FOUNTAIN CREEK WATERSHED

ENVIRONMENTAL PROTECTION AGENCY NINE-ELEMENT PLAN FOR THE MANAGEMENT OF *ESCHERICHIA COLI*

Fountain Creek Watershed
Environmental Protection Agency Nine-Element Plan for the Management of *Escherichia Coli*

Prepared for:
Section 319 Nonpoint Source Pollution Control Program
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Issue Statement

In September 2016, stakeholders from the Arkansas Fountain Coalition for Urban River Evaluation (AF CURE) formed a stakeholder group with the objective of developing a watershed plan to address excess nonpoint sources of *Escherichia coli* (*E. coli*) in Fountain Creek Watershed. The Fountain Creek Watershed-Based Plan (Plan) was overseen by the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (WQCD) Nonpoint Source Program and funded by the Colorado Water Resources and Power Development Authority and AF CURE. The primary water quality parameter evaluated in this Plan is *E. coli*. To meet requirements associated with the Environmental Protection Agency's (EPA's) 9 Elements of a Watershed Plan, this Plan also identifies additional nonpoint source water quality issues in the watershed. These additional issues are, however, not the focus of this plan and will need to be more fully evaluated and addressed in other watershed-wide efforts.

The funding received through the Nonpoint Source Program was used for the development of a strategy to address nonpoint sources of pollutants in the watershed; however, a large part of the watershed is covered under regulated stormwater (Municipal Separate Storm Sewer System (MS4)) permits. The Plan therefore also distinguishes sources of pollutants that are discharged to receiving waters through discrete conveyances included in MS4 permits and wastewater treatment facilities (WWTFs) which are point sources to provide a watershed-wide overview of potential *E. coli* sources.

During the development of the Plan, direction was provided by CDPHE reviewers to specifically include information pertaining to homeless camps and potentially faulty onsite wastewater treatment systems (OWTS) as nonpoint sources (whether located within or outside the boundaries of an MS4). These are the only nonpoint sources of *E. coli* that will be discussed in length in the Plan that may be located within the boundaries of an MS4. Other information provided about MS4 efforts to address *E. coli* are provided for context and because similar programs and best management practices will most likely be employed within the watershed to reduce the contribution of nonpoint sources.

The Plan serves as a reference and guide for understanding available data, stream standards and impairments, point source and nonpoint source loading, implementation strategies to reduce pollutant loading and identifies the need for additional monitoring to resolve data gaps.

Appendix A provides a series of Geographic Information System (GIS) maps that are referenced throughout this report. The maps are organized to first provide an overview of the entire Fountain Creek Watershed, the location of the sub-watersheds within the larger watershed, and then more specific information for each sub-watershed to allow the reader easy reference for quick comparison. The Plan is a living guidance document and will be periodically assessed and updated as necessary, based on the best available information. The topics covered in this Plan, cross-referencing the EPA's Nine Elements, can be found in Table 1-1.

Water Quality Goals

Many stream segments in the Fountain Creek watershed are included on the State of Colorado's Section 303(d) List of Impaired Waters (Regulation #93) for *E. coli* exceedances. The 303(d) priorities for these impairments are designated as high in the regulation based on a risk to human health, primarily in association with recreational activities. This Plan utilizes a well-established approach to resolve uncertainty regarding pollutant sources on a watershed scale using adaptive

management principles based on sound scientific analysis. The results of the Plan are designed to provide a solid foundation for future development of stakeholder-approved pollutant management strategies.

The development of a Fountain Creek Watershed Plan serves several purposes, including to:

1. Provide an appropriate planning framework around addressing *E. coli* sources;
2. Identify possible sources of *E. coli* as well as locations that need further investigation;
3. Identify projects and activities which may be implemented to improve in-stream *E. coli* levels; and,
4. Prioritize projects and expansion or implementation of programs and best management practices targeted at the reduction of *E. coli* within the watershed.

Potential Control Measures

This planning process took place over the last two years and engaged many diverse stakeholders. Section 6 describes strategies for water quality improvements based on the type of source (nonpoint and regulated point source/stormwater).

Measuring Progress and Next Steps

Given the size of the watershed, the complexity of possible contributing *E. coli* sources within the watershed, and the multitude of unknowns, progress will be measured by: 1) any reduction in *E. coli* concentrations within the watershed; 2) a more comprehensive understanding of the nonpoint sources contributing to increased loading; and 3) education of citizens about their role in helping to reduce *E. coli* levels.

Once approved, a schedule of presentations will be developed to share the process and outcomes of the Plan with grant signatories and other leadership throughout the watershed. Jurisdictions will be implementing their programs, and stakeholders would like to transition to a quarterly meeting schedule. Quarterly meetings will provide an opportunity for continued collaboration, updates on programs, sharing and continued assessment of water quality monitoring results and identification of potential grant opportunities to support continued funding of these on-going assessment and implementation efforts.

Section 1

A Watershed Approach

1.1 Definition of a Watershed

A watershed is defined as the land area that drains to a common water body such as a stream, lake, wetland, or ultimately the ocean. We all live in a watershed and some watersheds can be very small while others contain large portions of countries or continents. Sub-watersheds combine to form larger watersheds. The Fountain Creek Watershed is a part of the Arkansas River Basin, which is part of the Mississippi-Missouri Drainage Basin that drains to the Gulf of Mexico. (See Map A-1, Fountain Creek Connection to Ocean, and Map A-2 Colorado River Basins and Fountain Creek Watershed)

1.2 The Watershed Approach

A Watershed Approach, as defined by the EPA in 2008, is "a flexible framework for managing water resource quality and quantity within a specified drainage area or watershed." Table 1-1 indicates the nine required elements of an EPA Watershed Plan. This approach includes engaging stakeholders to make management decisions supported by sound science and appropriate technology. The following are components of a Watershed Approach:

- A geographic focus based on hydrology rather than political boundaries;
- Water quality objectives based on scientific data;
- Coordinated priorities and integrated solutions; and
- Diverse, well-integrated partnerships.

Table 1-1: EPA Nine Watershed Plan

EPA Watershed Plan Nine Required Elements	Section in the Fountain Creek Watershed-Based Plan
[1] Identify causes and sources of pollution	2.5, 3, 4.2, 4.3, 5.1
[2] Estimate pollutant loading into the watershed and the expected load reductions	5.3
[3] Describe management measures that will achieve load reductions and targeted critical areas	6.1, 6.3
[4] Estimate amounts of technical and financial assistance and the relevant authorities needed to implement the plan	Appendix C
[5] Develop an information/education component	Appendix C
[6] Develop a project schedule	6.3, Appendix C
[7] Describe the interim, measurable milestones	6.3, Appendix C
[8] Identify indicators to measure progress	6.3, Appendix C
[9] Develop a monitoring component	7

1.3 The Fountain Creek Watershed

The Fountain Creek Watershed comprises approximately 930 square miles of land and water located in the western portion of El Paso County and the northwestern portion of Pueblo County, along Colorado's Front Range. This area is classified as a semi-arid environment and receives approximately 15 inches of precipitation annually. The two main creeks in the watershed are Monument Creek, which begins northwest of the Air Force Academy, and Fountain Creek which has headwaters in Woodland Park, west of Manitou Springs. The two creeks meet south of downtown Colorado Springs and flow south into the Arkansas River in Pueblo. These creeks and the other 50+ sometimes-intermittent waterways provide critical habitat for numerous species of wildlife and are enjoyed by residents and visitors alike throughout the year who enjoy recreational and leisure activities within the numerous parks and open spaces found adjacent to the waterways. The region's largest water provider, Colorado Springs Utilities, sources about 85% of its water from trans-basin diversions, with the rest coming from exchanges and local sources. Fountain Creek, and ultimately the Arkansas River, provide water to irrigate over 100 farms and ranches. Fountain Creek alluvial wells provide more than half of the water supply to the smaller communities of Security, Widefield, Fountain, and Stratmoor Hills. The Fountain Creek Watershed contains about 13% of the total population of Colorado, including two of the largest metropolitan areas along the Front Range: Colorado Springs and Pueblo (CDPHE-WQCD, 2002a).

1.3.1 Fountain Creek Watershed Characterization

The primary issues of concern in the Fountain Creek Watershed are water quality, erosion, sedimentation, and flooding. However, the degree of each of these issues varies across the watershed and is impacted by different physical processes, the management practices in use, and the technical strategies being applied.

Many interrelated variables can affect this watershed's water quality, exacerbate erosion and contribute to sedimentation problems in the Fountain Creek Watershed, including but not limited to:

- Base flows;
- Precipitation and snow melt;
- Discharges from WWTFs;
- Sediment supply and transport;
- Floodplain encroachment;
- Channel morphology; and
- Channel bank protection and grade control.

Other factors that can potentially affect the health of the Fountain Creek Watershed are equally as complex and challenging to assess or manage. Some of these factors may include:

- Wildlife impacts;
- Potential failure of Onsite Wastewater Treatment Systems (OWTS) in close proximity to the waterways;
- Waste management associated with homeless populations that camp along the creeks and in stormwater infrastructure; and
- Challenges associated with affecting human behavioral change (e.g., pet waste management).

There are many stakeholders working to address the myriad of Fountain Creek Watershed issues – from stormwater infrastructure projects to public engagement and stewardship activities. The Fountain Creek Watershed has great potential, as described by former Senator Ken Salazar in 2006: "Now is the time…for the entire region to work together to create a Crown Jewel that will bring

unmatched recreational opportunities, create an environment for plants and wildlife to flourish, ensure that agricultural lands remain productive, and address the flood control and water quality issues on Fountain Creek." In 2009, as a result of a 2-year stakeholder process, the Fountain Creek Watershed Flood Control and Greenway District (the District) was created and works at the watershed scale. The District manages a robust website and meeting schedule with its committees to advance the protection and restoration of the watershed, and they have the potential to play a larger role in future watershed plan efforts as implementation continues.

It has become evident that as the Fountain Creek Watershed becomes increasingly urbanized, its land and waters face increased potential impacts. As a result, land managers and watershed stakeholders face an increasing number of complex issues that will require solutions that need to be developed collaboratively. Through continued assessment and the implementation of adaptive management principles and science-based solutions, the surface water quality within the Fountain Creek Watershed can be improved.

Section 2

Delineation of the Watershed, Sub-Watersheds, and Affected Segments

The Fountain Creek Watershed is located in central Colorado on the eastern slope of Pikes Peak. The watershed drains the Palmer Divide at its northern boundary, and the top of Pikes Peak at 14,114 feet (ft) south to the Upper Arkansas River in Pueblo at 4,640 ft. This 9,400+-ft elevation change occurs over just 50 miles – a significant drop that results in diverse ecosystems, extreme temperature and precipitation variations, and can greatly impact watershed health. To account for variations in stream morphology, land use and geographic diversity, the stakeholders evaluated ways to subdivide the watershed and begin to draw conclusions about contributing sources.

The United States Geological Survey (USGS) identifies hydrologic unit codes (HUCs), ranging from 2 to 12 digits that correlate to specific divisions of an area/watershed. HUC units with smaller numbers denote less divisions within a watershed resulting in fewer sub-watersheds of larger size, as compared to HUC units with larger numbers that denote more divisions within a watershed resulting in more sub-watersheds of smaller size, comparatively. Evaluating the Fountain Creek Watershed using HUC 10 units was determined to be less than ideal, as the resulting sub-watersheds were too large to ascertain enough detail on potential loading. Conversely, when Fountain Creek was divided into HUC 12 units, it yielded over 30 sub-drainage basins. The problem with assessing the landscape at this scale was the resulting "data deserts" caused by not all HUC 12 units having historic or active monitoring occurring within them. This would have made it difficult to account for source contributions within all of the resulting units as well as challenging to determine whether or not a reach may or may not be in attainment.

Delineating the Fountain Creek Watershed into units larger than HUC 10 and smaller than HUC 12 resulted in the best method for bracketing stream reaches into common landscape conditions. This involved performing a watershed delineation with the ArcGIS Spatial Analyst Tools for Hydrology. USGS gages with paired flow and *E. coli* data served as the pour point for each sub-drainage. Pour point is defined as the point at which water flows out of an area at the point of lowest elevation along the boundary of a drainage basin. The process yielded 12 sub-watersheds that best bracketed ecological zones, predominant land uses, and MS4 jurisdictions. Table 2-1 provides the list of gages that serve as the pour points for each sub-drainage area. Each sub-watershed is commonly referred to throughout the Plan by the name of the USGS gage/station located at its pour point. Maps of the Fountain Creek Watershed Stream Segments (Map A-3), Sub Watershed Pour Points (Map A-4), and Sub Watershed Impervious Areas (Maps A-6 through A-17), Sub Watershed and Stream Impairment Map Sets and Land Use Map Sets (Maps A-36 and A-37) are included in Appendix A at the end of this Plan. Sub-watershed descriptions are provided in Section 3 of this Plan.

Table 2-1: Fountain Creek Sub-watersheds	
Gage/Station Name	Gage/Station Number
Monument Creek above North Gate	07103780
Monument Creek above Woodmen Road	07103970
Cottonwood Creek at Mouth at Pikeview	07103990
Monument Creek at Bijou Street	07104905
Fountain Creek near Colorado Springs	07103700
Fountain Creek at Colorado Springs	07105500
Sand Creek above Mouth	07105600
Fountain Creek at Security	07105800
Jimmy Camp Creek at Fountain	07105900
Fountain Creek near Pinon	07106300
Fountain Creek at Pueblo	07106500
Fountain Creek at Mouth	FOUMOUCO

2.1 Physical and Natural Features

The highest point of the watershed is Pikes Peak at 14,114 ft, draining to a low elevation of 4,640 ft at the confluence with the Arkansas River. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the region's soils include alluvium derived from granite (locally known as Pikes Peak Granite) in the west, to fine sandy loam in the east, to clay/loam alluvium derived from weathered shale to the south. Soils are considered well-drained to somewhat excessively drained. The mean annual precipitation on Pikes Peak is 30 inches per year and drops to 12-14 inches on the plains. The mean annual air temperature is 48 to 52 degrees Fahrenheit (°F) with the coldest winter averaging around 22.8 °F and the warmest summer averaging 73.3 °F (National Weather Service).

The Fountain Creek Watershed includes a variety of ecoregions progressing from short grass prairie in the east, to lower montane and alpine on the western edge of the watershed. Within the watershed, short grass prairie systems cover most of the geography. Along Fountain Creek, riparian woodland forests are found consisting of cottonwood galleries and a dense understory of grasses, willows and shrubs which provides hundreds of species of wildlife with essential food, shelter, water and migration corridors. Agricultural lands are intermingled with the riparian forests and uplands within the rural corridor.

2.2 Major Land Uses

There are a variety of land uses within the Fountain Creek Watershed including residential (high, medium, and low density), commercial and office, industrial, parks and open space, military bases, schools and institutions, agricultural and undeveloped land. Table 2-2 summarizes the major land uses within the entire watershed. The City of Colorado Springs is the largest populated community within the Fountain Creek Watershed, with nearly 450,000 residents.

El Paso and Pueblo County parcel data from 2016 was used to evaluate connections between land activities, mechanisms for loading, and response of the waterway. Land uses were sorted using a land cover classification system that adopted criteria defined by development intensities including residential, rural residential, parks, open space or vacant, commercial/office, industrial, institutional,

agriculture and federal. More details on the land uses and characterization of pollutant loading are provided below for each sub-watershed. Land cover categories are defined as follows:

- **Residential.** Includes single family and multi-family housing units that are in high, medium and low-density neighborhoods. Lot sizes are generally under .5 acre.
- **Rural Residential.** Includes single family housing units that are on low density lots of 0.5 acre up to 5 acres with rural residential zoning. These types of developments are likely not connected to stormwater infrastructure, often include OWTS, and may contribute to nonpoint source loading.
- **Parks, Open Space or Vacant.** Includes neighborhood common areas, parks and undeveloped parcels that may contribute to nonpoint source or MS4 loading.
- **Commercial/Office and Institutional.** Includes service areas, schools and general commercial areas. There is generally an associated large impervious surface area for parking that may or may not have opportunity for managing surface runoff.
- **Industrial.** Includes light to heavy industrial areas. Industrial areas will have similar impervious surface cover and runoff patterns to commercial areas.
- **Agriculture.** Includes parcels that are 0.5 acre or more zoned A. Single family housing on agricultural parcels with a well are assumed to be serviced by an OWTS.
- **Federal.** Parcels under federal jurisdiction are primarily associated with the Pike National Forest, local military bases or the United States Air Force Academy (USAFA).

Agricultural land is primarily located along the main stem of Fountain Creek between the cities of Colorado Springs and Pueblo. Most land in the watershed is privately owned and managed. According to the El Paso County Policy Plan, the overall land development pattern in unincorporated El Paso County is for residential use. Rural unincorporated areas are either absorbed by urbanization as cities and towns grow or are developed into rural-residential subdivisions where lots are typically 2.5 to 5-acre tracts with a well and OWTS. With development comes an immediate need for facilities such as roads and utilities, and services like businesses and schools. These new hard surfaces increase impervious surfaces which can lead to potential water and land pollution increases as well.

Federal ownership, including military installations, is the single largest land use and ownership in the Fountain Creek Watershed. Development trends show overall an impervious surface increase of 5.5% to 6.7% between the years of 2001-2011 (National Land Cover Database). In 2007, the City of Colorado Springs assessed impervious surfaces within the city and calculated that over 17,600 acres of impervious surface exist within its over-124,500-acre boundary (about 17%). Per the EPA, a watershed defined as having 10-25% imperviousness cover is classified as an impacted system and will show clear signs of declining stream health. (EPA, 2004)

Table 2-2: Major Land Uses

Land Use Type	Acres	Percentage (%)
Commercial, Industrial, Institutional, Office	36,250	6.072
Open Space, Park, Undeveloped	60,811	10.186
Federal	180,157	30.176
Residential (multifamily up to 5 acres)	65,262	10.931
Rural Residential 5 acres and up	71,971	12.055
Agricultural	148,065	24.801
Other (Roads, ROW)	34,501	5.779
Total	597,018	100

2.3 Watershed Development and Population

The City of Colorado Springs Metropolitan Statistical Area (MSA) has a population estimate of 688,643[1]. Future forecasts suggest that more growth is expected in the unincorporated areas of El Paso and Pueblo counties. According to the El Paso County Consolidated Plan 2012-2016: A Five-Year Housing and Community Development Strategy, the 2010 Census calculated 235,959 households and a county density of 284 people per square mile (El Paso County, Budget and Economic Development Department). The population forecasts project the 2035 population for El Paso County at nearly one million people. The Pueblo County forecast shows a population of 200,000 by 2030 with around 62% living in and around the City of Pueblo and the rest in Pueblo West or rural subdivisions in unincorporated county areas (Pueblo County 2035 Long Range Transportation Plan). As the population and housing needs grow, larger developments could have correlating negative impacts on the Fountain Creek Watershed without appropriate land development and stormwater management.

2.4 Regulatory Framework

Under the federal Clean Water Act, every state must adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the goal of "swimmable/fishable" waters. The Water Quality Control Commission (WQCC) establishes water quality regulations for the State of Colorado and reviews them every five years, although the 303(d) list (Regulation #93) is updated every two years.

- Regulation #31, The Basic Standards and Methodologies for Surface Water, identifies stream standards, or water quality goals, for Colorado's surface waters. Standards are numeric (or narrative) restrictions to protect the classified uses of those waters. The *E. coli* standard of 126 colony forming units (CFU) per 100 milliliters (mL) was adopted by the WQCC to protect primary contact (i.e., ingestion of small quantities of water likely to occur) during recreational activities.
- Regulation #32, the Classifications and Numeric Standards for the Arkansas River Basin, implements the statewide surface water standards of Regulation #31 into the stream segments of the Arkansas River Basin.
- Regulation #93, the 303(d) List of Impaired Waters and Monitoring and Evaluation List, identifies water bodies that exceed water quality standards (303(d) List) and those that appear to be impaired but need additional data to confirm their status (monitoring and evaluation list).

2.5 Other Watershed Parameters of Concern

The primary water quality issue identified and explored in this Plan is *E. coli*. There is currently no Total Maximum Daily Load (TMDL), but a significant amount of water quality monitoring has occurred, primarily by USGS in different locations of Fountain Creek Watershed going back to the early 1920's. This Plan is a proactive effort to understand potential inputs and develop strategies for mitigation in advance of a TMDL. Other parameters of interest have also been identified as potential targets to enhance overall water quality within the watershed.

Two major fires, the Waldo Canyon Fire in 2012 and the Black Forest Fire in 2013, followed by flooding in 2015 and urban development throughout the watershed, have contributed to watershed health issues and water quality changes. Several studies have identified water quality problems and priorities that this Plan touches on, although none of the previous studies and mitigation strategies

[1] https://statisticalatlas.com/metro-area/Colorado/Colorado-Springs/Overview

have focused on *E. coli* specifically. The following studies have identified other interdependent water quality parameters of concern including:

- Fountain Creek Watershed Study (2009)
- Water Quality Management (208) Plan for the Pikes Peak Region (2010);
- Fountain Creek Watershed Strategic Plan (2011);
- Fountain Creek Corridor Restoration Master Plan (2011);
- Army Corps of Engineers Watershed Study (2011);
- Watershed Assessment and River Stability and Sediment Supply (WARSSS, 2013), developed for the Waldo Canyon Fire and lower Fountain Creek;
- Upper Fountain Creek and Cheyenne Creek restoration plans; and
- Upper Monument Creek restoration plan (2014).

The following parameters of concern are being explored through other water quality planning initiatives in the region:

- **Arsenic.** These standards protect agricultural, drinking water, and aquatic life uses. Arsenic is commonly present in groundwater at levels that exceed the stream standard. Groundwater encountered in excavations for construction or maintenance purposes must either be treated to remove arsenic to levels below the stream standards or hauled away and disposed of properly.
- **Copper.** Copper standards protect agricultural, drinking water, and aquatic life uses. Copper is often elevated in wastewater treatment facility discharges due to copper pipes in homes but may not be toxic to aquatic life at higher levels if certain stream characteristics are present.
- **Nutrients.** Interim stream values for nutrients (total phosphorus, total inorganic nitrogen and chlorophyll *a*) were adopted to protect direct use water supplies, aquatic life and recreation. Sources of nutrients include wastewater treatment discharges, agriculture, natural background from soil or atmospheric deposition and stormwater runoff. Existing stream data in most segments indicate that the interim stream values will not be attained.
- **Metals.** Although stream standards for metals are attained in most of the study area, portions are impaired for metals, including arsenic, iron, manganese, and selenium.
- **Temperature.** Stream standards for temperature are for the protection of aquatic life. Although data is somewhat limited, it indicates that impairments may exist.

2.6 Identification of Impairments within the Fountain Creek Watershed

As previously mentioned, the WQCC establishes basic standards and rules for classifying state surface waters, assigns water quality standards and performs regular review of the standards. Regulations addressing surface water quality aim to sustain classified uses such as water supply, recreation and aquatic life. The following table shows the segment descriptions and the impairments identified in Regulation #93 (CDPHE WQCC, Reg. 93), as well as the classifications and designations from Regulation #32 (CDPHE WQCC, Reg. 32).

Table 2-3: *E. coli* Impaired Segments within Fountain Creek Watershed

Segment	Description/Listed Portion	Category/ Impairment Status	Classifications	Designation
COARFO01a	Mainstem of Fountain Creek from source to above Monument Creek	303(d) / *E. coli*, Manganese (Mn, dissolved), Arsenic (As, total)	Agriculture Aq Life Cold 1 Recreation E Water Supply	Reviewable
COARFO01b	Severy Creek and all tributaries from the source to a point just upstream of where US Forest Service Road 330 crosses the stream.	303(d) / Zinc (dissolved)	Agriculture Aq Life Cold 1 Recreation E Water Supply	Outstanding Waters
COARFO02a	Mainstem of Fountain Creek from a point immediately above the confluence with Monument Creek to a point immediately above the State Highway 47 Bridge	303(d) / *E. coli*	Agriculture Aq Life Warm 2 Recreation E Water Supply	Reviewable
COARFO02b	Mainstem of Fountain Creek from a point immediately above the State Highway 47 Bridge to the confluence with the Arkansas River	303(d) / *E. coli* (May-October), Iron (dissolved and total), Temperature	Agriculture Aq Life Warm 2 Recreation E Water Supply	Reviewable
COARFO03a	All tributaries to Fountain Creek which are within the boundaries of National Forest or Air Force Academy lands, including all wetlands, from a point immediately above the confluence with Monument Creek to the confluence with the Arkansas River, except for the mainstem of Monument Creek in the Air Force Academy lands and specific listings in segment 3b (West Monument Creek and tributaries).	Macroinvertebrates (provisional)	Agriculture Aq Life Cold 1 Recreation E Water Supply	Reviewable
COARFO04a	Mainstems of Jackson Creek, Monument Branch, Elkhorn Springs, Pine Creek, South Pine Creek, South Rockrimmon Creek, Templeton Gap North, Templeton Gap Floodway, Douglas Creek and South Douglas Creek, from the sources to confluences with Monument Creek, including all tributaries and wetlands, which are not within the boundaries of the National Forest or Air Force Academy lands.	303(d) / *E. coli*, Selenium (dissolved)	Agriculture Aq Life Warm 2 Recreation E	Use Protected
COARFO04b	All tributaries to Monument Creek from their source to their confluence with Monument Creek, which are not within the boundaries of National Forest or Air Force Academy lands, including all wetlands, from a point immediately below the confluence with North Monument Creek to the confluence with Fountain Creek, except for specific listings in segments in 03a,04a an 04c. This includes Dirty Woman Creek, Smith Creek, Black Squirrel Creek, Cottonwood Creek, Dry Creek and an unnamed tributary with the confluence at Monument Creek located near latitude/longitude 38.948613, -104.829623.	303(d) / *E. coli*, Selenium (dissolved)	Agriculture Aq Life Cold 2 Recreation E Water Supply	Use Protected
COARFO04c	Kettle Creek, North Rockrimmon Creek and Mesa Creek, including tributaries and wetlands, from their source to the confluence with Monument Creek.	303(d) / *E. coli*, Selenium (dissolved)	Agriculture Aq Life Warm 1 Recreation E Water Supply	Reviewable

Table 2-3: *E. coli* Impaired Segments within Fountain Creek Watershed

Segment	Description/Listed Portion	Category/ Impairment Status	Classifications	Designation
COARFO04d	All tributaries with confluences with Fountain Creek from South Academy Blvd (CO83) to and including the unnamed tributary immediately south of Old Pueblo Road (38.585843, -104.669591), including tributaries and wetlands, except for Little Fountain Creek and its tributaries and wetlands, and specific listings in segments 3a, 5a and 5b. All tributaries with confluences with Fountain Creek from a point immediately above University Blvd (CO47) (38.312846, -104.590524), to the confluence with the Arkansas River.	303(d) / *E. coli*, Selenium (dissolved)	Agriculture Aq Life Warm 2 Recreation E Water Supply	Use Protected
COARFO04e	All tributaries to Fountain Creek, including tributaries and wetlands, from a point immediately below the confluence with Monument Creek to University Blvd (CO47) except for specific listings in 3a, 4d, 5a and 5b. COARFO04_G Little Fountain Creek and its Tributaries below the Deadman Canyon COARFO04_B Sand Creek and tributaries (near Wigwam)	303(d) / *E. coli*, Selenium (dissolved) M&E / Sulfate	Agriculture Aq Life Warm 2 Recreation E Water Supply	Use Protected
COARFO05a	COARFO05_A Marshland on Nash Property (60 acres at 13030 Old Pueblo Road, El Paso County) located in Section 28 T16S R65W; Jimmy Camp Creek from the irrigation diversion east of Old Pueblo Road to its confluence with Fountain Creek; unnamed tributary from the boundary of Fort Carson to the confluence with Fountain Creek; located in S1/2, SW1/4, Section 6 and N1/2. NW1/4, Section 7, T16S, R65W.	M&E / Iron (total)	Agriculture Aq Life Cold 1 Recreation E Water Supply	Reviewable
COARFO06	Mainstem of Monument Creek, from the boundary of National Forest lands to the confluence with Jackson Creek.	303(d) / *E. coli* (May – Oct), Macroinvertebrate, Manganese (dissolved), Temperature	Agriculture Aq Life Warm 2 Recreation E Water Supply	Reviewable
COARFO06	Mainstem of Monument Creek from the confluence with Jackson Creek to the confluence with Fountain Creek	303(d) / *E. coli*, Macroinvertebrate, Manganese (dissolved), Temperature	Agriculture Aq Life Warm 2 Recreation E Water Supply	Reviewable
COARLA01a	Mainstem of the Arkansas River from a point immediately above the confluence with Fountain Creek to immediately above the Colorado Canal headgate near Avondale	303(d) / *E. coli*, Sulfate, Manganese (dissolved), Temperature	Agriculture Aq Life Warm 2 Recreation E Water Supply	Use Protected

Section 3

Sub-watershed Descriptions

The following sections provide a description of each of the 12 sub-watersheds' geographic features, environment, land uses, percent area in MS4 and potential *E. coli* nonpoint sources, as identified through stakeholder input. Percent area within an MS4 was estimated using city, county or relevant municipal boundaries provided by stakeholders with the exception of the Colorado Department of Transportation (CDOT) MS4 whose area was not included in this calculation. A complete mapping of properties with OWTS has not yet been performed throughout the entire watershed; therefore, an assumption was made that those sites with well water also likely utilize an OWTS. Data from the Division of Water Resources was utilized to identify well locations. Where relevant, comments and information related to OWTS have been included in the descriptions of the sub-watersheds below. Mapping of homeless camp locations within the watershed is in the preliminary stages of development as tracking of this information has only recently been initiated by the City of Colorado Springs. A preliminary map can be found in the appendix, Map A-5.

As indicated previously in Section 2 of this plan, the sub-watersheds were defined in ArcGIS using the Watershed Tool with specific gages as pour points. A shapefile was created to identify the impervious area in each watershed using data from the National Land Cover Database (NLCD) and was broken out by HUC code. Percentages of each land use type are best estimates using the GIS analyses mentioned above. Maps of each sub-watershed can be found in Appendix A, Maps (A-5 through A-16 and A-36 and A-37 Map Sets) and include a detail showing the location of the sub-watershed within the larger Fountain Creek Watershed, as well as relevant land use information and percent imperviousness associated with each sub-watershed.

3.1 Monument Creek Above North Gate, Gage No. 07103780

This reach includes the upper portion of Monument Creek from the Palmer Divide to above the United States Air Force Academy at North Gate Boulevard. The towns of Monument and Palmer Lake are located within this sub-watershed area, which has a mix of public and private land ownership. Monument Creek is a tributary to the mainstem of Fountain Creek, and ultimately the Arkansas River.

3.1.1 Land Uses, Geographic Features, and Environment

The higher elevations consist of mixed conifer forests with over 50% of the area contained within the boundaries of the Pike National Forest. About 16% of the land use is rural and medium density residential. Approximately 6% of this sub-watershed is characterized by agricultural land, and nearly 2.5% is categorized by commercial, industrial, institutional and office space. This sub-watershed is characterized by forest, shrubland, and upland grasslands in addition to the urbanized areas. Table 3-1 provides a breakdown of land use cover by type. This area is at the top of the watershed, so no contributions are coming in from other sub-watersheds.

3.1.2 Point Source Dischargers

Permitted point source wastewater dischargers in this segment include Tri-Lakes Wastewater Treatment Facility (WWTF) and Upper Monument Creek Regional WWTF. Permitted point source MS4s within this sub-watershed include: El Paso County, Town of Monument and CDOT. MS4s account for 9.3% of the land use in this sub-watershed.

3.1.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified potential nonpoint source types with direct contact to the creeks or from runoff from land outside of the MS4 permit coverage areas to include wildlife, livestock, rural residential runoff and pet waste. There are a few OWTS near Beaver Creek and Upper Monument Creeks with the majority in the northeastern part of this sub-watershed. The USAFA recently produced a map of known septic treatment facilities on their property (See Map A-18 in Appendix A) that can help identify areas for further study in this part of the sub-watershed. There are a total of 93 wells in this sub-watershed, with likely as many OWTS.

Table 3-1: Monument Creek Above North Gate Percent Land Use Cover

USGS Watershed	Total Acres	Percent Cover
Gage 07103780 - Monument Creek Above North Gate	52,170	
Land Use Categories		
Agricultural	3,067	5.9%
Commercial, Industrial, Institutional, Office	1,247	2.4%
Federal	30,454	58.4%
Open Space, Park, Undeveloped	2,990	5.7%
Other (Roads, ROW)	1,967	3.8%
Residential (multi-family up to 5 acres)	4,396	8.4%
Rural Residential 5 acres and up	8,049	15.4%
Total	52,170	100.0%
Additional Characteristics		
Area in MS4	4,839	9.3%
Impervious Area	9,732	18.7%

3.2 Monument Creek above Woodmen Rd. Gage No. 07103970

This sub-watershed includes portions of Monument Creek and its tributaries from North Gate Boulevard to Woodmen Road. The City of Colorado Springs' northern boundary begins in this sub-drainage.

3.2.1 Land Uses, Geographic Features, and Environment

The largest landowner is the Federal government with the USAFA and Pike National Forest at 47%. The Federal lands are primarily on the west side of Monument Creek with approximately 7 stream miles contained within USAFA's borders. Cover types and land uses on the west side of the watershed consist of residential, campus housing, academy buildings and sporting facilities intermingled and buffered by mixed conifer forest or native grassland. The eastern portion of the sub-drainage is composed of residential, light industrial and commercial land uses. Portions of unincorporated El Paso County on the most eastern edge consist of rural residential housing within the community of Black Forest, which makes up approximately 24% of the sub-watershed. Many homes have wells and OWTS and the lots are likely to contain a small number of livestock. Table 3-2

provides a breakdown of land use cover by type. This sub-watershed is below, and incorporates any background pollutants, from the Monument Creek above North Gate sub-watershed. As described above, there are few contributing sources in these portions of the watershed.

3.2.2 Point Source Dischargers

Permitted point source dischargers in this segment include USAFA MS4 and wastewater. MS4s include the City of Colorado Springs, El Paso County, CDOT and school districts. MS4s account for 23.3% of this sub-watershed.

3.2.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint source types with direct contact to the creeks or from runoff from land outside of the MS4 permit coverage areas to include 201 wells, which suggests an equal number of OWTS (the most of any sub-watershed), wildlife, livestock, rural residential runoff and pet waste.

Table 3-2: Monument Creek above Woodmen Rd. Percent Land Use Cover

USGS Watershed	Total Acres	Percent Cover
Gage 07103970 - Monument Creek above Woodmen Rd.	63,000	
Land Use Categories		
Agricultural	1,909	3.0%
Commercial, Industrial, Institutional, Office	2,270	3.6%
Federal	29,668	47.1%
Open Space, Park, Undeveloped	2,977	4.7%
Other (Roads, ROW)	2,310	3.7%
Residential (multifamily up to 5 acres)	8,602	13.7%
Rural Residential 5 acres and up	15,264	24.2%
Total	63,000	100.0%
Additional Characteristics		
Area in MS4	14,684	23.3%
Impervious Area	19,541	31%

3.3 Cottonwood Creek at Mouth at Pikeview Gage No. 07103990

This reach includes the tributary to Monument Creek known as Cottonwood Creek, coming in from the east. The City of Colorado Springs is the only municipality in this sub-watershed.

3.3.1 Land Uses, Geographic Features, and Environment

Approximately 47% of this sub-watershed is developed with residential uses constituting nearly 37% of that and the remainder going to commercial, industrial, institutional and office uses. In the upper reaches, rural residential is the primary land use and covers approximately 21% of the watershed. Nearly 12% of this sub-watershed is attributed to other uses (i.e., roads, right of ways, etc.). Table 3-3 provides a breakdown of land use cover by type. One consideration of *E. coli* levels in this sub-watershed is the potential background contributions from the upstream sub-watersheds.

3.3.2 Point Source Dischargers

Permitted point source dischargers in this segment include the City of Colorado Springs, El Paso County, CDOT and school district MS4s. Nearly 74% of land use in this sub-watershed is attributed to MS4s.

3.3.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint source types with direct contact to the creeks or from runoff from land outside of the MS4 permit coverage areas to include small livestock/horse corrals (not concentrated animal feeding operation (CAFO)), 25 wells with likely as many OWTS, pet waste and wildlife.

Table 3-3: Cottonwood Creek at Mouth at Pikeview Percent Land Use Cover

USGS Watershed	Total Acres	Percent Cover
Gage 07103990 - Cottonwood Creek at Mouth at Pikeview	12,109	
Land Use Categories		
Agricultural	443	3.7%
Commercial, Industrial, Institutional, Office	1,230	10.2%
Federal	0	0.0%
Open Space, Park, Undeveloped	1,986	16.4%
Other (Roads, ROW)	1,409	11.6%
Residential (multifamily up to 5 acres)	4,433	36.6%
Rural Residential 5 acres and up	2,608	21.5%
Total	12,109	100.0%
Additional Characteristics		
Area in MS4	8,940	73.8%
Impervious Area	6,989	57.7%

3.4 Monument Creek at Bijou St. Gage No. 07104905

This reach includes portions of Monument Creek from Woodmen Road to the Bijou Street Bridge through the central part of the City of Colorado Springs.

3.4.1 Land Uses, Geographic Features, and Environment

Nearly 65% of the area directly draining into this reach of Monument Creek is developed and under the jurisdiction of the City of Colorado Springs. Outlying areas to the west include portions of the Pike National Forest and historically mixed conifer cover types. About 13% of the Monument Creek at Bijou sub-watershed was impacted by the 2012 Waldo Canyon Fire. The hillslopes that were mixed conifer forest have been converted to bare ground or a foothills shrub/grass cover type. This sub-watershed also contains many homeless service providers and, as a result, homeless camps. Table 3-5 provides a breakdown of land use cover by type.

3.4.2 Point Source Dischargers

Permitted point source dischargers in this segment include the Colorado Springs Utilities-operated JD Philips WWTF and the City of Colorado Springs, El Paso County, CDOT and school district MS4s. Over 86% of the land use in this sub-watershed is attributed to MS4s.

3.4.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint source types (outside of an associated MS4 or with direct contact to the creeks) to include wildlife and homeless camping as the largest potential contributors in this sub-watershed. As continued mapping efforts develop to better understand and define the extent of homeless camping within this sub-watershed, additional assessment of these areas can be performed, and the potential impacts of these camps better understood. There are no OWTS in this sub-watershed.

Table 3-5: Monument Creek at Bijou St. Percent Land Use Cover

USGS Watershed	Total Acres	Percent Cover
Gage 07104905 – Monument Creek at Bijou St.	18,408	
Land Use Categories		
Agricultural	839	4.6%
Commercial, Industrial, Institutional, Office	4,175	22.7%
Federal	2,447	13.3%
Open Space, Park, Undeveloped	3,015	16.4%
Other (Roads, ROW)	2,572	14.0%
Residential (multifamily up to 5 acres)	5,245	28.5%
Rural Residential 5 acres and up	116	0.6%
Total	18,409	100.0%
Additional Characteristics		
Area in MS4	15,974	86.8%
Impervious Area	9,914	53.9%

3.5 Fountain Creek near Colorado Springs Gage No. 07103700

This reach includes the headwaters of Fountain Creek, which begins at the eastern edge of the City of Woodland Park. The small communities of Green Mountain Falls, Chipeta Park, Cascade, Manitou Springs and small portions of Woodland Park and Colorado Springs are located within this sub-drainage.

3.5.1 Land Uses, Geographic Features, and Environment

Manitou Springs, Colorado Springs and Woodland Park are the only communities serviced by centralized wastewater facilities, so numerous wells and OWTS exist in this sub-watershed. There are numerous homeless camps as well. Over 68% of the watershed is undeveloped with 45% of those lands contained within the Pike National Forest boundary and the other 23% attributed to open space and parks. This reach has also been impacted by the 2012 Waldo Canyon Fire. The hillslopes that were mixed conifer forest have been converted to bare ground or a foothills shrub/grass cover type. Table 3-4 provides a breakdown of land use cover by type. As a headwaters sub-watershed, there are no contributions coming from upstream sources.

3.5.2 Point Source Dischargers

MS4s in this segment include the City of Manitou Springs, El Paso County, City of Colorado Springs and CDOT. MS4 account for 10% of the land use in this sub-watershed.

3.5.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint source types with direct contact to the creeks or in in runoff from land outside of the MS4 permit coverage areas to include non-CAFO livestock, OWTS, homeless camping, pet waste and wildlife. The El Paso County Public Health Department is resource limited and at the time of this Plan's development, had not performed any robust mapping of OWTS. Given the estimated high number of OWTS in this sub-watershed, a free internet program was utilized to create a pilot map of OWTS for Cascade and Crystal Park as a starting point that can found on Maps A-19 and A-20 in Appendix A and shows the locations of 441 mapped OWTS in that area.

Table 3-4: Fountain Creek Near Colorado Springs Percent Land Use Cover

USGS Watershed	Total Acres	Percent Cover
Gage 07103700 - Fountain Creek near Colorado Springs	65,138	
Land Use Categories		
Agricultural	3,096	4.8%
Commercial, Industrial, Institutional, Office	753	1.2%
Federal	29,705	45.6%
Open Space, Park, Undeveloped	14,997	23.0%
Other (Roads, ROW)	4845	7.4%
Residential (multifamily up to 5 acres)	6,300	9.7%
Rural Residential 5 acres and up	5,443	8.4%
Total	65,138	100.0%

Table 3-4: Fountain Creek Near Colorado Springs Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Additional Characteristics		
Area in MS4	6,502	10.0%
Impervious Area	7,248	11.2%

3.6 Fountain Creek at Colorado Springs Gage No. 07105500

This reach includes the portion of Fountain Creek between the gage near Colorado Springs from about 33rd St. to the Nevada St. Bridge. It includes the Camp Creek and Bear Creek drainages.

3.6.1 Land Uses, Geographic Features, and Environment

Approximately 20% of the land in this sub-drainage is developed. About 45% of the watershed is within the City of Colorado Springs city boundary and the remaining is in the Pike National Forest. The headwaters of Camp Creek were substantially impacted by the 2012 Waldo Canyon Fire. Little vegetative recovery has occurred on the steep hillslopes known as Queen's Canyon. Bear Creek headwaters originate in the Pike National Forest. A portion of Bear Creek falls under Segment 3b (from the source to a point near the Mount Buckhorn Trail off High Drive) and is excluded from this assessment. The portion of Bear Creek that is included in this assessment is generally where the gradient breaks and transitions to a more urban stream. Segment 3b is defined as Outstanding Waters and is not listed on Colorado's 303(d) list as impaired for *E. coli.* Table 3-6 provides a breakdown of land use cover by type.

3.6.2 Point Source Dischargers

MS4s in this segment include the City of Colorado Springs, El Paso County and CDOT. MS4s account for over 45% of the land use in this sub-watershed.

3.6.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint sources with direct contact to the creeks or outside of an associated MS4 to include wildlife, pet waste, seven OWTS, and transient camping.

Table 3-6: Fountain Creek at Colorado Springs Gage Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Gage 07105500 - Fountain Creek at Colorado Springs	18,545	
Land Use Categories		
Agricultural	135	0.7%
Commercial, Industrial, Institutional, Office	1,500	8.1%
Federal	7,648	41.2%
Open Space, Park, Undeveloped	3,848	20.7%
Other (Roads, ROW)	2,003	10.8%
Residential (multifamily up to 5 acres)	3,168	17.1%

Table 3-6: Fountain Creek at Colorado Springs Gage Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Rural Residential 5 acres and up	243	1.3%
Total	18,545	100.0%
Additional Characteristics		
Area in MS4	8,386	45.2%
Impervious Area	6,717	36.2%

3.7 Sand Creek above Mouth Gage No. 07105600

This reach is a tributary to Fountain Creek known as Sand Creek. The Sand Creek drainage enters Fountain Creek approximately two miles upstream of the Academy Boulevard Bridge over Fountain Creek. Headwaters of this basin originate in the conifer-covered area of the Black Forest.

3.7.1 Land Uses, Geographic Features, and Environment

The Sand Creek watershed is the second largest sub-drainage on the eastern side of Fountain Creek, with close to 54% of the 54-square mile watershed being fully developed. The upper reaches consist of rural residential and larger agricultural units that primarily support ranching on short grass prairie vegetative cover type. There are some wells and OWTS in the upper portions of this watershed. Current annexation proposals to become a part of the City of Colorado Springs is predictive of future housing development that would ultimately increase the developed area by approximately 26%. Table 3-7 provides a breakdown of land use cover by type.

3.7.2 Point Source Dischargers

Permitted MS4s in this segment include the City of Colorado Springs, El Paso County, CDOT, and school districts. MS4s account for over 70% of the land use in this sub-watershed.

3.7.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint sources with direct contact to the creeks or outside of an associated MS4 to include non-CAFO livestock areas, 21 OWTS, pet waste and wildlife.

Table 3-7: Sand Creek above Mouth Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Gage 07105600 - Sand Creek above Mouth	34,654	
Land Use Categories		
Agricultural	636	1.8%
Commercial, Industrial, Institutional, Office	6,056	17.5%
Federal	65	0.2%
Open Space, Park, Undeveloped	3,731	10.8%
Other (Roads, ROW)	2,223	6.4%

Table 3-7: Sand Creek above Mouth Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Residential (multifamily up to 5 acres)	12,468	36.0%
Rural Residential 5 acres and up	9,475	27.3%
Total	34,654	100.0%
Additional Characteristics		
Area in MS4	24,673	71.2%
Impervious Area	15,459	44.6%

3.8 Fountain Creek at Security Gage No. 07105800

This reach includes a portion of the Fountain Creek mainstem located upstream of the Security gage up to central Colorado Springs.

3.8.1 Land Uses, Geographic Features, and Environment

Some OWTS can be found here, mainly in the upper reaches of this sub-watershed. Approximately 70% of the sub-watershed is covered by MS4 providers from the City of Colorado Springs, El Paso County, City of Fountain and the Ft. Carson military base. Over 25% of the land is managed by Ft. Carson. The proximity of homeless service providers has led to homeless camping along the Fountain Creek corridor in this reach. The data collected at this gage incorporates water and pollutants from all upstream sub-watersheds, so there is likely a magnification of parameters occurring. Table 3-8 provides a breakdown of land use cover by type.

3.8.2 Point Source Dischargers

Permitted point source dischargers in this segment include the City of Colorado Springs, El Paso County, CDOT, City of Fountain, and various school district MS4s. Wastewater dischargers include Colorado Springs Utilities-operated Las Vegas WWTF and Security Sanitation District. Nearly 71% of land use in this sub-watershed is attributed to MS4s.

3.8.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint sources with direct contact to the creeks or outside of an associated MS4 to include wildlife, pet waste, 50 OWTS and transient camping.

Table 3-8: Fountain Creek at Security Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Gage 07105800 – Fountain Creek at Security	57,437	
Land Use Categories		
Agricultural	1,099	1.9%
Commercial, Industrial, Institutional, Office	7,688	13.4%
Federal	15,343	26.7%
Open Space, Park, Undeveloped	8,991	15.7%

Table 3-8: Fountain Creek at Security Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Other (Roads, ROW)	9,693	16.9%
Residential (multifamily up to 5 acres)	14,455	25.2%
Rural Residential 5 acres and up	168	0.3%
Total	57,437	100.0%
Additional Characteristics		
Area in MS4	40,605	70.7%
Impervious Area	20,526	35.7%

3.9 Jimmy Camp Creek at Fountain Gage No. 07105900

This reach is a tributary to Fountain Creek, Jimmy Camp Creek. The Jimmy Camp Creek watershed is the largest sub-drainage on the eastern side of Fountain Creek.

3.9.1 Land Uses, Geographic Features, and Environment

Similar to Sand Creek, the upper reaches consist of rural residential and larger agricultural units that primarily support ranching on short grass prairie vegetative cover type and make up the majority of the land cover type at 86%. Rural residential homes in this area are on wells, have OWTS, and the lots are likely to contain a small number of non-CAFO livestock. The Cities of Colorado Springs and Fountain have portions within this sub-drainage area with large tracts of undeveloped lands. Currently, approximately 5% is developed with residential and commercial uses. However, the potential full build-out within city limits could convert over 50% of the watershed to development. Table 3-9 provides a breakdown of land use cover by type.

3.9.2 Point Source Dischargers

MS4s in this segment include the City of Colorado Springs, El Paso County, CDOT and the City of Fountain. Future development for the Cherokee Metropolitan District has identified Jimmy Camp Creek for potential future surface water discharges. MS4s account for 57.7% of land use in this sub-watershed.

3.9.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint sources with direct contact to the creeks or outside of an associated MS4 to include non-CAFO livestock, 13 OWTS, and wildlife.

Table 3-9: Jimmy Camp Creek at Fountain Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Gage 0715900 - Jimmy Camp Creek at Fountain	42,176	
Land Use Categories		
Agricultural	18,615	44.1%
Commercial, Industrial, Institutional, Office	2,154	5.1%

Table 3-9: Jimmy Camp Creek at Fountain Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Federal	0	0.0%
Open Space, Park, Undeveloped	6,367	15.1%
Other (Roads, ROW)	710	1.7%
Residential (multifamily up to 5 acres)	1,997	4.7%
Rural Residential 5 acres and up	12,334	29.2%
Total	42,176	100.0%
Additional Characteristics		
Area in MS4	24,266	57.5%
Impervious Area	6,596	15.7%

3.10 Fountain Creek near Pinon Gage No. 07106300

This reach includes a portion of Fountain Creek upstream of the Pinon Gage to the unincorporated town of Security.

3.10.1 Land Uses, Geographic Features, and Environment

The Pinon drainage is the largest sub-watershed and reflects a transition area from high-density to low-density development. Agricultural uses associated with farming are concentrated along the Fountain Creek corridor with ranching occurring in the upland areas. Smaller scale livestock grazing activity occurs in riparian areas, but there are no CAFOs. The land uses are predominantly Federal (33%) or Agricultural (45%) in nature. The Ft. Carson military base has concentrated operations on the northern end of the installation and has stormwater facilities associated with the development. The majority of the base is undeveloped to support training operations. Urban areas include the communities of Security, Widefield, and Fountain with 8.1% of the watershed in an MS4. This area has residential development but primarily serves as a hub for commercial and industrial uses that support rural residential areas. Table 3-10 provides a breakdown of land use cover by type.

3.10.2 Point Source Dischargers

Permitted dischargers include the City of Fountain, Ft. Carson, City of Colorado Springs, and CDOT MS4s. Additionally, Ft. Carson, Fountain Sanitation District, Widefield Water and Sanitation District and Lower Fountain Metropolitan Sewage Disposal District operate WWTFs. Just over 8% of the land in this sub-watershed is attributed to MS4s.

3.10.3 Potential *E. coli* Nonpoint Sources

Nonpoint sources identified with direct contact to the creeks or outside of an associated MS4 for this reach are attributed to wildlife, livestock and 34 OWTS.

Table 3-10: Fountain Creek near Pinon Percent Land Use		
USGS Watershed	Total Acres	Percent Cover
Gage 07106300 – Fountain Creek near Pinon	192,705	
Land Use Categories		
Agricultural	87,340	45.3%
Commercial, Industrial, Institutional, Office	6,209	3.2%
Federal	64,893	33.7%
Open Space, Park, Undeveloped	10,581	5.5%
Other (Roads, ROW)	4,353	2.3%
Residential (multifamily up to 5 acres)	2,787	1.4%
Rural Residential 5 acres and up	16,543	8.6%
Total	192,705	100.0%
Additional Characteristics		
Area in MS4	15,585	8.1%
Impervious Area	19,999	10.4%

3.11 Fountain Creek at Pueblo Gage No. 07106500

This reach includes a portion of Fountain Creek from the Highway 50 Bridge in Pueblo, CO upstream to Pinon Rd.

3.11.1 Land Uses, Geographic Features, and Environment

Similar to the Pinon sub-watershed, the primary land use is agriculture at nearly 79%, with no CAFOs. As the reach approaches Highway 50, it transitions back to rural residential and urban land uses. A number of homeless camps have been found along Fountain Creek within the Pueblo City limits. There is 0% Federal, 2.4% residential, and 4.4% rural residential land use in the sub-watershed. Table 3-11 provides a breakdown of land use cover by type.

3.11.2 Point Source Dischargers

City of Pueblo, Pueblo County, and CDOT are the only permitted dischargers in this sub-watershed. MS4s account for 13.8% of the land use in this sub-watershed.

3.11.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint sources with direct contact to the creeks or outside of an associated MS4 to include wildlife, livestock and transient camps. A review of the DWR well database query showed no wells identified in this part of the watershed, so based on this information, there appear to be no OWTS in this sub-watershed.

Table 3-11: Fountain Creek at Pueblo Percent Land Use Cover		
USGS Watershed	Total Acres	Percent Cover
Gage 07106500 – Fountain Creek at Pueblo	39,168	
Land Use Categories		
Agricultural	30,886	78.9%
Commercial, Industrial, Institutional, Office	2,701	6.9%
Federal	0	0.0%
Open Space, Park, Undeveloped	1,060	2.7%
Other (Roads, ROW)	1,850	4.7%
Residential (multifamily up to 5 acres)	942	2.4%
Rural Residential 5 acres and up	1,729	4.4%
Total	39,168	100.0%
Additional Characteristics		
Area in MS4	5,425	13.8%
Impervious Area	5,402	13.8%

3.12 Fountain Creek at Mouth Station Name: FOUMOUCO

This reach includes the portion of Fountain Creek along Highway 50 to the mouth of the Arkansas River.

3.12.1 Land Uses, Geographic Features, and Environment

This portion is highly urbanized at 31.1% residential and 17.7% commercial, industrial and office uses. Numerous homeless camps can be found along waterways in this sub-watershed. Due to the high urbanization, there is also a correlated high level of other (roads and right of way) land uses at 33.4%. No land uses in this sub-watershed are attributed to agriculture, federal, or rural residential. Table 3-12 provides a breakdown of land use cover by type.

3.12.2 Point Source Dischargers

The area is covered 100% by the City of Pueblo's and CDOT's MS4 permits.

3.12.3 Potential *E. coli* Nonpoint Sources

Stakeholders identified nonpoint sources with direct contact to the creeks or outside of an associated MS4 to include wildlife and transient camps. Pueblo County has around 17,300 approved OWTS permits (not including properties built prior to 1960).

Table 3-12: Fountain Creek at Mouth Percent Land Use		
USGS Watershed	Total Acres	Percent Cover
Station FOUMOUCO – Fountain Creek at Mouth	1,507	
Land Use Categories		
Agricultural	0	0.0%
Commercial, Industrial, Institutional, Office	267	17.7%
Federal	0	0.0%
Open Space, Park, Undeveloped	268	17.8%
Other (Roads, ROW)	503	33.4%
Residential (multifamily up to 5 acres)	469	31.1%
Rural Residential 5 acres and up	0	0.0%
Total	1,507	100.0%
Additional Characteristics		
Area in MS4	1,507	100.0%
Impervious Area	325	21.6%

Section 4

Goals of the Watershed Plan

A watershed plan was completed for the Fountain Creek Watershed in 2003, but it did not address the EPA's nine essential elements (listed in Section 1.3), nor did it specifically address *E. coli* impairment. Twelve stream segments within the watershed are currently listed in Colorado Regulation #32 as either seasonally impaired or impaired for *E. coli* year-round. Table 2-3 provides a description of these twelve segments and their impairment status. This Plan identifies relative potential sources of *E. coli* and other pollutants from nonpoint sources (NPS), identifies possible solutions for reducing NPS pollutant loading that contribute to the impairments of these streams, and outlines the implementation of Best Management Practices (BMPs) for targeting these nonpoint sources.

Collaborating at the watershed scale and including partners from local and state governments, nonprofits, individuals, and other local stakeholders allowed for a robust discussion, analysis and generated a summary of potential solutions benefitting the Fountain Creek Watershed. All stakeholders have an interest in reducing *E. coli* levels over time for the health of their own communities and for those downstream.

4.1 Stakeholder Process

AF CURE was convened in 2012 to consolidate the efforts and resources of multiple agencies to meet the compliance requirements of CDPHE Regulation #85 (Nutrients Management Control Regulation) and Regulation #31 (The Basic Standards and Methodologies for Surface Water). AF CURE consists of ten independent wastewater discharging entities from El Paso and Pueblo counties. In addition to assisting in the development of the *E. coli* Watershed Plan, AF CURE participates in monitoring nutrients in Monument and Fountain Creeks and their tributaries, as well as the Arkansas River to better understand how to manage nutrient sources and collaborates on general water quality data collection and management.

The multiple interests of management and diverse directives amongst watershed stakeholders greatly impact the ability to address resource issues on a landscape scale. Through AF CURE, stakeholders identified current and potential partners that will play a critical role in addressing watershed-wide water quality management goals. This Plan will serve as an important communication tool for increasing collaboration of partners through its presentation of technical material, planning processes and recommended best management practices for water quality managers in the region. Along with members of AF CURE, numerous stakeholders participated in the creation of this Plan. These participants include, but are not limited to, the following:

- Brown and Caldwell
- Cherokee Metropolitan District
- Colorado Department of Transportation, (CDOT) Region 2
- City of Colorado Springs
- City of Fountain
- City of Manitou Springs
- City of Pueblo
- Colorado Parks and Wildlife
- Colorado State Extension
- Donala Water and Sanitation District
- El Paso County Public Health Department
- El Paso County
- Fort Carson Director of Public Works (DPW) Planning
- Fort Carson
- Fountain Sanitation District
- GMS, Inc.
- Individual Citizens
- Lower Fountain Metropolitan Sewage Disposal District
- Peterson Air Force Base
- Pueblo Community College
- Pueblo County
- Pueblo Department of Public Health and Environment
- Pueblo West Metropolitan Distric
- School Districts 2, 3, 11, 12, 20, 49
- Security Water and Sanitation Districts
- The Greenway Fund
- Town of Palmer Lake
- Triview Metro
- United States Air Force Academy (USAFA)
- University of Colorado, Colorado Springs

Each entity involved in this planning effort recognizes the importance of educating and engaging the public on water quality issues. Several watershed-wide Education/Outreach (E/O) efforts are already in place that increase awareness and encourage behavior changes that can lead to reductions of multiple parameters. Refer to Appendix C: Fountain Creek Watershed *E. coli* reduction strategies by Jurisdiction under the section "Strategies for Water Quality Improvement" for more details on those existing programs. A recent local television story[2] highlighted Fountain Creek's *E. coli* impairments and identified AF CURE and other Plan stakeholders as collaboratively working to improve the watershed's health.

[2] https://youtu.be/UmORwd0zp2s

The communities within the Fountain Creek Watershed value clean, safe waterways as amenities for recreational, environmental, and economic growth opportunities. Grants obtained through Great Outdoors Colorado (GOCO) and other funding sources have brought dollars to the region for the development of waterfront parks and trails along the creeks. Healthy waterways foster tourism, economic growth and a high quality of life for residents and visitors alike. Outreach and behavior changes around meeting recreational *E. coli* standards will continue to be important to promote the safe use and enjoyment of the waterways as amenities. As the population continues to increase, it is critical that the watershed not become a liability for recreation, tourism, and economic growth. A local nonprofit, The Greenway Fund, recently funded a study touting the benefits of greenways for community well-being, natural and man-made environments, and tourism[3], and implementation of this Watershed Plan can help to realize those benefits and in addition to meeting water quality goals.

This watershed planning stakeholder group has engaged in conversation, information sharing, and collaboration during its monthly meetings since September 2016. Guest speakers from the City and County of Denver and the USGS have participated in meetings and shared lessons learned as subject matter experts. Additionally, a field trip was conducted within the Fountain Creek Watershed on July 24, 2017 to provide an overview of *E. coli* issues, view existing BMPs, and discuss solutions that could address potential nonpoint sources of pollution. (**See Appendix D "E. coli Tour 2017" document.**)

4.2 Regulated Point Sources

The focus and purpose of this Plan is to evaluate nonpoint sources of pollutants contributing to exceedances of water quality standards in the planning area. However, in order to analyze nonpoint source contributions in the context of all potential pollutant sources, the Plan does include information about regulated point sources as well. The National Pollutant Discharge Elimination System (NPDES) was developed by the EPA to regulate pollutants from point sources such as industrial dischargers, wastewater treatment facilities and municipal stormwater systems. The study area for this Plan includes several different types of dischargers that meet the above description.

There are ten (10) major domestic wastewater treatment dischargers, two (2) Phase I and ten (10) Phase II MS4 permit holders in the study area. The table below summarizes the municipal and special district wastewater treatment plant dischargers for the study area, as well as the MS4 permit holders. National Pollutant Discharge Elimination System (NPDES), Colorado Discharge Permit System (CDPS) or MS4 permit numbers are also included. There are numerous Non-Standard MS4s in the Fountain Creek Watershed including school districts and colleges. A map of the MS4 coverage area boundaries and major domestic wastewater treatment dischargers is attached in Appendix A as Map A-21.

Table 4-2: Summary of Municipal and Special District Wastewater Treatment Plant Dischargers and MS4 Permit Holders

Stream Segment	Facility Name	City	NPDES/CDPS Permit No.	Permitted Discharge (MGD)	MS4 Permit No.
COARFO06	Air Force Academy WWTF		CO0020974	2.2	N/A
Multiple	Colorado Department of Transportation	N/A - Statewide	N/A	N/A	COS000005
Multiple	City of Colorado Springs	Colorado Springs	N/A	N/A	COS000004

[3] "The Economic Benefit of Greenways in the Pikes Peak Region," principal authors Tom Binnings and Jason Doedderlein

Table 4-2: Summary of Municipal and Special District Wastewater Treatment Plant Dischargers and MS4 Permit Holders

Stream Segment	Facility Name	City	NPDES/CDPS Permit No.	Permitted Discharge (MGD)	MS4 Permit No.
Multiple	City of Fountain	Fountain	N/A	N/A	COR-090008
Multiple	City of Manitou Springs	Manitou Springs	N/A	N/A	COR-090012
Multiple	City of Pueblo	Pueblo	N/A	N/A	COR-090040
Multiple	El Paso County	N/A	N/A	N/A	COR-090011
Multiple	Fort Carson	N/A	N/A	N/A	COR042001
COARFO02a	Fort Carson WWTF	N/A	CO0021181	4	N/A
COARFO02a	Fountain Sanitation District	Fountain	CO0020532	1.908	N/A
COARFO02a	Lower Fountain Metropolitan Sewage Disposal District	Fountain	CO0000005	2.5	N/A
Multiple	Peterson Air Force Base	Colorado Springs	N/A	N/A	COR042006
Multiple	Pueblo County	N/A	N/A	N/A	COR-090060
Multiple	Pueblo West Metropolitan District	Pueblo West	N/A	N/A	COR-090096
COARFO06	Upper Monument Creek Regional WWTF	Colorado Springs	CO0042030	1.75	N/A
COARFO02a	Security Sanitation District WWTF	Security	CO0024392	1.95	N/A
COARFO06	Springs Utilities JD Phillips Water Resource Recovery Facility	Colorado Springs	CO0046850	20	N/A
COARFO02a	Springs Utilities Las Vegas Street Water Resource Recovery Facility	Colorado Springs	CO0026735	75	N/A
Multiple	Town of Monument	Monument	N/A	N/A	COR-090039
COARFO06	Tri-Lakes WWTF	Monument	CO0020435	4.2	N/A
Multiple	US Air Force Academy	N/A	N/A	N/A	COR042007
COARFO02a	Widefield WWTP	Widefield	CO0021067	2.5	N/A

4.3 Unregulated Nonpoint Sources

The focus and purpose of this Plan is to evaluate nonpoint sources of pollutants contributing to exceedances of water quality standards in the watershed area. The following describes potential nonpoint sources of *E. coli*:

4.3.1 Human Waste (e.g., Homeless camping, illegal disposal of human waste)

Homeless populations can be contributors to the pollution of storm systems (point sources) and waterbodies (nonpoint sources). Many encampments can be found along waterways due to a need for a source of water and for the tree canopy cover. These encampments do not have a sanitary method of fecal, food, and other waste disposal, which results in direct discharges to the nearby stream or river during rain and snow events, or by directly using waterways as restrooms. Additionally, recreational vehicle owners can illegally dispose of their waste from holding tanks in storm drains or directly to water bodies.

4.3.2 Human Waste (leaking OWTS, leaking/infiltration from sanitary sewer systems, cross connections, sanitary sewer overflows)

When OWTS fall into disrepair or reach capacity, the sewage can leak directly into nearby waterways or into groundwater sources. A sanitary sewer overflow is an overflow of untreated wastewater from a collection system that reaches, or has the potential of reaching, state waterways such as Fountain Creek. Overflows can be caused by vandalism, tree roots, pipeline settling/failure, grease/debris blockages and severe storm events. Aging infrastructure can lead to leaks in the system.

4.3.3 Pet Waste

With the increase in population and related increase in impervious areas comes higher potential impact on our waterways from pet feces. Pet waste (and the bacteria contained within it) that is not picked up and properly disposed of has a higher likelihood of getting into local streams and rivers than it did in the past due to the rapid development seen in the region over the past 50 years. Fecal matter from household pets and wildlife has the potential to contaminate both surface and ground water. As of July 1st, 2018, ESRI Demographics estimated that there were 279,669 total households in the Colorado Springs Metropolitan Statistical Area with a total population of 737,907. According to the American Pet Products Association, 68 percent of all U.S. households own pets, 48 percent of those animals are dogs, for a total of about 350,000 dogs[4] in the Colorado Springs area alone. According to www.petpooskiddoo.com the average dog produces 0.75 pounds of waste daily, equating to 92,400 pounds per year of waste. Only pet waste located in areas outside of MS4 boundaries or in areas where the waste can directly enter the creek (not through a discrete conveyance) are included in this category.

4.3.4 Wildlife (birds, raccoons, deer, etc.)

Waste from ducks, deer, geese, raccoons, and other fauna living on or near water can contaminate waterways with their feces. Only wildlife waste located in areas outside of MS4 boundaries or in areas where the waste can directly enter the creek (not through a discrete conveyance) are included in this category.

4.3.5 Livestock

Waste from pets, farm animals, and manure applications can be sources of *E coli*. Only livestock waste located in areas outside of MS4 boundaries or in areas where the waste can directly enter the creek (not through a discrete conveyance) are included in this category.

4 http://digital.olivesoftware.com/Olive/ODN/CSBusinessJournal/shared/ShowArticle.aspx?doc=CSBJ%2F2018%2F12%2F07&entity=Ar00301&sk=433D72C7&mode=text

Section 5

Identification of Priority/Critical Areas of Concern

5.1 Characterization of Pollutant Sources

Watershed Plan stakeholders reviewed maps of each sub-watershed that identified the known point source discharges and potential nonpoint source types and locations.

As a recipient of large volumes of stormwater runoff, Fountain Creek may be vulnerable to surface water impacts from agricultural and residential fertilizers, pesticide/herbicide application, industrial wastes such as oil and grease, as well as fecal coliform impacts from various sources. Prior to the establishment of the Colorado Springs Utilities Sanitary Sewer Creek Crossing Program (further described in Section 6.3) in 2005, sanitary sewer overflows periodically occurred during major storm and flooding events, impacting receiving waters and creating a major concern for those downstream. In 2008, Fountain Creek was placed on the Colorado 303(d) list of impaired streams due to exceedances of the *E. coli* standard. A 2007-2008 study in Manitou Springs performed by the USGS suggested that the rise in *E. coli* in that part of the watershed during the warm months was likely attributed to birds, not humans or ruminants[5]. Despite several initiatives including securing sanitary sewer line crossings, improvements to aging wastewater infrastructure, public education and controls for regulated stormwater runoff, *E. coli* continues to exceed the recreation use standard of 126 colony-forming units (CFU)/100 mL in numerous streams during most of the year throughout the Fountain Creek Watershed.

Loading of *E. coli* during dry weather periods is attributable to both point sources and nonpoint sources. In rural environments, low flow loading may be due to nonpoint sources such as aging or potentially failing OWTS, livestock or wildlife with access to waterways. Fountain Creek is a wildlife corridor, concentrating wildlife and migratory birds due to the presence of food, water and shelter. In urban environments, low flow nonpoint sources include wildlife and homeless camping where waste is directly entering the creek.

Regulated stormwater loading occurs largely during wet weather events via stormwater runoff. Eleven out of twelve stream gage locations demonstrate a need for a waste load reduction during high flow events in order to achieve the stream standard. (reference Maps A-22 through A-34) showing potential waste load reductions needed throughout the watershed). According to Bushon, et. al. (2017), urbanization can increase the amount and type of contaminants found in nearby surface waters. Preliminarily and generally, the data shows an increase in wet weather loading starting at the Monument Creek at North Gate gage through the urban corridor, attenuating through the rural landscape south of the Fountain Creek at Security gage, then loads slightly increase again at the Fountain Creek at Pueblo gage to the Pedestrian Bridge. Additional data collection is needed to better understand the source types and loading prior to and through the urban corridor and is further discussed later in this Plan.

[5] https://pubs.usgs.gov/fs/2011/3095/fs2011-3095.pdf

Point sources have been identified as either urban runoff through the MS4s or WWTF effluent discharges. Those WWTFs must meet permit limits and report chronic or recurrent discharges that lead to violations. In general, WWTF effluent has not exceeded stream standards and, at multiple locations, provides a diluting effect by adding flows with very low *E. coli* levels. Runoff from buildings, roadways and landscaped areas primarily enter the MS4 system following wet weather events, however, dry weather discharges can indicate leaking domestic sewage, cross-connections, infiltrating groundwater and/or illicit discharges. Additional inputs come from direct runoff into water bodies.

5.2 Data Inventory and Analysis

Data was compiled from several sources including databases, reports, various monitoring programs and instream gages. Multiple sources for data were utilized to gather the most complete and reliable data sets for analysis, including the Colorado Data Sharing Network (CDSN), EPA STOrage and RETreval (STORET), USGS, AF CURE, other watershed planning stakeholders, and the Environmental Resource Assessment and Management System (eRAMS). eRAMS is an open source online service that provides analysis and modeling tools for planning and management of water, land and energy sources. The Flow Analysis interface allows the user to access stream monitoring stations from USGS, STORET and the Colorado Division of Water Resources to model flow and load duration curves. A flow duration curve is a cumulative frequency graph that represents the percentage of time during which a given flow value is equaled or exceeded. Load duration curves are developed from flow duration curves and illustrate water quality conditions compared to a desired target and flow regime. Results from the load duration curves were used to determine load reductions that would be needed to meet the water quality standards for *E. coli* during varying flow regimes. Geographic information was sourced from City, County, State, Federal and Environmental Systems Research Institute (ESRI) data.

The current data available for determining nonpoint source contributions is limited. While some nonpoint sources are known/suspected (i.e., homeless camps, OWTS, etc.), there is insufficient data at this time for quantifying the impacts from those sources. Nonpoint sources will be addressed in more detail in a later section.

Table B-1 in Appendix B identifies the data by source, location, date range and number of sampling events evaluated for developing the Plan. Analysis for the current conditions and cumulative effects within the Fountain Creek Watershed focused on the most representative *E. coli* data, which was determined to be a 10-year period of record, during which both flow and *E. coli* data were available at each gage site.

5.3 Data Analysis and Preliminary Water Quality Goals

5.3.1 Instream Data

The 61-day geometric means were calculated for the impaired segments to evaluate spatial, climatic and temporal trends. The geometric mean calculations followed the 303(d) listing methodology found in the 2018 Listing Metholodology[6]. A summary of exceedances of the 126 CFU/100 mL water quality standard is provided in Table 17-2 by sampling location. Ruxton Creek, Dirty Woman Creek, Kettle Creek, Douglas Creek, Bear Creek, Cottonwood Creek, Sand Creek, Jimmy Camp Creek, Little Fountain Creek and the mainstems of Monument Creek and Fountain Creek all have

[6] https://www.colorado.gov/pacific/sites/default/files/303d_LM_2018.pdf

exceedances. Many of the highest exceedances occur on the mainstem of both Monument and Fountain Creeks. *E. coli* concentrations are typically lower along tributaries near headwater streams. The highest exceedances occurring in the Fountain Creek watershed with geomean concentrations greater than 9,000 MPN (Most Probable Number[7])/100mL are: Fountain Creek near Colorado Springs (August 2013) and Bear Creek at 21st Street. (September 2012). *E. coli* concentrations increase near the Colorado Springs boundary and within the boundaries of Colorado Springs. There are point source discharges and multiple nonpoint sources where loading is not quantified within the city limits contributing to elevated *E. coli* concentrations.

Data demonstrates that exceedances occurred primarily within the May to October timeframe with most exceedances in July and August. Some locations exceeded the stream standard 11 out of 12 months and demonstrated at least one exceedance in every month over the 10-year period, such as at Fountain Creek below Janitell Road. The highest values occur more often in July, August and September, likely due to higher potential for storm events. No exceedances of the *E. coli* standard were identified in several smaller headwater streams, such as Lion Creek, Sheep Creek, Cabin Creek, Cascade Creek, and others. A table is provided in Appendix B which details station names, geomean exceedances (by month and year), highest geomean value (by month) and total individual geomean samples that exceed the standard.

5.3.2 Estimating Pollutant Contributions

A linkage analysis shows the relationships between pollutant loading and response of the waterbody to the loading. The analysis helps better identify the links between human activities, hydrologic cycles and impaired waters. By including this analysis, the Plan can provide more detail on land-based activities that impact water quality and provide focus for developing management actions.

Each sampling location was evaluated by pairing mean daily flow with *E. coli* results. Sites with field-collected flow data only provided instantaneous flow values, which are not adequate to construct flow and load duration curves and so were not included. Additionally, stakeholders supported using data from USGS gages that could be accessed through eRAMS for calculating load and flow duration curves. Use of the open source tool within eRAMS automates the data retrieval process which potentially allows for consistency, transparency and trending of the data by other interested parties outside of the watershed planning stakeholder group. Twelve gages, including 11 operated by USGS and one operated by the Division of Water Resources (DWR) have, at a minimum, 10 years of hydrologic data. The gage operated by the DWR could not be accessed by eRAMS and had data errors resulting from gage malfunctions. A manual flow and load duration curve was developed to pair flow data from the USGS gage 7106500 with *E. coli* samples collected by Pueblo Wastewater at the mouth of Fountain Creek (FC at Pedestrian Bridge). To have comparative results between the gages, criteria for pulling data from eRAMS was established.

[7] The MPN unit is a statistical probability of the number of organisms, and was determined by reviewing geomean data, vs. CFU units which are actual data points.

Steps for building the Flow and Load Duration Curves included:

1. Ten years of flow data was used for developing the duration curves. The date range of January 2006 to April 2017 provided consistency between gages and was determined to be representative for the following reasons:
   a. The historic sampling record start dates varied between 1922 to 2003. Flow duration curves were not comparable to each other within such a large range.
   b. Using the entire historic period does not reflect the changes in hydrology that have occurred more recently as a result of development and trans-mountain diversions. Historical results showed Low and Dry flow regimes at significantly reduced levels that are improbable when considering current wastewater discharges.
   c. Ten years of flow data (from January 2006 to April 2017) correlated best with the available *E. coli* data.

2. Flow regimes are defined as intervals grouped into hydrologic conditions. Per EPA's guide for "An Approach for Using Load Duration Curves in the Development of TMDLs", intervals are divided into these five hydrologic regimes:
   a. High Flows representing those flows that occur 0-10% of the time;
   b. Moist Conditions at 10-40%;
   c. Mid-Range Conditions at 40-60%;
   d. Dry Conditions at 60-90%; and
   e. Low Flows representing the flows expected to occur 90-100% of the time.

3. *E. coli* data became more consistently available in 2008 through the USGS. Data collected by other agencies is also included in the Load Duration Curves.

An estimated allowable load was determined for each flow regime at each gage by multiplying the median flow for that regime by the 126 CFU/100 mL standard. This estimation allowed stakeholders to assess potential load reductions. Percent reductions were determined by subtracting the existing load at the gage (calculated from actual data collected at each gage for each specific flow regime) from the estimated allowable load. On the other hand, percent reductions that are negative indicate a low priority for programs, projects or further study given the low loads. Percent reductions that are positive identified areas of focus/priority for the stakeholder group. This methodology gives a reasonable initial analysis of *E. coli* loading at each gage for various flows. Gages with small sample sizes have been noted because this can result in biased percent reduction values. A map describing the watershed reductions at a glance can be found on Map A-22 in Appendix A, with sub-watershed reductions broken down in the appendix (Maps A-23 through A-34). Results from the loading assessment per sub-watershed are disclosed in the tables below. (Note: Negative percent reductions indicate no reduction is needed.)

Table 5-3: Load Reduction Results for Monument Creek above North Gate (Gage 07103780).					
Loading Calculations	High Flows	Moist Conditions	Mid-Range	Dry Conditions	Low Flows
Median Flows in Cubic Feet per Second (cfs)	51.75	11.5	6.5	4.67	3.29
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	16.10E+10	3.577E+10	2.022E+10	1.453E+10	1.023E+10
Existing Load at North Gate[8]	5.045E+10	0.8845E+10	0.4998E+10	0.3064E+10	0.1419E+10
Difference	-11.05E+10	-2.692E+10	-1.522E+10	-1.146E+10	-0.8814E+10
Percent Reduction	-219.0%	-304.4%	-304.5%	-374.1%	-621.2%

Includes USGS and UMCRWWTF E. coli Data

Table 5-4: Load Reduction Results for Monument Creek at Woodmen Rd (Gage 07103970).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	90.4	27.5	17.1	12	7.3
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	28.12E+10	8.554E+10	5.319E+10	3.732E+10	2.271E+10
Existing Load at Above Woodmen[9]	233.3E+10	8.034E+10	3.438E+10	1.729E+10	2.458E+10
Difference	205.2E+10	-0.5197E+10	-1.881E+10	-2.003E+10	0.1875E+10
Percent Reduction	87.9%	-6.5%	-54.7%	-115.9%	7.6%

[8] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 7, Moist Conditions = 21, Mid-Range = 15, Dry Conditions = 24, Low Flows = 2.

[9] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 22, Moist Conditions = 34, Mid-Range = 34, Dry Conditions = 47, Low Flows = 18.

Table 5-5: Load Reduction Results for Cottonwood Creek at Mouth at Pikeview (Gage 07103990).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	20	6.155	4.54	3.62	2.59
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	6.221E+10	1.914E+10	1.412E+10	1.126E+10	0.8056E+10
Existing Load at Cottonwood Cr.[10]	89.04E+10	2.731E+10	0.9095E+10	0.4525E+10	0.4997E+10
Difference	82.82E+10	0.8164E+10	-0.5026E+10	-0.6735E+10	-0.3059E+10
Percent Reduction	93.0%	29.9%	-55.3%	-148.8%	-61.2%

Table 5-6: Load Reduction Results for Monument Creek at Bijou Street (Gage 07104905).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	163	49.6	34.1	26.9	20.2
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	50.70E+10	15.43E+10	10.61E+10	8.367E+10	6.283E+10
Existing Load at Bijou[11]	727.9E+10	32.87E+10	7.314E+10	8.029E+10	17.92E+10
Difference	677.2E+10	17.44E+10	-3.292E+10	-.3381E+10	11.64E+10
Percent Reduction	93.0%	53.1%	-45.0%	-4.2%	64.9%

[10] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 13, Moist Conditions = 17, Mid-Range = 11, Dry Conditions = 15, Low Flows = 6.

[11] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 23, Moist Conditions = 47, Mid-Range = 24, Dry Conditions = 40, Low Flows = 6.

Table 5-7: Load Reduction Results for Fountain Creek near Colorado Springs (Gage 07103700).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	51.05	17.5	11.9	7.73	4.03
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	15.88E+10	5.443E+10	3.701E+10	2.404E+10	1.253E+10
Existing Load at FC near COS[12]	168.4E+10	13.29E+10	4.842E+10	4.108E+10	1.763E+10
Difference	152.5E+10	7.846E+10	1.140E+10	1.703E+10	0.5096E+10
Percent Reduction	90.6%	59.0%	23.6%	41.5%	28.9%

Table 5-8: Load Reduction Results for Fountain Creek at Colorado Springs (Gage 07105500).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	267	74.7	48.7	37.2	26
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	83.05E+10	23.23E+10	15.15E+10	11.57E+10	8.087E+10
Existing Load at FC at COS[13]	1301E+10	53.27E+10	10.10E+10	12.16E+10	15.83E+10
Difference	1218E+10	30.03E+10	-5.043E+10	0.5905E+10	7.739E+10
Percent Reduction	93.6%	56.4%	-49.9%	4.9%	48.9%

[12] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 26, Moist Conditions = 60, Mid-Range = 44, Dry Conditions = 74, Low Flows = 23.

[13] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 26, Moist Conditions = 58, Mid-Range = 40, Dry Conditions = 66, Low Flows = 18.

Table 5-9: Load Reduction Results for Sand Creek above Mouth (Gage 07105600) (Small sample size, percent reduction for High flow regime biased high)					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	65.75	6.36	2.54	1.09	0.39
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	20.45E+10	1.978E+10	0.7900E+10	0.3390E+10	0.1213E+10
Existing Load at Above Sand Creek[14]	4101E+10	4.948E+10	0.7999E+10	0.9923E+10	0.06.92E+10
Difference	4081E+10	2.970E+10	.0099E+10	0.6533E+10	-0.0521E+10
Percent Reduction	99.5%	60.0%	1.2%	65.8%	-75.2%

Table 5-10: Load Reduction Results for Fountain Creek at Security (Gage 07105800).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	409	140	104	78.5	58.4
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	127.2E+10	43.55E+10	32.35E+10	24.42E+10	18.16E+10
Existing Load at Security[15]	1268E+10	42.91E+10	26.60E+10	14.23E+10	13.67E+10
Difference	1141E+10	-0.6359E+10	-5.750E+10	-10.18E+10	-4.491E+10
Percent Reduction	90.0%	-1.5%	-21.6%	-71.6%	-32.8%

[14] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 4, Moist Conditions = 7, Mid-Range = 2, Dry Conditions = 1, Low Flows = 2.

[15] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 24, Moist Conditions = 57, Mid-Range = 43, Dry Conditions = 57, Low Flows = 25.

Table 5-11: Load Reduction Results for Jimmy Camp Creek at Fountain (Gage 07105900)
(Small sample size, percent reduction for Low flow regime biased high and no data in Mid-Range flow regime)

Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	3.33	1.23	0.93	0.77	0.42
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	1.036E+10	0.3826E+10	0.2893E+10	0.2395E+10	0.1306E+10
Existing Load at Above Jimmy Camp[16]	197.7E+10	0.2508E+10	NA	0.2965E+10	0.0832E+10
Difference	196.7E+10	-0.1318E+10	NA	0.0570E+10	-0.0475E+10
Percent Reduction	99.5%	-52.5%	NA	19.2%	-57.0%

Table 5-12: Load Reduction Results for Fountain Creek near Pinon (Gage 07106300).

Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	379	147.5	105	73.6	29.7
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	117.9E+10	45.88E+10	32.66E+10	22.89E+10	9.238E+10
Existing Load at Pinon Bridge[17]	2369E+10	33.68E+10	7.647E+10	7.104E+10	9.282E+10
Difference	2251E+10	-12.20E+10	-25.01E+10	-15.79E+10	0.0441E+10
Percent Reduction	95.0%	-36.2%	-327.1%	-222.2%	0.5%

[16] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 5, Moist Conditions = 4, Mid-Range = 0, Dry Conditions = 5, Low Flows = 1.

[17] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 18, Moist Conditions = 42, Mid-Range = 20, Dry Conditions = 35, Low Flows = 9.

Table 5-13: Load Reduction Results for Fountain Creek at Pueblo (Gage 07106500).					
Loading Calculations	High Flows	Moist-Conditions	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	376.5	155	111	73.4	23.6
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	1.17.1E+10	48.21E+10	34.53E+10	22.83E+10	7.341E+10
Existing Load at FC at Pueblo[18]	2229E+10	19.68E+10	8.068E+10	4.902E+10	1.469E+10
Difference	2112E+10	-28.53E+10	-26.46E+10	-17.93E+10	-5.871E+10
Percent Reduction	94.7%	-144.9%	-328.0%	-365.8%	-399.7%

Table 5-14: Load Reduction Results for Fountain Creek at the Mouth (Gage FOUMOUCO).					
Loading Calculations	High Flows	Moist-Condition	Mid-Range	Dry Conditions	Low Flow
Median Flows in Cubic Feet per Second (cfs)	376.5	154	110	73.3	23.6
Water Quality Standard (WQS) (CFU/100 ml)	126	126	126	126	126
Load at WQS (CFU/day)	117.1E+10	47.90E+10	34.21E+10	22.80E+10	7.341E+10
Existing Load at Fountain at Mouth[19]	584.5E+10	30.94E+10	11.36E+10	14.04E+10	5.924E+10
Difference	467.4E+10	-16.96E+10	-22.86E+10	-8.755E+10	-1.417E+10
Percent Reduction	80.0%	-54.8%	-201.3%	-62.3%	-23.9%

Includes Pueblo WW E. coli Data

[18] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 21, Moist Conditions = 38, Mid-Range = 26, Dry Conditions = 33, Low Flows = 12.

[19] Existing loads were calculated (per flow regime) using varying numbers of available samples. The number of samples associated with each flow regime are as follows: High flows = 9, Moist Conditions = 28, Mid-Range = 24, Dry Conditions = 33, Low Flows = 12.

Line graphs were developed for each flow regime. These figures, shown below, depict changes in *E. coli* loading spatially through the watershed and are helpful when determining reaches where loading increases or decreases. The data depicted in the figures below are representative of the data provided above in Tables 5-3 through 5-14. Gages along the main stem are shown separately from tributary gages. The existing loads at each gage are shown compared to the standard-based load for each flow regime. The standard-based loading at each flow regime was calculated by multiplying 126 CFU/100 mL by the median flow for that flow regime. The standard-based loading was calculated to provide a preliminary analysis of how the loading changes throughout the watershed. Also depicted in these graphs is the difference between the standard-based loading and the existing loading (shown as a gray bar) at each gage. A positive value for the gray bar indicates that the existing load is greater than the standard-based load. This information helps identify potential areas of focus for future monitoring efforts or BMP implementation.

There are multiple tributaries that enter Monument and Fountain Creeks. These tributaries contribute flow to the mainstem and are represented as X's. The tributaries are placed in the figure between the mainstem gages in which they enter. As noted in each station's table, some tributaries have small sample sizes, which may result in biased existing loads. An example of this is Sand Creek's existing load during the High Flow regime. Sand Creek has only four *E. coli* samples that were collected during high flows. The resulting existing load is higher than all other stations in the watershed and may not be representative of high flows due to the relatively small number of samples and that its effects are not seen downstream where more samples are available during high flow periods.

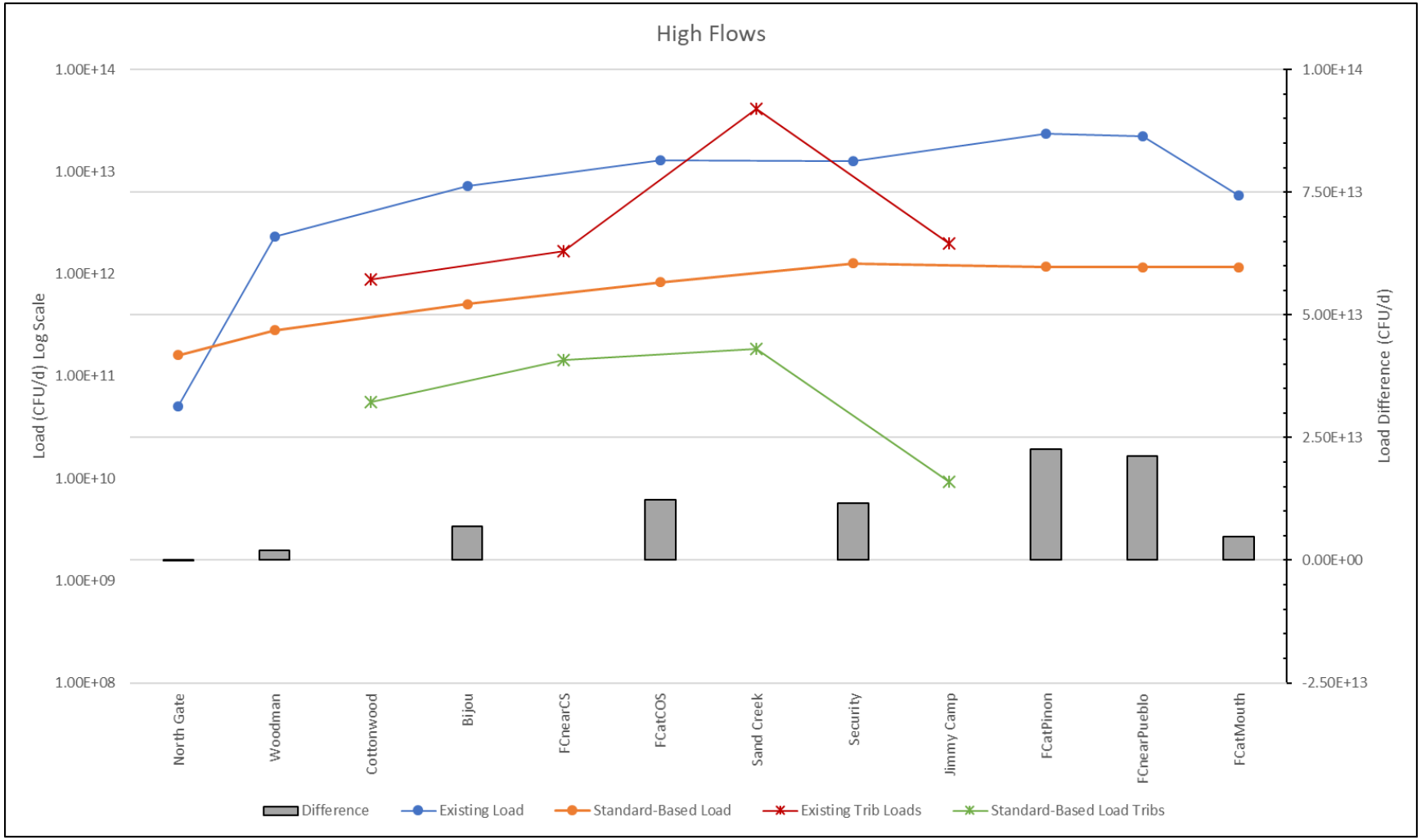


Figure 5-1: High Flow Regime

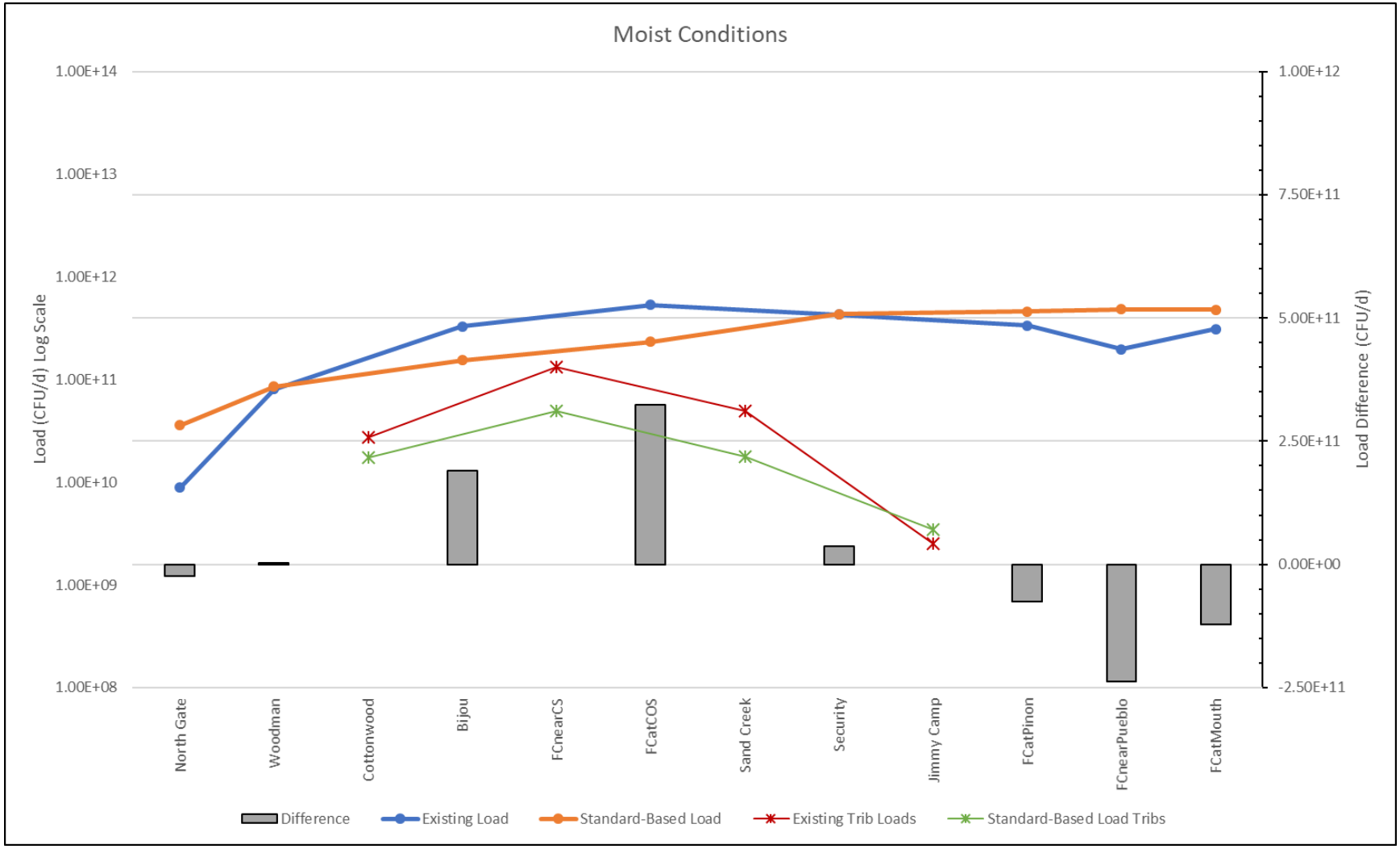


Figure 5-2: Moist Condition Flow Regime

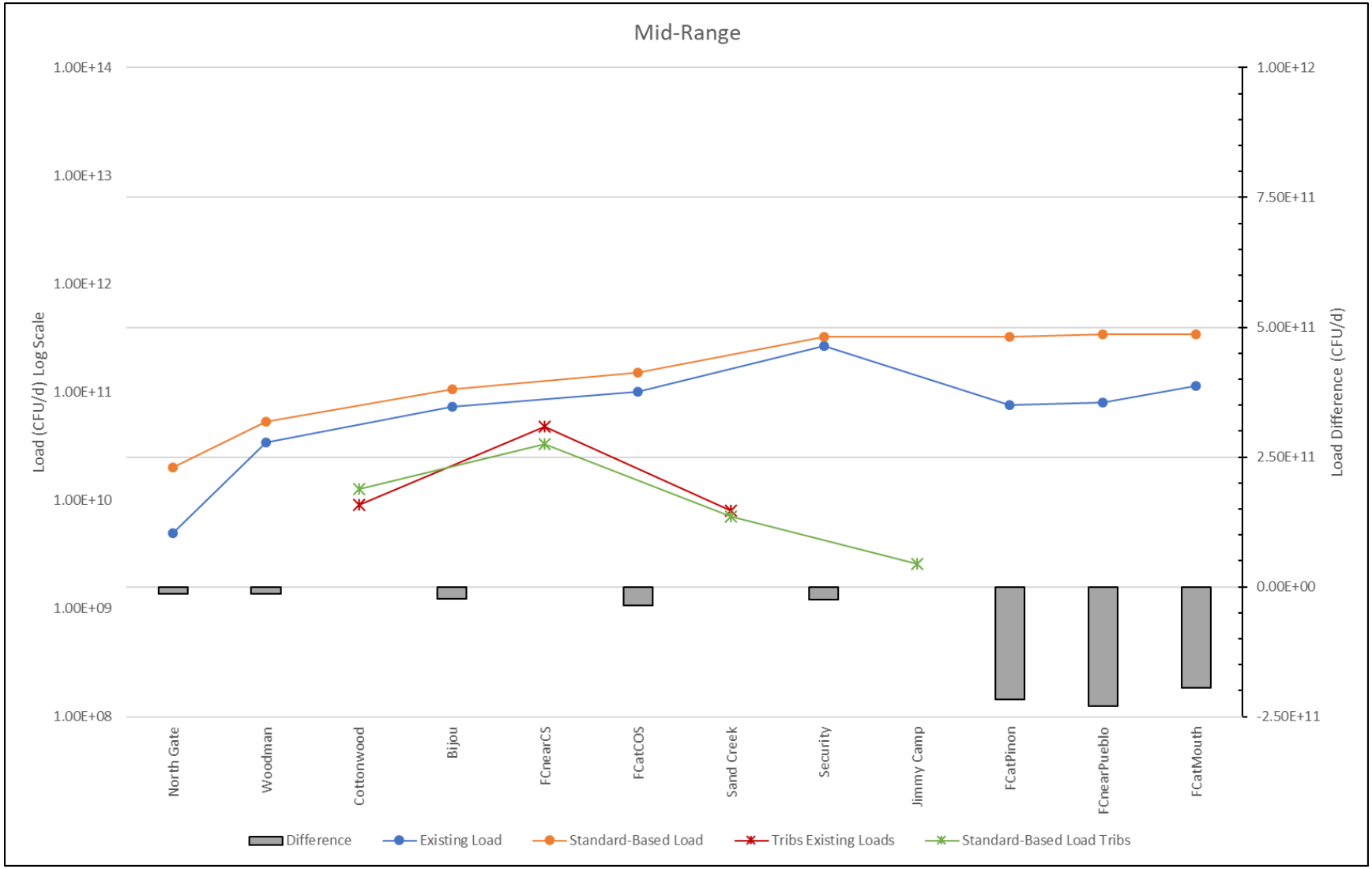


Figure 5-3: Mid-Range Flow Regime

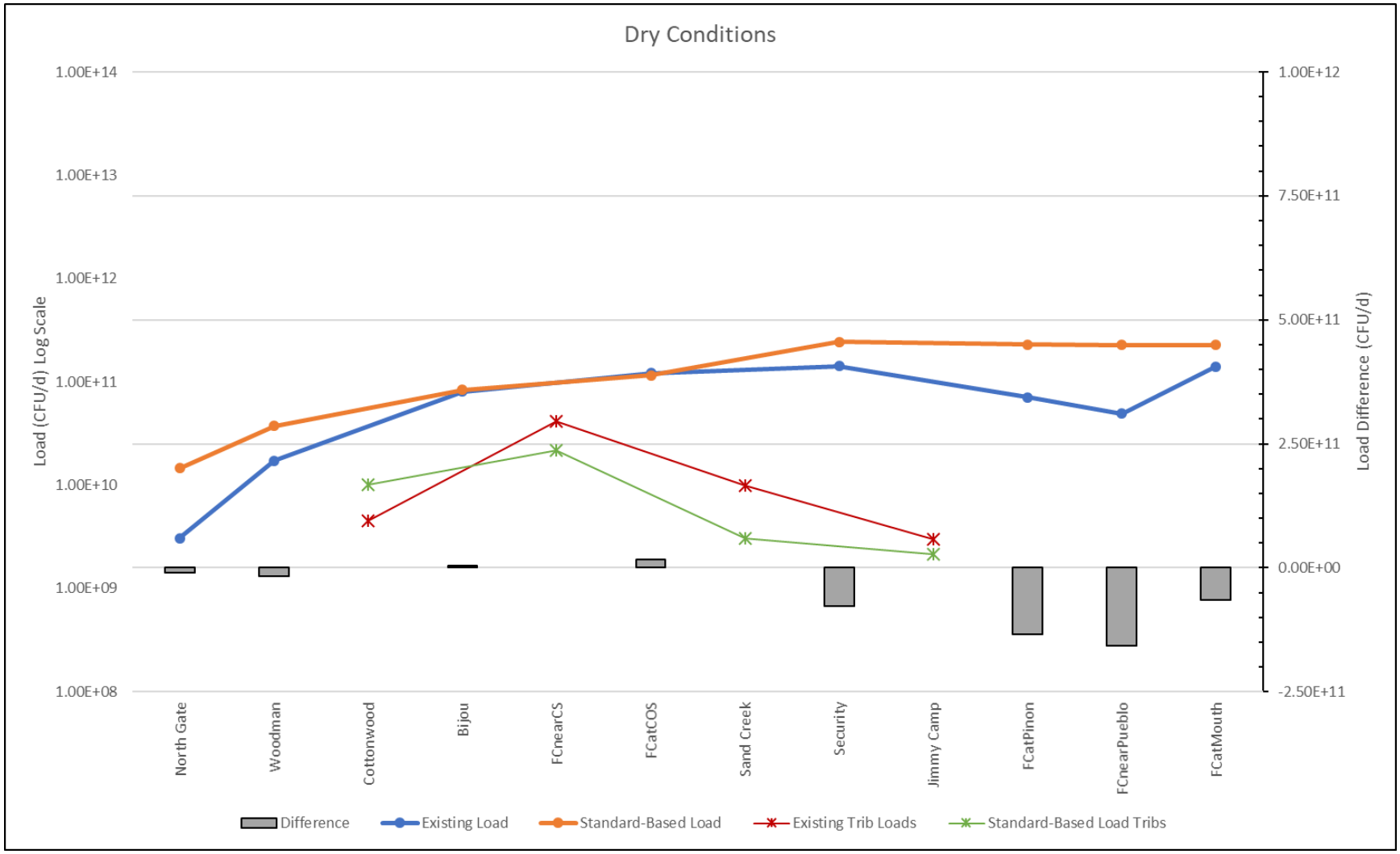


Figure 5-4: Dry Conditions Flow Regime

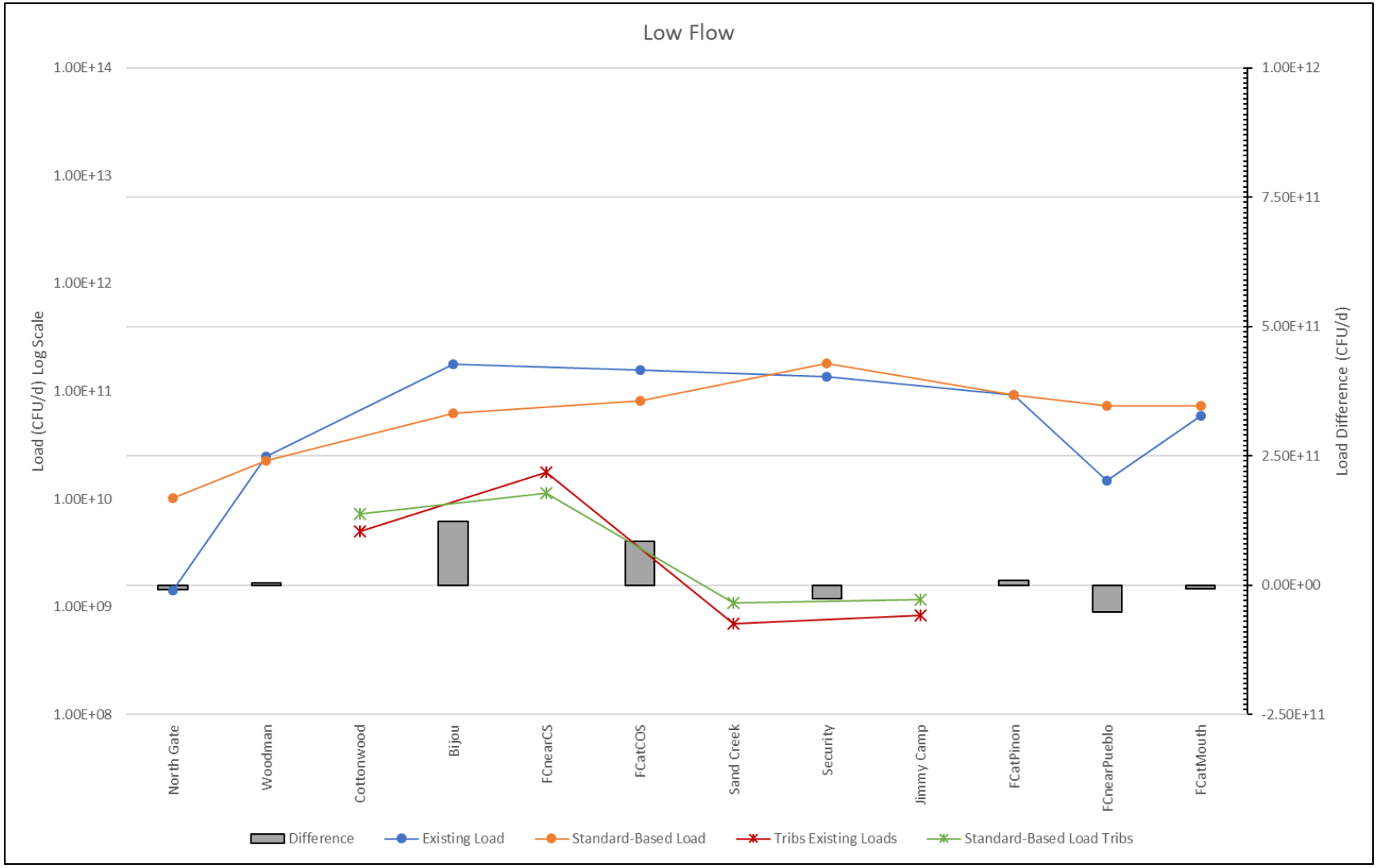


Figure 5-5: Low Flow Regime

5.3.3 Data Findings

5.3.3.1 Findings by Flow Regimes

E. coli loading by specific sources cannot be identified with the current data sets. Certain drivers such as wet weather hydrology and timing of the impairment have been identified through the analysis. The main findings are bulleted with additional discussion below:

- High flow events (description of reductions for all sampling locations except North Gate)
- Moist and mid-range flows reflect elevated levels through the urban corridor
- Attenuation occurs between Security and Pueblo
- Exceedances occur during the recreation season of May - October

All gages besides North Gate have positive percent reductions at high flow regimes. The high flow regimes represent the worst-case scenario of *E. coli* levels. During high flows, the largest increase in *E. coli* loading occurs along the stream segment between North Gate and Woodmen on Monument Creek (Figure 5-1). There are no point sources between North Gate and Woodmen, so the increase in loading is likely attributed to MS4s and/or nonpoint sources along the reach. MS4 contributions of *E. coli* loading is difficult to approximate with current data. An attempt was made early on to approximate MS4 contributions using percent land cover in order to provide some estimate of unregulated nonpoint source contributions; nonpoint source contributions consist of the remaining percentage unaccounted for after point sources and MS4s were calculated. Therefore, any additional loading cannot be definitively tied to MS4 versus unregulated nonpoint source contribution until further data analysis and possible additional monitoring is conducted.

During high flows, from Fountain Creek at Colorado Springs to Fountain Creek at Security, *E. coli* loading remains stable despite the high concentrations in Sand Creek (Figure 5-1). As mentioned previously, Sand Creek had very few data points and may be biased high. High flow *E. coli* loading decreases from Fountain Creek near Pueblo to Fountain Creek at Mouth. The decrease in *E. coli* loading in the southern portion of the watershed is likely due to diversions away from the mainstem and natural attenuation. This area of the watershed is not particularly urbanized, and there are few regulated point source contributors.

E. coli levels at Mid-Range to Low regimes are mostly in compliance throughout the watershed Figure 5-5). At Mid-Range flows, all *E. coli* loadings are less than the standard. Levels of *E. coli* during low flow conditions in Upper Fountain Creek and the urban corridor are elevated. Farther downstream, loadings decrease, and the standard is achieved. From Mid-Range to Low flow regimes, there are overall declines in *E. coli* loading from Security to Fountain Creek at mouth. A slight reduction at low-flow may be needed at the Pinon Bridge gage which may indicate there is a chronic source such as livestock or wildlife accessing the creek, or leaking OWTS. Alternately, if loadings are reduced further upstream, the Pinon Bridge location may end up below the standard-based loading. Below is a brief discussion of the data findings per sub-watershed (upstream to downstream):

5.3.3.2 Findings by Sub-Watershed

Monument Creek above North Gate

Monument Creek above North Gate is in the upstream portion of Monument Creek. The reach contains permitted point source dischargers, Tri-Lakes WWTF and Upper Monument Creek Regional WWTF. There are no MS4 permittees within this reach. Flows at North Gate gage are lower than all other gages along Monument and Fountain Creek across all flow regimes. Even at high flows the existing load at North Gate is much lower than the estimated standard-based loading (Figure 5-1). North Gate is the only sub-watershed with loadings lower than the estimated standard at high flows.

Monument Creek above Woodmen Road

There is a zero discharger, USAFA, and several MS4s in the reach between North Gate and Woodmen. MS4s include the City of Colorado Springs, USAFA, El Paso County, CDOT and school districts. Existing loads are higher than the standard at high, moist-condition, and low flow regimes. The median flow for the high flow regime (90.4 cfs) is about three times greater than the moist condition median flow (27.5 cfs). The existing *E. coli* load is greater at Woodmen than North Gate for all flow regimes. The largest loading increase is at high flow regimes where *E. coli* loading increases almost two orders of magnitude as compared to the upstream gage (Figure 5-1), which exceeds the estimated standard-based loading.

Cottonwood Creek at Mouth

Cottonwood Creek is a tributary that enters Monument Creek between Woodmen Road and Bijou Street. The MS4 dischargers in this sub-watershed include the City of Colorado Springs, El Paso County, CDOT and school district MS4s. *E. coli* loadings at Cottonwood Creek are less than the existing loading at both the upstream and downstream gages for all flow regimes. *E. coli* loading at Cottonwood Creek is less than the standard-based loading for all flows except high flows (Table 5-5).

Monument Creek at Bijou Street

E. coli loading at Bijou St. on Monument Creek is greater than the estimated standard-based loading at all flow regimes except for during dry conditions. For all flow regimes, there is a consistent increase in *E. coli* loading between Woodmen and Bijou St. There is one permitted point discharger, JD Philips WWTF, and several MS4s in this sub-watershed. The MS4s in this reach include the City of Colorado Springs, El Paso County, CDOT and school districts. Cottonwood Creek enters Monument Creek in this reach. Cottonwood Creek has much lower *E. coli* loadings than along the mainstem, but is a contributor to total loading at Bijou St.

Fountain Creek near Colorado Springs

This gage represents the headwaters of Fountain Creek to a point above the confluence with Monument Creek. There are no permitted point source dischargers and MS4s in this segment include the City of Manitou Springs, El Paso County, City of Colorado Springs and CDOT. *E. coli* loadings at this gage exceed the estimated standard for all flow regimes (Table 5-7). Fountain Creek near Colorado Springs' *E. coli* loadings are less than the *E. coli* loadings in Monument Creek and at the downstream gages on Fountain Creek for all flows.

Fountain Creek at Colorado Springs

Existing *E. coli* loading is greater than the estimated standard-based load at all flow regimes except the mid-range flows for Colorado Springs at Fountain Creek. There are no permitted point dischargers in this reach. MS4s in this segment include the City of Colorado Springs, El Paso County and CDOT. At low flows, while still above the estimated standard-based load, *E. coli* loading is less than the *E. coli* loading at upstream gage Fountain Creek at Bijou Street (Figure 5-5). This sub-watershed is along the main urban corridor where elevated *E. coli* concentrations are anticipated.

Sand Creek above Mouth

Sand Creek tributary enters Fountain Creek along this segment. MS4s account for over 70% of the land use in this sub-watershed and include the City of Colorado Springs, El Paso County, CDOT, and school districts. Sand Creek loading is low compared to upstream and downstream gages besides in the high flow regime. At high flows, Sand Creek *E. coli* loading is above the estimated standard. While this number is likely biased due to the small sample size, it could also be a contributor to the

elevated *E. coli* loading at this flow regime. At all flow regimes, with the exception of low flow conditions, the estimated standard is not met.

Fountain Creek at Security

E. coli loadings begin to stabilize in the reach between Fountain Creek at Colorado Springs and Fountain Creek at Security. The greatest potential reductions are required during high flow conditions. At high, moist, and low flow regimes, *E. coli* loading decreases from the previous upstream gage. There are two permitted point dischargers, Colorado Springs Utilities Las Vegas WWTF and Security Sanitation District WWTF. The MS4s in this reach are the City of Colorado Springs, El Paso County, CDOT, City of Fountain, and various school districts.

Jimmy Camp Creek at Fountain

Jimmy Camp Creek enters the main stem of Fountain Creek between Security and Pinon. *E. coli* loadings at Jimmy Camp are low. Loadings are higher than the estimated standard at the high and dry flow regimes. At mid-range flows no *E. coli* measurements were taken so the loading value is blank. MS4s in this segment include the City of Colorado Springs, El Paso County, CDOT and the City of Fountain.

Fountain Creek near Pinon

There are four permitted point dischargers in this segment: Ft. Carson, Fountain, Widefield Water and Sanitation, and Lower Fountain Districts WWTFs. City of Fountain, Fort Carson, City of Colorado Springs and CDOT are the only MS4s in this sub-watershed. All flow regimes except the high flow regime have decreasing *E. coli* loads when compared to the upstream gage (Security). Jimmy Camp Creek tributary enters the mainstem in this segment and has low *E. coli* concentrations as compared to Fountain Creek for all flow regimes besides the high flow regime. At high flows the Jimmy Camp *E. coli* loading is greater than the standard-based loading at Pinon (Figure 5-1).

Fountain Creek at Pueblo

There are no permitted point dischargers in this stream segment and three MS4s; City of Pueblo, Pueblo County, and CDOT. While *E. coli* loading remains above the estimated standard-based loading at high flow regimes, all other flow regimes have loadings below the estimated standard-based loading. Existing *E. coli* loadings continue to decrease as compared to the upstream gage, with *E. coli* concentrations at low flows decrease by almost half.

Fountain Creek at Mouth

E. coli loadings for all flow regimes are under the estimated standard-based loading except the high flow regime. Also, for all flow regimes besides the high flow regime, *E. coli* loading increases in the segment from Pueblo to the Mouth. At high flow regimes *E. coli* loading decreases. Although most flow regimes are still below the estimated standard-based loading, the increase in *E. coli* in this segment brings *E. coli* loadings closer to the estimated standard-based loading as compared to Pueblo.

In conclusion, flow regimes mimic one another from upstream to downstream sub-watersheds and have comparable changes in *E. coli* loading other than during high flow regime (Figures 5-2 through 5-5). The high flow regime is characterized by an increase in loading from North Gate to Woodmen (Figure 5-1). All other flow regimes show a decrease in *E. coli* loading from Security to Pinon, and existing loads mostly stay below the estimated standard-based loading.

Geomean data shows the seasonality of exceedances of the primary recreation standard during the recreation season (May-October) when primary contact is most likely. July and August have almost double the exceedances than the other months within the recreation season. However, findings

indicate the exceedances have extended well beyond the recreation season at multiple locations along Fountain and Monument Creeks with exceedances extending into the November – April period.

The results of this preliminary data analysis have provided insight into which areas of the watershed warrant additional focus, to include data analysis and/or monitoring. Additional data analysis is necessary before an understanding of unregulated nonpoint source versus point source contribution can be established.

Section 6

Strategies for Water Quality Improvements

Source Types and Potential Control Measures

The following is a description of nonpoint sources of *E. coli* found in the Fountain Creek Watershed, and potential control measures that were identified by stakeholders during a planning meeting. Additional quantification of loading is still needed as a next step in this effort. These can be implemented by individual or collaborative jurisdictions as resources become available.

6.1 Nonpoint Sources

6.1.1 Onsite Wastewater Treatment Systems (OWTS)

Failing, improperly-maintained or improperly-located OWTS (septic systems) are potential sources of *E. coli*. Unapproved, aging, and failing OWTS can have a large impact on the quality and safety of our water supply.

Potential Control Measures:

- Implement programs to identify potentially failing OWTS such as: permits review, maintenance records review, aerial photography to identify potential problem areas, and dye testing systems where system failure is suspected.
- According to El Paso County Public Health and Environment, there are well over of 33,000 OWTS systems in El Paso County (a majority of which are outside of City limits as shown on Maps A-19 and A-20), and 17,300 approved permits in Pueblo County. A robust map identifying locations, ages, and historical information would be a large undertaking, and could be done within the next 5 years if funding became available.
- Provide education and outreach (E/O) to owners of OWTS, including homeowners and RV parks.

6.1.2 Homeless Camping

In urban areas where homeless camps are located immediately adjacent to streams (i.e., where there is no potential for human waste from the homeless camps to be collected by a regulated MS4), runoff from homeless camps can potentially contribute to elevated *E. coli* levels.

Potential Control Measures:

- Encourage the development of additional shelters and support services to reduce impacts from homeless populations.
- Partner with non-governmental organizations and other stakeholders to address homelessness.
- Partner with community organizations to perform periodic and/or ongoing cleanup of homeless camps.
- Provide increased access to public restrooms/alternative waste disposal options.
- Promote Police/code enforcement of City of Colorado Springs ordinance passed July 2018 which makes it illegal to camp within 100 feet of a public waterway.

6.1.3 Rural Livestock

Livestock and manure spreading are potential sources of *E. coli*.

Potential Control Measures:

- Exclude livestock from riparian zones. Restrict riparian areas from being utilized as shade, holding areas, or feeding areas for livestock.
- Encourage uniform livestock distribution over the pasture.
- Fence streamside corridors to restrict unrestrained access while still providing drinking water for grazing animals.
- Divert runoff from animal confinement areas and manure stockpiles away from riparian zones.
- Remove manure from stormwater runoff, streams, ditches or other channels that can carry waste.

6.1.4 Domestic Pet Waste

In those areas covered by this Plan where pet waste is not regulated through MS4 permit control measures or directly enters creeks, this type of waste can contribute to nonpoint source pollution. Pet waste contains harmful bacteria and parasites and is high in nitrogen and phosphorus. Pet feces can contain fecal coliform bacteria, which can spread diseases like Giardia, Salmonella, and Campylobacter, causing serious illness in humans.

Potential Control Measures:

- Provide signs instructing pet owners to pick up pet waste, pet waste bags and disposal containers.
- Adopt and enforce pet waste ordinances.
- Establish E/O programs targeting pet owners.
- Develop Standard Operating Procedures (SOPs) for dog parks.
- Place dog parks away from environmentally-sensitive areas.
- Protect vegetative buffers along streams to discourage stream access.
- Explore options for pet waste composting.

6.1.5 Wildlife

Wildlife live and reproduce in the watershed. Where wildlife nests or rests in the watershed can cause different water quality problems. Birds roosting under bridges and roadway overpasses, is an example of this issue. Another is fecal matter being washed into the creeks and streams during storm events from the riparian habitat. Future efforts include better understanding of contributions from wildlife via sampling and monitoring, as funding permits.

Potential Control Measures:

- Reduce food sources available to rural wildlife (manage garbage/dumpsters)
- Install bird roosting deterrents, population controls, and habitat modifications that may reduce bird waste inputs
- E/O

6.2 Regulated Point Source/Stormwater

6.2.1 Domestic Pet Waste

Pet waste is a major contributor to stormwater pollution. Pet waste contains harmful bacteria and parasites and is high in nitrogen and phosphorus. Pet feces can contain fecal coliform bacteria, which can spread diseases like Giardia, Salmonella, and Campylobacter, causing serious illness in humans.

Potential Control Measures:

- Provide signs instructing pet owners to pick up pet waste, pet waste bags and disposal containers.
- Adopt and enforce pet waste ordinances.
- Establish E/O programs targeting pet owners.
- Develop Standard Operating Procedures (SOPs) for dog parks.
- Place dog parks away from environmentally-sensitive areas.
- Protect vegetative buffers along streams to discourage stream access.
- Explore options for pet waste composting.

6.2.2 Urban/Homeless Camping

In urban areas, homeless camps typically employ poor waste management practices producing runoff that potentially contributes to elevated *E. coli* levels.

Potential Control Measures:

- Encourage the development of additional shelters and support services to reduce homelessness.
- Partner with non-governmental organizations and other stakeholders to address homelessness.
- Partner with community organizations to perform periodic cleanup of homeless camps.
- Providing increased access to public restrooms/alternative waste disposal options.
- Promote Police/code enforcement – prohibit streamside camping except in designated campgrounds.

6.2.3 Urban Livestock

Livestock and manure spreading are potential sources of *E. coli*.

Potential Control Measures:

- Exclude livestock from riparian zones. Restrict riparian areas from being utilized as shade, holding areas, or feeding areas for livestock.
- Fence streamside corridors to restrict unrestrained access while still providing drinking water for grazing animals.
- Divert runoff from animal confinement areas and manure stockpiles away from riparian zones.
- Locate manure away from stormwater runoff, streams, ditches or other channels that can carry waste.

6.2.4 Illicit Discharges

An illicit discharge is any discharge into the stream (or other Waters of the State) that is not composed entirely of stormwater. Examples of illicit discharges include:

- Sanitary sewer overflows that flow into the stream,
- OWTS malfunctioning, and
- Dumping of human wastes into the stream or inlets from campers or recreational vehicles.

Potential Control Measures:

- Identify priority areas through screening based on likelihood of illicit connections (areas with older sanitary sewer lines)
- E/O around public detection/reporting.

6.2.5 Cross Connections

A cross connection is a connection made between two or more distinct things. The two distinct things, or systems, in the watershed Plan, are sanitary sewers and storm sewers. A prohibited cross connection occurs if the sanitary sewer flow enters the storm sewer system. This connection can be a direct connection between the two systems, or an indirect connection. An illustration of an indirect connection is a leaking sanitary sewer line, where the flow from the sanitary sewer line infiltrates the storm sewer line.

Potential Control Measures:

- Sanitary sewer collection system inspection, evaluation, repair and rehabilitation programs

6.2.6 Wildlife

Wildlife live and reproduce in the watershed. Where the wildlife chose to live in the watershed can cause water quality problems. Birds roosting under bridges and over passes, is one example of this issue. Another is fecal matter being washed into the creeks and streams during storm events from the riparian habitat.

Potential Control Measures:

- Reduce food sources available to urban wildlife (manage garbage/dumpsters)
- Install bird roosting deterrents, population controls, and habitat modifications that may reduce bird waste inputs
- E/O

E. coli source identification can be complicated and require large amounts of data collection. A sampling program will be important to appropriately identify sources, understand contribution, trend elevated levels and measure if reduction strategies are working. Load and flow duration curves have shown overall reductions needed across the watershed, yet additional monitoring will be necessary to better understand the sources by type and overall contribution to loading. A monitoring plan has been developed with this plan (see Section 7). Additional monitoring sites have been suggested and, after evaluating any additional data available, implementing additional sampling at those locations will be evaluated (funding permitted).

For the purposes of the Plan, estimations were made on the percentage of loading that may be attributable to nonpoint sources. Maps A-22 through A-34 provide a rough estimate of the load reduction needs for nonpoint sources, beginning with the whole watershed, then drilling down to sub-watershed level.

6.3 Implementation Strategies

6.3.1 *E. coli* Best Management Practice Identification, Priorities and Milestones

Preliminarily, the available data shows potential sources of *E. coli* contamination correlating to land use types and associated activities. Stakeholders identified potential sources to develop proactive reduction strategies and with the intent to study specific load reductions and further refine strategies and economize efforts. Successful long-term implementation of this Plan will require stakeholders to have a primary focus on monitoring but also regular data assessment to better identify sources and loads, develop information for public E/O, improve management practices, as well as regular meetings to maximize limited resources.

Proactive load reduction strategies have been identified as associated to three themes of management:

1. Human behavior changes
2. Resourcing existing or new programs, and
3. Infrastructure improvements.

Many stakeholders identified the primary *E. coli* sources of concern and has developed their own implementation plan including current efforts, 1-5 year priorities, 6-10 year priorities, and Monitoring Plan where applicable in the "*E. coli* Planning Implementation by Jurisdiction" in Appendix C.

6.3.2 Next Steps

The results from this plan's data analysis point to the need for additional data collection and analysis. One identified step is to verify locations and ages of OWTS throughout the watershed. This will be a large and resource-intensive effort and may require the review of active and inactive wells, mapping infrastructure, obtaining additional water quality data, at a minimum, and reviewing records. Additional next steps include reviewing all available data in the area, evaluating the potential for additional sampling locations in specific locations, and engaging additional appropriate stakeholders. Based on this stakeholder process, a map has been developed indicating new proposed sampling locations to pursue in the future (A-35). Much of this work will require more resources, so exploring grant opportunities is also high on the implementation priority list.

Section 7

Monitoring Plan

As a result of this planning process, multiple layers of data have been developed that help to hone in on the issues, target sources, and consider ways to reduce inputs to the waterways. There is an identified need to continue gathering information to better inform the effort. The intention is to develop a monitoring plan that will lead to additional information, measure implementation, and inform future programs and projects related to water quality. A basic monitoring program could include visual surveys, GIS, dry weather screening, microbial source tracking (MST) and regular surface water sampling.

7.1 Monitoring Plan Objectives

For several years, this coalition, entities of AF CURE, and other stakeholders have conducted water quality monitoring in the Fountain Creek watershed with the purpose of collecting reliable data for use in assessing the quality of surface waters in the mainstems of, and tributaries to, Fountain Creek, Monument Creek and Chico Creek. While data for *E. coli* have been collected at many monitoring sites within the watershed, the Fountain Creek *E. Coli* Watershed Plan identifies locations where additional monitoring is needed to further identify potential nonpoint sources of *E. coli*.

This Monitoring Plan provides a general description of water quality sampling efforts to meet the informational needs of the Watershed Plan (sample locations and parameters) and is intended to be a guide for sampling protocol, quality assurance/quality control (QA/QC) measures, and data quality objectives. Although this Monitoring Plan provides general sampling protocols and group expectations, each watershed stakeholder organization will utilize their own entity-specific Sampling and Analysis Plans (SAPs) and Quality Assurance Project Plans (QAPPs), where available. Updating and maintenance of the individual SAPs/QAPPs is the responsibility of each jurisdiction.

7.2 Sampling Locations

The following describes the monitoring locations where *E. coli* is sampled. Sampling locations were selected to monitor the impact/influence of nonpoint sources of *E. coli* in the Fountain Creek watershed. Current *E. coli* sampling locations in the Fountain Creek watershed are summarized in Table 7-1. Table 7-2 lists potential new monitoring sites that would supplement the data collection already occurring, helping to further distinguish nonpoint sources of *E. coli*. Map A-35 identifies sampling locations (color coded by monitoring program and AF CURE member) within the watershed.

Table 7-1: Current *E. Coli* Sampling Locations

Data Source By Entity	Station Name	Gage/Station Number	Location		Data Range (Years)	Total Number of Samples
			Latitude	Longitude		
USGS	Fountain Creek near Colorado Springs	07103700	38.85471357	-104.8780314	2008-2016	211
USGS	Fountain Creek below Ruxton Creek at Manitou Springs	n/a	38.857342	-104.914108	2007-2008	20
USGS	Cottonwood Creek at Mouth	07103990	38.927222	-104.814167	2008-2017	54
USGS	Monument Creek at Bijou Street, Colorado Springs	07104905	38.837222	-104.828889	2008-2017	117
USGS	Fountain Creek at Colorado Springs	07105500	38.81638158	-104.8227519	2008-2016	189
USGS/CSU	Sand Creek above Mouth (also called SAP22)	07105600	38.78832768	-104.773862	2008-2016	17
USGS	Fountain Creek below Janitell Road	n/a	38.803056	-104.795278	2008-2017	134
USGS	Fountain Creek at Security	07105800	38.729444	-104.733333	2008-2017	199
USGS	Fountain Creek at Pueblo	07106500	38.28778	-104.600556	2008-2016	114
Pueblo/USGS	Fountain Creek at Pinon Bridge	07106300	38.429447	-104.598056	2009-2017	93
Pueblo	Fountain Creek at Pedestrian Bridge near mouth	FOUMOUCO	38.255344	-104.59085	2008-2017	100
Pueblo	Fountain Creek at Hwy 50	n/a	38.287731	-104.601744	2008-2017	120
Pueblo	Fountain Creek at Beacon Hill	n/a	38.389651	-104.6057766	2015-2017	8

Table 7-2: Potential New *E. Coli* Sampling Locations			
Station Name	Location		Reason for New Site
	Latitude	Longitude	
Fountain Creek below Woodland Park at Talcott Gulch	38.947800	-105.0264146	Potential impacts from OWTS and smaller tributaries not associated with MS4
Fountain Creek below Crystal Creek at Green Mountain Falls	38.930544	-105.009514	Previous USGS site (2007) Potential impacts from development along Hwy 24, OWTS and smaller tributaries not associated with MS4
Fountain Creek above Ruxton Creek	38.860278	-104.919444	Previous USGS site (2007-2008) Will help quantify loading between Manitou Springs and Old Colorado City
Monument Creek at Pikeview	38.901671	-104.822873	Previous SU site (2015-2016) Understand impacts below Cottonwood, including large green spaces along creek
Pine Creek at Mouth	38.938059	-104.814495	Tributary to Monument Creek – understand impacts from NE Colorado Springs
Kettle Creek at mouth	39.003905	-104.73849	Tributary to Monument Creek – impacts from more rural residential area north of Colorado Springs
West Monument Creek at mouth	38.958134	-104.835530	Determine impacts from USAFA

7.3 Sampling Protocol

Samples for water quality analyses will be collected, at a minimum, on a monthly basis. The AF CURE routine monitoring schedule is available on the AF CURE website, http://www.ppacg.org/index.php?option=com_content&view=article&id=1061, and was used as a guide to inform this monitoring effort. The schedule summarizes monthly sampling activities by sampling locations and associated site identification number. Samples will be collected in containers provided by an analytical laboratory and shipped or delivered for analysis per laboratory recommendations.

The following sampling recommendations and protocols are provided for reference and for use as a supplement to existing SAP protocols. Where appropriate, sampling will be conducted in accordance with WQCD guidance, such as the Standard Operating Procedures for the Collection of Water Chemistry Samples[20].

7.3.1 Field Notes, Sample Labeling, and Chain of Custody

Field notes are taken for all sample sites and recorded. Information recorded includes: identification of the monitoring site; date and time of sampling; identity of the sampler(s); description of the type of samples taken; method of sampling; results of any field analyses; description of the weather, including percent cloud cover and air temperature; flow; description and photograph of the site appearance; and any unusual conditions observed.

Collected samples are designated by sample location using the site names shown in Tables 1 and 2. Each sample container is individually labeled, with the label affixed directly to the bottle or bag itself with the preservative and analysis to be performed printed on the label. Additional sampling

[20] https://www.colorado.gov/pacific/sites/default/files/SOP%20-%20Collection%20of%20Water%20Chemistry%20Samples%20-%20042116.pdf

information, date, time, location, sampling medium, and sampler initials, is also written on the label with indelible waterproof ink.

Chain of custody (COC) documentation identifies sample containers and provides a complete inventory of all containers in a sample set and will provide an audit trail identifying the persons who have custody of a sample, in order, and the exact date and time when custody was relinquished from one person to the next.

7.3.2 General Sampling Recommendations

Following are general recommendations for water quality sampling:

- Since sampling is taking place year-round, it is possible that instream sampling may not be safe at certain times. If alternative methods of sample collection are not possible, it is up to the discretion of the individual sampling personnel whether sampling will take place during high flows. The turbidity of the stream, visual flow, and previous rain events may also affect the sampling schedule.
- When using watercraft, take samples near the bow, away and upwind from any gasoline outboard engine. Orient watercraft so that the bow is positioned in the upstream direction.
- When wading, collect samples upstream from the body and avoid disturbing sediments in the immediate area of sample collection.
- Sampling at or near structures (e.g., dams, weirs, or bridges) may not provide representative data because of unnatural flow patterns.
- Collect grab samples within the top 12 inches of the water column but avoid skimming the surface of the water during collection.
- Where practical, use the actual sample container as the collection device (direct grab). If a direct grab sample cannot be collected, ensure that the intermediate sample container is well rinsed with site water before sample collection.

7.3.3 Grab Sample Technique

Grab samples will be collected for analysis of water quality. Grab sample technique is summarized as follows:

- Use an unpreserved sample container to collect the sample.
- If using pre-preserved sample bottles, collect sample water (in same manner described below) in a clean carboy that is rinsed with sample site water. Fill the bottles from that carboy. This method cannot be used for volatile organics.
- Remove the container cap and slowly submerge the container, opening first, into the water.
- Invert the bottle so the opening is facing toward the water and parallel to water flow. Allow water to run slowly into the container until filled.
- Return the filled container quickly to the surface.
- Pour out a small volume of sample away from and downstream of the sampling location. This procedure allows for addition of preservatives (if using) and sample expansion. Do not use this step for volatile organics or other analytes where headspace is not allowed in the sample container.
- Add preservatives (provided by the analytical laboratory) if required, securely cap container, label, and complete field notes.
- If preservatives have been added, invert the container several times to ensure sufficient mixing of sample and preservatives.

7.3.4 Field Parameters

Field parameters include temperature, pH, conductivity, total dissolved solids (TDS), and dissolved oxygen (DO). Note that TDS can either be measured in the field or in the laboratory based on each sampler's discretion. Field parameters are measured at all stations directly in the water column at the midpoint of each transect at mid-depth. Under non-wadable conditions, field measurements are taken from the water samples collected to rinse collection equipment. Field measurements will be taken using a water quality meter following standard techniques and equipment calibration procedures provided by the manufacturer. Equipment calibration is performed on the day of sampling before sample collection or as needed, and calibration recorded in the field book.

7.3.5 Flow Determination

Flow is an important tool in assessing water quality. Measurements will be recorded or collected to help understand flow regimes within the watershed and to determine constituent loading. United States Geological Survey (USGS) gage station data can be used to determine flow where gage data are continuously monitored at no less than 15-minute increments. Sampling sites with applicable USGS flow data are noted in Table 1. Prior to each field visit, the USGS website should be checked to confirm that the gage is active and flow data are available. Outfall flow is often monitored at the outfall and measurements can be obtained by the agency or entity that operates the outfall.

Where USGS or outfall flow data are not available, flow data are collected from stream channels and point source or outfall locations according to the procedures described below.

7.3.5.1 Stream Channel Measurements (Including Canals and Ditches)

Stream channel flow is calculated by velocity and area measurements taken at instream sample locations. Stream width is determined with a tape measure across a sample transect perpendicular to the channel. Streams are generally waded to collect measurements of depth (staff gage) and velocity (current velocity meter). Current velocity measurements may be obtained using an electromagnetic flow instrument (e.g., Global Flow Probe, Marsh McBurney). Where streams cannot be accessed by wading, flow can be measured from a bridge using a weighted line marked in feet for the depth with the flow meter attached.

Measurements of depth and velocity are taken on the same vertical line at even distances across the stream at the center of equally spaced intervals. Interval width is determined by how even and consistent the flow is across the channel, as well as the width of the channel. A stream strewn with boulders without a uniform channel would demand closer intervals than an even channel with a sandy bottom. Generally, velocity readings will be recorded at the center of intervals that are ten percent of the width of the stream along the cross-section transect at each sample site.

Flow for each section of the sample transect is calculated by multiplying the velocity by the area of the individual transect section. Flows for each transect section are then summed to determine an overall transect flow rate. This flow rate calculation method is shown schematically on Figure 3.

How to Calculate Flow

Calculating discharge from each of the width intervals:

$q_2 = v_2 d_2 (w_3 - w_1) / 2$

where: q_2 = discharge at width interval 2 (cfs)
v_2 = velocity measure at width interval 2 (ft./sec.)
d_2 = depth at interval 2 (feet)
w_3 = distance from the bank or initial measuring point to the point following interval 2 (feet)
w_1 = distance from the bank or initial measuring point to the point preceding interval 2 (feet)

Calculate the total discharge (flow) as the sum of each of the partial discharges.

$Q = q_1 + q_2 + q_3 + q_4 \ldots . q_0$

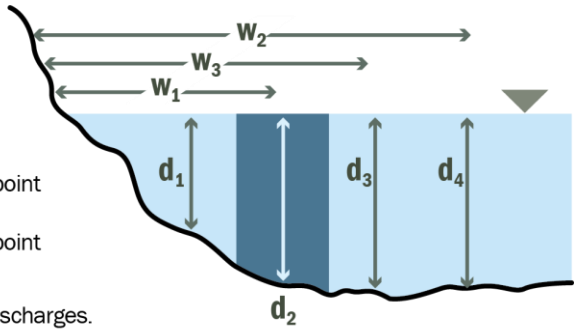


Figure 7-1: Stream Channel Flow Calculation

Another flow measurement option, the sixth tenths depth method (0.6 method) is summarized below. The 0.6 method consists of measuring the velocity at 0.6 of the depth from the bottom of the stream and is generally used for shallow flows where the water depth is less than 2 feet. A single velocity measurement is taken at each interval, at 0.6 of the depth from the bottom. It is essential that a portable flow meter be in place long enough to get a reliable average of the velocity. Electromagnetic velocity meters are counted or observed for a minimum of 20 seconds.

4. Adjust the time averaging interval with the up/down arrows until twenty (20) seconds is displayed on the screen.
5. Measure the width of the stream leaving the tape suspended several feet above the water.
6. Beginning 6 inches from either bank, measure the depth.
7. Adjust the wading rod to the 0.6 tenth position.

Holding the rod in a steady upright position, push the START button on the meter. The movement screen will begin moving left to right measuring velocity for 20 seconds. At the end of 20 seconds, the average velocity will appear on the screen and the display will again begin another 20-second period.

8. Record the first velocity reading, ignoring the second displayed velocity.
9. Move the wading rod 1 foot into the stream and record the depth.
10. Adjust the wading rod to the 0.6 tenth position.
11. Push the START button on the display. A new 20-second interval period will begin. At the end of the 20-second period, the average velocity will again appear on the screen.
12. Record the second velocity reading, ignoring the display counting the third display period.
13. Repeat steps 7-10 until you reach 6 inches from the far bank. The 6-inch reading will be your last reading.
14. Add all the velocities and divide by the number of readings to get the average.
15. Add all the depths and divide by the number of readings to get the average depth.
16. Multiply the width by the average depth and the average velocity to determine flow in cubic feet per second (cfs).

7.3.5.2 Measuring Flow from Discharge Pipes

Wastewater treatment plant (WWTP) flows will be measured using existing, continuously recording flow measurement devices. For other piped discharges from circular conduit, flow is calculated for fully and partially discharging pipes as described in Attachment B.

Pipes that have a low flow and some free fall may be measured using the bucket method. A bucket of known volume is allowed to fill while being timed with a stop watch, as follows:

((60 seconds) / (# seconds to fill)) X volume of bucket in gallons = flow in gpm

7.3.5.3 Estimating Flow Volumes

Excessive flow velocities and flow depth may impede the measurement of flow at some sample locations. In this case, flow will be estimated using an approximate velocity, water depth, and the known cross-sectional geometry from previous sampling events. It is critical that the field sheet is marked "estimated" using this method.

7.4 QA/QC

All information produced as a result of the proposed *E. coli* sampling must be of reliable and documented quality. The primary means for ensuring data quality is through implementation of Quality Assurance Project Plans (QAPPs) developed by each stakeholder. The following QA/QC recommendations and protocols are provided for reference and for use as a supplement to existing QAPP protocols.

7.4.1 Field QA/QC

Field QA/QC includes thorough cleaning of sampling equipment, use of appropriate sample containers, and maintaining Chain of Command (COC) procedures. Analytical QA/QC measures are also followed by the laboratories and include equipment blanks and spikes. Analytical QA/QC results are provided by the laboratory.

Field duplicates and field blanks should be collected, one for every 20 samples collected. The field duplicate is collected immediately after the primary sample is collected at the site. Field blanks are taken by pouring reagent water from the laboratory into sample bottles at the site. Field duplicates/blanks are labeled as separate samples to avoid confusion and to provide an unbiased blind evaluation.

7.4.2 Data Review

Data review consists of reviewing the data package received from the contracted laboratories to ensure the package is complete and consistent. The following data review procedures are performed following receipt of each data package:

- **Step 1:**
  - Review the data set for completeness. Confirm that all sample sites and constituents are reported or that there is an explanation for any missing data point.
  - Review the data report. Confirm that all titles, labels, column headings, and footnotes are accurate and complete. Confirm that all constituents are reported in proper units.
  - Review the date and time documentation. Confirm that the sample dates and times are consistent with the date and time received in the laboratory. Confirm that the dates and time for analysis are consistent with the dates and times of the analysis. Confirm that the

holding times were not violated, based on a comparison of sampling and analysis date and times.

- **Step 2:** Review all values that are reported as "None Detected." Confirm that the analytical detection limits are low enough to accomplish project goals. Confirm that all values are either reported as values or less than the detection limit. Confirm that the detection limit is used consistently on all samples.
- **Step 3:**
  - Review data for internal consistency. Confirm that values have a logical relationship to one another. Confirm that values are within the historical range of data for a given site and constituent. Confirm that values vary logically according to known conditions, such as seasonal temperature and presence or absence of dilution flows.
  - Review the internal and external quality control results. Confirm that spike recovery percentages on matrix spikes, relative percent difference on laboratory duplicates, and percent error on known laboratory standards were within acceptance limits. Confirm that digestion blanks, reagent blanks, and method blanks do not contain concentrations of analyte that interfere with interpretation of data.

7.5 Data Reporting

Sampling results will be made available on the Ambient Water Quality Monitoring System (AQWMS), which can be accessed through the Colorado Water Quality Monitoring Council's webpage, http://www.coloradowaterquality.org or the Data Sharing Network (DSN) website, www.coloradowaterdata.org.

To access AQWMS for data modification or upload, go to http://cdsn.awqms.com >AWQMS Applications>AWQMS. Contact the AF CURE coordinator for individual login username and password. AQWMS data can be publicly accessed by going to http://cdsn.awqms.com >AWQMS Applications>AWQMS -- USERNAME: cdsnpublic | PASSWORD: cdsnpublic.

Appendix A: Maps

Appendix B: Data Tables

B-1: Sampling Locations by Entity

B-2: Geometric Mean Summary per Sampling Location

Appendix C: *E. Coli* Planning Implementation by Jurisdiction

Appendix C

E. Coli Planning Implementation By Jurisdiction

MS4 Jurisdictions within Fountain Creek Watershed

- City of Colorado Springs
- City of Fountain
- City of Manitou Springs
- City of Pueblo
- Colorado Department of Transportation
- Colorado Springs Utilities
- Colorado State University - Pueblo
- El Paso County
- El Paso County Public Health
- Ft. Carson
- Peterson AFB
- Pikes Peak Community College
- Pueblo County
- Pueblo Department of Public Health and Environment
- Town of Monument
- Town of Palmer Lake
- United States Air Force Academy
- University of Colorado – Colorado Springs

JURISDICTION: City of Colorado Springs

1. Current Efforts/Existing Nonpoint Source Program by Source

City of Colorado Springs				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Parties**
Livestock	E/O to small non-commercial operations on proper waste management practices.	Conduct an inventory of private livestock lots near waterways.		El Paso County, MS4 Programs, Potential partnerships, NRCS, CSU Extension Agency, Code enforcement
	Include stables for horseback riding in outreach and evaluation	Form partnership with agencies like NRCS to address waste management issues.		

City of Colorado Springs				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Parties**
Wildlife (e.g., birds, raccoons, deer, etc.)	Residential and restaurant E/O on how to help manage urban wildlife to improve water quality, i.e. securing garbage, reduce food sources.	Assess need for dumpster/ grease management programs @restaurants.	Evaluate/propose BMP for restaurants to improve grease and trash management/ reduce spills.	MS4 Programs CDOT Colorado Parks and Wildlife
		Consider implementing inspection of problems areas. Explore opportunities and encourage wildlife population management. (i.e. developing the City of Colorado Springs deer management policy)	Assess stormwater micro-pool contributions from water fowl. Identify deterrents or modifications to reduce potential loads.	
Pet Waste	E/O to pet owners, dog-specific businesses, vet offices	Code enforcement, more "Scoop the Poop" events, distribute pet waste bag dispensers.	Install bag station/waste containers at high usage areas.	MS4 Programs City and County Parks, Humane Society, pet-related businesses
	Increased messaging via social media, TV, radio	Evaluate current park maintenance practices/create SOP for dog parks.	Assess opportunity to expand locations for Scoop the Poop signage at all parks/trails.	
Human Waste (e.g, campers, homeless/ homeless population)	E/O with stakeholders (utilizing data to tell the story)	Encourage policy development to restrict camping near waterways.	Assess waste management services, such as public restrooms or mobile shower/restrooms to provide sanitary facilities.	MS4 Programs, Parks Departments, Homeless service providers
	Increase bathroom usage and access.	Identify areas with concentrated populations and camps. Trend water quality impacts with population numbers.	Partner with organizations to provide appropriate sanitary facilities, alternative waste collection kit options, and/or additional waste collection locations.	
		Continue to promote Adopt –a-waterway and increase the numbers of cleanup activities adjacent to streams.	Support agencies that manage sites and make modifications to deter camping.	
Illicit Discharges	E/O to RVs, homeless camps, Septic haulers, Campgrounds, camping retailers	Trend Code Enforcement and MS4 Program data on illegal dumping.	RV waste collection systems	MS4 Programs
		IDDS surveys Hauler programs	Evaluate infrastructure and policy to improve WWTF access for private RV dumping.	CSU/WW Utilities
			Post signage @storm drains/common dumping sites adjacent to RV parks, etc. (Include info for where can take wastes, ID citation, phone # to report and fine information).	

City of Colorado Springs				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Parties**
Cross Connections, Leaking Sanitary Sewer	E/O to plumbers, builders and DIY Homeowners	Code Enforcement	Aging Infrastructure,	MS4 Program, CSU,
		IDDS Surveys	Rehabilitation/Prioritization program review	WW Utilities
		Call in number for reporting		
Sediment/ Debris in Storm Sewer System	E/O to homeowners re: yard debris/trash, ID ordinance	Evaluate program to collect yard debris.	Assess adequacy of refuse containers and areas where yard waste can be taken.	MS4 Programs
	E/O to City contractors (e.g., landscape maintenance)	Re-assess current storm sewer maintenance practices for potential enhancement (e.g., address biofilms?)		
		Assess current City-contractor practices; evaluate need for SOP.		
Storm Runoff from Urban Areas	E/O to development community.	Re-assess current practices.	Create opportunity with CIPs to showcase this methodology (Lead by example).	MS4 Programs
	Consider creating SW award/designation recognizing developers that lead in this area.	Encourage site designs that minimize directly connected impervious areas.		
Dry Weather Urban Flows (e.g., irrigation, car washing, power washing, etc.)	E/O to homeowners, landscape maintenance companies, local garden centers, golf courses, cemeteries, etc.	Assess current irrigation practices (e.g., regular maintenance of systems and assessment for excessive runoff) for City-owned/managed properties; evaluate need for SOP.	Perform field reconnaissance/further assess potential sources in sub-watersheds associated with dry weather/outfall hotspots.	MS4 Programs
		Consider adding ability to report excessive sprinkler runoff on City app.	Consider additional sampling locations.	
		Enforcement of applicable ordinances.		

City of Colorado Springs Current *E. coli Reduction* Efforts			
Responsible Party	**Management Tool**	**Extent of Program/Tool (membership, funding, events)**	**Metrics**
City of Colorado Springs Water Resources Engineering Division and Stormwater Enterprise	Enviroscape Stormwater Model	Interactive demonstration of how pollution from humans impacts waterways	89 presentations to 6,014 students in 2017
	Children's Water Festival	Partnered with a spectrum of regional partners/stakeholders to develop a local annual water festival for children that was first offered in 2017 and expanded in 2018	800 students participated in 2018
	Illicit Discharge Detection (ID) and Elimination Program	Dedicated program manager put in place in 2017 resulting in improved outreach/education, incident tracking/mapping, effective response times and enforcement action; 24-hour reporting hotline, website and City app	Investigated 125 reported incidents with a total of 29 IDs in 2017. Distributed 200 various brochures (depending on spill type) in 2017.
	Scoop the Poop Program	Education program that includes artwork from local schoolchildren in signage that is installed at local parks.	50 signs installed Summer of 2017 through Pikes Peak Youth Leadership Program. Distributed 100 pet waste brochures and 1,140 pet waste bags in 2017.
	Trash Mobs	Targeted at public places with significant litter; one hour targeted cleanup fun with costumes/theme	In 2017, 310 volunteers collected over 8 tons of trash.
	Adopt-a-Waterway Program	Groups adopt segments of waterways and participate/promote cleanups of their segments.	82 cleanup events occurred in 2017 with over 18 tons of litter removed.
	Storm Drain Marking Program	Decal stickers are provided to interested groups to mark the storm drains.	Over 300 drains were marked in 2017.
	Stormwater BMP Field Academy	Erosion and sediment control BMP hands-on class for the installation of construction site BMPs.	Held 2 classes with 60 attendees total in 2017.
	Stormwater University	City provides presentations related to MS4 Permit requirements for the regulated community with clarification of existing requirements/policy.	Provided 3 presentations from 2017-2018 so far.
	Wet Wednesdays	In collaboration with the HBA and El Paso County, the City participates in Stormwater-related presentations put on throughout the year for the development and construction community.	142 attendees in 2017.
	Street Sweeping Program	Year-round effort by dedicated staff to help prevent pollutants (e.g., sediment, organics, oil, grease, trash, road salt and trace metals) from entering the storm sewer system.	The City recovers and disposes of an average of 18,000 cubic yards of sediment, leaves and other debris annually. In 2016, the City swept 33,387 miles of roadway.
	Maintenance of Public Structural Controls	Sediment, trash & debris removal from municipal-owned detention facilities; open channel drainageways & storm sewer infrastructure including inlets, catch basins and siphons.	Total of 3,448 cubic yards of material removed in 2017.
	Dry Weather Screening	41 Outfalls of concern identified as meeting criteria outlined in MS4 Permit and monitored for *E. coli*	Monitored 4xs/year for *E. coli* and total coliform since 2015.

Human Waste-Related Sources:

a. The City hosts numerous cleanup events throughout the year that target waterways, has a growing adopt-a-waterway program, and a full-time Education and Outreach Coordinator who continually looks to partner with local businesses, neighborhood groups, schools, and other organizations in promoting educational activities that support long-term stewardship of clean waterways.

b. The City provides trash receptacles throughout the City (including downtown areas, local parks) and has recently added several trash roll-off containers in areas adjacent to waterways that campers frequent to provide additional waste disposal options.

c. In 2018, the City passed an ordinance for no camping within 100 feet of waterways within the City. A no camping ordinance previously existed within the City but was often unenforceable when no shelter beds were available. Some shelter beds have specific criteria (e.g., youth, women, alcohol and drug use restrictions) while others are low barrier and have far fewer requirements. Previously, the available beds were often occupied and the camping ban could not be enforced consistently. In 2018, admission requirements for shelter beds were adjusted to create an extra 370 low-barrier beds (220 existing beds were converted and 150 beds were added). The new ordinance is not dependent on availability of shelter beds for enforcement. The goal of this new ordinance is to reduce life safety risks associated with people camping in the drainage ways from flash flood events as well as to improve water quality in the City's waterways by reducing the trash and waste that continually accumulates around homeless camps adjacent to creeks and streams within the City.

d. In addition to providing $500,000 in 2018 towards the addition of low-barrier beds, the City created a 2018/2019 Action Plan for Homelessness Response which includes goals for continued education via the HelpCOS campaign, development of a comprehensive affordable housing plan, additional Neighborhood Services staff to aid in cleaning up illegal camps and other efforts aimed at reducing homelessness within the City. The City also promoted and hosted three town home meetings and offered a survey to collect input from the community to incorporate feedback on the response plan.

e. The City is currently performing an assessment of elevated *E. coli* hotspots in comparison with known locations of homeless camping sites. Coordination efforts with the City's Homeless Prevention and Response Coordinator, the Homeless Outreach Team (HOT), and other local homeless advocates/support organizations are on-going to gather information related to this effort and to facilitate outreach and education activities.

Other Human Waste-Related Sources:

a. Colorado Springs Utilities has a program that evaluates for leaking sanitary sewer lines. The El Paso County Public Health has a program that addresses the maintenance of privately owned septic systems (OWTS).

b. The City utilizes a small vehicle-mounted camera to remotely monitor and investigate storm drain lines, as needed, to assess for damage, blockages, confirm drainage infrastructure layout/construction materials, investigate illicit discharges, and detect cross connections to the storm sewer system.

Pet Waste: The City is a regional partner with other stakeholders in promoting the Scoop the Poop Program which includes signage, cleanup and education efforts at local parks, dog parks, trails/natural areas, and schools. This effort also includes the installation of dispenser stations and distribution of dog waste bags.

Illicit Discharges (IDs):

a. The City has a full-time program manager responsible for education/outreach related to preventing IDs and promoting responsible practices, ID tracking/data management, ID investigation/site visits, enforcement actions and required reporting.
b. To educate the public that storm drains and inlets drain to the City's waterways, the City has a Storm Drain Decal Marking Program utilized by cleanup groups, neighborhood organizations, individuals and City O&M personnel.
c. In 2018, the City initiated a collaborative art education program with other local stakeholders utilizing local artists in promoting awareness messaging through their art; art is currently displayed on storm sewer manhole covers and inlets in prominent downtown locations.

Dry Weather Urban Flows: Forty-one (41) City storm sewer outfalls have been identified with dry weather flows and have been monitored for *E. coli* since 2015.

Wildlife:

a. The City provides continual education and outreach to restaurant owners regarding grease/garbage management and prevention of IDs that can also attract vermin/scavenger animals.
b. The development of a deer management policy is being evaluated for the City.

Livestock:

a. Existing City ordinance addresses management of animals/animal waste near waterways.

2. 1- to-5-Year Implementation Plan with Priorities

Human Waste-Related Sources:

a. Identify areas with concentrated populations and camps. Trend water quality impacts with population numbers and assess additional sampling needs (potential use of Microbial Source Tracking).
b. Continue to increase and encourage the involvement of the community in promoting activities/behaviors that reduce trash and waste from getting into waterways as well as enlist community members in on-going clean-up activities to maintain these areas for mutual enjoyment. Partner with Manitou Springs and other local municipalities in promoting solutions that address this regional challenge.
c. Look for opportunities to partner with other stakeholders/homeless service providers to provide additional sanitary facilities, assess the option to provide waste disposal kits, and assess providing education and outreach with the homeless population regarding alternative waste disposal practices/options.
d. Promote the provision of more shelter options that are low barrier and/or other alternative short-term housing arrangements that can better accommodate the number of unsheltered homeless the City is currently experiencing.
e. Promote the development of long-term lower cost housing options throughout the City but predominantly within areas of the City adjacent to other local resources (e.g., transportation/bus routes, job/career services, healthcare/clinics, low-income support agencies) to reduce the number of people seeking shelter near waterways.

Other Human Waste-Related Sources:

a. Work with and support the efforts of Colorado Springs Utilities to further evaluate potential hotspots in the City for possible cross connections between sanitary and storm sewer infrastructure.

b. Work with and support the efforts of the El Paso County Public Health to promote maintenance of privately-owned septic systems and reduce incidences or potential for septic system discharges/impacts.
c. Continue to utilize the City's camera truck to aid in the investigation of hot spot areas.
d. Initiate/increase education and outreach (in partnership with CSU) to plumbing companies/contractors and do-it-yourselfers regarding cross-connections; provide information/resources regarding how to make appropriate connections/tie-ins to sanitary lines and the associated permitting and approval process.
e. Determine locations where ID of human waste has either been reported or where an increased likelihood of potential ID of human waste could occur (e.g., storm drains/drainages adjacent to camping areas, RV parks, remote areas with easy access that correlate with elevated *E. coli* data). Post signage at these locations with information related to appropriate places for waste disposal, impacts of illegal dumping/waste disposal, citations from City Code and a number to report IDs anonymously to promote reporting.
f. Work with CSU and other WWTF providers to evaluate existing infrastructure and policy to improve access for private RV dumping.

Pet Waste:

a. Continue to support and promote the Scoop the Poop efforts and expand the coverage of these awareness/outreach campaigns with additional signage, cleanup efforts, and resources.
b. Create a plan to increase the number of waste receptacles in parks and at trail heads to further encourage increased participation of dog owners in this effort. Allocate and/or obtain additional funding for long-term waste disposal costs.
c. Partner with El Paso County in the development of a Standard Operating Procedure for the maintenance of City and County parks/dog parks that specifically addresses the removal of dog waste
d. Grow existing education and outreach efforts related to pet stores, shelters, pet adoption fairs, and veterinarians.

Illicit Discharges:

a. Perform a more detailed assessment of historical ID data to identify hotspots where additional education and outreach and/or signage may be beneficial to reduce ID incidents. Coordinate with other assessment efforts to further delineate potential *E. coli* sources and implement BMPs targeted at reducing these sources.
b. Further promote storm drain decal program to increase coverage throughout high ID incidence areas.
c. Further expansion of the storm drain art education program to other areas.

Dry Weather Urban Flows:

a. Continue *E. coli* monitoring of identified dry weather flows at existing 41 outfalls.
b. Perform detailed assessment of potential *E. coli* sources in areas/sub-basins associated with dry weather monitoring locations where elevated *E. coli* levels have been recorded. Develop plan to address identified sources.
c. Assess current irrigation practices (e.g., regular maintenance of systems), presence of excessive runoff for City-owned/managed properties; evaluate need for additional SOPs. Consider adding ability to report excessive sprinkler runoff/malfunction on City app.
d. Continued education and outreach to homeowners, landscape maintenance companies, local garden centers, golf courses, cemeteries, etc.

e. Re-evaluate/assess current dry weather flows at MS4 outfalls for any necessary additions and/or withdrawals to monitoring network.

Wildlife:

a. Assess need for dumpster/grease management programs for restaurants; consider implementing inspection of problem areas.
b. Evaluate/propose BMP for restaurants to improve grease and trash management/reduce spills
c. Use means to discourage bird nesting and roosting under bridges
d. Assess potential for stormwater permanent BMP micro-pool contributions from water fowl; identify deterrents or modifications to reduce potential loads (if identified).
e. Partner with other MS4 Programs, municipalities, stakeholders (e.g., CDOT, Colorado Parks and Wildlife) to assess potential wildlife-related sources of *E. coli* in the watershed and planning of actions to reduce these loads.

Livestock:

a. Provide education and outreach to small non-commercial operations on proper waste management practices; partner with other stakeholders (e.g., El Paso County, other MS4s/municipalities, NRCS, Colorado State University Extension Agency).
b. Conduct an inventory of private livestock lots near waterways; form partnership with agencies like NRCS to address waste management issues.
c. Reach out to local stables for horseback riding within the watershed to discuss street clean-up and proper waste disposal.

3. 6- to 10-Year Implementation Plan with Priorities

Human Behavior Changes: Continued assessment and evaluation of effectiveness of educational and outreach programs targeted at human behavioral change to determine necessary modifications and additions.

Resourcing Existing or New Programs: As further water quality data collection and trending is developed for the City's MS4 and more definitive determinations are made regarding E. coli sources, the City will continue to assess and evaluate the effectiveness of existing programs to determine necessary modifications and additions to best address and reduce known contributions.

Infrastructure Improvements: On-going implementation of the City's Stormwater Control Program Intergovernmental (IGA) Projects associated with the City's commitment to invest $460 million dollars on the City's Stormwater Control Program (including infrastructure improvements) by 2035.

4. Monitoring Plan

Historically, the City (in conjunction with USGS, Colorado Springs Utilities (CSU), and the Office of Emergency Management) has developed a network of sampling locations (predominantly at existing USGS gage locations for wet weather monitoring and at identified Outfalls of Concern for dry weather monitoring) for assessment of water quality in the watershed and to better define impacts from the City's MS4, as well as other sources. To date, the City has collected water quality data since at least the 1970s and as required and in accordance with the City MS4 Permit.

The City recognizes the need for a more robust data set regarding the presence of different forms of *E. coli* within and around the City MS4 and throughout the entire watershed. Additional data would allow the City to better delineate specific *E. coli* sources so that appropriate BMPs targeting those sources could be prioritized/expanded to facilitate reduction of *E. coli* contributions in these areas.

Identification of specific sources of *E. coli* is imperative before BMP selection and prioritization can be determined. MST is a developing methodology that is showing promise in defining specific *E. coli*

sources in elevated areas. The City would like to evaluate the potential for the targeted use of MST in known elevated areas of the watershed to aid the City in determining what BMPs would be most effective at reducing existing E. coli sources.

Before the City can effectively incorporate MST analysis or propose changes to its existing monitoring program, a more detailed assessment of the existing program and historical *E. coli* data will need to be performed. The City has initiated this analysis as part of the *E. coli* Watershed Planning effort in conjunction with other watershed stakeholders and municipalities. This analysis will be time-consuming and involve additional information-gathering to produce an accurate assessment of current conditions and potential *E. coli* sources.

The process will involve the following:

1. Perform a detailed evaluation of existing *E. coli* data for both wet weather and dry weather monitoring efforts to date to determine effectiveness of existing sampling plan/program. More data will ultimately be needed to further delineate potential sources.
    a. This evaluation includes identifying areas of highest exceedance and performing a focused study of relevant sub-basins/drainages and associated possible *E. coli* sources by reviewing information related but not limited to land use (e.g., parks, dog parks, rural residential, etc.) and locational information for other permitted dischargers, storm sewer and wastewater infrastructure, OWTs, IDs, homeless camp areas, USGS and other sampling sites/gages (where flow and water quality data exist), MS4 Dry Weather Outfalls of Concern, bridges (bird nesting sites), and ponds (geese/ducks).

The results of this on-going in-depth analysis will be utilized to:

- Revise the existing monitoring program, as needed to obtain additional data to assist in this effort of better delineating *E. coli* sources in hotspot areas.
- Determine how and where MST could best be utilized to supplement the existing *E. coli* data that is being collected.
- Generate a hierarchy of sampling needs that can be implemented in a phased approach as funding allows and regulatory requirements dictate.

5. Technical and Financial Assistance Sources

With passage of ballot measure 2A in 2018, the City was able to re-establish a Stormwater Enterprise and initiate a stormwater fee for residential and non-residential property owners within the City. It is estimated that this fee will generate approximately $12 million dollars a year of dedicated stormwater-related funding. The City will continue to utilize available grants/alternative funding mechanisms to supplement and grow existing funding for stormwater programs and projects. The City will also continue to partner and pool funding with other stakeholders in the region to advance watershed-wide initiatives.

In 2016, the City established the Water Resources Engineering Division, a new division dedicated to stormwater management, programs and projects. Over the course of three years, the City grew this division to include 68 employees to provide services including engineering, technical review, program and project management, construction oversight, education and outreach, MS4 permit coordination, water quality monitoring, watershed planning, municipal facilities and illicit discharge management. The City will continue to enhance the capabilities of the Water Resources Engineering Division, as priorities change and the City's MS4 Permit is modified, to address associated stormwater control requirements.

JURISDICTION: City of Fountain

1. Current Efforts/Existing Nonpoint Source Program

Human Waste-Related Sources: The City of Fountain provides trash receptacles throughout the City including downtown areas, local parks and adjacent to waterways that campers frequent to provide additional waste disposal options.

Pet Waste:

a. The City of Fountain is a regional partner with other stakeholders in promoting the Scoop the Poop Program which includes signage, cleanup and education efforts at local parks, dog parks, trails/natural areas, and schools. This effort also includes the installation of dispenser stations and distribution of dog waste bags.
b. The City of Fountain participates in an Education and Outreach Strategy that contains a list of targeted *E. coli* sources including dog owners, commercial landscapers and residential DIY landscaping activities.
c. The City of Fountain currently actively participates in the delivery of radio, TV, and print media campaign. The campaign delivers targeted messages on proper pet waste management and landscaping alternatives to reduce transfer of microorganisms into the MS4.

Illicit Discharges:

a. The City of Fountain has a part-time program manager who is responsible for education/outreach related to preventing illicit discharges and promoting responsible practices, illicit discharge tracking/data management, illicit discharge investigation/site visits, enforcement actions, and required reporting.
b. The City of Fountain has a Storm Drain Decal Marking Program to educate the public that storm drains and inlets drain to the City's waterways.
c. The City of Fountain also implements an Illicit Discharge Detection and Elimination process. *E. coli* discharges to the MS4 occur from occasional sanitary sewer overflows generated by Special District operated sanitary sewage systems. Notices of Violation are issued and prompt cleanup of discharged material is required.

2. 1- to 5-Year Implementation Plan with Priorities

Human Waste-Related Sources: The City of Fountain will continue to increase and encourage the involvement of the community in promoting activities/behaviors that reduce trash and waste from getting into waterways as well as enlist community members in on-going clean-up activities to maintain these areas for mutual enjoyment. The City of Fountain will continue to partner with the region in promoting solutions that address this challenge.

Other Human Waste-Related Sources: The City of Fountain will continue to partner with the Fountain Sanitation District to utilize their small vehicle-mounted camera to remotely monitor and investigate storm drain lines, as needed, to assess for damage, blockages, confirm drainage infrastructure layout/construction materials, investigate illicit discharges, and detect cross connections to the storm sewer system.

Pet Waste:

a. The City of Fountain will continue to support and promote the Scoop the Poop efforts and expand the coverage of these awareness/outreach campaigns with additional signage, cleanup efforts, and resources.

b. The City of Fountain will create a plan to increase the number of waste receptacles in parks and at trail heads to further encourage increased participation of dog owners in this effort.
c. The City of Fountain will partner with El Paso County in the development of an SOP for the maintenance of City and County parks or trail heads that specifically addresses the removal of dog waste.
d. The City of Fountain will grow existing education and outreach efforts related to pet stores, shelters, pet adoption fairs, and veterinarians.

Illicit Discharges: The City of Fountain will further promote the storm drain decal program to increase coverage throughout high illicit discharge incidence areas.

Dry Weather Urban Flows:

a. The City of Fountain will assess current irrigation practices (e.g., regular maintenance of systems), presence of excessive runoff for City-owned/managed properties; evaluate need for additional SOPs.
b. The City of Fountain will continue education and outreach to homeowners, landscape maintenance companies, and Parks Dept.

3. 6- to-10-Year Implementation Plan with Priorities

Not yet identified.

4. Monitoring Plan

The Fountain Sanitation District is currently monitoring their discharge flow. The City of Fountain is exploring the option of monitoring specific storm sewer discharge locations in the future.

JURISDICTION: City of Manitou Springs

1. Current Efforts/Existing Nonpoint Source Program

City of Manitou Springs Current *E. coli Reduction* Efforts				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Entity**
Pet Waste	Education/outreach	Code enforcement	Signage, pet waste bags & stations provided at all parks and public parking areas	Manitou MS4 Program
	Public messaging	Pet waste ordinance		
Homeless Camps	Education/outreach	Enforcement	Public bathroom access	Manitou MS4 Program
	NGO partnering	City ordinance prohibiting camping on public property		
Septic (on-site wastewater treatment)	Education/outreach	Prohibited in municipal boundaries	Monitoring in Green Mountain Falls/Cascade	Manitou MS4 Program
Livestock	Education/outreach	Code enforcement	Buffers	Manitou MS4 Program
		Comprehensive City ordinance for sanitary requirements	Fencing	
Wildlife	Education/outreach	Prohibition against feeding wildlife	Identify high wildlife population areas and evaluate available deterrent measures	Manitou MS4 Program
	Waste management	Wildlife resistant waste containers required		

City of Manitou Springs Current *E. coli Reduction* Efforts				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Entity**
Illicit discharges	Education/outreach	Code enforcement MS4 IDDE program	RV/campground waste collection systems	Manitou MS4 Program
Cross connections	Education/outreach to plumbing and building industry – DIY	Code enforcement IDDE program	Aging infrastructure evaluation/rehabilitation program review	Manitou MS4 Program
Sanitary Sewer Overflows	Education/outreach	Emergency assistance program	Inspection/maintenance program Wastewater Master Plan	Manitou MS4 Program

Human Waste-Related Sources:

a. The City of Manitou Springs supports cleanup events that target waterways and looks to partner with local businesses, neighborhood groups, schools, and other organizations in promoting educational activities that support stewardship of clean waterways.

b. The City of Manitou Springs provides multiple public restrooms and trash receptacles throughout the City including downtown areas and City of Manitou Springs parks.

c. The City of Manitou Springs Police Department enforces no trespassing violations on private property and enforces the city ordinance banning camping on public property. In addition, homeless camp cleanups are periodically conducted.

Pet Waste: The City of Manitou Springs is a regional partner with other stakeholders in promoting the Scoop the Poop Program which includes signage, cleanup and education efforts at local parks, trails/natural areas, and schools. This effort also includes the installation of dispenser stations and distribution of dog waste bags throughout the downtown area and City of Manitou Springs parks.

Illicit Discharges:

a. The City of Manitou Springs maintains Illicit Discharge reporting instructions, available 24/7 through is Stormwater online government webpage(s). In addition, this online resource contains numerous educational topics informing the public how they can be involved to prevent illicit discharges from occurring.

b. The City of Manitou Springs utilizes a remote camera and Closed Circuit Television to monitor and investigate storm drains, as needed, to assess for damage, blockages, confirm drainage infrastructure layout/construction materials, investigate illicit discharges, and detect cross connections to the storm sewer system.

Wildlife: The City of Manitou Springs currently enforces proper urban trash management practices which includes municipal code requiring trash be kept from wildlife penetration and highly recommends wildlife-proof trash receptacles to its residents.

Livestock: The City of Manitou Springs enforces existing ordinances and municipal code that address management of animals/animal waste near waterways.

2. 1- to 5-Year Implementation Plan with Priorities

The City of Manitou Springs intends to continue its existing activities and increase its focus to the MS4 permit compliance program to include additional public outreach and involvement. The City would also like to focus human waste reduction efforts along the Ruxton Creek corridor.

3. 6- to 10-Year Implementation Plan with Priorities

The City of Manitou Springs has not yet identified priority goals for this time period.

4. Monitoring Plan

The City of Manitou Springs would like to become more involved with monitoring and sampling potential *E. coli* sources within its jurisdiction if funding sources become available.

JURISDICTION: City of Pueblo

1. Current Efforts/Existing Nonpoint Source Program

City of Pueblo Current *E. coli Reduction* Efforts				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Entity**
Pet Waste	E/O with pet owners, dog-specific businesses, vet offices. Presentations at local schools.	Distribute pet waste bag dispensers through vet clinics and booths to the public.	Install bag station/waste containers at high usage areas. Install bag dispensers at parks and at the dog park	MS4 Program, Pueblo Department of Public Health and the Environment, City Parks,
Human Waste	E/O with homeless, contractors, and private land owners about illicit camping, trespassing, failing septic systems.	Encourage policy development to restrict camping near waterways. Identify areas with concentrated populations and camps. Have a reporting call line	Cleanups of abandoned illicit camping areas, have home owners repair, or replace failing systems	MS4 Program, Code Enforcement, City Stormwater, Pueblo Department of Public Health and the Environment
Illicit Discharges	E/O with contractors, homeless camps, the public. "Drains to River" storm drain decals	IDDE surveys, Management of construction sites.		MS4 Program, Code Enforcement, City Stormwater; Pueblo Department of Public Health and the Environment
Cross Connections		Cross Connection program	Disconnect the cross connection, fix or repair any leaking pipes	City Wastewater

Human Waste:

a. The City of Pueblo, through Pueblo Code Enforcement is educating and notifying homeless camp residents that they are not allowed to camp in undesignated areas as these encampments are unsanitary.

b. Code has also been working with private property owners to notify homeless people on private property that they need to disperse and stay off private land. This education and notification have mainly targeted areas near the Fountain Creek.

c. Upon proper notification to homeless campers, Code Enforcement works with the Pueblo Stormwater Department crews in removing these abandoned illegal encampments. Trash, waste, and other left behind items are properly removed and disposed of from the abandoned sites.

d. The Pueblo Department of Public Health and the Environment (PDPHE) responds to reports of failing OWTS. The PDPHE has a 24/7 phone line to report any sanitary sewer overflows, or illicit discharges into the storm sewer system.

Pet Waste:

a. Currently the PDPHE gives out pet waste bag dispensers throughout the City. They are distributed at businesses with a high percentage of dog owning customers, including vet clinics and dog groomers. These dispensers are also given out at local festivals and events.

b. An ongoing project, with room for better implementation, is the installation of waste disposal stations. As with any new infrastructure, comes a maintenance schedule. Disposal stations and trash receptacles have been added in certain parks, but an implementation plan is missing. Aside from the addition of these in other infrastructure projects, the targeted installation near waterways, for *E. coli* reduction, would be a long-term implementation (5-10 years).

Illicit Discharge:

a. The City of Pueblo has a 24/7 hotline that is utilized in the detection of illicit discharge within the City MS4. This number is listed on the Stormwater website; https://www.pueblo.us/458/Stormwater-Utility

b. Public Education about illicit discharge is an ongoing process. The City works with the PDPHE in educating the public about illegal dumping and contamination of storm water. Passive outreach includes newspaper ads, storm drain markings (drains to river), brochures and pamphlets, and the website. Active outreach includes ongoing social media, cleanups, hazardous waste events, pet waste stations, school stormwater presentations, etc.

c. The City tracks and eliminates illicit discharges as situations arise. Public involvement is ongoing to help eliminate illicit discharge. Inspection personnel and cleanup crews can be dispatched as needed after a call is made to the illicit discharge hotline. Storm drain markers are both an educational and public involvement tool. Most of the drain markers throughout the City have been installed by school classes and other voluntary sources. Education of the public leads to involvement of the public in educating others. Teaching children in schools the importance of clean stormwater may be passed along to their parents and friends. School presentations also educate professional staff about clean stormwater, which can be passed down to students and other faculty members. This is an ongoing process which can directly or indirectly eliminate the frequency of illicit discharge and reduce *E. coli.*

d. Once an illicit discharge is detected, it must be addressed. The discharge is first contained. Then, if able, the source of the discharge must be found to eliminate the potential of another or ongoing discharge (“point source”). Depending on the severity, several options are available to remove the discharge, ranging from the violator doing the cleanup, to a HAZMAT cleanup.

e. The City can address illicit discharge in the Code of Ordinances. Depending on the type of discharge and whether it is a repeated offense, a summons and complaint can be sent to the violator. Restitution for cleanup performed by the City is sought if needed.

2. 1- to 5-Year Implementation Plan with Priorities

Human Waste: This management strategy is new for the City of Pueblo, which just recently began implementation. Currently there is no defined policy for restricting the homeless camping along waterways on public land. This *E. coli* reduction strategy will need to be addressed in the near term (1-5 years).

Priority for reduction of E. coli in the Fountain Creek Watershed:

1. Homeless and Illicit Camping (Human Waste):
    a. Homeless camps contribute to the pollution of storm systems, streams, and rivers. Many camps are developed along streams because of the vicinity to water for use. These camps do not have a sanitary method of fecal, food, and other waste disposal, thus resulting in common direct illicit discharge to the nearby stream or river.
    b. The City of Pueblo understands that these camps are unsanitary and need to be addressed. Currently, Pueblo Code Enforcement is educating and notifying homeless camp residents that they are not allowed to camp in undesignated areas. Code has also been working with private property owners to notify homeless people on private property that they need to disperse and stay off private land. This education and notification has mainly targeted areas near the Fountain Creek.
    c. Upon proper notification to illicit campers, Code Enforcement works with The Pueblo Stormwater Department crews in removing these abandoned illegal camps. Trash, waste, and other left behind items are properly removed and disposed of from the abandoned sites.
    d. This management strategy is new for the City of Pueblo, just recently began implementation. Currently there is no defined policy for restricting the illicit camping along waterways on public land. This E. coli reduction strategy will need to be addressed in the near term (1-5 years).

Current implemented E. coli reduction strategies with room for development:

2. Pet Waste:
    a. With the increase in population and new construction of impervious area, comes the higher impact on our waterways from pet feces. Pet waste that is left on the ground next to waterways has a higher probability of contaminating streams and rivers with E. coli than it did in the past.
    b. Currently the County Health Dept gives out pet waste dispensers throughout the City. They are distributed at businesses with a high percentage of dog owning customers, including vet clinics and dog groomers. These dispensers are also given out at local festivals and events.
    c. An ongoing project, with room for better implementation, is the installation of waste disposal stations. As with any new infrastructure, comes a maintenance schedule. Disposal stations and trash receptacles have been added in certain parks, but an implementation plan is missing. Aside from the addition of these in other infrastructure projects, the targeted installation near waterways, for E. coli reduction, would be a long-term implementation (5-10 years).
3. Illicit Discharge:
    a. This is the discharge of any non-stormwater, including liquids and solids, into the MS4's stormwater conveyance system. The CDPS General Permit defines allowed discharges in section Part 1.E.2.a.v
    b. Plan
        1) The City of Pueblo has a 24/7 hotline that is utilized in the detection of illicit discharge within the City MS4. This number is listed on the Stormwater website; https://www.pueblo.us/458/Stormwater-Utility
        2) Public Education about illicit discharge is an ongoing process. The City works with the Pueblo County Health Department in educating the public about illegal dumping and contamination of storm water. Passive outreach includes newspaper ads, storm drain markings (drains to river), brochures and pamphlets, and the website. Active outreach

includes ongoing social media, cleanups, hazardous waste events, pet waste stations, school stormwater presentations, etc.

3) The City tracks and eliminates illicit discharges as situations arise.

c. Execution

1) Public involvement is ongoing to help eliminate illicit discharge. Inspection personnel and cleanup crews can be dispatched as needed after a call is made to the illicit discharge hotline. Storm drain markers are both an educational and public involvement tool. Most of the drain markers throughout the City have been installed by school classes and other voluntary sources. Education of the public leads to involvement of the public in educating others. Teaching children in schools the importance of clean stormwater may be passed along to their parents and friends. School presentations also educate professional staff about clean stormwater, which can be passed down to students and other faculty. This is an ongoing process which can directly or indirectly eliminate the frequency of illicit discharge and reduce E. coli.

2) Once an illicit discharge is detected, it must be addressed. The discharge is first contained. Then, if able, the source of the discharge must be found to eliminate the potential of another or ongoing discharge ("point source"). Depending on the severity, several options are available to remove the discharge, ranging from the violator doing the cleanup, to a HAZMAT cleanup.

3) The City can address illicit discharge in the Code of Ordinances. Depending on the type of discharge and whether it is a repeated offense, a summons and complaint can be sent to the violator. Restitution for cleanup done directly by the City is sought if needed.

3. 6-to 10-Year Implementation Plan with Priorities

Pet Waste: An ongoing project, with room for better implementation, is the installation of waste disposal stations. As with any new infrastructure, comes a maintenance schedule. Disposal stations and trash receptacles have been added in certain parks, but an implementation plan is missing. Aside from the addition of these in other infrastructure projects, the targeted installation near waterways, for *E. coli* reduction, would be a long-term implementation (5-10 years).

4. Monitoring Plan

Sanitary Sewer Monitoring:

a. City of Pueblo wastewater is responsible for the safe and effective transportation and treatment of municipal wastewater. The wastewater department monitors the sanitary sewer collection system through cleaning and using closed circuit television cameras to ensure any cross connections with the storm sewer system are corrected, and any breaks in the line are fixed.

b. The Pueblo Wastewater Department does monitor E. coli at four different monitoring sites along Fountain Creek. The testing is done to determine the amount of E. coli in the creek for informational purposes. The monitoring is not done to target sources, or before or after storms to determine the effect of wet weather.

c. The wastewater department also takes samples along Fountain Creek for informational purposes to determine the upstream water quality.

d. GIS

e. City of Pueblo utilizes ArcMap for GIS needs for all departments. For illicit discharge tracking, the different complaint areas and discharges can be tracked for further evaluation. Trends of certain discharges can be analyzed to focus funds and resources at targeted areas.

f. Using an illicit discharge map in GIS allows the City to identify priority locations, identify areas needing more patrol, and to help track the methods used in removing and cleaning up an illicit discharge.

g. The entire stormwater system for the City of Pueblo is created in GIS. If there is a question as to where an illicit discharge such as E. coli may have ended up, the GIS mapping can be referred to. ArcMap aids in the cleanup and identification of discharges and helps in the reduction of E. coli. The City of Pueblo can also trace back to the source of an illicit discharge from an outfall location.

JURISDICTION: Colorado Department of Transportation

E. coli is not included as a highway pollutant of concern within CDOT's modified MS4 Permit (COS000005, July 31, 2017), however there maybe three potential sources of *E. coli* within CDOT Right-of-Way – Illicit Discharges, Homeless Camping and Wildlife.

1. Current Efforts/Existing Non-Point Source Program

a. Illicit Discharge (ID) Program is to identify and eliminate any discharge that is not composed entirely of stormwater. CDOT's MS4 ID Program uses training/education, identification, reporting, investigation, tracking, and removal to curtail IDs.

b. Annual Permanent Water Quality (PWQ) Facilities Inspections and Maintenance – CDOT annually inspects each permanent water quality facility within the Region and conducts maintenance and repairs of these facilities as warranted.

c. CDOT has developed a new contracting method to accomplish Region 2 PWQ maintenance that is funded at $500,000, to conduct a thorough one-time cleaning of these facilities, establish a sustainable process to repair and maintain these facilities and track maintenance with CDOT's Maintenance business processes.

d. CDOT has removed nine (9) homeless camps along Fountain Creek from CDOT right-of-way, removing over 1,300 cubic yards of trash and debris at a cost of over $30,000. This work has reduced future loadings of trash, debris and potential *E. coli* discharges to the creek from these camps.

e. CDOT maintains approximately 10 miles of wildlife fencing along the I-25 corridor (on both the east and west sides of the highway) between Colorado Springs and Pueblo within the Fountain Creek Watershed. The purpose of this fencing is primarily to limit wildlife access to I-25 to reduce wildlife collusions and accidents. There are approximately 20 wildlife emergency escape ramps within this fencing to allow wildlife to exit the ROW and prevent entry into the ROW. Wildlife fencing also serves an ancillary purpose that by limiting wildlife access to CDOT ROW and thereby potentially reducing wildlife *E. coli* loadings from entering CDOT's Permanent Water Quality facilities. Additionally, CDOT Maintenance staff quickly remove carcasses of hit wildlife along all highways within the watershed reducing the potential of *E. coli* from decaying carcasses.

f. CDOT requires bird netting during construction activities under bridge and box culverts preventing bird nesting under bridges and culverts during project work. This limitation reduces bird droppings to flow ways and waterways during construction.

g. CDOT requires that sanitary facilities at all construction sites be properly secured to prevent tipping and blow over, limiting the potential for spills and leaks of effluent.

2. 1- to 5-Year Implementation Plan with Priorities

a. ID Program

b. PWQ Inspections and Maintenance – PWQ Cleaning Contract

c. Homeless Camp Removals from ROW

d. Maintain wildlife fencing and escape ramps between Colorado Springs and Pueblo

3. 6- to 10-Year Implementation Plan with Priorities

a. ID Program
b. PWQ Inspections and Maintenance
c. Homeless Camp Removals from ROW
d. Maintain wildlife fencing and escape ramps between Colorado Springs and Pueblo

4. Monitoring Plan -N/A

JURISDICTION: Colorado Springs Utilities

Colorado Springs Utilities Current *E. coli Reduction* Efforts			
Responsible Party	**Management Tool**	**Extent of Program/Tool (membership, funding, events)**	**Metrics**
Colorado Springs Utilities	E/O with partners, stakeholders, homeless service providers	Presentations, tabling at events, summer intern, cleanups across the watershed	25 events and 6,735 contacts in 2018
	Leading Edge Teen Volunteer Program - Raingarden	Designed and installed a demonstration raingarden at Milibo Art Theater	Educational brochure on site, thousands of visitors annually
	Pet waste bag dispenser distributions	Thousands purchased annually and distributed at events watershed-wide	Distributed 2,000 dispensers in 2017; 2,500 in 2018
	Sanitary Sewer Evaluation and Rehabilitation Program (SSERP)	Evaluates and repairs wastewater system	30% of system each year (Spent $74.85M since 2000)
	Sanitary Sewer Creek Crossings Program (SSCC)	Monitors and addresses wastewater pipes that cross creeks and those running parallel to creeks. $3.3 million spent annually	Repaired or rehabilitated 5 creek crossings in 2017 at a cost of $3.9M. (Total cost since 2008 $45.4M)
	Local Collectors Evaluation and Rehabilitation Program (LCERP)	Reducing sanitary sewer overflows through a systematic inspection, rehabilitation, replacement and monitoring program. $3.32 million spent annually	Repaired or rehabilitated 75,807' of <10" pipe at a cost of $3.106M in 2017
	Collection System Rehabilitation and Replacement Program	Large diameter pipes. Annual budget $1.25 million	Spent $3.191M in 2017 replacing 1691' of 12-inch, 2,995' of 42-inch, 540' of 60-inch pipes.
	Manhole Evaluation and Rehabilitation Project (MHERP)	Rehabilitate sanitary sewer manholes throughout the collection system.	$1.16M spent in 2018

The Colorado Springs Utilities Wastewater Collection System Rehabilitation Programs are comprehensive programs that systematically inspect, evaluate, prioritize, and rehabilitate the entire Springs Utilities collection system. These projects are independent of Springs Utilities' normal operation and maintenance programs.

1. Current Efforts/Existing Nonpoint Source Program

a. Sanitary Sewer Evaluation and Rehabilitation Program (SSERP): Inspect, evaluate, rehabilitate, repair or replace pipes 10" or greater diameter sanitary pipes, 30% of system each year. $74.85M has been spent since 2000 on this program. SSERP was completed on December 31, 2012, meeting all the requirements of the CDPHE Compliance Order on Consent (COC). Closure of the COC was requested on January 29, 2013 and granted by CDPHE on March 8, 2013.

b. Sanitary Sewer Creek Crossings Program (SSCC): Inspection, evaluation, repair or replacement of sanitary sewer pipes and erosion protection of creek crossings structures. $3.M spent annually, tied to City/Pueblo County Inter-Governmental Agreement (IGA) dated April 27, 2016.

c. Local Collectors Evaluation and Rehabilitation Program (LCERP): Reducing sanitary sewer overflows through a systematic inspection, rehabilitation, replacement and monitoring program. $3.32 million spent annually. LCERP, is the primary program for the requirements of the Pueblo County 1041 Permit for the SDS Project. LCERP has contributed over $60 million to the $75 million commitment since 2009.

d. Collection System Rehabilitation and Replacement Program (CSRR): Inspect, evaluate, rehabilitate, repair or replace pipes 10" or greater diameter sanitary pipes. Spent $3.191M in 2017 replacing 1691' of 12-inch, 2,995' of 42-inch, 540' of 60-inch pipes.

e. Manhole Evaluation and Rehabilitation Project (MHERP): Rehabilitate sanitary sewer manholes throughout the collection system. 6 manholes repaired in 2017 at a cost of $7,841 in 2017

2. 1- to 5-Year Implementation Plan with Priorities

a. SSERP has now been replaced by CSRR (see below)

b. SSCC $3M/year earmarked for this program through 2046

c. LCERP $2.5M/year budgeted

d. CSRR $1.25M/year budgeted

e. MHERP $120K budgeted for 2022 and 2023

f. Identify opportunities to collaborate with other stakeholders on education/outreach, additional water quality monitoring, and innovative solutions to *E. coli* reductions.

3. 6- to 10-Year Implementation Plan with Priorities

a. SSCC $3.3M/year earmarked for this program through 2046

b. LCERP $1.5M/year budgeted

c. CSRR $1.25M/year budgeted

d. MHERP budget TBD

4. Monitoring Plan

Currently, Colorado Springs Utilities has a robust monitoring plan for numerous parameters and at a variety of frequencies each month. Utilities will consider additional sites to monitor *E. coli* where resources allow.

5. Operations & Maintenance

a. The Distribution, Collection and Treatment Department (DCT) provides water and wastewater services that represent the full cycle of service from distribution of finished water to release of clean water back to the creeks (including wastewater solids disposal at Clear Spring Ranch). Specifically, the Distribution, Collection and Treatment Department maintains and rehabilitates the water distribution system and the wastewater collection system; operates the water resource

recovery facilities; and provides construction support and equipment services for energy, water and wastewater services.

b. Wastewater collection system assets include (as of January 31, 2018):
   1) 19 Lift Stations
   2) 36,257 Manholes
   3) 1,724 miles of wastewater mains

c. Service Levels Monitor
   1) Number of failures per hundred miles of pipe
   2) Number of SSO'S per hundred miles of pipe

JURISDICTION: El Paso County

1. Current Efforts/Existing Nonpoint Source Program

El Paso County Current *E. coli Reduction* Efforts			
Responsible Party	**Management Tool**	**Extent of Program/Tool (membership, funding, events)**	**Metrics**
El Paso County	Education and Outreach plan targeting specific sources	Outreach to targeted sources	??
	Annual Regional Stormwater Education and Outreach Media Campaign	$20K watershed-wide TV, bus, bus stop, billboard, and radio messaging	1.3 million contacts/year
	Pet Waste bags and dispensers at parks	Ongoing, funded by donations to parks	?
	Scoop the Poop events	Two outreach events at Bear Creek Dog Park, each spring and fall; mascots "Scoopy" and "Eli", distributed pet waste bags	400 contacts/year

The El Paso County nonpoint source program for *E. coli* consists of implementation of various activities centered on compliance with its Municipal Separate Storm Sewer System (MS4) permit including:

- Implementation of an Education and Outreach Strategy that contains a list of targeted *E. coli* sources including dog owners, commercial landscapers and residential DIY landscaping activities with pet waste and fertilizer being the primary vectors for pathogens, respectively.
- Coordination and delivery of radio, TV, and print media campaign with an annual budget of $20,000. The campaign delivers targeted messages on proper pet waste management and landscaping alternatives to reduce transfer of pathogens into the MS4.
- Pet waste stations at all dog parks operated by El Paso County. Bear Creek Park is the only dog park within the El Paso County MS4 area.

El Paso County also implements an Illicit Discharge Detection and Elimination process. Historically, *E. coli* discharges to the MS4 occur from occasional sanitary sewer overflows generated by Special District operated sanitary sewage systems. Notices of Violation are issued and prompt cleanup of discharged material is required.

2. 1- to 5-Year Implementation Plan with Priorities

Increase resources to the MS4 program to include additional inspectors, enforcement and record keeping.

3. 6- to 10-Year Implementation Plan with Priorities

Not yet identified.

4. Monitoring Plan

Neither Outfall Monitoring nor ambient water quality monitoring are required by the El Paso County MS4 permit. As such no monitoring plan is in place.

However, in an effort to better quantify sources of *E. coli* in El Paso County, the stormwater program is interested in sponsoring three (3) or four (4) new *E. coli* monitoring locations, depending on cost. The locations proposed for *E. coli* monitoring include three (3) ambient monitoring locations on Fountain Creek:

- Upstream and downstream of Pine Crest Stables (2 locations);
- USGS Gauge Station in Cascade (1 location); and
- One (1) storm sewer outfall in the MS4 area with dry weather discharges.

JURISDICTION: El Paso County Public Health

El Paso County Public Health Division Current *E. coli Reduction* Efforts			
Responsible Party	**Management Tool**	**Extent of Program/Tool (membership, funding, events)**	**Metrics**
El Paso County Public Health	Transfer of Title Program	OWTS systems required to go through a certified inspection as part of the sale of the home. Inspections are reviewed by specialist and issued an acceptance document based on repairs to the system being required (Conditional) or warranted (regular).	Conditionals require repair be made to system within 90 days for failing systems, follow ups are conducted on issuance of these. Regular acceptance documents are issued when repairs do not constitute a failure but should be corrected.
	OWTS Operation and Maintenance Program	Program designed for annual evaluation of certified inspections on all systems with higher level treatment or mechanical components (i.e pumps)	There are approximately 42 systems currently required to submit annual O&M inspections
	Public education/outreach to home buyers	Discussion with realtors and educational presentations to realtors in relation to the Transfer of Title program.	

1. Describe your jurisdiction's main non-point sources of E. coli

On-site Wastewater Treatment Systems (OWTS): On-site wastewater treatment systems treat and dispose of waste in areas were central sewer does not exist for disposal of waste products.

2. Current Efforts/Existing Non-Point Source Program

a. **New Systems:** Applications are evaluated with a soil and site evaluation prior to issuance of the OWTS permit. The soil and site evaluation is used to determine the potential public health risks involved in the selected location. Any new OWTS installed on a property that borders a creek, stream, or body of water is required to install a higher level treatment system.

b. Existing systems:

   1) Complaint evaluation: Complaints are evaluated for active failure of systems. Typically systems with surfacing sewage are found via complaints and required to be brought into compliance.

   2) Transfer of Title program: All existing OWTS systems on a property, which are being sold, require an inspection by a certified inspector prior to sale or transfer of the property. An Environmental Health Specialist then evaluates the inspection for any potential public health concerns.

      a) Systems deemed to be in failure: A Conditional acceptance document is issued requiring a repair of the system.

      b) Systems with deficiencies noted but not deemed a failure: An acceptance document is issued in which the deficiencies are disclosed to both the buyer and seller, and repair is then left up to the interested parties to determine. These repairs typically do not require permit and are not indicative of a failure, such as accessibility of the system.

3. 1- to 5-Year Implementation Plan with Priorities

a. Continue improvement rate of Conditional Acceptance document closure.

   1) Closure is through OWTS permit issuance and completion or verification of follow up inspection where concerns have been resolved or are no longer an issue.

b. Work with El Paso County Assessor office to map OWTS systems within a specified area of waterways.

c. Implementation of Operation and Maintenance inspections on systems with higher-level treatment to ensure components are functioning as intended.

d. Implement a Certified Inspectors audit program to ensure inspections are being conducted in as uniform a manner as possible between inspectors.

e. Education of Realtor Industry to ensure compliance with the inspection process

   1) Attendance by invitation at realtor meetings to provide education on transfer of title program

4. 6- to 10-Year Implementation Plan with Priorities

a. Continue to monitor Operation and Maintenance inspections on systems with higher-level treatment to ensure components are functioning as intended.

b. Education of Realtor Industry to ensure compliance with the inspection process

   1) Attendance by invitation at realtor meetings to provide education on transfer of title program

5. Monitoring Plan

Not Applicable

JURISDICTION: Ft. Carson

1. Current Efforts/Existing Nonpoint Source Program

Current *E. coli Reduction* Efforts in the Fountain Creek Watershed			
Responsible Party	**Management Tool**	**Extent of Program/Tool (membership, funding, events)**	**Metrics**
Construction Contractors on Fort Carson		Stormwater Pollution Prevention Plans (SWPPPs)	Fort Carson directs contractors using portable toilets in their construction sites to stake the toilets to the ground to prevent them from tipping over. Fort Carson reviews construction project SWPPPs, monitors construction BMPs, identifies and submits work requests for maintenance to sanitary sewer and stormwater conveyance systems.
Fort Carson	MS4 Illicit Discharge Survey	Annual survey of B-Ditch, Clover Ditch, Infantry Creek and Rock Creek through the cantonment area.	Survey Report, Red/Amber/Green Assessments
	Maintain Low Impact Design features	Identify and recommend courses of action for wildlife issues	
	E/O to units, residents, and contractors	Public events, label storm drains with "Drains to River" or similar decals.	
	New Resident Guide	The Fort Carson Housing office provides new residents with a resident's guide which includes requirements for handling pet waste.	No
	Environmental Protection Officer Course	Fort Carson Directorate of Public Works conducts training on gray water handling and disposal.	Number of Soldiers Trained
	MSGP Impaired Waters Sampling	Annual sampling of five MSGP facilities to determine the presence of *E. coli*	MPN/100 ml
	Signage	The dog park at Iron Horse Park directs uses to clean up pet waste.	No
	Field Sanitation Course	4th Infantry Division conducts training for Soldiers on field sanitation to protect human health and reduce disease. A portion of the class covers the proper handling and disposal of human waste	No
	Portable Toilet Contract	Fort Carson uses portable toilets during field training to reduce the use of austere human waste controls to protect human health and reduce disease.	No
	Bird Spikes	Bird spikes are installed on buildings and facilities to prevent birds from roosting. The spikes reduce the concentrations of bird dropping over impervious surface.	No

Illicit Discharges: Fort Carson's illicit discharge detection and elimination plan includes prevention and prohibition of specific discharges, field screening, and investigation procedures. Ongoing E/O efforts directed to units, residence, and contractors which work and live on the installation reinforce this plan as to mitigate illicit discharges before they happen.

a. Deliberate dumping into the stormwater system or a body of water is illegal under the Federal Clean Water Act, and is therefore enforceable and punishable by Fort Carson law enforcement officers and outside entities. Additionally, Fort Carson Garrison Commander (GC) Policy #17 requires compliance with Fort Carson Stormwater Management Plan (SWMP) requirements relating to elimination of illicit discharges. Fort Carson also maintains a Spill Prevention Control and Countermeasures Plan (SPCCP) which guides the response actions to unintentional spills or leaks. Storm drain stenciling as well as hazardous waste collection efforts work towards prevention of illicit discharges, in addition to the prohibitory mechanisms.
b. Fort Carson conducts annual dry weather field screening at the four major cantonment drainages within Fort Carson (B-Ditch, Clover Ditch, Infantry Creek, and Rock Creek) to investigate for illicit discharges. Qualified personnel physically inspect the drainages looking for illicit discharge pipes, seeps, or other suspect flows. Tools to help personnel identify potentially illicit discharges include field test kits to determine chemical characteristics (such as pH or nutrients) and the storm sewer map, which shows base infrastructure in addition to other items required by the permit. This map is maintained by the Fort Carson GIS. Field personnel utilize this map for reporting source tracking the discharge.
c. Fort Carson conducts various types of system investigations including: collection system surveys, oil water separator surveys, sanitary sewer inflow and infiltration surveys, and smoke tests. These surveys investigate system connections and functionality; and provide another mechanism for identifying potential illicit discharges and cross connections.
d. Fort Carson includes contact information for the stormwater program on the program's website for public reporting of (non-emergency) potentially illicit discharges as another means of illicit discharge identification in addition to the field screening efforts. 911 is used to report emergency situations involving spills and leaks over five (5) gallons in volume. The spill line is for spills less than five (5) gallons in volume.
e. Fort Carson investigates potential illicit discharges within 15 days of detection and takes action to eliminate the source within 45 days. The USEPA is notified if elimination efforts are expected to extend past 45 days. The stormwater program utilizes a spreadsheet on SharePoint to track field screening, illicit discharges, and restoration efforts.
f. Fort Carson has long utilized portable latrines during training events, on construction sites, and during special events. This practice reduces environmental impact caused by improper waste disposal. The installation will continue the use of these facilities as needed. The facilities are routinely inspected to ensure they are properly secured to prevent tipping.
g. Review construction project SWPPPs for approval by installation.
h. Conduct IDDE surveys and actions.
i. Maintain and implement policies.
j. Conduct environmental training classes.
k. Participate in Household Hazardous Waste Disposal Event.
l. Identify and submit work requests for maintenance and upgrades to sanitary sewer and stormwater conveyance systems via inspections and surveys.
m. Label storm drains with "Drains to River" or similar decals.

Pet and Wildlife Waste:

a. Decrease the potential for pet and wildlife waste to enter into Fort Carson stormwater conveyance systems. Conduct education, public outreach, and coordination with Fort Carson conservation representatives to help reduce preventable causes of contamination.
b. Construction site stormwater runoff at Fort Carson is managed through on-site control of erosion and sediment, project reviews prior to ground disturbances, active site inspections, and required project close outs with the stormwater program.
c. Post-construction BMPs are installed to prevent or minimize water quality impacts on new and re-development projects. Fort Carson follows the Army Low Impact Development (LID) Guidance to implement such requirements.
d. Distribution of a resident guide to all new tenants is conducted upon arrival to Fort Carson. Participation in public E/O events are conducted on a routine basis. These events may include environmental training classes, community outreach events, and publication of information in community newsletters, social media, and within the Consumer Confidence Report.
e. Coordinate with Fort Carson conservation branch pertaining to wildlife issues is conducted on an as needed basis. Guidance from the conservation branch is sought out to ensure compliance with applicable wildlife laws and regulations (i.e., Endangered Species Act).
f. Distribute resident guide to all new tenants. Participate in public E/O events.
g. Conduct inspections.
h. Coordinate with conservation branch as needed for wildlife issues.
i. Maintain LID features.
j. Identify and recommend courses of action for wildlife issues, (example: deterring migratory bird nesting within the vicinity of stormwater conveyance systems).
k. v. The serviceability of installation trash dumpsters is the responsibility of the installation refuse contractor. Fort Carson works closely with the contractor to ensure that lids are operable and dumpster do not seep. This mitigates the possibility of pet waste and other sources of e-coli found in dumpsters from entering the Fort Carson stormwater conveyance system and ultimately our waters of the state.

2. 1- to 5-Year Implementation Plan with Priorities

Illicit Discharges: Nothing planned beyond existing activities.

Pet and Wildlife Waste: Nothing planned beyond existing outreach/education activities. Additional plans to avoid nesting areas on the airfield and on new construction sites have been identified as priorities.

3. 6- to 10-Year Implementation Plan with Priorities

Illicit Discharges: Nothing planned beyond existing activities.

Pet and Wildlife Waste: Nothing planned beyond existing activities.

4. Monitoring Plan

a. Fort Carson is subject to environmental requirements like large MS4s. Other programs supporting these requirements at Fort Carson provide a benefit to the MS4 program goals. Programs most applicable to the MS4 compliance include the Multi-Sector General Permit (MSGP) for industrial stormwater discharges and associated Stormwater Pollution Prevention Plan (SWPPP), the construction stormwater program, and the Spill Prevention, Control and Countermeasures Plan (SPCCP). Permit requirements mandate monitoring and reporting requirements not only for *E. coli* but other contaminants, water quality parameters, and constituents.

b. Fort Carson also operates a Federally owned wastewater treatment plant which is subject to EPA Region 8 issued NPDES permit. This permit requires monitoring and reporting of influent and effluent discharges from the treatment plant. The plant is equipped with a state certified laboratory. If specific labs are not able to be accomplished within Fort Carson's wastewater treatment plant laboratory, then analysis is outsourced to an approved laboratory.

c. Fort Carson utilizes geographic information system mapping to maintain up-to-date maps depicting stormwater related features and events.

JURISDICTION: Pueblo Department of Public Health and Environment (PDPHE)

1. Describe your jurisdiction's main non-point sources of E. coli

On-site Wastewater Treatment Systems (OWTS): On-site wastewater treatment systems treat and dispose of wastewater for properties in areas were a municipal or centralized sewer system does not exist for treatment and disposal of wastewater.

2. Current Efforts/Existing NonPoint Source Program

a. **New Systems:** A site and soil evaluation is conducted on each property to ensure that the installation of an OWTS will not have negative impacts on surface or ground waters and well as impacts on public health. Sites that are not suitable for a standard OWTS (shallow ground water, shallow bedrock, unsuitable soils) and commercial sites must have the OWTS designed by a professional engineer. Each OWTS that is installed is inspected by the Pueblo Department of Public Health and Environment to ensure that the OWTS was installed in accordance with the approved permit.

b. Existing systems:

   1) Complaint evaluation: PDPHE receives and investigates complaints regarding failing on-site wastewater treatment systems and surfacing of sewage. If the OWTS is found to be in state of failure a notice of violation is issued to the property owner to have the OWTS repaired and brought into compliance with the regulations.

   2) Transfer of Title program: All existing OWTS systems on a property, which are being sold, require an inspection by a NAWT certified inspector prior to sale or transfer of the property. An Environmental Health Specialist then evaluates the inspection for any potential public health concerns.

      a) Systems deemed to be in failure: Must be repaired and brought into compliance prior to the issuance of an acceptance document. The purchaser of the property may purchase the property as is if they issue a statement that they will take responsibility for the repairs and will repair the system within 30 days (or a reasonable timeframe) after closing on the property.

      b) Systems with deficiencies noted but not deemed a failure: An acceptance document is issued in which the deficiencies are disclosed to both the buyer and seller, and repair is then left up to the interested parties to determine.

3. 1- to 5-Year Implementation Plan with Priorities

a. Evaluate the Transfer of Title Program to ensure property owners are complying with the Transfer of Title Regulation.

b. Provide more public education regarding the maintenance and use of OWTS to property owners.

c. Provide more education to OWTS Professionals regarding design, installation, pumping and inspection of OWTS.

d. Implement an audit program to ensure all OWTS professionals are conducting OWTS functions in uniform in compliance with local and state regulations.
e. Continue the education of Realtor Industry to ensure compliance with the inspection process
f. Attendance by invitation at realtor meetings to provide education on transfer of title program

4. 6- to 10-Year Implementation Plan with Priorities

a. Continue existing OWTS functions to ensure the protection of the environment and Public Health.
b. Evaluate failure rates of OWTS in Pueblo County to determine if a use permit program should be implemented in Pueblo County to better protect public health and the environment.
c. Continue the education of the public and OWTS professionals on all aspects of on-site wastewater treatment systems.

5. Monitoring Plan

Not Applicable

JURISDICTION: University of Colorado – Colorado Springs (UCCS)

1. Current Efforts/Existing Nonpoint Source Program

UCCS Current *E. coli Reduction* Efforts				
Potential Source	**Human Behavior**	**Programmatic**	**Infrastructure Improvements**	**Responsible Entity**
Pet Waste	E/O with pet owners.	Distribute pet waste bag dispensers.	Install bag station/waste containers at high usage areas.	MS4 Program, Sustainability, Campus Recreation
Human Waste	E/O with Contractors and Outdoor Services Staff.	Incorporate into Pre-Construction Meetings and Training Sessions.	N/A	MS4 Program, Environmental Health and Safety Department
Ilicit Discharges	E/O with Contractors and "Drains to River" storm drain decals	Hazardous waste/recycling days.	Site plan review and execution of WQCD in new construction.	MS4 Program

Pet Waste:

a. Educating residents along with the campus community that have service, therapy and emotional support animals on campus about the specific areas to be used by their pets and the importance of picking up after them.
b. Distribute pet waste bag dispensers.
c. An ongoing discussion related to the installation of bag stations is taking place.

Human Waste:

a. UCCS has been keeping a close eye on Port-O-Lets to ensure they are emptied regularly and properly secured to prevent them from tipping over and spilling onto the ground.
b. UCCS will continue to keep these facilities secure to prevent any contamination of Monument Creek.

c. Incorporate discussions related to Port-O-Let maintenance into Pre-Construction meetings and training sessions.

Illicit Discharges:

a. UCCS has a process that is utilized in the detection of illicit discharge within the Campus. This is listed on the Facilities website: https://www.uccs.edu.facsrvs/stormwater-program
b. Education about illicit discharge is an ongoing process.
c. UCCS tracks and eliminates illicit discharges as situations arise.
d. Hazardous waste/recycling days.
e. Employee involvement is ongoing to help eliminate illicit discharge. Inspection personnel and cleanup crews can be dispatched as needed after a call is made. Once an illicit discharge is detected, it must be addressed. The discharge is first contained. Then, if able, the source of the discharge must be found to eliminate the potential of another or ongoing discharge. Depending on the severity, several options are available to remove the discharge, ranging from the violator doing the cleanup, to a HAZMAT cleanup.

2. 1- to 5-Year Implementation Plan with Priorities

Pet Waste: Installation of bag stations could take place in years 2-5.

3. 6- to 10-Year Implementation Plan with Priorities

Pet Waste:

a. Support and promote the Scoop the Poop efforts with signage, cleanup efforts, and resources.
b. Create a plan to increase the number of waste receptacles on campus and at trailheads to further encourage increased participation of dog owners in this effort. Allocate and/or obtain additional funding for long-term waste disposal costs.

4. Monitoring Plan

UCCS will monitor this program by utilizing our Outdoor Services Department presence on campus. They will be reporting to us letting us know if the addition of bag stations are working toward a decrease of pet waste left on the ground surface. They will inform us if we need to add additional stations or relocate stations that may not be effective.

OTHER JURISDICTIONS

A list of potential stakeholders was developed as a part of this process, and efforts to engage were made. In some cases we received specific jurisdictional input, in others no response was received. One identified goal in the 1-5 year time frame is to attempt to connect with those entities listed below that did not submit programs of work that contribute to the watershed-wide *E. coli* reduction goals.

- Cherokee Metropolitan District
- Colorado Parks and Wildlife
- Colorado State Extension
- Colorado State University – Pueblo
- Donala Water and Sanitation District
- Peterson Air Force Base is a non-contributor to *E. coli* impairment in the watershed and has received concurrence from the EPA through Region 8's MSGP Permit.

- Pikes Peak Community College
- Pueblo County
- Pueblo Community College
- Pueblo West
- Pueblo Department of Public Health and Environment
- School Districts 2, 3, 11, 12, 20, 49
- Security Water and Sanitation District
- Triview Metro
- Town of Monument
- Town of Palmer Lake
- United States Air Force Academy

Appendix D: *E. Coli* Watershed Planning Field Tour Overview

Monday, July 24 | 12 to 4 p.m.

Appendix D

E. Coli Watershed Planning Field Tour Overview

Monday, July 24 | 12 to 4 p.m.

Overview

- A four-hour tour through Fountain Creek Watershed to view sites with known or improved E. coli pollution inputs
- Invitations to AF CURE members and E. coli stakeholders
- Transportation – 2 – 15 passenger vans available for ride sharing (1st come, 1st serve); carpool with additional vehicles (the fewer the better!)
- BYO brown bag snacks/lunch/beverages

Goals

- Enhance understanding of the watershed and our E. coli issues
- Strengthen stakeholder relationships
- Illustrate BMPs that are currently in place; discuss additional potential BMPs to implement
- Discuss issues and solutions associated with nonpoint pollution

Sites

A. Meet noon at Palmer Lake Reservoir Trailhead (Old Carriage Rd)
12-12:15 Pet waste issue – Cathy Green, Town of Palmer Lake

B. 12:15 leave for Jackson Creek in Monument (15 min drive)
12:30-12:45 Free grazing cattle, development upstream, beaver activity – Roger Sams, GMS, Inc.

C. 12:45 leave for Chapel Hills Dr. and Willow Glen Dr. at Pine Creek (15 min drive)
1:00-1:15 Bridges with nesting swallows – Ginny Johnson, CS Utilities

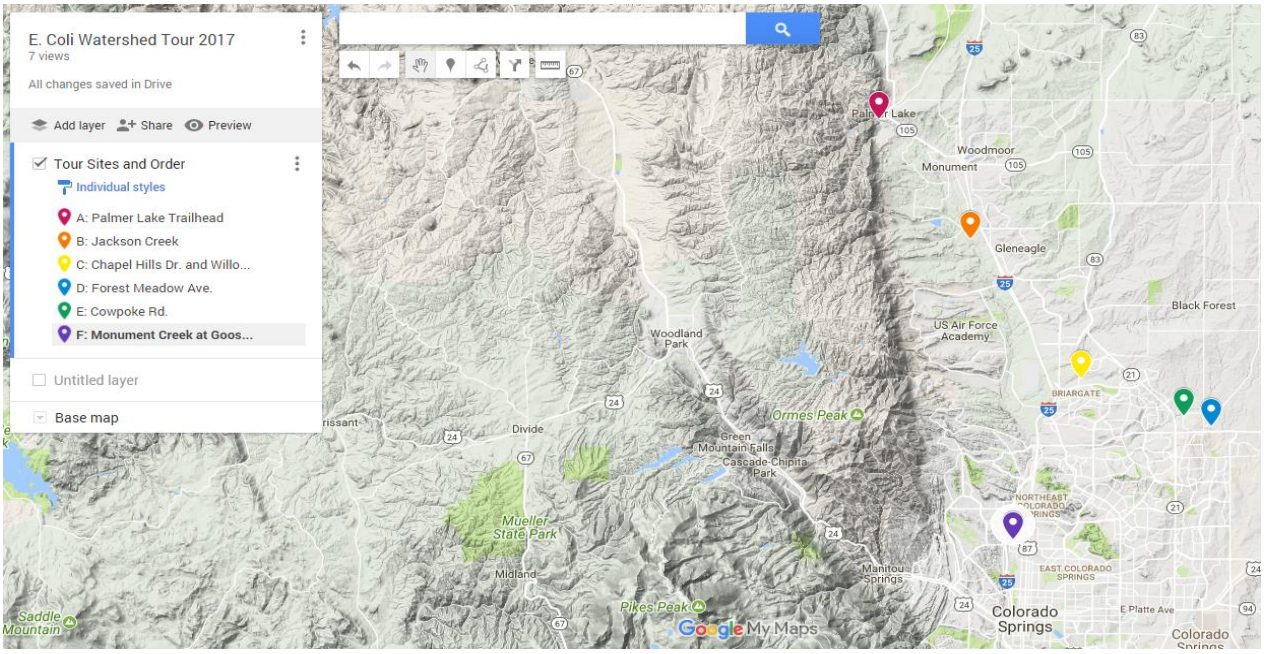
D. 1:15 leave for Forest Meadows Ave (15 min drive)
1:30-1:45 Pond 3 – Jeff Besse, Water Resources Engineering

E. 1:45 leave for 6045 Cowpoke Rd. (15 min)
2:00-2:15 El Paso County septic site – Kat McGarvy, EPC health dept.

F. 2:15 leave for Monument Creek at Goose Gossage Park
2:30-2:45 CSU wastewater repairs – cross connect – e. coli hotspots – Jed Chambers, CS Utilities

Handouts/Packet Info

- Map with directions/all stops
- Transient camp before/after cleanup pictures of cleanups only, no site visit
- Additional handouts with site specific info – speakers bring as needed/available



Map/Route