Indian Hills Water District
Source Water Protection Plan

Jefferson County, Colorado
March 14, 2017

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For the Water Provider:
Indian Hills Water District: ID # CO0130065

Cover photo by Cheryl Touryan

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ACRONYMS

AST	Aboveground Storage Tank
BMP	Best Management Practice
CAP	Cleanup Action Plan
CCR	Consumer Confidence Report
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CRWA	Colorado Rural Water Association
CWCB	Colorado Water Conservation Board
DOC	Dissolved Organic Carbon
DOLA	Department of Local Affairs
DWR	Division of Water Resources
EAP	Emergency Action Plan
EPA	Environmental Protection Agency
GIS	Geographic Information System
IHWD	Indian Hills Water District
MOU	Memorandum of Understanding
NRCS	Natural Resource Conservation Service
OEM	Office of Emergency Management
OWTS	Onsite Wastewater Treatment System
PSOC	Potential Source of Contamination
SDWA	Safe Drinking Water Act
SWAA	Source Water Assessment Area
SWAP	Source Water Assessment and Protection
SWPA	Source Water Protection Area
SWPP	Source Water Protection Plan
USDA	United States Department of Agriculture
UST	Underground Storage Tank

EXECUTIVE SUMMARY

There is a growing effort in Colorado to protect community drinking water sources from potential contamination. Many communities are taking a proactive approach to preventing the pollution of their drinking water sources by developing a source water protection plan. A source water protection plan identifies a source water protection area, lists potential contaminant sources and outlines best management practices to implement to decrease risks to the water source. Implementation of a source water protection plan provides an additional layer of protection at the local level beyond drinking water regulations.

The Indian Hills Water District (IHWD) values a clean, high quality drinking water supply and decided to work collaboratively with area stakeholders to develop a source water protection plan (SWPP). The source water protection planning effort consisted of public planning meetings and individual meetings with the water operator during the months of September 2016 through February 2017 at the Indian Hills Community Hall and Indian Hills Fire House in Indian Hills, Colorado. During the development of this SWPP, interested stakeholders gathered to develop and implement this SWPP. The Colorado Rural Water Association was instrumental in this effort by providing technical assistance in the development of this SWPP.

The IHWD obtains their drinking water from groundwater in the Parmalee Gulch and Turkey Creek aquifers. The source water protection area (SWPA) includes the Turkey Creek watershed. This SWPA is the area that Indian Hills Water District has chosen to focus its source water protection measures to reduce source water susceptibility to contamination.

The stakeholders conducted an inventory of potential contaminant sources and identified other issues of concern within the SWPA that may impact the drinking water sources. The stakeholders ranked the issues of concern in priority as wildland fire, septic systems, climate change and drought, spills on roads, residential lot sizes, future development, storage tanks, open and abandoned wells, deicers on roadways, stormwater runoff, herbicides, fertilizers, wastewater dischargers, flooding, horse properties, development (modifications to existing), and hazardous waste generators.

The stakeholder group developed several best management practices (BMPs) that may help reduce the risks from the potential contaminant sources and other issues of concern. The BMPs are centered on the themes of building partnerships with community members and local decision makers; raising awareness of the value of protecting community drinking water supplies; and empowering local communities to become stewards of their drinking water supplies by taking actions to protect their water sources.

At the completion of this plan, members of the stakeholder group will meet to develop an action plan of BMPs to implement during 2017. It is recommended that the SWPP be reviewed at a frequency of once every three years or if circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

INTRODUCTION

The Indian Hills Water District operates a Public Water System subject to Safe Drinking Water Act (SDWA) regulations that supplies drinking water to approximately 400 residences located within Parmalee Gulch in Jefferson County, Colorado. Indian Hills Water District obtains their drinking water from groundwater in the fractured rock and alluvial aquifers of Parmalee Gulch and Turkey Creek. They recognize the potential for contamination of the source of their drinking water, and realize that it is necessary to develop a protection plan to prevent the contamination of this valuable resource. Proactive planning and implementing contamination prevention strategies are essential to protect the long-term integrity of their water supply and to limit their costs and liabilities.[1]

Table 1. Primary Contact Information for the Indian Hills Water District

PWSID	PWS Name	Name	Address	Phone
CO0130065	Indian Hills Water District	Kristin Waters	P.O. Box 710 Indian Hills, CO 80454	303-697-8810

Purpose of the Source Water Protection Plan

The Source Water Protection Plan is a tool for the Indian Hills Water District to ensure clean and high quality drinking water sources for current and future generations. This SWPP Plan is designed to:

- Create an awareness of the community's drinking water sources and the potential risks to surface water and/or groundwater quality within the watershed;
- Encourage education and voluntary solutions to alleviate pollution risks;
- Promote management practices to protect and enhance the drinking water supply;
- Provide for a comprehensive action plan in case of an emergency that threatens or disrupts the community water supply.

Developing and implementing source water protection measures at the local level (i.e., county and community) will complement existing regulatory mandates implemented at the state and federal governmental levels by filling any gaps through local management strategies that are collaboratively developed.

[1] The information contained in this Plan is limited to that available from public records and the Indian Hills Water District at the time that the Plan was written. Other potential contaminant sites or threats to the water supply may exist in the source water protection area that are not identified in this Plan. Furthermore, identification of a site as a "potential contaminant site" should not be interpreted as one that will necessarily cause contamination of the water supply.

Protection Plan Development

The Colorado Rural Water Association's (CRWA) Source Water Protection Specialist, Mark Williams, helped facilitate the source water protection planning process. The goal of the CRWA's Source Water Protection Program is to assist rural and small communities served by public water systems to reduce or eliminate the potential risks to drinking water supplies through the development of source water protection plans, and aid with the implementation of prevention measures.

The source water protection planning effort consisted of a series of public planning meetings and individual meetings (Table 2). Information discussed at the meetings helped the Indian Hills Water District develop an understanding of the issues affecting source water protection for the community. The stakeholder group then made recommendations for management approaches to be incorporated into the SWPP. In addition to the planning meetings, data and other information pertaining to the SWPA was gathered via public documents, internet research, phone calls, emails, and field trips to the SWPA. A summary of the meetings is represented below.

Table 2. Planning Meetings

Date	Purpose of Meeting
September 28, 2016	First Planning Meeting – Presentation on the process of developing a source water protection plan for the Indian Hills Water District. Review of Colorado's source water assessment and the delineation of the source water protection area.
October 12, 2016	Second Planning Meeting – Re-delineated source water protection area; developed an inventory of potential contaminant sources and issues of concern.
November 10, 2016	Third Planning Meeting – Prioritized issues of concern; developed best management approaches to implement to decrease risks to the drinking water sources.
January 11, 2017	Fourth Planning Meeting – Jefferson County Public Health presentation. Continued discussions of appropriate best management approaches to implement.
March 9, 2017	Fifth Planning Meeting - Reviewed and edited draft Source Water Protection Plan; appointed stakeholder group members to help implement the Plan; and set the date for the final edits and first plan implementation meeting.

Stakeholder Participation in the Planning Process

Source water protection was founded on the concept that informed citizens, equipped with fundamental knowledge about their drinking water source and the threats to it, will be the most effective advocates for protecting this valuable resource. The Indian Hills Water District's

source water protection planning process attracted interest and participation from 29 stakeholders including landowners, water operators, local and county governments, and agency representatives (Table 3). During the months of September 2016 – February 2017, five stakeholder meetings were held at the Indian Community Hall and Indian Hills Fire House in Indian Hills, Colorado to encourage local stakeholder participation in the planning process. Input from these participants was greatly appreciated.

Table 3. Table of Stakeholders Who Participated on the Stakeholder Group

Stakeholder	Title	Affiliation
Kristin Waters	Office Manager	Indian Hills Water District
Steve Hosie	Board President	Indian Hills Water District
Randy Evans	Operations and Maintenance	Indian Hills Water District
Nelson Goodreau	Board Member	Indian Hills Water District
Kayra Pearson	Resident	Indian Hills
Chad Pearson	Resident	Indian Hills
Maureen Hodgins	Resident	Indian Hills
Holly Ryan	Resident	Indian Hills
Paul Ryan	Resident	Indian Hills
Joe Calabrese	Resident	Indian Hills
Carol Monroe	Resident	Indian Hills
Jim Rada	Environmental Health Director	Jefferson County Public Health
Roy Laws	Environmental Health Services	Jefferson County Public Health
Margaret Herzog	Professional Engineer/Researcher	PH Associates, LLC
Kevin Reese	Resident	Indian Hills
Joyce Reese	Resident	Indian Hills
Mike Fahy	Resident/ Retired Hydrologist	Evergreen Highlands
Ken Touryan	Resident	Indian Hills
Cheryl Touryan	Resident	Indian Hills
John Beard	Resident	Indian Hills
John Severing	Resident	Indian Hills
Emery Carson	Fire Chief	Indian Hills Fire Rescue
Mary Wagner	Resident	Indian Hills
Ron Williams	Resident	Indian Hills
Tris Woolen	Resident	Indian Hills
Nick Nelson	Planner	Jefferson County Planning and Zoning
David Weeks	Firefighter	Indian Hills Fire Rescue
Randy Rudloff	Fire Marshall	Indian Hills Fire Rescue
Mark Williams	Source Water Protection Specialist	Colorado Rural Water Association

WATER SUPPLY SETTING

Location and Description

The Indian Hills Water District provides drinking water to residents of the unincorporated subdivision of Indian Hills in Jefferson County, Colorado. The District is located approximately six miles up U.S. Highway 285 from the mouth of Turkey Creek canyon in central Colorado. This small rural community is located at Latitude 39°37’02”N, Longitude 105°14’13”W at an elevation ranging from 6,800 to 7,500 feet.

Jefferson County is located in central Colorado on the eastern side of the Continental Divide (Fig. 1). The County covers a total area of 774 square miles and according to the 2010 U.S. Census, has a population of 534,543 people. Seven percent of the population lives in rural areas (DOLA, 2012). The county seat is located in the city of Golden.

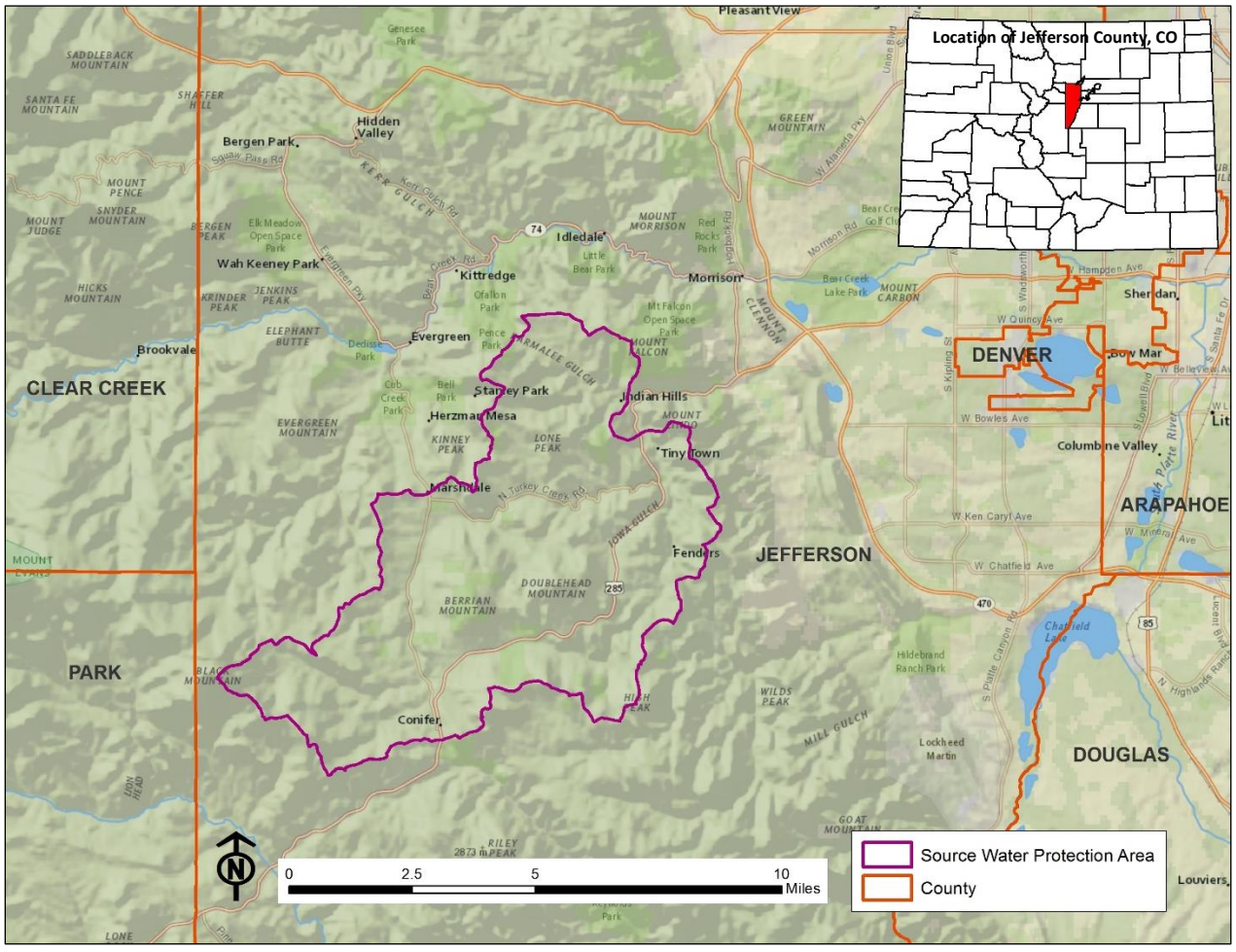


Figure 1. Regional setting map.

Physical Characteristics

The Indian Hills Water District's source water protection area, the Turkey Creek and Parmalee Gulch watersheds, lies within the Southern Rocky Mountains physiographic province area that encompasses the center of the state and runs its entire north-south length. Most of the source water protection area lies within the crystalline mid-elevation forest ecological zone (7,000-9,000 feet). The area is partially glaciated with low mountain ridges, slopes, and outwash fans. Natural vegetation includes aspen, ponderosa pine, Douglas-fir, and areas of lodgepole pine and limber pine. (Chapman et al, 2006).

The Parmalee Gulch watershed surrounds and encompasses the entire Indian Hills subdivision. The Turkey Creek watershed includes South Turkey Creek and North Turkey Creek upstream of the District's infiltration gallery near Tiny Town. The northern portion of the Parmalee Gulch watershed, inclusive of Indian Hills, is around 7,500 feet in elevation, while the southwest portion of the Turkey Creek watershed lies within the Pike National Forest bordered by Black Mountain at an elevation of 10,740 feet. (Fig. 2).

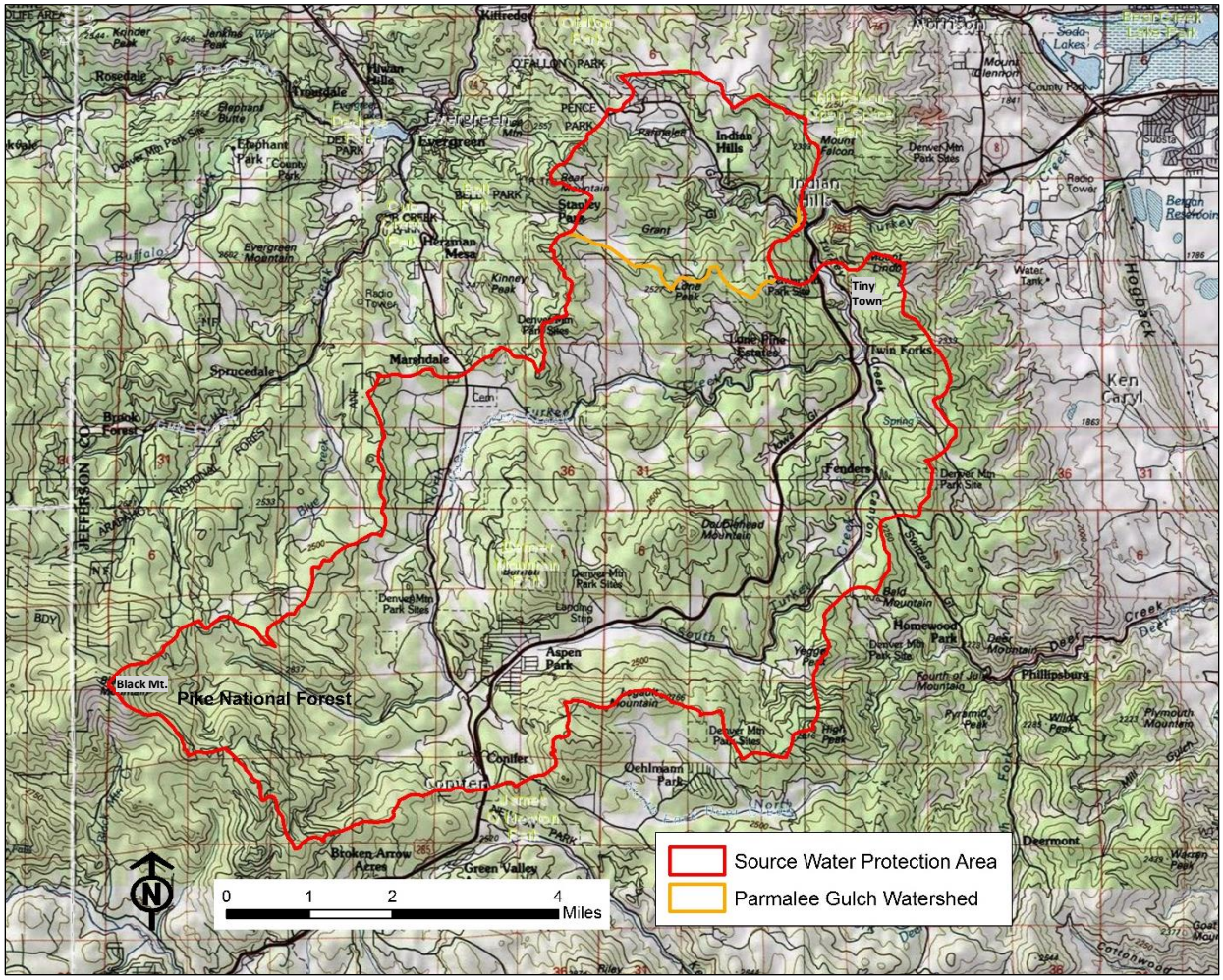


Figure 2. Topographic map of the Source Water Protection Area.

Geology

The Turkey Creek watershed's geology consists of Precambrian-age crystalline metamorphic and intrusive rock types. These rocks were formed during the latter part of the Precambrian age, the Proterozoic Era (Fig. 3). Three hydraulically significant rock groups were identified in previous geological and hydrologic studies include (1) metamorphosed and foliated gneisses and schists, (2) large-scale intrusive quartz monzonites and other granitic rocks found in plutons, and (3) major fault zones that cut both the metamorphic and intrusive rock groups. The major rock types include approximately 1.7-billion-year-old gneisses and schists (metamorphic rocks).

The major geologic structures in the watershed include folds and fault zones. The layering in the metamorphic rocks is generally steeply to moderately tilted and generally strikes northwest to southeast. A variety of brittle fault structures or fault zones are present in the watershed (Bossong et al, 2003). A fault is a fracture in rock along which there has been an observable amount of displacement from extensive tectonic forces (Whitten, 1974). Faults in the watershed may serve as a potential conduit for contaminants to enter the groundwater aquifer.

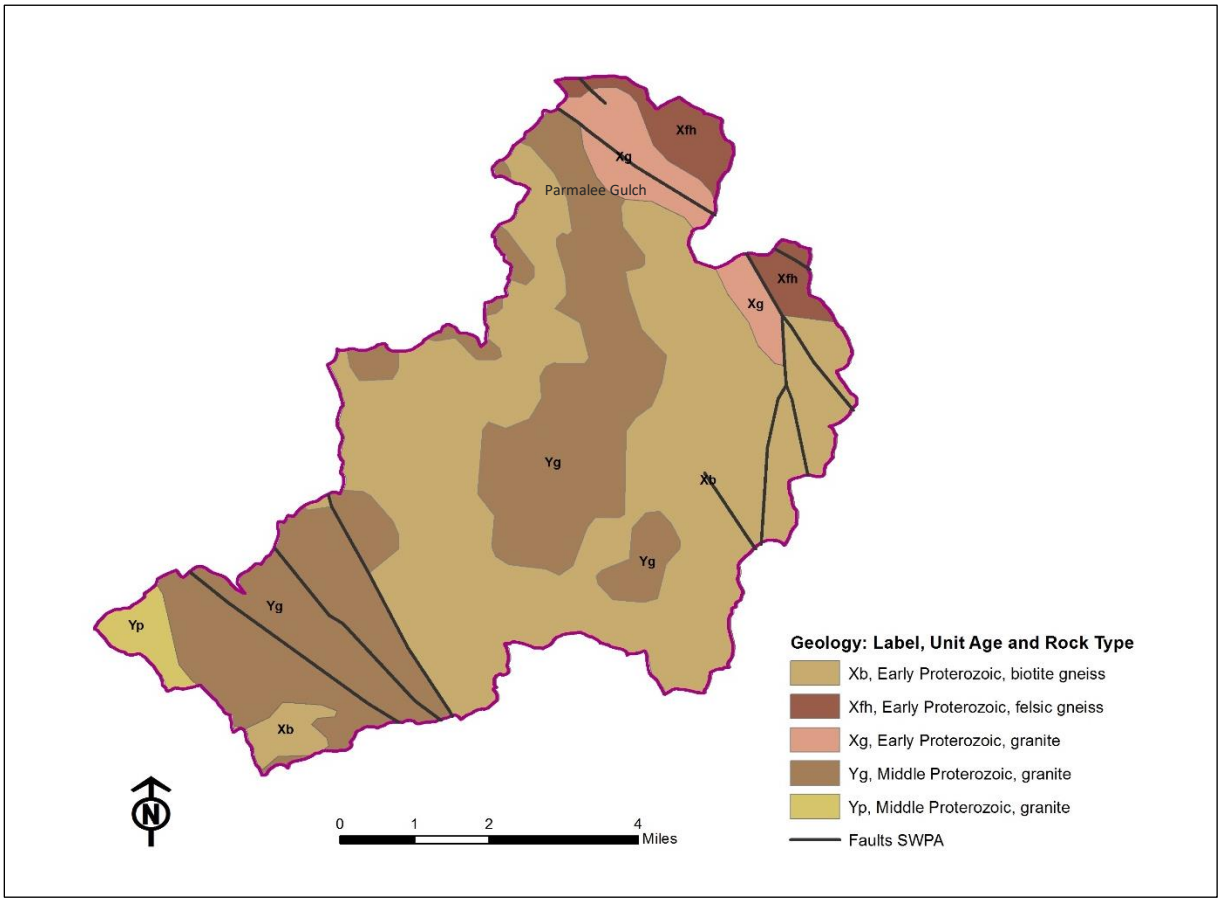


Figure 3. Geologic map of the Source Water Protection Area.

Climate

The climate within the Indian Hills Source Water Protection Area (SWPA) is dependent on elevation and location, with precipitation increasing moderately with altitude. Average annual precipitation ranges from about 20 inches in the lowest reaches to 27 inches in the highest reaches (Fig. 4). Much of the precipitation in the higher elevations is in the form of snow during the winter and spring.

Most of the precipitation that falls on the land surface during spring and late summer storm events flows directly into drainages, streams, and rivers as runoff. Some of the water will infiltrate the soil and recharge the underlying aquifers. The average runoff for the watershed is 2.0 to 4.0 inches depending on elevation (Topper et al, 2003).

Temperatures also vary depending on elevations with average high temperatures during summer around 70 degrees Fahrenheit and winter lows around 30 degree Fahrenheit. Jefferson County receives 255 days of sunshine per year (JCCWPP, 2011).

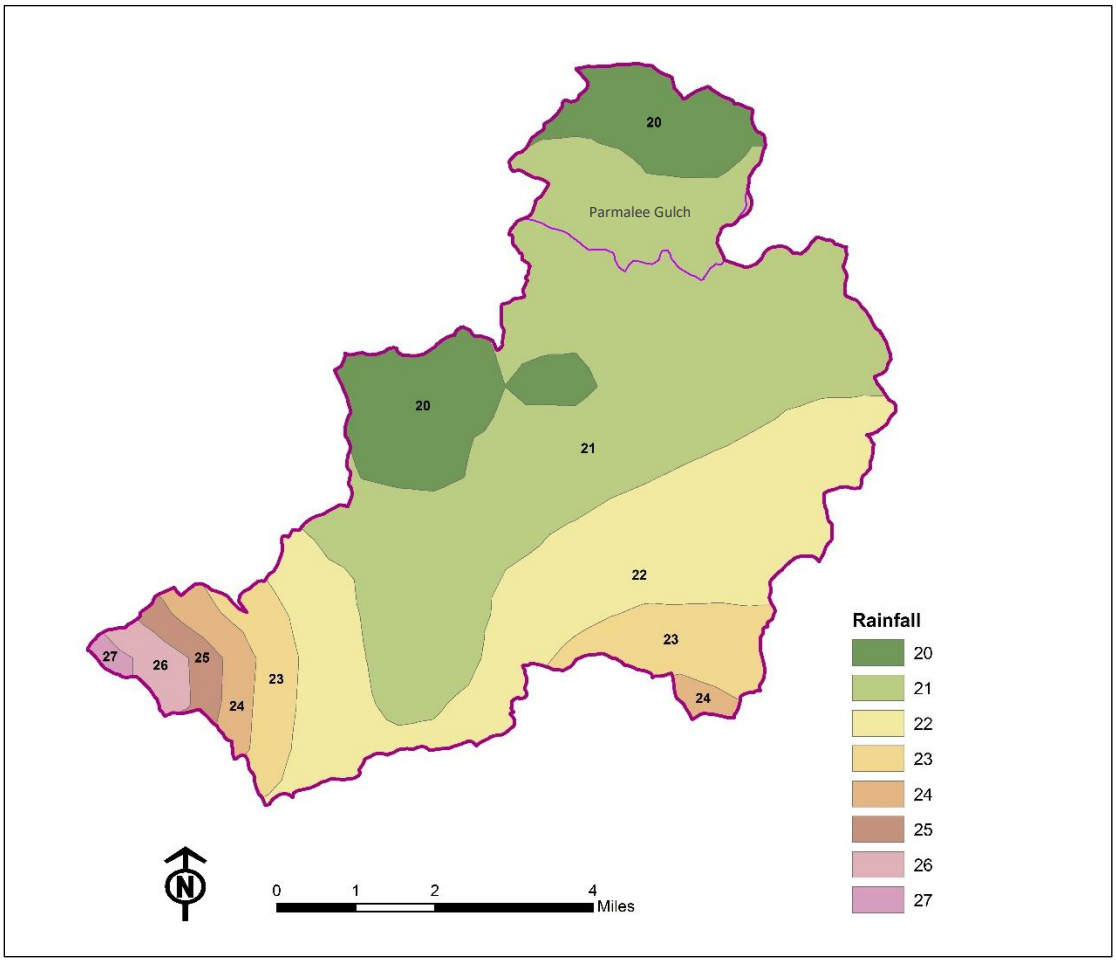


Figure 4. Average annual precipitation map of the Source Water Protection Area (1981-2010).

Land Use

The Source Water Protection Area lies private lands in Jefferson County. The private land lies within the unincorporated areas of Jefferson County. Current land use includes rural residential development, transportation, commercial, industrial, rangeland, agriculture, forest, water supply, recreation, tourism, and wildlife habitat. The major land use in the Turkey Creek Watershed is residential development.

The Jefferson County Board of County Commissioners makes land use decisions on private land with recommendations from the Jefferson County Planning Commission and department staff. The Planning Commission is appointed by the Board of County Commissioners to hear land use cases. Per Colorado State Statute, the Planning Commission is charged with making and adopting the county's Community Plans and Comprehensive Master Plan. The Jefferson County Planning and Zoning Division provides the general public with a variety of planning services and information based on land development regulation and zoning resolution for the unincorporated portion of Jefferson County. These services include, but are not limited to interpretation of current and future land use, development and subdivision consultation, and issuance of fence, sign, grading, driveway and building permits (Jefferson County, 2016).

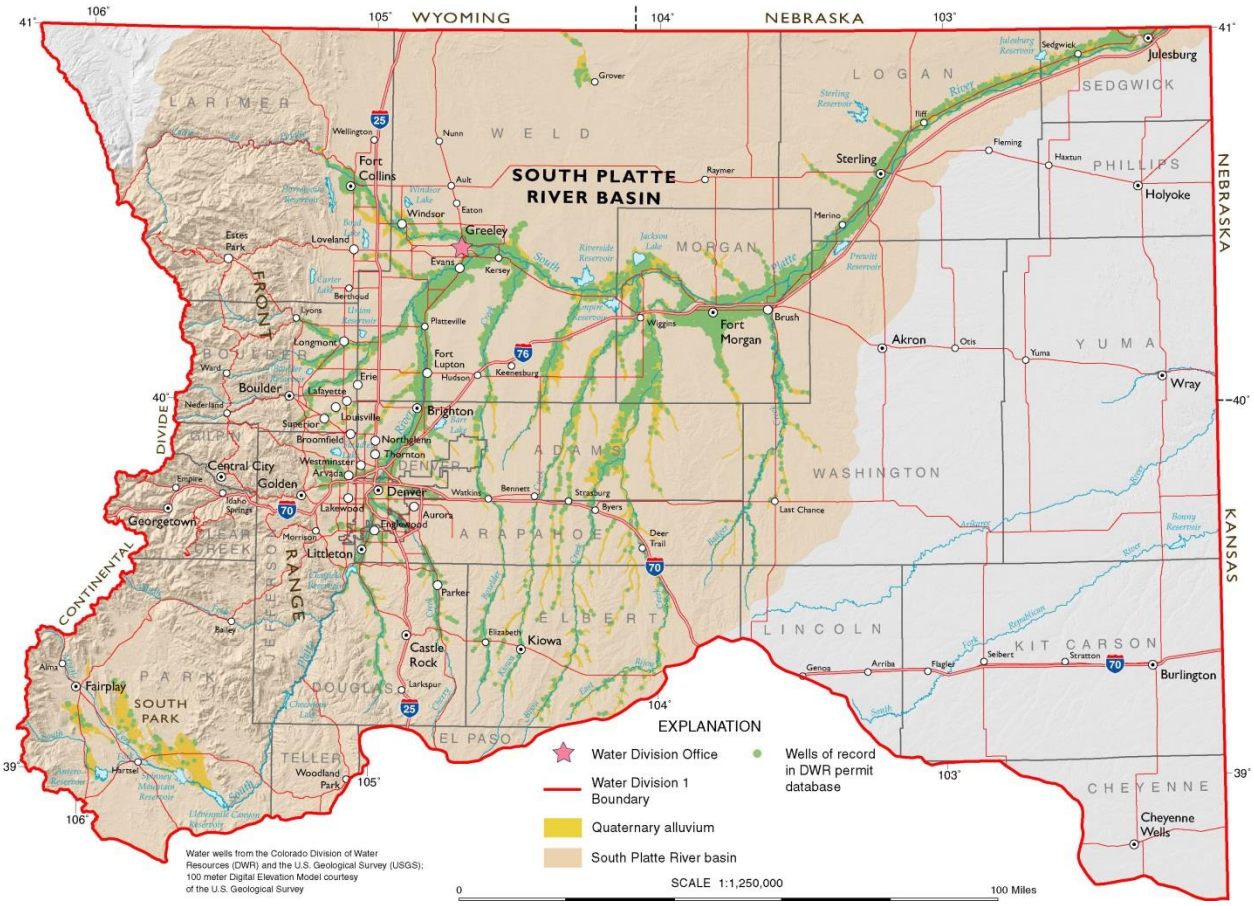
The Indian Hills Area Plan, an update of the 1997 Indian Hills Community Plan, contains information, land use recommendations, and policies specific to the Indian Hills Area. The Indian Hills Community Plan was revised and approved by the Planning Commission on July 24, 2013. The plan is no longer a separate document but is now the Indian Hills Area chapter of the Jefferson County Comprehensive Master Plan. As such, the policies in both the Area Plan and the Comprehensive Master Plan apply to land use proposals.

WATER QUALITY

Hydrologic Setting

The Indian Hills Water District obtains its drinking water supply from groundwater in the fractured rock and alluvial aquifers of Parmalee Gulch and Turkey Creek. The source water protection area lies within the Turkey Creek watershed (Hydrologic Unit Code 101900020210) which drains approximately 45 square miles (28,757 acres). The Parmalee Gulch watershed is a subwatershed of Turkey Creek (Hydrologic Unit Code 101900020212).

The South Platte River Basin is part of Colorado Water Division One with the office of the Division Engineer in Greeley (Fig. 5) (Topper et al, 2003). Division 1 includes the South Platte River basin, Republican River basin, and Laramie River basin. Division 1 staff administer water rights for water users, measure water flow and maintain gaging stations, ensure interstate compact and agreement compliance, inspect dams to determine safe water store levels, and maintain water records within these basins (DWR, 2016).



SOURCE: GROUND WATER ATLAS OF COLORADO

Figure 5. Map of the South Platte River Basin in Colorado.

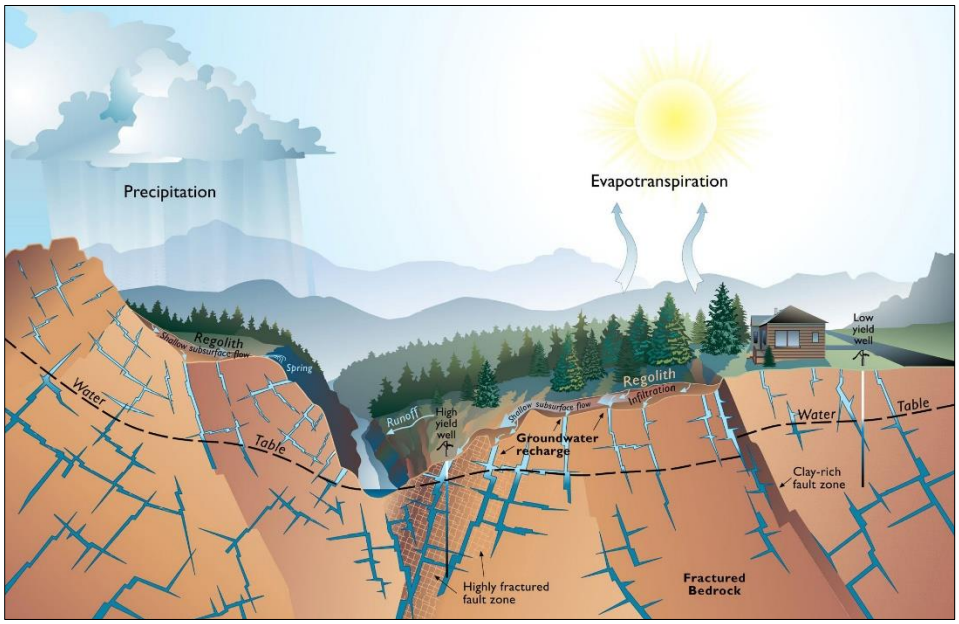
Ground Water Source: Parmalee Gulch and Turkey Creek Aquifers

The Indian Hills Water District's drinking water source is dependent on groundwater from the fractured rock and alluvial aquifer in the Parmalee Gulch and Turkey Creek watersheds. The Parmalee Gulch watershed is the basin containing the Indian Hills subdivision. The boundary of the watershed is determined by the topography of the area with a line drawn around the top of the watershed. Local precipitation and runoff over the Parmalee Gulch watershed flows downhill from the top of ridges into the lower areas of the basin and then in a northwest to southeast direction both above and below the ground. The Parmalee Gulch watershed is 5.7 square miles (3,649 acres).

Runoff from the Parmalee Gulch watershed recharges the groundwater in the lowest areas of the basin in the fractured rock and alluvial aquifer. An aquifer is a groundwater reservoir composed of soil and rock which are saturated with water and sufficiently permeable to yield water in a usable quantity to wells and springs. Aquifers provide two important functions: 1) they transmit ground water from areas of recharge to areas of discharge, and 2) they provide a storage medium for useable quantities of ground water.

Fractured Rock Aquifers

The District's more reliable wells in terms of water quality are drilled into the fractured rock aquifer. In fractured rock aquifers, groundwater is stored in the fractures, joints, bedding planes and cavities of the rock (Fig. 6). Water availability is largely dependent on the nature for the fractures and their interconnection. A fractured rock aquifer has limited storage capability and transports water along planar breaks.



SOURCE: GROUND WATER ATLAS OF COLORADO

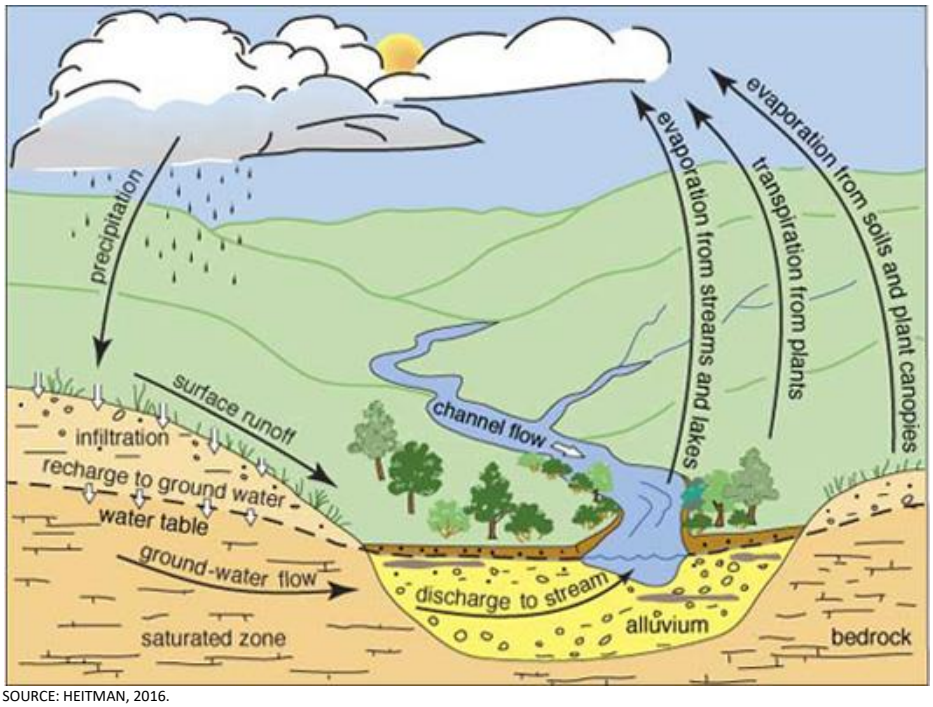
Figure 6. Conceptual model of the aquifer system in fractured, crystalline rock.

The productivity of a well drilled into a fractured rock aquifer is dependent on several variables including the density of fractures, their orientation, and their "potential fracture network porosity" – the capacity of those fractures for groundwater storage (Caine and Tomusiak, 2003). Another factor is the number of competing wells in the area that draw on the same resource.

Alluvial Aquifer

The District's older and shallower wells in Parmalee Gulch are completed in the alluvial aquifer. An alluvial aquifer is generally the unconsolidated layer of sand, soil, gravel and rock eroded from the bedrock and deposited over geologic time on the land surface at the bottom of a drainage. An alluvial aquifer stores and transports water through pore spaces of those unconsolidated sediments. The alluvial aquifer may be considered more susceptible to contaminant sources at, or near, the land surface (for example septic systems).

The alluvial aquifers are unconfined. An unconfined aquifer is open to receive water from the surface. The water table surface is free to fluctuate depending on the recharge and discharge rate. There are no overlying "confining beds" to physically isolate the groundwater system (Fig. 7).



SOURCE: HEITMAN, 2016.

Figure 7. An alluvial aquifer is an aquifer with geologic materials deposited by a stream and that retains a hydrologic connection with the depositing stream.

There are ten public water supply wells owned by the District (Table 5), but there are another 540 private water wells drilled into the Parmalee Gulch aquifer throughout its watershed.

Groundwater Quality: Nitrates

It has been known for decades that nitrates are a significant contaminant in the groundwater wells in Indian Hills. By 1968, nitrates in some public drinking water wells had exceeded the 10 milligrams per liter (mg/L) EPA standard, with Onsite Wastewater Treatment Systems (OWTS)/septic systems being identified as a contributing factor. At that time, some development was occurring with densities of more than one dwelling per acre – and subsequently more than one OWTS per acre. By 1979 the Board of Health had recognized where higher risk areas were located and implemented a prohibition on further OWTS development in those areas (Laws, 2017).

Between 1975 and 1981, 123 samples of water wells for nitrates indicated average nitrate concentrations of 7.08 mg/L with ranges in concentration of 0.1 to 40 mg/L. An additional set of 116 samples analyzed between 1996 and 2004 showed average concentrations of 7.12 mg/L with ranges in concentration between .02 to 35 mg/L (Laws, 2017).

In a groundwater modeling study commissioned by Jefferson County Public Health, and completed in 2016, Dr. Margaret Herzog analyzed the relationship between development and its associated OWTS and potential increases in nitrate levels in Parmalee Gulch groundwater. Water quality sampling data gathered over the years was integrated into geospatial analysis. The report is well worth reading in its entirety, and excerpted here for salient points regarding her findings on nitrate levels.

- There is no clear relationship between well depth and nitrate levels, most likely because the water production in any particular well is very site and hydrology dependent.

- In the upper high density development zone (PH Associates, p. 34) - at the upper elevations of Parmalee Gulch, nitrate concentrations were estimated at 8.8 mg/L, and in the lower zone at 8.0 mg/L. Indications are that there are less nitrates on upslope areas of lower intensity development, and higher nitrate concentrations where there is a higher concentration of development in the flatter valley areas closer to Parmalee Gulch.

Groundwater Protection

Groundwater protection is managed as two separate issues of quantity and quality in Colorado. Quantity issues are managed through the Colorado Division of Water Resources/Office of the State Engineer. The Division of Water Resources administers and enforces all surface and groundwater rights throughout the State of Colorado, issues water well permits, approves construction and repair of dams, and enforces interstate compacts. The Division of Water Resources is also the agency responsible for implementing and enforcing the statutes of the Groundwater Management Act passed by the Colorado Legislature as well as implementing applicable rules and policies adopted by the Colorado Groundwater Commission and the State Board of Examiners of Water Well Construction and Pump Installation Contractors.

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain and improve the quality of the nation's surface waters. Water quality is protected under the Colorado Water Quality Control Act through a number of state agencies. The Colorado Department of Public Health and Environment is the lead agency. The Colorado Water Quality Control Commission is responsible for promulgating groundwater and surface water classifications and standards. Colorado's Water Quality Control Commission has established basic standards for groundwater regulations that apply a framework for groundwater classifications and water quality standards for all waters within their jurisdictions. Standards are designed to protect the associated classified uses of water or a designated use. The groundwater classifications are applied to groundwaters within a specified area based upon use, quality and other information as indicated in Regulation No. 41, "The Basic Standards for Ground Water" (CDPHE, 2008). Statewide standards have been adopted for organic chemicals and radionuclides. Significant areas of the state have been classified for site-specific use classification and the remainder of the state's groundwater is protected by interim narrative standards.

Classifications and standards are implemented by seven separate state agencies through their rules and regulations for activities that they regulate. Regulated activities include mining and reclamation, oil and gas production, petroleum storage tanks, agriculture, Superfund sites, hazardous waste generation and disposal, solid waste disposal, industrial and domestic wastewater discharges, well construction and pump installation, and water transfers.

Colorado has a proactive groundwater protection program that include monitoring groundwater for agricultural chemicals and pesticides, issuing groundwater discharge permits, voluntary cleanup program, permitting for large hog farm operations, and educational programs. In addition, water wells must have a permit and meet minimum standards of construction and pump installation.

Surface Water Influence: Turkey Creek

The IHWD's groundwater infiltration gallery is located in the alluvium of Turkey Creek. Turkey Creek is fed by two main perennial tributaries: South Turkey Creek and North Turkey Creek Fig. 8). North Turkey Creek's headwaters originate within the mountainous area of Black Mountain at an elevation near 10,000 feet. North Turkey Creek flows generally north to northeasterly for approximately 13 miles to its confluence with Turkey Creek and South Turkey Creek. South Turkey Creek originates near Aspen Park at an elevation of 8,000 feet and flows easterly for 7.4 miles to the confluence with Turkey Creek. Turkey Creek begins at the confluence of South Turkey Creek and North Turkey Creek. It flows along South Turkey Creek Road and Highway 285 for one mile to the source water protection border and then empties into Bear Creek Lake east of Morrison further downstream.

Surface water records for Turkey Creek indicate that streamflow in the watershed is seasonal due to precipitation and snowmelt. Although streamflow generally recedes to less than about one cubic foot per second later in the year, Turkey Creek is rarely dry.

The length of Turkey and North Turkey Creek from its headwaters to the northeastern border of the source water protection area is approximately 14 miles. The drainage area of the Turkey Creek source water protection area is 45 square miles (including Parmalee Gulch).

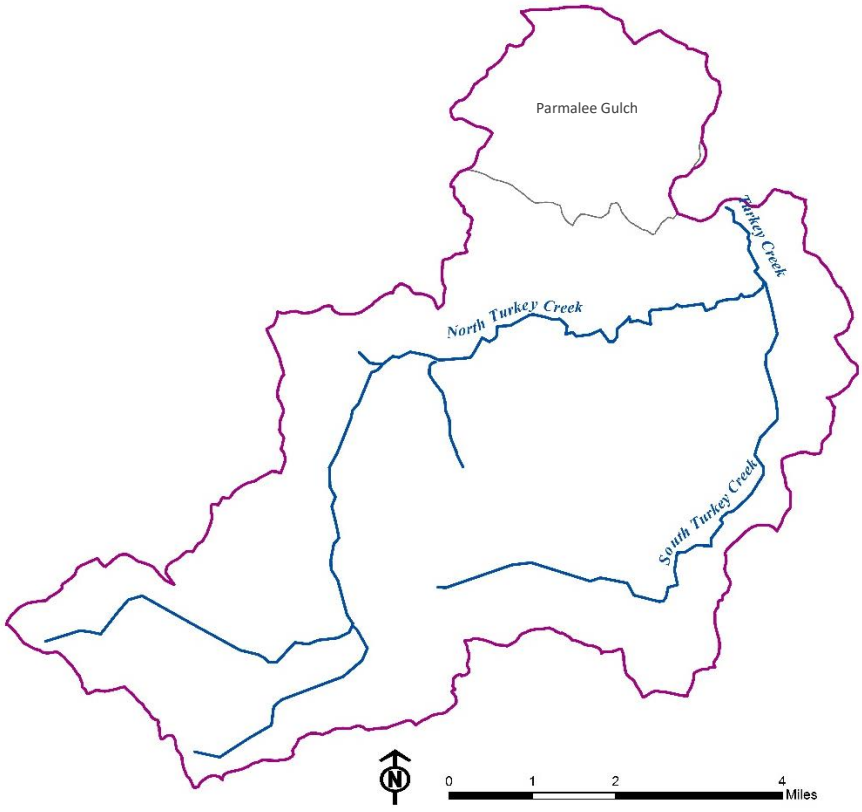


Figure 8. Stream segments in the Source Water Protection Area.

Surface Water Quality Standards

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain and improve the quality of the nation's surface waters. The State of Colorado's Water Quality Control Commission has established water quality standards that define the goals and limits for all waters within their jurisdiction. Colorado streams are divided into individual stream segments for classification and standards identification purposes (Table 4). Standards are designed to protect the associated classified uses of the streams (Designated Use).

Stream classifications can only be downgraded if it can be demonstrated that the existing use classification is not presently being attained and cannot be attained within a twenty- year time period (Section 31.6(2)(b)). Turkey Creek below Parmalee Gulch designated uses are fully supported. Turkey Creek system and the mainstem of North Turkey Creek has insufficient data for attainment of designated use for aquatic life (WQCC, 2016).

Table 4. Main Stream Segments within the Source Water Protection Area and Their Designated Use

Segment WBID	Portion of Segment	Designated Use
COSPBE06a	Turkey Creek system, including all tributaries and wetlands, from the source to the inlet of Bear Creek Reservoir, except for specific listings in Segment 6b.	Aquatic Life Cold 2 Water Supply Agriculture Recreation E
COSPBE06b	Mainstem of North Turkey Creek, from the source to the confluence with Turkey Creek.	Aquatic Life Cold 1 Water Supply Agriculture Recreation E

SOURCE: WQCC, 2016

Definitions of Designated Uses

The following definitions are paraphrased from WQCC Regulation 31, January 31, 2013:

- Aquatic Life: Cold 1 - Refers to waters that are capable of sustaining a wide variety of cold water biota, including sensitive species, or could sustain such biota in correctable water quality conditions. Cold 2 - Refers to waters that are not capable of sustaining a wide variety of cold water biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species.
- Water Supply: These surface waters are suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent), these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements.
- Agriculture: These surface waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock.
- Recreation Class E - Existing Primary Contact Use. These surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975. Primary Contact recreation refers to waters suitable for full-body contact and ingestion. Class E also includes a Water Quality Standard for E.coli not to exceed 126/100 ml (WQCC, 2013).

Drinking Water Supply Operations

Water System Information

The Indian Hills Water District (District) was created in 1964 to provide drinking water to the residents of Indian Hills, Colorado. The District provides drinking water to approximately 400 households. The water system consists of ten groundwater wells, an infiltration gallery, two water treatment plants, storage, and distribution facilities. The infiltration gallery and wells are located on easement property.

Figure 9. Turkey Creek Treatment Plant.

The groundwater wells are in both alluvial and fractured rock aquifers; while the infiltration gallery collects water from a large perforated pipe buried into the alluvium of Turkey Creek (Table 5).

Table 5. Table of Indian Hills Water District's Wells

Water System Facility Name	Water System Facility Number - CDPHE	Permit No. - DWR	Aquifer Type	Total Depth of Well (ft)	Year Drilled
Well #1	130065-003	33780-F	alluvial	24	1913
Well #2	130065-011	33781-F	alluvial	10	1988
Well #4	130065-007	013452-F	fractured	190	1968
Well #5	130065-005	33782-F	alluvial	18	1913
Well #6	130065-010	2238	fractured	50	1958
Well # 7	130065-009	33783-F	fractured	48	1956
Well #8	130065-008	33784-F	fractured	70	1956
Well #10	130065-013	046940-F	fractured	303	1987
Well #11 R	16840	247376	fractured	1000	2016
Well #12		79581-F	fractured	1000	2013
Turkey Creek Gallery	130065-004	038858-F	alluvial	n/a	1992

Raw water from the infiltration gallery and the two groundwater wells nearby is pumped to a nearby Turkey Creek water treatment plant, where it is treated by membrane filtration and chlorine (Fig. 9). Potassium permanganate is also added to help with iron and manganese filtration, and a sequestering agent is added to keep minerals in suspension. Raw water from the Parmalee Gulch wells is pumped to the Upper Well Field treatment plant which also uses membrane filtration, and ion exchange, a more expensive filtration process.

Treated water is stored in six above ground storage tanks with a combined capacity of 464,000 gallons prior to being gravity fed to residents through a twelve-mile network of underground pipes to 363 service connections or taps. The size of the service area is approximately nine square miles.

The treated water distribution system for the District is divided into three pressure zones. Zone 1 is at the bottom of Parmalee Gulch, Zone 2 in the middle, and Zone 3 is at the upper end. Zone 1 is supplied by the Turkey Creek infiltration gallery; two newer and deeper groundwater wells in the same vicinity (Wells #11 and 12); and an older well further up Parmalee gulch that is used as a "peaking well" (Well #1) when there is high demand. The water quality from these sources is low in nitrates, and generally quite excellent.

The water source for Zone 2 is primarily the Turkey Creek wells and infiltration gallery. Well #2 is in this zone, but is not used, as its production is seasonal at best, and then only 2.5 gallons per minute (gpm). At the upper end of Parmalee Gulch in Zone 3, there is a combination of wells with varying depths and varying issues with nitrates. Well #4 is an important resource, continuing to produce water even during dry spells. However, it has nitrates, and slows down significantly after 10-14 days of continual production and therefor is currently not used. Well #5 is a good producer that is used continually, but has to be blended with Turkey Creek water to dilute its nitrates. Wells 6, 7, and 8 are low producers. Well #6 is infrequently used, as it also has high nitrates. Well #10 is the biggest producer, but it has high nitrates and has water rights restrictions that don't allow it to pump more than 22 gpm (Evans, 2017).

Turkey Creek water provides all of the water for Zone 1 and can be blended into all of the zones, supplying up to 100% of Zone 2, and 30% of Zone 3 if needed. That flexibility in distribution, and balancing of sources also allows for Zone 3 groundwater wells to supply Zone 1 if the Turkey Creek supply were to be compromised. However, the extent to which the wells in Zone 3 are used is dependent on water availability, and which of them is contaminated by groundwater nitrates.

The Indian Hills Water District provides an Annual Drinking Water Quality Report to the public that provides information on the results of their water monitoring program. The Consumer Confidence Report for calendar year 2016 is available at the District's office, and on their web site (https://indianhillswater.com).

Water Supply Demand Analysis

The Indian Hills Water District water system currently has the capacity to produce about 100,000 gallons per day. Average daily demand is about 38,000 gallons per day in winter, and 55,000 gallons per day in summer. Peak daily demand reached 102,000 gallons in the 1980's, but now ranges from 55-58,000 gallons per day. (Evans, 2017).

This capacity however is dependent on a portfolio of wells with compromised water quality, tenuous production, and blending with a source that needs to be pumped from the bottom of the watershed. Meeting demand for an extended period of time if a significant source becomes disabled would be a challenge. Potential contamination of the source waters could increase treatment costs and/or result in abandoning a source and seeking a replacement.

The potential financial and water supply risks related to the long-term disablement of the community's water source are a concern to the stakeholder group. As a result, the steering committee believes the development and implementation of a source water protection plan for Indian Hills Water District can help to reduce the risks posed by potential contamination of its water source. Additionally, the Indian Hills Water District has developed an emergency response plan or contingency plan to coordinate rapid and effective response to any emergency incident that threatens or disrupts the community water supply.

OVERVIEW OF COLORADO'S SWAP PROGRAM

Source water assessment and protection 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 Source Water Assessment and Protection (SWAP) program. The Water Quality Control Division, an agency of the Colorado Department of Public Health and Environment (CDPHE), assumed the responsibility of developing Colorado's SWAP program. Colorado's SWAP program is a two-phased process designed to assist public water systems in preventing potential contamination of their untreated drinking water supplies.

Source Water Assessment Phase

The Assessment Phase for all public water systems consists of four primary elements:

1. Delineating the source water assessment area for each of the drinking water sources;
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;
4. Reporting the results of the source water assessment to the public water systems and the public.

The Assessment Phase involves understanding where the Indian Hills Water District's source water comes from, what contaminant sources potentially threaten the water source, and how susceptible the water source is to potential contamination.

Source Water Protection Phase

The Protection Phase is a voluntary, ongoing process in which all public water systems have been encouraged to voluntarily employ preventative 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. 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 of their 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.

SOURCE WATER PROTECTION PLAN DEVELOPMENT

Source Water Assessment Report Review

The Indian Hills Water District received their Source Water Assessment Report from the Colorado Department of Public Health and Environment in November 2004. During the Source Water Protection stakeholder meetings, the assessment report was reviewed and used as a starting point to guide the development of this Source Water Protection Plan. A copy of the Source Water Assessment Report for the Indian Hills Water District can be obtained by downloading a copy from the CDPHE's SWAP program website located at: http://www.colorado.gov/cs/Satellite/CDPHE-WQ/CBON/1251596793639.

Defining the Source Water Protection Area

The State's Assessment Report included a delineated source water assessment area for the Indian Hills Water District's water sources. Delineation is the process used to identify and map the area around a pumping well that supplies water to the well or spring, or the drainage basin that supplies water to a surface water intake. The size and shape of the area depends on the characteristics of the aquifer and the well, or the watershed. The delineated source water assessment area provides the basis for understanding where the community's source water and potential contaminant threats originate.

The stakeholder group reviewed the state's delineated source water assessment area for the Indian Hills Water District's groundwater sources and decided to increase the 500 feet Zone 1 around each well to 1000 feet. The source water protection area includes Turkey Creek watershed (45 square miles). This protection area is where the community has chosen to implement its source water protection measures to decrease risk to their source water from potential contamination.

Source Water Protection Zones

The source water protection area includes the following protection areas (Fig. 10):

- **Zone 1** – This area includes a 1000-foot radius around each of the groundwater wells and a 1000-foot area around the surface water drainage area. This is the most sensitive and important area to protect from potential sources of contamination.

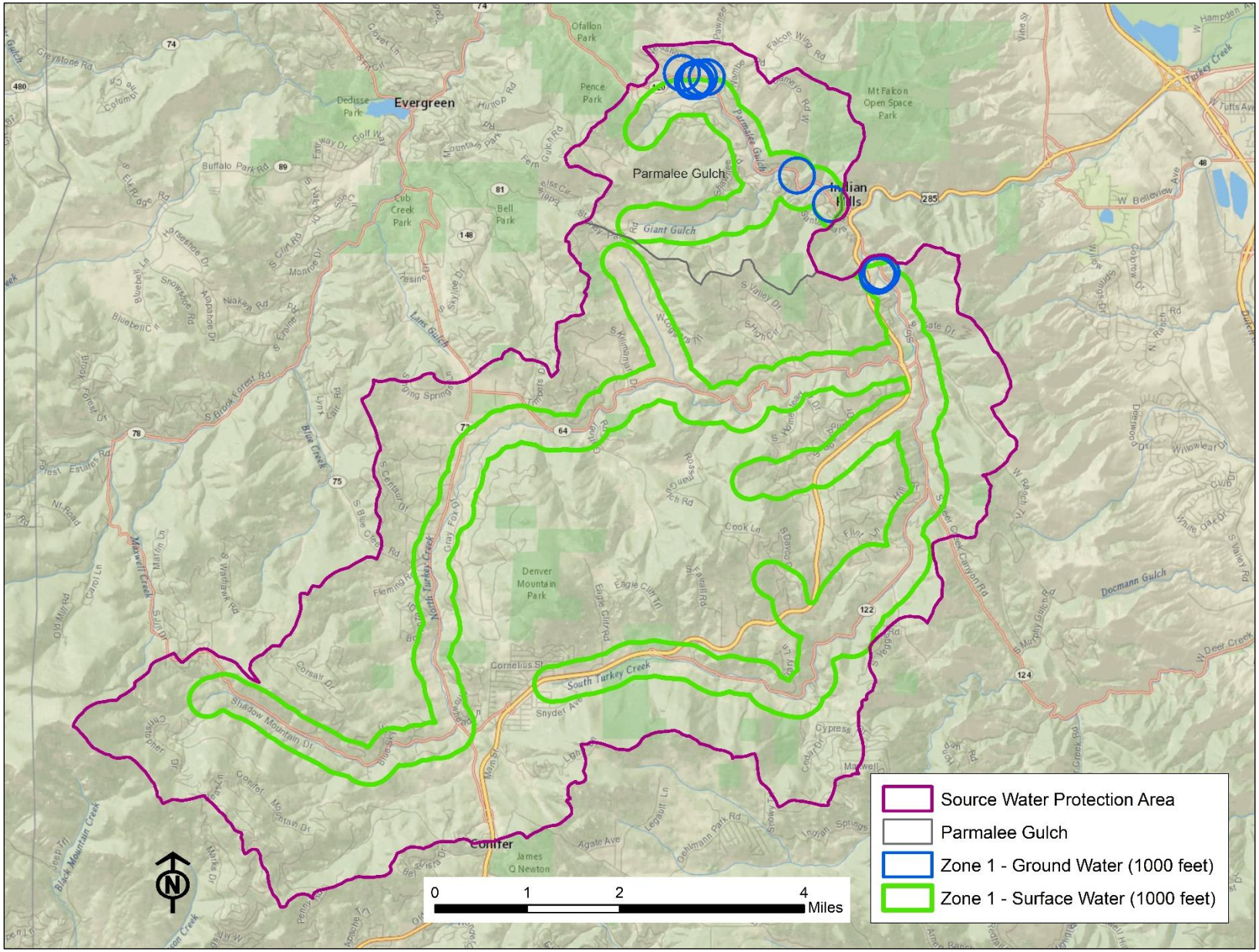


Figure 10. Map of the Indian Hills Water District's Source Water Protection Area.

Potential Contaminant Source Inventory

The State's Source Water Assessment Report identified potential sources of contamination (PSOCs) that might be present within the source water assessment area. In 2016, CDPHE provided the Indian Hills Water District with geographic information system (GIS) information on these potential contaminant sources located within the assessment areas. The stakeholder group conducted a more accurate and current contaminant source inventory of the source water protection area. This report will only reflect the current inventory.

Discrete contaminant sources (point sources) were inventoried using selected state and federal regulatory databases including: mining and reclamation, oil and gas operations, above and underground petroleum tanks, Superfund sites, hazardous waste generators, solid waste disposal, industrial and domestic wastewater dischargers, solid waste sites, and water well permits.

Dispersed contaminant sources (nonpoint sources) were inventoried using recent land use, land cover and transportation maps of Colorado, along with selected state regulatory databases. A table of Contaminants Associated with Common PSOCs is included in the Appendices of this report.

The stakeholder group identified other areas of concern to add to the potential contaminant source inventory, combining these into a list of issues of concern within the source water protection area that may impact the Indian Hills Water District's drinking water source.

Issues of Concern

- Spills and deicers on roads
- Wastewater dischargers
- Herbicides and fertilizers
- Wildland fire
- Horse properties
- Septic systems
- Current and future development
- Open and abandoned water wells
- Flooding
- Storage tanks
- Hazardous waste generators
- Climate Change and Drought

Priority Strategy

The stakeholder group used the SWAP Risk Assessment Matrix developed by CRWA to prioritize the issues of concern (Fig. 11). Using SWAP Risk Assessment Matrix, the steering committee considered the following criteria when estimating the risk of each issue of concern.

1. **Impact to the Public Water System** – The risk to the source waters increases as the impact to the water system increases. The impact is determined by evaluating the human health concerns and potential volume of the contaminant source. CDPHE developed information tables to assist with this evaluation (See Appendices). The following descriptions provide a framework to estimate the impact to the public water system.
    - **Catastrophic** - irreversible damage to the water source(s). This could include the need for new treatment technologies and/or the replacement of existing water source(s).
    - **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.
    - **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.
    - **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.
    - **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.

2. **Probability of Impact** – The risk to the source waters increases as the relative probability of damage or loss increases. The probability of impact is determined by evaluating the number of contaminant sources, the migration potential or proximity to the water source, and the historical data. The following descriptions provide a framework to estimate the relative probability that damage or loss would occur within one to ten years.
    - **Certain**: >95% probability of impact
    - **Likely**: >70% to <95% probability of impact
    - **Possible**: >30% to <70% probability of impact
    - **Unlikely**: >5% to <30% probability of impact
    - **Rare**: <5% probability of impact

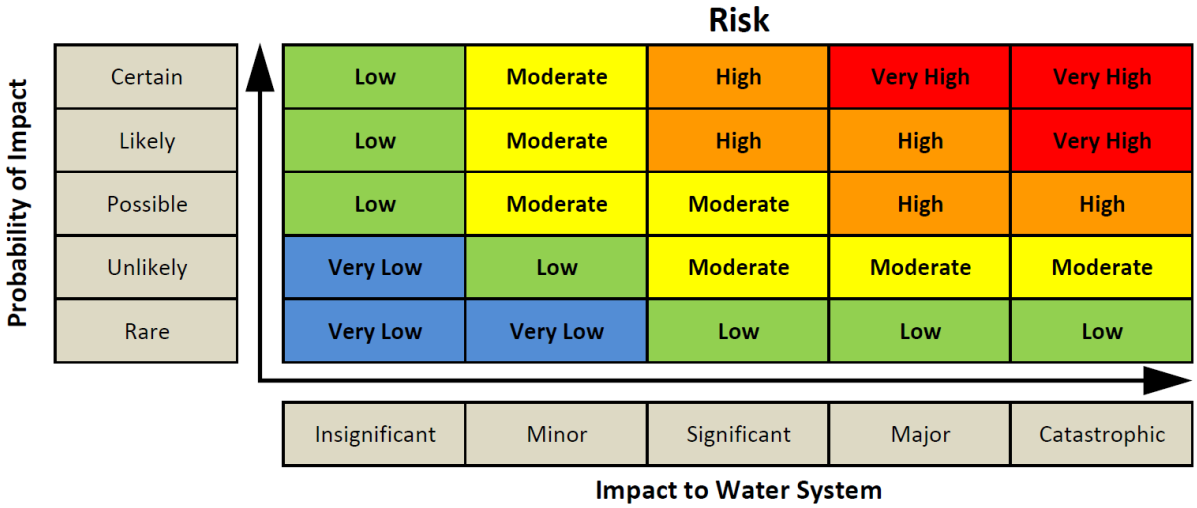


Figure 11. CRWA's SWAP Risk Assessment Matrix.

The stakeholder group ranked the potential contaminant source inventory and issues of concern in the following way (Table 6):

Table 6. Potential Contaminant Source Prioritization using SWAP Risk Assessment Matrix

Potential Source of Contamination or Issue of Concern	Impact to Water System (Insignificant, Minor, Significant, Major, Catastrophic)	Probability of Impact (Rare, Unlikely, Possible, Likely, Certain)	Risk (Very Low, Low, Moderate, High, Very High)
Stormwater runoff	Significant	Possible	Moderate
Spills on roads	Major	Possible	High
Herbicides	Minor	Possible	Moderate
Wildland fire	Significant	Likely	Very High
Wastewater dischargers	Significant	Possible	Moderate
Storage Tanks	Major	Likely	High
Septic systems	Major	Certain	Very High
Residential lot size	Major	Likely	High
Hazardous waste generators	Minor	Rare	Very Low
Open and abandoned wells	Major	Likely	High
Climate change and drought	Catastrophic	Likely	Very High
Flooding	Minor	Possible	Moderate
Future development	Major	Likely	High
Horse properties	Significant	Possible	Moderate
Development (modifications to existing)	Significant	Possible	Moderate
Deicers on roadways	Significant	Likely	High
Fertilizer	Major	Unlikely	Moderate

DISCUSSION OF ISSUES OF CONCERN

The following section provides a description of the issues of concern that have been identified in this plan, describes the way in which they threaten the water sources and outlines best management practices. The purpose of this section is as a guidance document to understand the issues. The stakeholder group prioritized the list of issues of concern as:

- Wildland fire
- Septic systems
- Climate Change and Drought
- Spills on roads
- Residential lot sizes
- Future development
- Storage tanks
- Open and abandoned wells
- Deicers on roadways
- Stormwater runoff
- Herbicides
- Fertilizers
- Wastewater dischargers
- Flooding
- Horse properties
- Development (modifications to existing)
- Hazardous waste generators

Surface and Groundwater Contaminants

Many types of land uses have the potential to contaminate source waters: spills from tanks, trucks, and railcars; leaks from buried containers; failed septic systems; buried or injection of wastes underground; use of fertilizers, pesticides, and herbicides; road salting; as well as urban and agricultural runoff (Fig. 12). While catastrophic contaminant spills or releases can wipe out a water resource, groundwater degradation can result from a plethora of small releases of harmful substances. According to the U.S. EPA, nonpoint-source pollution (when water runoff moves over or into the ground picking up pollutants and carrying them into surface and groundwater) is the leading cause of water quality degradation (GWPC, 2008).

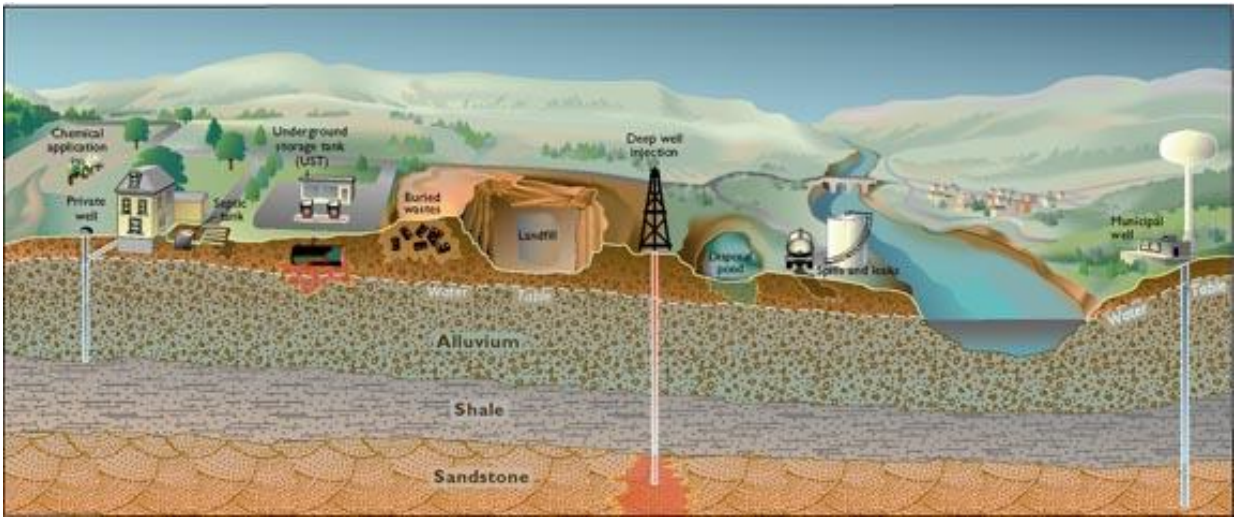


Figure 12. Schematic drawing of the potential source of contamination to surface and groundwater in a generic "basin" aquifer.

Transportation Impacts

The source water protection area is accessed by a network of paved and gravel rural roads. Highway 285 is a designated hazardous material transportation route located in the 1000-foot Zone 1 of source water protection area adjacent to the infiltration galleries and is maintained by the Colorado Department of Transportation.

Spills on Roads

Vehicular spills may occur along the transportation routes within the protection area from trucks that transport fuels, waste and other chemicals that have a potential for contaminating the groundwater. Accidental spills of small amounts of contaminants may not be detected or reported and are often diluted with rainwater or snowmelt, potentially washing the chemicals into the soil or nearby waterways. Large spills require immediate emergency response from the local fire department to ensure contaminants do not enter the source waters.

A release of any chemical, oil, petroleum product, sewage, etc., which may enter waters of the state of Colorado (which include surface water, ground water and dry gullies and storm sewers leading to surface water) must be reported immediately to CDPHE. Spills and incidents that have or may result in a spill along a highway must be reported to the nearest law enforcement agency immediately. The Colorado State Patrol and CDPHE must also be notified as soon as possible (CDPHE, 2009).

Chemical Applications

During the winter season CDOT applies a salt-sand mixture and deicer (magnesium chloride, M1000, or Ice Slicer) to highways along routes within the source water protection areas. Surface and groundwater quality problems resulting from the use of road deicers are causing concern among federal, state, and local governments. Salt from the highway is introduced into the groundwater through several ways:

1. When runoff occurs from highways, flows are sometimes carried to ditches and unlined channels through which the water infiltrates into the soil and eventually into the groundwater.

2. Also, when snow is plowed together with the salt, the pile that is accumulated on the roadside melts during warmer weathers. The water that results contains dissolved salt which can also infiltrate. Plowing and splashing of salt causes the salt to deposit along the pavement, especially near the shoulders where it melts causing runoff to enter drainage ways and then the groundwater system (Seawell, et al, 1998).

Salt contributes to increased chloride levels in groundwater through infiltration of runoff from roadways. Unlike other contaminants, such as heavy metals or hydrocarbons, chloride is not naturally removed from water as it travels through soil and sediments and moves towards the water table. Once in the groundwater, it may remain for a long time if groundwater velocity is

slow and it is not flushed away. Chloride may also be discharged from groundwater into surface water and can account for elevated levels of chloride throughout the year, not just in winter. Thus, regardless of the path that the runoff takes, salt poses a water quality problem.

Transportation Impacts Recommendations:

1. Educate the local community on how to respond to a hazardous spill in the SWPA by calling "911". This can be done with signage on the roadways entering the protection area along with information in a public brochure distributed to residents and visitors in the protection area. Obtain approval from County Planning Department prior to constructing "Drinking Water Protection Area" signage on roadways.

2. Work with local emergency response teams to ensure that any spill within the protection areas can be effectively contained and proper protocols is followed for clean-up of hazardous materials spilled within the transportation corridors. Refer to the County Emergency Management Plan.

3. Keep informed on road maintenance practices and schedules within the SWPA.

4. Provide a copy of the Source Water Protection Plan and map of the SWPA to Jefferson County Transportation Department, Indian Hills Fire Protection District, Jefferson County Office of Emergency Management (OEM), and CDOT.

5. Request to be notified by Jefferson County OEM when a hazardous spill occurs within the SWPA.

6. Consider the purchase of small spill kits to be used by utility managers, and responders within the SWPA.

7. Recommend secondary containment of deicer chemicals at storage sites.

8. Provide CDOT with a copy of the source water protection plan. Encourage the proper road BMPs to prevent the transport of road deicers into the groundwater.

Wildland Fires

The forests throughout Colorado are dense with fuel build-up from a century of fire suppression and thus more vulnerable to high-intensity fires than it was historically. The entire Rocky Mountain region has been plagued with wildfires in the past several years and has consistently ranked as the most severe problem facing the state's counties. The wildfire situation has been exacerbated by the onset of severe drought conditions for much of this decade throughout the western U.S. Most of Colorado's wildfires are caused by lightning strikes from thunderstorms that pass through the state on a regular basis during the summer.

Wildfire/Watershed Assessment

In 2009, the Upper South Platte Watershed Assessment was completed to prioritize the watershed-based risk from wildfire to water supplies. The Assessment was divided into four components most critical to the protection of watershed conditions including wildfire hazard, flooding or debris flow risk, soil erodibility, and water uses (i.e. drinking water sources). The Assessment resulted in a watershed hazard ranking of one through five, with five being the highest ranking. The Turkey Creek watershed was ranked 3.0 (moderate) for overall risk, and the Parmalee Gulch area was ranked 1.0 (low) (Fig. 13) (JWA, 2009).

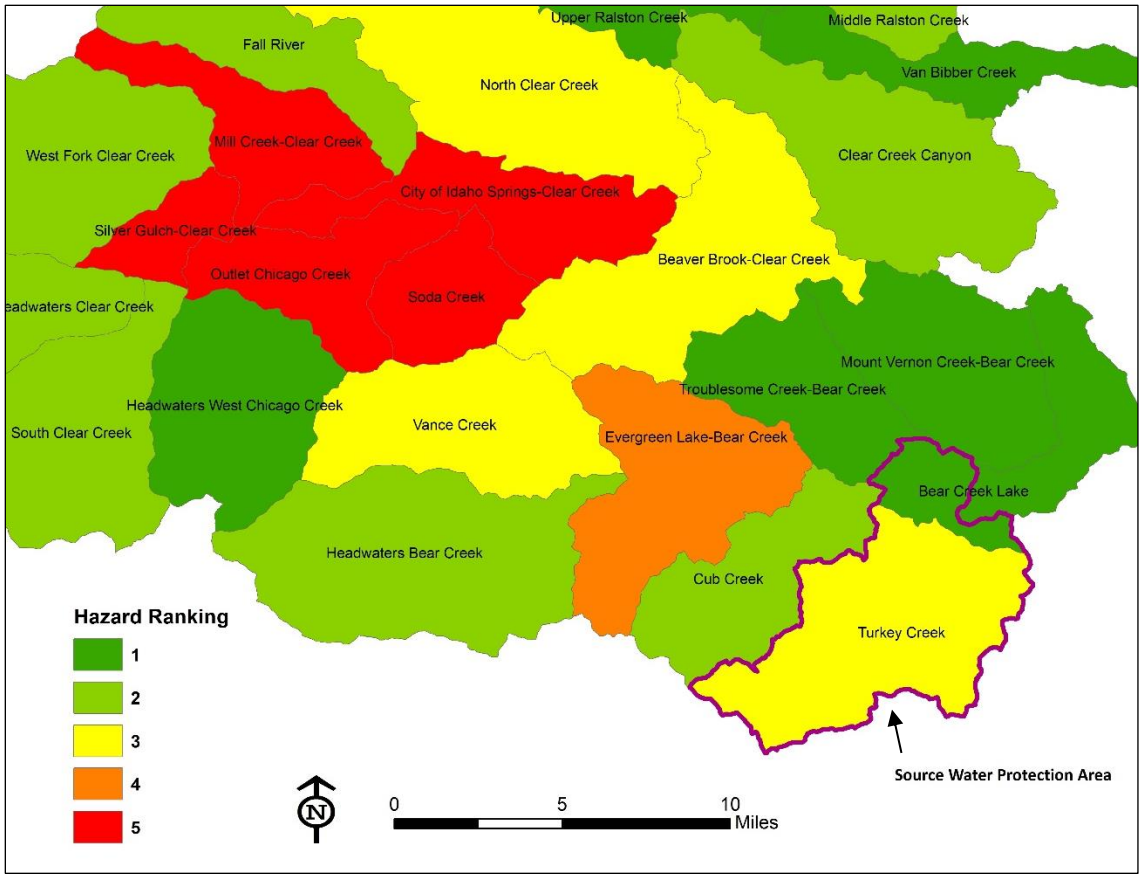


Figure 13. Map of the Final Hazard Ranking of watersheds within the Upper South Platte watershed.

Community Wildfire Protection Plan

Jefferson County has experienced several large fire events in recent, including the 138,114-acre Hayman Fire in 2002, the 10,761-acre Hi Meadow Fire in 2000, and the 11,853-acre Buffalo Creek Fire in 1996. In 2011, Jefferson County completed their Community Wildfire Protection Plan (CWPP), which identifies specific wildland fire risks facing communities and neighborhoods and provides prioritized mitigation recommendations designed to reduce those risks (CWPP, 2011).

Water Quality Effects from Fire

The degree to which wildfire degrades water quality and supply depends on wildfire extent and intensity, post-wildfire precipitation, watershed topography, and local ecology. Potential effects of wildfire on municipal water supplies include the following:

- Increase in runoff over devegetated slopes and reduced infiltration rates,
- Changes in magnitude and timing of groundwater recharge of the aquifer,
- Increased loading of nutrients (nitrogen and phosphorus), dissolved organic carbon (DOC), major ions, and metals,
- Post-fire erosion and transport of sediment and debris to water resources, and
- Changes in source-water chemistry that can alter drinking water quality (Writer and Murphy, 2012.

Post-fire impacts to water quality occurred during “first flush” storm events, snowmelt, and high intensity thunderstorms. Thunderstorms can transport substantial amounts of sediment and debris from hillslopes of the burned area into the source waters. Even though the Indian Hills Water District’s drinking water source is from alluvial and fractured rock aquifers, there may be a potential for impact to the shallow groundwater from a catastrophic wildland fire in the nearby watershed.

The chemicals used in fire retardants can also be a source of contamination should they migrate through runoff into drinking water supplies. The degree of contamination is controlled by the size of the burned area, distance to surface water, remaining vegetation cover, terrain, soil erosion potential, and subsequent precipitation and intensity (Walsh Environmental, 2012).

Wildland Fire Recommendations:

1. Refer to the Jefferson County Multi-Hazard Mitigation Management Plan as guides to understand emergency response during a disaster event.
2. Share map of the SWPA, GIS shape files, and Emergency Notification Cards with Indian Hills Fire Rescue and Jefferson County OEM at a meeting that IHWD hosts.
3. Consider becoming a FireWise Community and create an action plan to decrease risk from wildfire (i.e. defensible space, evacuation plan, and fuel reduction).
4. Avoid spraying fire retardant near the infiltration galleries.

Onsite Wastewater Treatment Systems/Septic Systems

All of the private residential properties within the SWPA rely on onsite wastewater treatment systems (OWTS) to dispose of their sewage. A septic system is a type of OWTS consisting of a septic tank that collects all the sewage and a leach field that disperses the liquid effluent onto a leach field for final treatment by the soil (Fig. 14).

Many older properties have these conventional "pipe and gravel" systems that rely on the soil treatment area, or leach field, to remove contaminants. The average nitrate levels leaving the septic tank in those systems averages 65 mg/L and is often not adequately treated by the soil alone (Jefferson County, 2017).

Septic systems are the second most frequently cited source of groundwater contamination in our country.

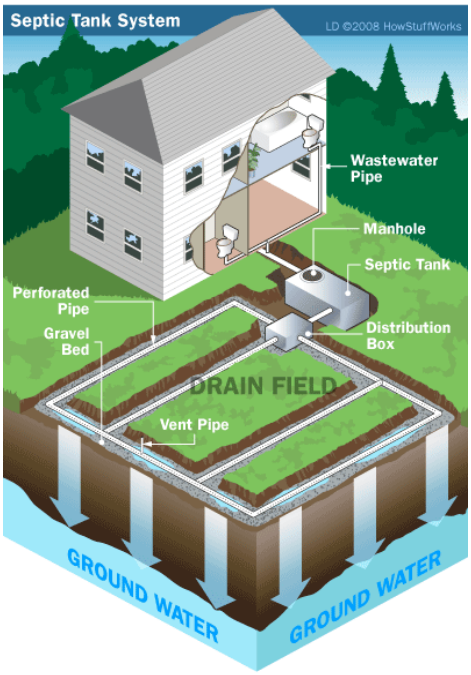


Figure 14. Septic system diagram.

Unapproved, aging, and failing septic systems have a large impact on the quality and safety of the water supply. The failure to pump solids that accumulate in the septic tank will also eventually clog the lines and cause untreated wastewater to back up into the home, to surface on the ground, or to seep into groundwater. If managed improperly, these residential septic systems can contribute excessive nutrients, bacteria, pathogenic organisms, pharmaceuticals, and household chemicals to the groundwater.

In Jefferson County, Jefferson County Public Health (JCPH) requires and issues permits for onsite wastewater treatment systems. JCPH administers and enforces the minimum standards, rules, and regulations outlined in the state of Colorado's Revised Statutes (CRS 25-10-105) and Jefferson County OWTS regulations.

JCPH currently requires that Higher Level Treatment (HLT) systems with greater nitrate removal capacity be installed in Indian Hills for all new development on lots less than 5 acres. Leading up to that Board of Health action in 2002, and with subsequent regulation and policy development, JCPH has been proactive in striving to "preclude further degradation" of groundwater by nitrates from OWTS:

- 1973-1977 minimum lot sizes were prescribed for properties with well and septic (2 acres), and 1/2 acre for lots with public water and private septics.
- 1978 – a more restrictive 200-foot setback between well and septic was implemented.

- 1979 – a prohibition on further OWTS installations was implemented for particular acreage with existing high density of OWTS.
- 1996 – a review of the 1979 prohibition area and nitrate levels, along with nitrate reducing HLT.
- 2002 – Board of Health clarified the 1979 prohibition area with regard to privies, hybrid lots, and holding tanks, and implemented the HLT requirement for OWTS on < 5 acres.
- 2004 – The "Use Permit" requirement was implemented for inspection of OWTS at time of sale.
- 2014 – Operating Permit program was implemented requiring maintenance contracts for HLT systems.

Onsite Wastewater Treatment Systems/Septic System Recommendations:

1. Seek referrals from Jefferson County Public Health on septic system replacements within or near the "prohibition area".

2. Collaborate with Jefferson County Public Health on a referral basis to review septic system designs and development within important recharge zones.

3. Educate property owners within the SWPA on the source water protection plan, the proper use and maintenance of their septic systems and how the source of their drinking water can be affected by an inadequate functioning septic system.

4. Encourage Jefferson County Environmental Health to educate property owners when they apply for a septic permit on the link between good septic practices and protecting groundwater.

5. Encourage Jefferson County Public Health to limit new OWTS development to 2+ acres.

6. Work with JCPH to create GIS database of all OWTS and domestic water well locations.

7. Encourage JCPH to require mandatory replacement of aging/undocumented/unpermitted OWTS within 1000 feet of District wells with HLT systems, and by a specified date.

Land Use Planning and Development

Land use issues within the Indian Hill's area of the source water protection area include lot size, modification of existing development and future development. All of these issues are linked to water quality associated with Onsite Wastewater Treatment Systems (OWTS)/ septic systems that handle the human waste inherent with that development. Septic systems and water quality are discussed in more detail in a separate section of this plan.

Indian Hills was first platted as a subdivision in the 1920's and 1930's. These plats created 3,500 small individual lots, many of which are as small at 50' a 50' in size. As individual lots, they do not meet current buildable standards for septic/leach fields or setbacks. Development over time has sought to merge those lots into parcels that are at least one acre. The density of this development along with the density and number of septic systems is directly tied to the amount of human waste byproducts that are injected into the groundwater resource that is important to Indian Hills' drinking water supply.

Land development can affect the supply, demand and quality of water within the Indian Hills area. In 1996, approximately half of the residents in the community were served by the Indian Hills Water District. The other half depended on individual private wells. Future development will further stress the ground water supply of the basin. Areas of the Indian Hills drainage system currently experiences ground water supply problems. In addition, a significant portion of Indian Hills has already been designated as a "Septic Prohibition Area" due to elevated nitrate concentration in ground water from septic systems (Jefferson County, 2013).

PH Associates, LLC recently did a study to "determine if and how planned and potential development might increase nitrate exceedance risks above 10 mg/L limit". At current "build-out", and not considering recharge from upslope areas, concentrations of nitrates in already densely development areas could average 10 mg/L - the SDWA standard (PH Associates, 2016). One of the report's conclusions is that "Development of more parcels in high-density areas in the upper and lower valley may reduce groundwater recharge and thus increase pollution concentrations to both IHWD community wells, and private wells."

Urbanization increases the amount of impervious surface, thereby decreasing the available land for infiltration of precipitation and recharge of the aquifer. Site specific effects would be dependent on the current function of existing OWTS, the number of water wells, the density of development, the underlying soils, fractured bedrock geology, and "complex surface and groundwater flow patterns and interaction" (PH Associates, 2016). The groundwater modeling resulted in a recommendation to use only HLT systems in all new development, and to strive to keep those densities above 2 acres.

Land Use within the Source Water Protection Area is managed by the Jefferson County Planning and Zoning Division. The Jefferson County Board of Health also has a significant role in the

environmental aspects of land use planning through its efforts over the decades to implement best management practices around the installation of OWTS.

Land Use Planning and Development Recommendations:

1. Provide Jefferson County with a copy of the Source Water Protection Plan and GIS mapping information of the SWPA and encourage them to overlay this area on their land use maps.
2. Request to be notified by Jefferson County officials of land use hearings or meetings regarding land within the SWPA to have the opportunity to participate in the process (i.e. formal agreement, MOU between Water District and County, ongoing cross communication).
3. Recommend instituting a minimum 2-acre lot size for future development.
4. Request that the Colorado Division of Water Resources implement a moratorium on new domestic water well development within Indian Hills/Parmalee Gulch watershed until such time as research demonstrates that the aquifer can sustain additional wells.
5. Implement a point-of-sale water well inspection and testing program.
6. Refer to the Jefferson County Comprehensive Plan's land use recommendations.

Open and Abandoned Water Wells

There are approximately 540 private water wells within the Source Water Protection Area. Private wells can be a direct route for contaminants to enter the groundwater if not properly cased and maintained. Contaminants that infiltrate from the surface are more likely to pollute old, shallow, uncased or abandoned wells by entering the aquifer through the unsealed well, which may eventually harm the water quality in other nearby wells.

Figure 15. Example of an improperly abandoned well.

Open and Abandoned Wells Recommendations:

1. Inventory and GPS locations of open and abandoned water wells within the SWPA.
2. Seek grant funding to support improving surface casings and proper abandonment techniques that are covered in regulation.

Flooding

Flooding was considered by the stakeholder group to be a moderate risk in creating a possible impact to the Indian Hills Water District's source waters. Flooding occurs when soils become saturated from prolonged rains and/or snowmelt. If runoff or rain continues, water begins to accumulate faster than it can be absorbed or carried away in stream channels, stream levels begin to rise and eventually overflow the normal stream channel. Communities in Jefferson County are susceptible to various types of flood events including riverine or overbank flooding and flash flooding; gulches, irrigation ditch and canal flooding; and urban or street flood events.

Figure 16. A heavy rain event in the aftermath of the 1996 Buffalo Creek fire resulted in flooding, erosion and debris flows.

The potential for flooding can change and increase through various land use changes and changes to land surface. These changes are commonly created by human activities and other events such as wildfires. Wildfires create hydrophobic soils, a hardening or "glazing" of the earth's surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff, erosion, and downstream sedimentation of channels (Fig. 16).

Flooding Recommendations:

1. Continue to periodically update the County's floodplain regulations to keep them current with FEMA standards. Support and enforce regulations that limit development within the 100-year floodplain.

2. Include flood preparedness and an evacuation plan in the County's Emergency Response Plan.

3. Refer to the Jefferson County Multi Hazard Mitigation Plan.

4. Look for strategies that would protect the Turkey Creek infiltration gallery.

Storage Tanks

There are ten active permitted fuel storage tank sites within the source water protection area and ten inactive permitted sites (Table 7). Information on the status of Aboveground Storage Tanks (AST) and Underground Storage Tanks (UST) within the Source Water Protection Area was obtained from the Colorado Department of Labor and Employment Division of Oil and Public Safety's database via their Colorado Storage Tank Information (COSTIS) website at http://costis.cdle.state.co.us.

Table 7. Permitted Storage Tanks within the Source Water Protection Area

Tank Site	Facility ID#	Status	Spill Event	Information
Bradley #50 108800 Highway 73	5381	Active	X	3 UST
Safeway 27102 Main Street	18088	Active		2 UST
Evergreen #20 26431 Main St.	1970	Active	X	3 UST, Implementing CAP (Clean-up Action Plan stared in 1994 & closed in 1998)
Loaf N Jug 26067 Conifer Rd.	15342	Active	X	3 UST
Stop 4 Gas 9064 S. US Hwy 285	7507	Active		3 UST
Inter-Canyon Fire District 7939 S. Turkey Creek Rd.	19048	Active		1 AST
Evergreen South Deli 7071 Hwy 73	1938	Active	X	3 UST
Jefferson County Public Schools West Area Terminal 7000 S. Hwy 73	4266	Active	X	2 UST
Jim Noble Excavating 4460 Parmalee Gulch Rd.	15864	Active		1 AST
Indian Hills Shop 4267 Comanche Rd.	3259	Active	x	2 AST
R Greens Contracting 10221 Hwy 73 S	543	Inactive	x	
Little Log Store 6328 S. Turkey Creek Rd.	2590	Inactive	X	Implementing CAP (Clean-up Action Plan started in 2010 & closed in 2010)
Indian Hills Trading Post 5409 Parmalee Gulch	5034	Inactive	X	
CDOT Soda Lakes 12400 W. Hwy 285	6087	Inactive	X	
Sky Village 9064 S Hwy 285	7507	Inactive	X	
Gas-A-Car #46 25997 Conifer Rd.	8575	Inactive	X	
Evergreen Garage – Qwest 6991 Hwy 73	9705	Inactive	X	
Wrights Conoco 10895 Hwy 285 S	10756	Inactive	X	
Marshdale Waste Oil 7000 W. Hwy 73	12139	Inactive	X	
Kevin's Co. Inc. 9754 Hwy 285	12378	Inactive	X	

Storage Tank Spills

Of these permitted facilities 6 of the active (currently used) and 10 of the inactive (not used) storage tank facilities had above or underground storage tanks with spill events, recorded as Confirmed Releases (Fig. 18). Two of the sites are currently being remediated (Table 7). A release means any spilling, leaking, emitting, discharging, escaping, leaching, or disposing of a regulated substance from a storage tank into groundwater, surface water or soils. The owner/operator must report a suspected release within 24 hours and investigate suspected releases within seven days. After confirming a release and conducting the initial response and abatement, the owner/operator must continue further source investigation, site assessment, characterization and corrective actions. Some of the sites were cleaned up by the State with federal funding through the Leaking Underground Storage Tank (LUST) Trust Fund financed by a 0.1 cent tax on each gallon of motor fuel sold nationwide (EPA, 2012).

The leaky underground storage tank releases gasoline or "liquid phase hydrocarbon." The gasoline descends through the unsaturated soil zone to float on the water table (gasoline is lighter than water). The gasoline releases compounds like benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tert-butyl ether (MTBE) to the groundwater and they are carried in the direction of groundwater flow. The extent of contamination is defined by the concentration of benzene (from 10 to 10,000 parts per billion) in the groundwater.

Spills from leaking underground storage tanks (LUST) sites can contaminate the groundwater. Because gasoline is lighter than water, gasoline floats on the water table and remains relatively close to the land surface (Fig. 17). The most hazardous compounds in groundwater (the BTEX compounds) are quite volatile and carcinogenic. (Ryan, 2006).

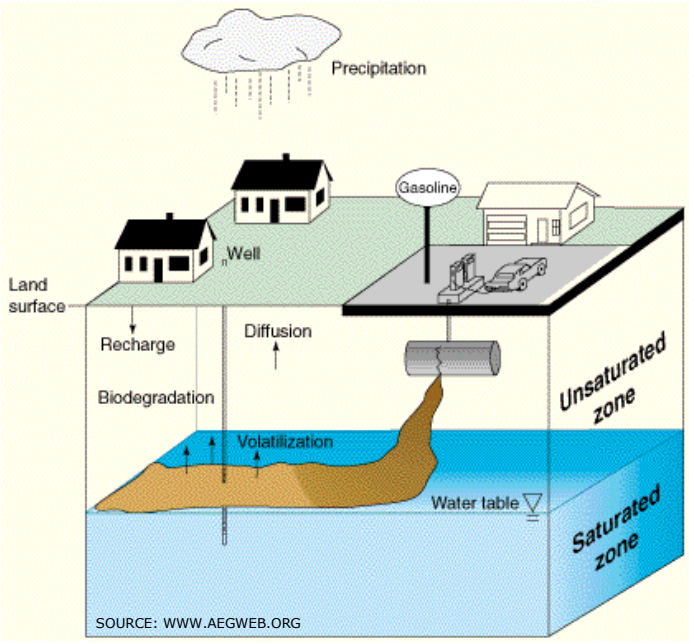


Figure 17. Schematic of a leaking underground storage tank.

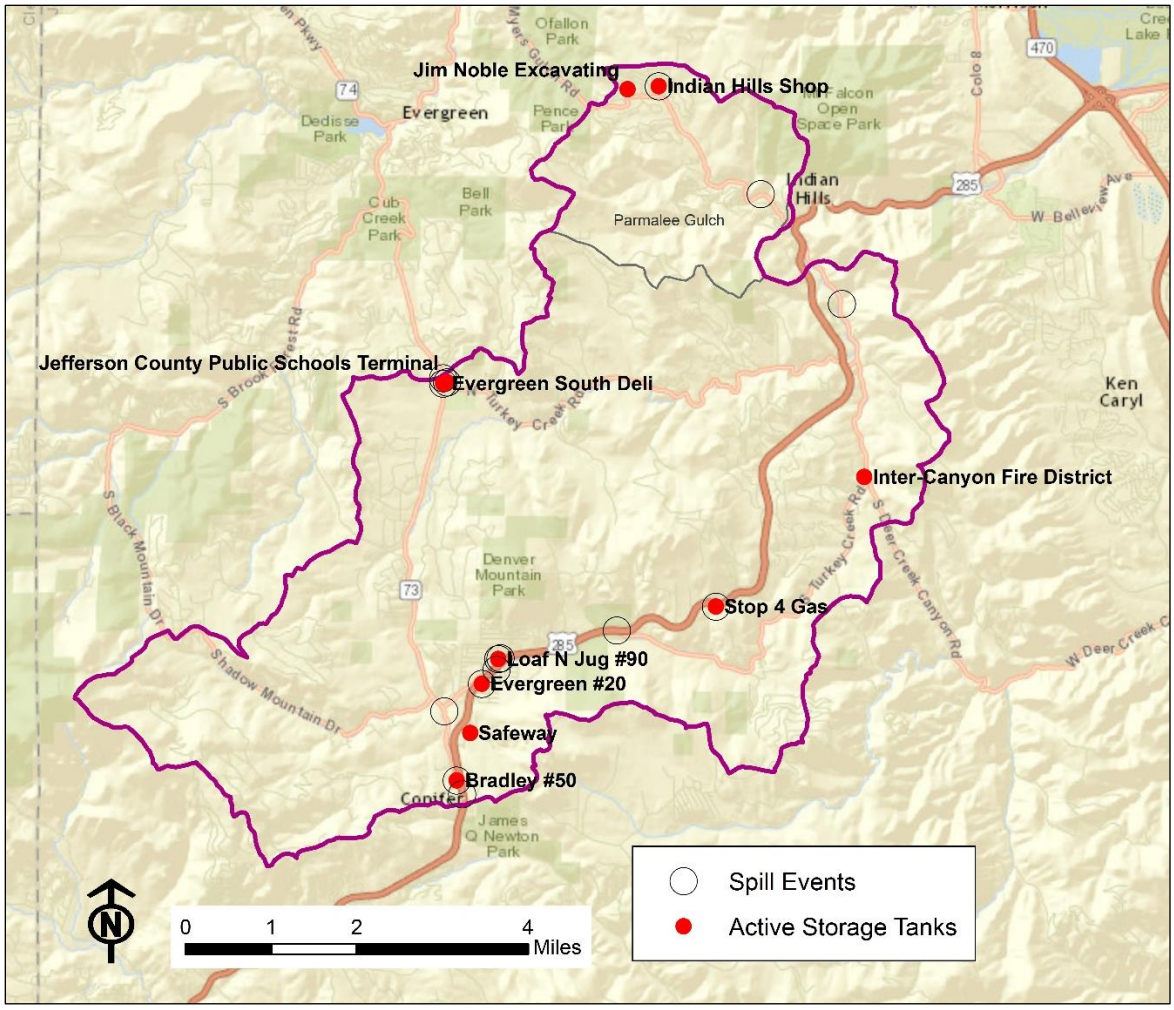


Figure 18. Map of permitted active storage tank facilities and facilities with spill events.

Unregulated Storage Tanks

Rural residents and businesses within the SWPA may have private above ground storage tanks containing gasoline to store vehicular fuel. The private above ground storage tanks are a concern because they may be old and subject to leakage. It only takes a small amount of petroleum to contaminate the ground or surface water.

Storage Tank Recommendations:

1. Develop an inventory of unregulated storage tanks within the SWPA
2. Provide information to tank owners on how they can implement storage tank practices to prevent petroleum products from leaking onto the ground (i.e. secondary containment).

Climate Change and Drought

Drought is shortage of water associated with a deficiency of precipitation, and occurs when a normal amount of moisture is unavailable to satisfy an area's usual water consumption. Drought occurs slowly, over a multi-year period and its effects can last for years. Drought is a regional event, sometimes impacting multiple states simultaneously. According to the *2013 Colorado Drought Mitigation and Response Plan*, there have been seven recorded drought incidents totaling 41 'dry' years, which impacted Jefferson County between 1893 and 2012. The probability of drought occurring in any given year is 36%; therefore, the probability is likely (JCMHMP, 2016).

The 2015 calendar year was the warmest on record globally, the second warmest on record nationally and the third warmest on record in Colorado. Colorado ended the year 2.9 degrees Fahrenheit above the 100-year average for temperature (CWCB, 2016). Climate models project Colorado will warm by four degrees by 2050. This, combined with a seasonal shift in precipitation, warmer spring temperatures, and increase evaporation rates, will result in an impact to Colorado's water resources (CWCB, 2008). Variability in weather is projected to increase due to climate change. More frequent extreme weather events such as drought, flood and early runoff are expected. This will put a strain on infrastructure and require different policies than with the more consistent climate that Colorado has experienced in the past (DiNatale, 2014).

Drought conditions may result in both short term and long-term impacts. In order to appropriately address and reduce drought-related impacts, it is imperative for community water providers throughout the state to anticipate and plan for droughts and a loss of drinking water supply. The Colorado Water Conservation Board recommends that water providers develop a Drought Mitigation Plan to preserve essential public services and minimize the adverse effect of a water supply emergency. The drought plan would identify actions and procedures for responding to a drought-related water supply shortage before an actual water supply emergency occurs.

Climate Change and Drought Recommendations:

1. Stay informed on the effects of future climate changes and impacts to the water sources. Monitor the U.S. Drought Monitor monthly to stay informed on drought conditions in Colorado.
2. Monitor the level of the infiltration gallery and wells, the future water supply needs of the community, and assess the need to build additional water storage.
3. Prepare plans for rapid response to severe drought and implement emergency water restriction measures as needed.
4. Provide education on allowable uses of well water to private well owners in the SWPA.

Wastewater Dischargers

There are five state permitted wastewater facility discharge sites within the source water protection area (Fig. 19, Table 8). These facilities are permitted under the CDPHE National Pollutant Discharge Elimination System (NPDES) regulation. The Water Quality Control Division issues and administers discharge permits and other control mechanisms as provided by the Colorado Water Quality Control Act. Accidental spills from these dischargers into receiving waters (i.e., Turkey and South Turkey Creek) has a potential to contaminate these water sources.

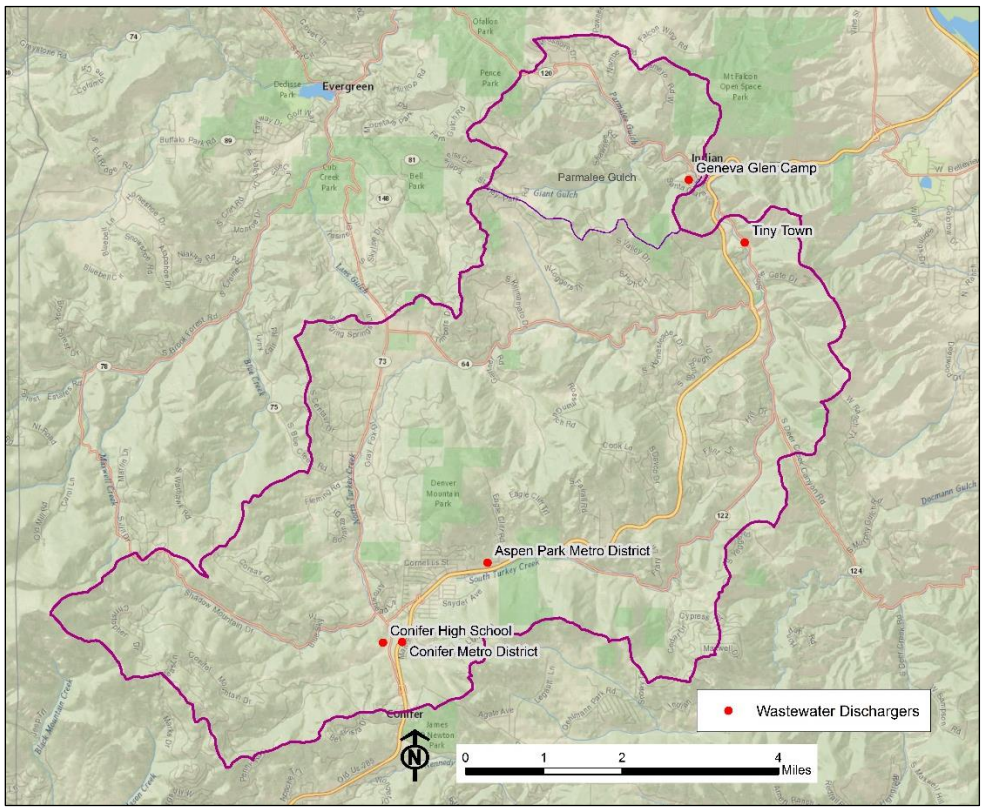


Figure 19. Location of wastewater dischargers within the Source Water Protection Area.

Table 8. Wastewater Discharge Sites with Active Permits

Permit ID	Facility	Address	Description	Receiving Waters
CO0036129	Tiny Town	6249 South Turkey Creek Rd. Morrison, CO	Sewerage System	Turkey Creek
CO0044652	Geneva Glen Camp	5793 Santa Clara Road Indian Hills, CO	Sewerage system (Non-NPDES)	Land application
CO0000001	Aspen Park Metro District	25517 Conifer Road Conifer, CO	Sewerage System	South Turkey Creek
COX047392	Conifer Metro District	10420 South US Hwy 285 Conifer, CO	Sewerage system; (Non-NPDES)	Groundwater
CO0044644	Conifer High School WW REC PLT	10441 County Highway 73 Conifer, CO	Sewerage System	Lobo Reservoir/Lobo Creek/Bear Creek

SOURCE: EPA ENVIROMAPPER

Wastewater Dischargers Recommendations:

1. Provide Emergency Notification Card to the upstream WWTF operators and request notification of emergency upsets and spills.

Horse Property

Within Indian Hills there are 543 acres of pasture area, 55 parcels with stables, and an estimated 76 horses. Horses on residential properties in Jefferson County are regulated under their Zoning Regulations. Indian Hills is zoned as Mountain Residential – One (MR-1). This zoning regulation stipulates that there be 9000 square feet available for the first animal, and 6000 square feet available for each additional animal. In addition, "*manure shall not be allowed to accumulate so as to cause a hazard to the health, safety or welfare of humans and/or animals. The outside storage of manure in piles shall not be permitted within 100 feet of the front lot line and shall conform to the side and rear setback requirements for a dwelling*" (Jefferson County, 2016).

Horse properties, if improperly managed, can be a significant source of nitrates to the groundwater. Under those conditions, nitrates in shallow groundwater may exceed OWTS levels by an order of magnitude. Indian Hills Water District Wells #4 and #6 are both too high in nitrates to use consistently, and are down-gradient of one or more, smaller than average horse properties. In the PH Associates study it was noted that "the parcel-based Mass Balance Analysis indicates that horse lots of 1 acre could generate about 39 mg/L nitrate, and overall, upper zone analysis area horse properties may average about 32 mg/L and lower zone properties about 40 mg/L based on differences in average horse pasture size."

Actual nitrate concentrations from any horse property will be determined by several factors including number of horses, parcel size, appropriate manure disposal practices, terrain slopes, vegetation, soil characteristics, and underlying geology (PH Associates, 2016).

Horse Property Recommendations:

1. Host a community workshop to educate horse property owners in the SWPA on proper manure management strategies and BMPs.

2. Encourage the County to evaluate compliance with their MR-1 zoning designation by the number of head of stock and carrying capacity of the land.

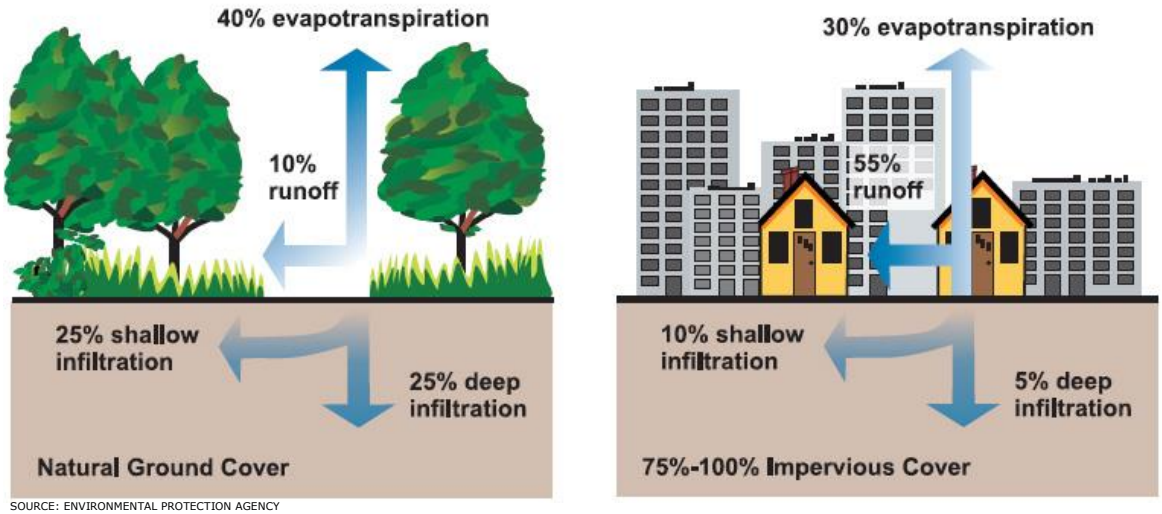
Stormwater Runoff

Stormwater run-off has the potential to introduce untreated pollutants into waterways during wet weather events. Stormwater runoff occurs when water from rain, snowmelt flows, or irrigation over the ground over streets, lawns, farms, and other construction and industrial sites. Stormwater runoff can pick up fertilizers, dirt, pesticides, oil and grease, and many other pollutants and flow into waterbodies used for swimming, fishing and providing drinking water.

Runoff can affect the stream hydrology, morphology, water quality and aquatic ecology. Water quality problems include turbid water, nutrient enrichment, bacterial contamination, organic matter loads, metals, salts, temperature increases, and increased trash and debris.
Urbanization affects stormwater runoff by increasing the following:

- The volumes and rates of surface runoff,
- The concentrations and the types of pollutants,
- The amount of pollutants carried to receiving waters.

As communities become increasingly developed with more roads, parking lots, cars and homes, the increased urbanization and increased amount of impervious surface directly impacts our water (Fig. 20). The creation of impervious surfaces profoundly affects how water moves above and below ground during storms. These impervious surfaces impact the quality of stormwater, and the condition of our creeks.



SOURCE: ENVIRONMENTAL PROTECTION AGENCY

Figure 20. An increase in impervious coverage increases stormwater runoff

Stormwater Runoff Recommendations:

1. Create a stormwater management plan to incorporate BMPs that are protective of District's wells and water resources.

Herbicides and Fertilizers

Pesticides are widely used in Colorado to protect crops and livestock from losses due to insects, weeds, and diseases. The major groups of pesticides include insecticides, herbicides, and fungicides. Because herbicides are the most widely used class of agricultural and urban use pesticides, they are the pesticides most frequently found in ground and surface water. Improper pesticide use has led to human illness, wildlife losses, and water quality degradation. The development of extremely sensitive detection methods has led to the discovery that commonly used management practices may lead to small amounts of pesticide that contaminate ground and surface water supplies. Since we depend on these water supplies for drinking water, pesticide users need to exercise a high level of care and sound pesticide use management to avoid contamination. These chemicals can enter the water source through direct application, runoff, and wind transport.

Herbicides are used to control roadside noxious weeds by Jefferson County Road and Bridge in the source water protection area along Highway 126. Certain noxious weeds in the County that are on the State's List A are required to be eradicated (destroyed). Noxious weeds in the County on List B are treated chemically with herbicides, but may also be controlled mechanically. The remaining noxious weeds on List C are recommended for voluntary management (Jefferson County, 2017).

Fertilizers can also migrate into surface and groundwater. The two main components of fertilizer that are of greatest concern to source water quality are nitrogen and phosphorus. Improper or excessive use of fertilizer can lead to nitrate pollution of ground or surface water. Nitrogen fertilizer, whether organic or inorganic, is biologically transformed to nitrate that is highly soluble in water. In this soluble form, nitrate can readily be absorbed and used by plants. On the other hand, soluble nitrate is highly mobile and can move with percolating water out of the soil, thus making it unavailable for plant uptakes. Fertilizer applicators – including those spreading biosolids and manure, need to match nitrogen applications to plant uptake to minimize nitrate leaching and maximize efficiency.

Herbicides and Fertilizers Use Recommendations:

1. Provide the County weed manager with a copy of the Source Water Protection Plan, a map of the source water protection area and location of water intakes. Encourage the use of non-herbicide alternatives in a 50-foot buffer zone around drinking water intakes, ditches, and streams.
2. Distribute BMP outreach material concerning the proper storage and application of fertilizer and herbicides to the local users. Information will include:
    - fertilizer usage and turf management
    - irrigation practices
    - storage, handling, and disposal of fertilizers, and washing of application equipment
    - hazardous spills clean up and disposal plan

Hazardous Waste Generators

There are four Small Quantity Generator (100 to 1,000 kg/month) Hazardous Waste sites within the Source Water Protection Area (Fig. 21). Hazardous waste transporters, generators and other facilities that manage hazardous waste are required to obtain an EPA Identification Number that is issued by the State and EPA to identify a facility for hazardous waste management and tracking purposes (Table 9).

A hazardous waste is a solid, a liquid or a contained gaseous material that is no longer used or that no longer serves the purpose for which it was produced, and could pose dangers to human health and the environment after it is discarded. Hazardous Waste Activities include generators, storers, transporters, recyclers, treaters, transfer facilities, exempt boiler and/or industrial furnace, and underground injection control.

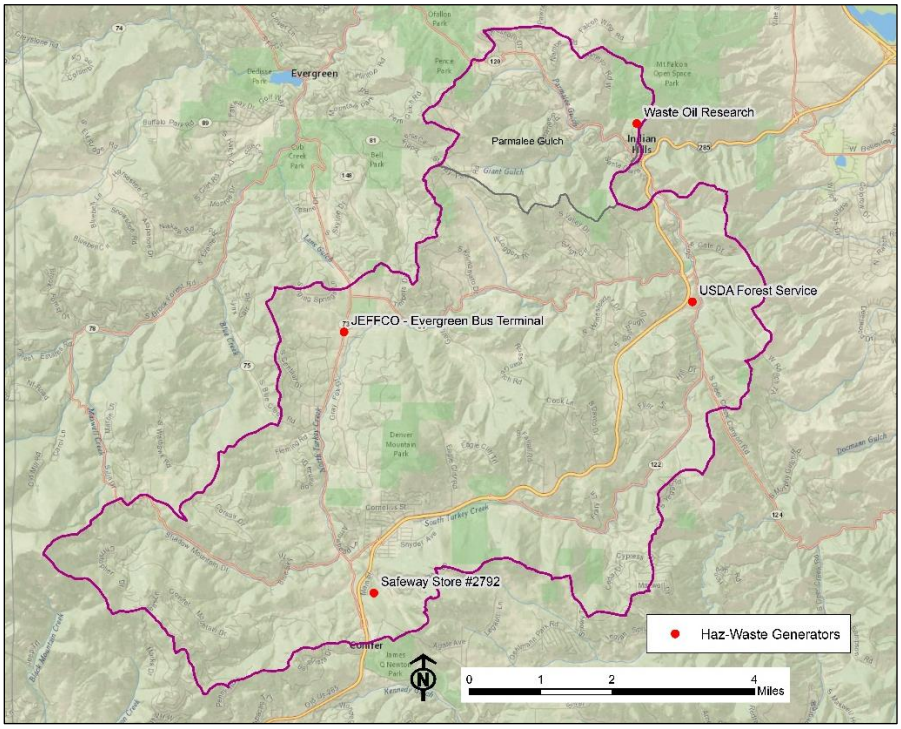


Figure 21. Small quantity hazardous waste generators in the SWPA.

Table 9. Table of Hazardous Waste Sites within the Source Water Protection Area

Facility Name	Facility ID	Address	Status
Waste Oil Research	COD980960157	2370 S. Algonquin Rd. Indian Hills, CO 80454	Small quantity generator
USDA Forest Service	COR000015735	19316 Goddard Ranch Ct. Morrison, CO 80465	Conditionally exempt small quantity generator
Safeway Store #2792	COR000235002	27152 Main St. Conifer, CO 80433	Conditionally exempt small quantity generator
JeffCo – Evergreen Bus Terminal	COD981547581	7000 S. Hwy 73 Evergreen, CO 80439	Small quantity generator

SOURCE WATER PROTECTION MEASURES

Best Management Practices

The stakeholder group reviewed and discussed several possible best management practices that could be implemented within the Source Water Protection Area to help reduce the potential risks of contamination to the community's source water. The stakeholder group established a "common sense" approach in identifying and selecting the most feasible source water management activities to implement locally. The focus was on selecting those protection measures that are most likely to work for the community. The best management practices were obtained from multiple sources including: Environmental Protection Agency, Colorado Department of Public Health and Environment, Natural Resources Conservation Service, and other source water protection plans.

The stakeholder group recommends the best management practices listed in Table 10, "Source Water Protection Best Management Practices" be considered for implementation by:

- Indian Hills Water District
- Jefferson County
- Indian Hills Fire Rescue
- Jefferson Conservation District
- Colorado Rural Water Association
- Visitors to the Source Water Protection Area

Evaluating Effectiveness of Best Management Practices

The Indian Hills Water District is committed to evaluating the effectiveness of the various source water best management practices that have been implemented. The public will be informed by updates at community meetings on the outcomes of the various source water best management practices implemented. It is recommended by CRWA that this Plan be reviewed at a frequency of once every 1-3 years or if circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

The Indian Hills Water District is committed to a mutually beneficial partnership with the Colorado Department of Public Health and Environment in making future refinements to their source water assessment and to revise the Source Water Protection Plan accordingly based on any major refinements.

Table 10. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
Transportation Impacts	1. Educate the local community on how to respond to a hazardous spill in the SWPA by calling "911". This can be done with signage on the roadways entering the protection area along with information in a public brochure distributed to residents and visitors in the protection area. Obtain approval from County Planning Department prior to constructing "Drinking Water Protection Area" signage on roadways.	Indian Hills Water District Jefferson County Transportation Indian Hills Fire Rescue
	2. Work with local emergency response teams to ensure that any spill within the protection areas can be effectively contained and proper protocols is followed for clean-up of hazardous materials spilled within the transportation corridors. Refer to the County Emergency Management Plan.	Indian Hills Fire Rescue Jefferson County OEM
	3. Keep informed on road maintenance practices and schedules within the SWPA.	Indian Hills Water District
	4. Provide a copy of the Source Water Protection Plan and map of the SWPA to Jefferson County Transportation Department, Indian Hills Fire Protection District, Jefferson County Office of Emergency Management (OEM), and CDOT.	Indian Hills Water District
	5. Request to be notified by Jefferson County OEM when a hazardous spill occurs within the SWPA.	Jefferson County OEM Indian Hills Water District
	6. Consider the purchase of small spill kits to be used by utility managers, and responders within the SWPA.	Indian Hills Water District
	7. Recommend secondary containment of deicer chemicals at storage sites.	IHWD, Jefferson County Transportation
	8. Provide CDOT with a copy of the source water protection plan. Encourage the proper road BMPs to prevent the transport of road deicers into the groundwater.	CDOT
Wastewater Dischargers	1. Provide Emergency Notification Card to the upstream WWTF operators and request notification of emergency upsets and spills.	Indian Hills Water District

Table 10. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
Climate Change and Drought	1. Stay informed on the effects of future climate changes and impacts to the water sources. Monitor the U.S. Drought Monitor monthly to stay informed on drought conditions in Colorado.	Indian Hills Water District
	2. Monitor the levels of the infiltration gallery and wells, the future water supply needs of the community, and assess the need to build additional water storage.	Indian Hills Water District
	3. Prepare plans for rapid response to severe drought and implement emergency water restriction measures as needed.	Indian Hills Water District
	4. Provide education on allowable uses of well water to private well owners in the SWPA.	DWR and IHWD
Onsite Wastewater Treatment Systems/Septic Systems	1. Seek referrals from Jefferson County Public Health on septic system replacements within or near the "prohibition area".	Indian Hills Water District
	2. Collaborate with Jefferson County Public Health on a referral basis to review septic system designs and development within important recharge zones.	Jefferson County Public Health
	3. Educate property owners within the SWPA on the source water protection plan, the proper use and maintenance of their septic systems and how the source of their drinking water can be affected by an inadequate functioning septic system.	Indian Hills Water District
	4. Encourage Jefferson County Environmental Health to educate property owners when they apply for a septic permit on the link between good septic practices and protecting groundwater.	Jefferson County Public Health
	5. Encourage JCPH to limit new OWTS development to 2+ acres.	Jefferson County Board of Health
	6. Work with JCPH to create GIS database of all OWTS and domestic water well locations.	Jefferson County Public Health
	7. Encourage JCPH to require mandatory replacement of aging/undocumented or unpermitted OWTS within 1000 feet of District wells with HLT systems, and by a specified date.	Jefferson County Board of Health

Table 10. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
Wildland Fire	1. Refer to the Jefferson County Multi-Hazard Mitigation Management Plan as guides to understand emergency response during a disaster event.	Indian Hills Water District
	2. Share map of the SWPA, GIS shape files, and Emergency Notification Cards with Indian Hills Fire Rescue and Jefferson County OEM at a meeting that IHWD hosts.	Indian Hills Fire Rescue Jefferson County OEM
	3. Consider becoming a FireWise Community and create an action plan to decrease risk from wildfire (i.e. defensible space, evacuation plan, and fuel reduction).	Indian Hills Fire Rescue
	4. Avoid spraying fire retardant near the infiltration galleries.	Jefferson County OEM
Flooding	1. Continue to periodically update the County's floodplain regulations to keep them current with FEMA standards. Support and enforce regulations that limit development within the 100-year floodplain.	Jefferson County Planning and Zoning
	2. Include flood preparedness and an evacuation plan in the County's Emergency Response Plan.	Indian Hills Fire Rescue
	3. Refer to the Jefferson County Multi Hazard Mitigation Plan.	Jefferson County OEM
	4. Look for strategies that would protect the Turkey Creek infiltration gallery.	Indian Hills Water District
Horse Property	1. Host a community workshop to educate horse property owners in the SWPA on proper manure management strategies and BMPs.	Jefferson Conservation District
	2. Encourage the County to evaluate compliance with their MR-1 zoning designation by the number of head of stock and carrying capacity of the land.	Jefferson County Planning and Zoning
Stormwater Runoff	1. Create a stormwater management plan to incorporate BMPs that are protective of District's wells and water resources.	Indian Hills Water District

Table 10. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
Herbicides and Fertilizers	1. Provide the County weed manager with a copy of the Source Water Protection Plan, a map of the source water protection area and location of water intakes. Encourage the use of non-herbicide alternatives in a 50-foot buffer zone around drinking water intakes, ditches, and streams. 2. Distribute BMP outreach material concerning the proper storage and application of fertilizer and herbicides to the local users. Information will include: • fertilizer usage and turf management • irrigation practices • storage, handling, and disposal of fertilizers, and washing of application equipment • hazardous spills clean up and disposal plan	Indian Hills Water District Jefferson County Transportation Indian Hills Water District
Storage Tanks	1. Develop an inventory of unregulated storage tanks within the SWPA 2. Provide information to tank owners on how they can implement storage tank practices to prevent petroleum products from leaking onto the ground (i.e. secondary containment).	Indian Hills Water District Indian Hills Water District
Open and Abandoned Water Wells	1. Inventory and GPS locations of open and abandoned water wells within the SWPA. 2. Seek grant funding to support improving surface casings and proper abandonment techniques that are covered by regulation.	Jefferson County Public Health Indian Hills Water District

Table 10. Source Water Protection Best Management Practices

Issue	Management Approach	Partners
Land Use Planning	1. Provide Jefferson County with a copy of the Source Water Protection Plan and GIS mapping information of the SWP area and encourage them to overlay this area on their land use maps.	Indian Hills Water District
	2. Request to be notified by Jefferson County officials of land use hearings or meetings regarding land within the SWPA to have the opportunity to participate in the process (i.e. formal agreement, MOU between Water District and County, ongoing cross communication).	Indian Hills Water District
	3. Recommend instituting a minimum 2-acre lot size for future development.	Indian Hills Water District
	4. Request that the Colorado Division of Water Resources implement a moratorium on new domestic water well development within Indian Hills/Parmalee Gulch watershed until such time as research demonstrates that the aquifer can sustain additional wells.	Indian Hills Water District
	5. Implement a point-of-sale water well inspection and testing program.	Jefferson County Board of Health
	6. Refer to the Jefferson County Comprehensive Plan's land use recommendations.	Indian Hills Water District

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APPENDICES

A. Contingency Plan*

B. Source Water Assessment Report and Appendices

C. Meeting Agendas and Presentations

D. Contact List of Stakeholders Invited to Participate

E. Citizen Guides

F. Contaminant Health Concerns

G. PH Associates' Indian Hills Water Quality Modeling Project

H. Additional Resource

*Notice: This public document will only include information that is not deemed sensitive to the safety and operation of the individual community's water plan operation. Appendices marked with a * are only included in the Public Utility's report or kept on file at their office. All other documents are included on the CD located in the back pocket of this report. All documents can be reprinted.*