Ledges - Collett		30000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	16110		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Eagles Nest		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	18393		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Kerosene	Fuel	Operational storage	Discrete/point	Vail Eagles Nest		3000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	18393		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Eagles Nest - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7066		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Eagles Nest - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7066		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Eagles Nest - Collett		10000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	7066		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Pride Chair 26		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	17604		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel - Dyed #2	Fuel	Operational storage	Discrete/point	Vail Born Free Chair 8		1000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	17609		rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel	Fuel	Operational storage	Discrete/point	Vail Vehicle Maintenance - Collett	862 S Frontage Rd	20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10500		rare	1	minor	2	2	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Gasoline - Unleaded Regular (RUL)	Fuel	Operational storage	Discrete/point	Vail Vehicle Maintenance - Collett	862 S Frontage Rd	20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10500		rare	1	minor	2	2	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	Diesel	Fuel	Operational storage	Discrete/point	Vail Vehicle Maintenance - Collett	862 S Frontage Rd	20000	gal		https://opus.cdle.state.co.us/OIS2000/home.asp	10500		rare	1	minor	2	2	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
Vail Resorts	super crop fertilizer	Chemicals, non-fuel	Non-residential land use practices	Discrete/point	mountainwide usage					self-inventory			rare	1	insignificant	1	1	Very Low	none	Double walled tanks, Secondary containment, automated leak detection	
USFS	Fecal coliform bacteria, non-system waste disposal facility	Pathogens	OWTS	Dispersed/non-point	Gore Creek Campground	Big Horn Road				self inventory		1	rare	1	insignificant	1	1	Very Low	none	maintain USFS inspection and maintenance schedule for facility	
Town of Vail	Fecal coliform bacteria, pet waste	Pathogens	Recreation, pets	Dispersed/non-point	Bighorn Park	E Meadow Dr				self inventory			rare	1	minor	2	2	Very Low	indirect	Free pet waste bags and disposal	
Town of Vail	Fecal coliform bacteria, pet waste	Pathogens	Recreation, pets	Dispersed/non-point	Stephen's Park	South Frontage Road				self inventory			rare	1	minor	2	2	Very Low	indirect	Free pet waste bags and disposal	
Private	Home use chemicals, lawn and garden	Chemicals, non-fuel	Residential practices	Dispersed/non-point	n/a								rare	1	insignificant	1	1	Very Low	indirect	Overlaps with education/outreach campaigns for existing programs like Restore The Gore	
ERWSD	Flooding of intake or well infrastructure	Infrastructure damage	Flooding	Discrete/point	East Vail well heads, R7, R2/6, R4					self inventory			unlikely	2	minor	2	4	Low	indirect		
Private	Illicit discharges	Pathogens			multiple/unknown, generally on town reach near hotels etc																