Water Quality Technical Memorandum

US 24 West

CDOT Project No. NH 0242-040

Project Control No. 187824

Colorado Department of Transportation

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US 24 West Environmental Assessment: Water Quality

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1.0 Introduction

The Colorado Department of Transportation (CDOT) is conducting an Environmental Assessment (EA) for changes to a 4-mile portion of US 24 between Interstate (I)-25 and Manitou Springs. This technical memorandum (TM) summarizes potential water quality impacts on water resources in the study area as a result of the No Action Alternative and the Proposed Action described below.

2.0 No Action Alternative

The No Action Alternative consists of existing transportation facilities and committed transportation projects that would occur regardless of whether the Proposed Action is constructed. The No Action Alternative would not make any improvements to the existing condition beyond those which are already planned and funded. The projects listed below are shown in existing adopted transportation plans and are locally funded projects.

- **8th Street Intersection Improvements.** Lengthens turn lanes and acceleration and deceleration lanes on US 24, and widens 8th Street north and south of US 24.
- **8th Street Bridge Replacement.** Replaces the existing four-lane bridge structure over Fountain Creek at 8th Street.
- **21st Street Roadway Improvements.** Includes the widening of 21st Street south of US 24 to four 12-foot travel lanes with dedicated turn lanes, extended acceleration lane, and curb and gutter. Geometric improvements to the US 24/21st Street intersection will also be constructed.
- **21st Street Bridge Replacement.** Replaces the existing four-lane bridge structure over Fountain Creek.
- **25th Street Bridge Replacement.** Replaces the existing two-lane bridge structure over Fountain Creek at 25th Street.
- **Midland Trail Extension.** Extends Midland Trail between 21st Street and Manitou Avenue to connect with Manitou Springs' Creekside Trail.

Under the No Action Alternative, improvements to intelligent transportation systems (for example, variable message signs) would be implemented as part of the congestion management program. Existing bus routes and service would continue as they are today, and bike and pedestrian facilities would only be extended or improved as local funds and grants allow.

3.0 Proposed Action

The Proposed Action would provide additional capacity on US 24 by building additional travel lanes, two new interchanges, and one new overpass. The Proposed Action includes rebuilding several cross-streets, replaces bridges over Fountain Creek, and includes modifications to Fountain Creek's channel at each bridge crossing. Sidewalks would be built at all intersections and interchanges. The Proposed Action would also accommodate a park and ride facility and two future local access points along the route, which would be built by others. The Proposed Action is illustrated in Exhibit 1.

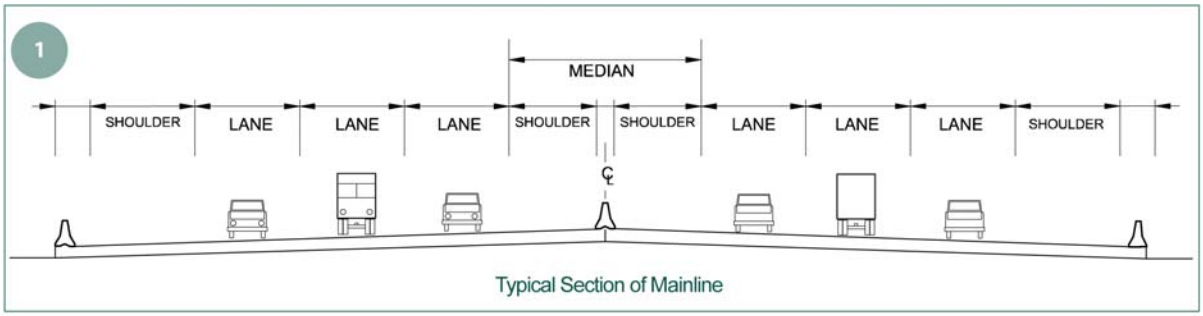
A single point diamond interchange is proposed at the Cimarron Interchange. This interchange design differs from what was originally presented in the *I-25 Improvements through the Colorado Springs Urbanized Area EA* (CDOT, 2004). Since the I-25 EA was approved, new opportunities have been identified to improve existing and future traffic operations, making this improved design now feasible.

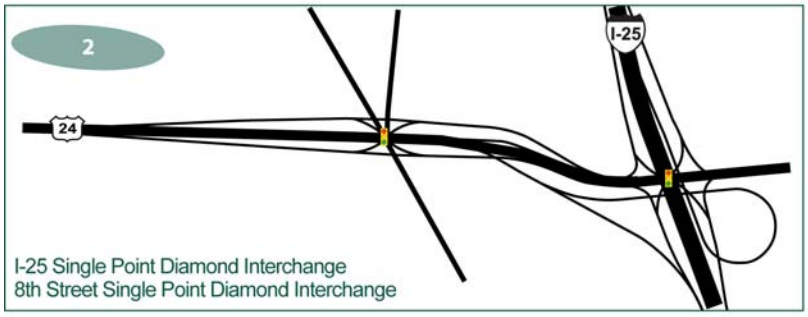
US 24 in the project area would be built to have eight through-lanes, four in each direction, east of 8th Street, and six through-lanes, three in each direction, from 8th Street to a point west of 31st Street. New interchanges are proposed at 8th and 21st Streets.

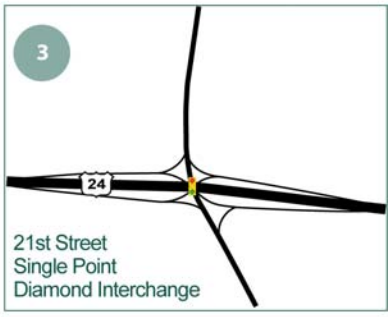
Intersection upgrades are proposed at 26th Street. The intersection of US 24 and 31st Street would be widened, as would the intersection with Colorado Avenue to the north. South of US 24, 31st Street would be rebuilt to align with the highway intersection.

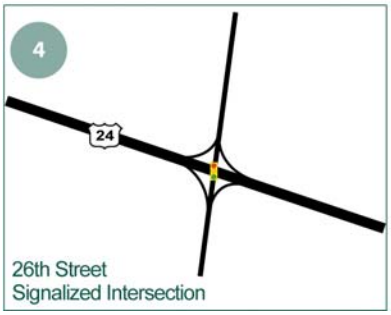
At the west end of the corridor, an overpass would be built to carry US 24 over Ridge Road. Ridge Road would be widened between High Street and Colorado Avenue. The west end of the Proposed Action is approximately 1,800 feet west of the Ridge Road overpass where the overpass connects to the existing highway. Because there is not an existing or future congestion problem between Ridge Road and Manitou Avenue, no changes are proposed west of Ridge Road.

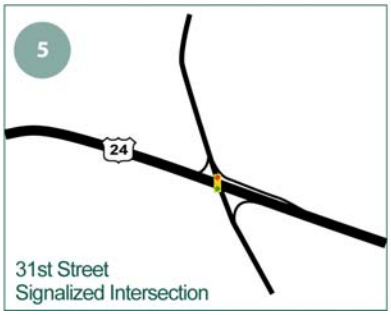
EXHIBIT 1
Proposed Action

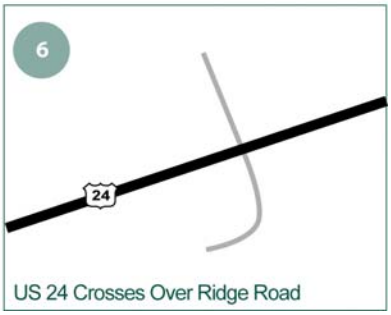












Accommodations would be made for the following features that will be built by others in the future:

- At 15th Street an overpass would be constructed to carry 15th Street over US 24 and Fountain Creek, and connect to the street network of Old Colorado City and Gold Hill Mesa. This overpass would include ramps on the east side to connect to the 8th Street intersection. Between the ramps and Colorado Avenue, 15th Street would be reconstructed to provide pedestrian features such as sidewalks.
- At Ridge Road ramps providing direct access to US 24 would be constructed to convert the overpass to a tight diamond interchange.
- At 31st Street a park and ride facility would be constructed in the northeast quadrant of the intersection, with access from Colorado Avenue.

As described in Chapter 4 of the EA, the Proposed Action also includes various mitigations such as the construction of a greenway and the extension of some trails. The Proposed Action is illustrated in Exhibit 1.

4.0 Methodology

The objective of this assessment is to estimate general water quality effects on the receiving watercourses adjacent to the US 24 West corridor that are expected from highway runoff as a result of the No Action Alternative and Proposed Action. Various methodologies were discussed with the Federal Highway Administration (FHWA) and the Colorado Department of Transportation (CDOT). The chosen methodology to determine the impacts of highway improvement projects on water quality using the mass balance equation was approved by FHWA and CDOT for the US 24 analysis. The assessment was performed in accordance with National Environmental Policy Act (NEPA) guidelines. The initial analysis included determination of existing conditions or "baseline conditions." Predicted conditions were determined based on preliminary design layouts that have incorporated initial effect avoidance efforts. The existing and predicted conditions were compared both qualitatively and quantitatively to determine impacts from the project.

The study area in which water quality resources were evaluated consists of the existing and proposed US 24 Right-of-Way (ROW) between I-25 and the Manitou Avenue interchange, including the existing and proposed paved surface for all improvements to US 24 and intersecting streets included in the project. Stormwater contaminant contributions to the CDOT ROW from surrounding impervious and pervious surfaces such as homes, commercial properties, parks, agricultural areas, and contributing streams and ditches were not considered in this analysis. If significant amounts of pipes and culverts are needed to convey stormwater flows, they would generally only handle runoff from the study area, and would not account for additional potential sources of contamination from the surrounding landscape.

Fountain Creek, the main water body within the study area, was the focus of the analysis. Tributaries within the study area, such as Camp Creek, Sutherland Creek, and Williams Canyon are identified, but their effects on the water quality of Fountain Creek were not directly analyzed in this study.

Mass-balance equation

To determine potential concentrations of contaminants that are commonly associated with highway runoff that could possibly degrade water quality within Fountain Creek, a mass-balance equation was created. The equation was set up to determine the concentrations due to the roadway improvements, in micrograms per liter (µg/L). Existing pollutant concentrations were available for Fountain Creek within the study area from the United States Geological Service (USGS), and were used as the baseline condition.

The mass-balance equation was constructed as follows:

$$M_3 = \frac{M_2 Q_2 + M_1 Q_1}{Q_3}$$

Q_1	=	Average Annual Upstream Volume (cubic feet)
Q_2	=	Annual Runoff Volume (cubic feet)
Q_3	=	Total Volume ($Q_1 + Q_2$) (cubic feet)
M_1	=	Average In-stream Background Pollutant Concentrations (µg/L)
M_2	=	Calculated effluent pollutant concentration (CALTRANS) (µg/L)
M_3	=	Downstream Concentration (µg/L)

The following provides additional details and assumptions made concerning each of the variables used in the equation.

Q1: The average Annual Upstream Volume is derived from 2003-2007 yearly mean flow data from USGS station 7103700 on Fountain Creek. USGS flow data is presented in cubic feet per second (cfs). The average flow rate in the years 2003-2007 was 14 cfs. This value was multiplied by the number of seconds in a year to calculate the total number of cubic feet of water that passes by USGS station 7103700 in one year.

Q2: Annual Runoff Volumes were calculated for both the existing highway design and the proposed as-built design. The runoff calculations are based on the total impervious area of the roadway surface within the CDOT ROW for each alternative in square feet, multiplied by the average annual rainfall for the area (in feet) based on 30 years of rainfall data located at the ASOS site at the Colorado Springs airport (NOAA, 2008). The result is anticipated cubic feet of runoff. Pervious areas within CDOT ROW, such as purchased commercial and residential properties or vacant areas, were not taken into consideration in the model.

Q3: This is the total volume that is expected downstream of the study area, in cubic feet. It is calculated by adding the yearly average volume from Fountain Creek (Q_1) to the impervious surface runoff volume (Q_2). The impervious surface runoff volume is calculated for both the existing condition and the proposed as-built condition.

M1: In-stream Background Pollutant Concentrations come from USGS station 7103700 field data from 2003-2007. The mean of all field data collected within the 5 year period was used in the analysis. For non-detected parameters, the full detection limit was used if it was

above the water quality standard. Detection limits below the water quality standard were reassigned to zero. This is consistent with CDPHE policies.

M2: Calculations of pollutants from highway runoff come from the California Department of Transportation (CALTRANS) Discharge Characterization Study Report (CALTRANS, 2003). The CALTRANS data were selected because they offer a wider range of data than many other potential resources considered, such as the CDOT Erosion Control and Stormwater Quality Guide. The CALTRANS data includes a relatively complete list of total and dissolved metals, as well as information for oil & grease, heavy oil, diesel, and gasoline. The CALTRANS report includes an analysis of the factors affecting the quality of runoff from highways and other transportation facilities from 2001 to 2003. Presented concentration data were based on the event mean concentration (EMC) of selected contaminants from 684 samples at 39 highway facility locations throughout the state of California. The EMCs provided by CALTRANS were based on highways with a wide range of AADT levels, ranging from 1,800 to 259,000. A Multiple Linear Regression (MLR) was applied to the dataset, with a statistical significance set at a confidence level of 95% ($p < 0.05$).

Since the CALTRANS data was collected over the course of multiple years, a Cumulative Seasonal Precipitation effect was observed. As total precipitation increased, pollutant concentrations decreased. This effect was evidence of pollutant "wash-off" during California's wet season, as pollutant concentrations in runoff are highest in the early wet season and tend to decrease thereafter. This effect was consistent for all pollutant categories and constituents. California's climate and rainfall patterns are different than those found in Colorado, and this may affect EMC values. The climactic differences between California and Colorado have not been factored into the study and present an inherent limitation when interpreting the data.

One other limitation of the CALTRANS data is that it does not provide comparative EMC values based on AADT levels for highways, although they assert that sample locations with higher AADT have higher concentrations of nearly every pollutant evaluated (CALTRANS, 2003). Because of the wide range of AADT levels used in the CALTRANS analysis, actual concentration values at US 24 may be different. However, despite the limitations of the CALTRANS data, a literature review of comparable studies that may link EMC levels with highway AADT values revealed that relevant baseline data that would meet the needs of this study do not appear to be readily available.

One alternate source of data considered for this report was a dataset presented in Table 3-4 in the CDOT Erosion Control and Stormwater Quality Guide. This dataset indicates that traffic volumes in urban and rural areas contribute different contaminant concentrations based on the AADT levels above or below 30,000, respectively. However, the current maximum AADT listed for the busiest portion of US 24 is 46,100, and the 2035 projected maximum AADT for the same highway portion is 83,700. Since the AADT threshold presented by CDOT is below the current and estimated traffic levels for US 24, the median EMC data from CDOT were not used in this analysis. This CDOT source may have been adapted to the purpose of this project, however, their list of EMCs evaluated was not adequate for this study.

It is important to note that some studies have come to other conclusions about the applicability of AADT to EMC levels. Some studies indicate that a direct linear correlation between AADT and roadway runoff pollutant concentrations does not appear to exist (Kayhanian, et. al, 2003). Various other studies have come to similar conclusions, including the Washington State Transportation Center (TRAC) of Washington State University, which found that AADT is "not, by itself, a reliable estimator for dissolved metals concentrations" (Barber, et. al, 2006).

M3: The downstream concentration is the total expected concentration of pollutants found within Fountain Creek downstream of the entire study area. This number includes both the background pollutants already in the creek and the expected added pollutants from the highway runoff. Calculated concentrations are based on available existing data, and are expected to be conservatively high because this model does not take into account the removal of pollutants that will result from the implementation of Best Management Practices (BMPs) that will be incorporated into the actual design.

Current measured concentrations of arsenic appear to be far above the water quality standard based on USGS measurements, and the highway would only have a slight effect on those concentrations. Mercury is presented as above the water quality standard, but the high values are related to the detection limit.

According to the Urban Drainage and Flood Control District (UDFCD) Drainage Criteria Manual (Version 3), EMCs may be reduced by varying amounts with the implementation of BMPs. Table SQ-6 in the Drainage Criteria Manual provides expected probable ranges of annual EMC reductions based on the various types of BMPs implemented. For example, annual concentrations of total suspended solids (TSS) may be reduced by a significant percentage based on the following types of BMP implemented:

- Retention ponds: 80-90 percent removal
- Constructed wetland basis: 50-60 percent removal
- Grass swales: 20-40 percent removal
- Grass buffers: 10-20 percent removal

For a more complete list of estimated removal ranges of several common contaminants based on a wide variety of BMP types, see Table SQ-6 from the Drainage Criteria Manual (Version 3) in Appendix D.

Assuming the entire water quality capture volume is accounted for in the final design of the project BMPs, total concentrations presented in the mass-balance table could be significantly reduced. However, even without the consideration of BMPs, the project would not contribute a significant amount of contaminants to Fountain Creek and would not cause an exceedance of the water quality standards. Final project designs are expected to include BMPs that could handle all runoff from the pavement surface.

5.0 Governing Regulations

The primary federal regulatory drivers for the current stormwater quality program are the Phase I and Phase II Stormwater Regulations under the Clean Water Act (CWA), which, among other requirements, require regulated entities to acquire a National Pollutant Discharge Elimination System (NPDES) Permit for their stormwater discharges. The U.S.

Environmental Protection Agency's (USEPA) stormwater NPDES regulations specify that entities that are required to have municipal permits must control the discharge of pollutants to the maximum extent practicable. The Colorado Department of Public Health and Environment (CDPHE) has jurisdiction over the NPDES permit program in Colorado.

Clean Water Act (40 CFR Part 401, 402)

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants to waters of the United States. It provides the statutory basis for the NPDES permit program and the basic structure for regulating the discharge of pollutants into waters of the U.S.

The NPDES permit program is authorized by CWA section 402. In 1987, the CWA was amended to include a program to cover stormwater discharges from municipal separate storm sewer systems (MS4) and industrial sources. The MS4 NPDES permits require regulated municipalities to use Best Management Practices to reduce pollutants to the Maximum Extent Practicable.

Safe Drinking Water Act (40 CFR 141 – 143)

The Safe Drinking Water Act (SDWA) protects public health by regulating the nation's public drinking water supply and protecting drinking water and its sources. The 1996 Safe Drinking Water Act Amendments directed that each state develop a SWAP Program. Each state developed a SWAP program plan outlining how the state will conduct an assessment of all its public water supplies. CDOT is a stakeholder in the Colorado Source Water Assessment and Protection (SWAP) program mandated by the SDWA.

Erosion and Sediment Control (23 CFR 650 Subpart B)

According to the Federal Highway Administration (FHWA), all highways funded in whole or in part under title 23 must be designated, constructed, operated according to standards that will minimize erosion and sediment damage to the highway and adjacent properties and abate pollution of surface and ground water resources. The FHWA adopts the AASHTO Highway Drainage Guidelines, Volume III, "Erosion and Sediment Control in Highway Construction," 1992, as guidelines to be followed on all construction projects funded under title 23, United States Code. These guidelines are not intended to preempt any requirements made by or under State law if such requirements are more stringent.

The *CDOT Drainage Design Manual* was developed to provide guidance and to establish criteria for engineers performing hydrologic and hydraulic analysis and design (CDOT 2004b). *CDOT's Erosion Control and Stormwater Quality Guide* provides direction, criteria, and procedures to ensure that a stormwater management plan will be developed and detailed BMPs to be used for construction (CDOT 2002). Additionally, CDOT *Standard Specifications for Road and Bridge Construction* details practices that should be used on CDOT projects to minimize water pollution during construction (CDOT 2005).

Colorado Water Quality Control Act

EPA has delegated authority for the implementation of the CWA and SDWA to the Colorado Department of Public Health and Environment (CDPHE). The Colorado Water

Quality Control Act (CWQCA) was passed to protect and maximize the beneficial uses of state waters and regulate water quality of the state's waterbodies. The CWQCA established the Water Quality Control Commission (WQCC) as the rulemaking body for regulations that protect Colorado waterbodies. The Commission adopts water quality classifications and standards for surface and groundwaters of the state, as well as various regulations aimed at protection of streams and the implementation of the CWQCA and CWA programs. Information such as surface water classifications and standards, groundwater classifications and standards, point source discharge regulations, watershed protection regulations, drinking water regulations, and CWA Section 303(d) requirements will be utilized in the evaluation of water quality baseline conditions and impacts.

The WQCC has promulgated Regulation 61, the Colorado Discharge Permit System Regulations (5 CCR 1002-61), which conforms to the NPDES program set forth in the CWA. Sections 25-8-501 through 505 of the CWQCA are designed to be in conformity with the federal CWA. Per Regulation 61, CDOT fell under the municipal stormwater program and was required to obtain a permit as a regulated separate storm sewer system (MS4). An MS4 is a separate storm sewer system owned or operated by public agency. A separate storm sewer system is made up of ditches, gutters, storm sewers, and similar means of collecting and conveying runoff that do not connect with a wastewater collection system or treatment plant.

Colorado Discharge Permit System (MS4)

The primary federal regulatory drivers for the current stormwater quality program are the Stormwater Regulations under the Clean Water Act, which, among other requirements, require regulated entities to acquire a National Pollutant Discharge Elimination System (NPDES) Permit for their stormwater discharges. The EPA issued regulations in two phases: the first Phase I addressed municipalities with populations over 100,000, and the second Phase II for those with populations less than 100,000. The state of Colorado, as the delegated authority in Colorado, has adopted its own regulations regarding implementation of this program. Regulation 61 outlines the requirements for the Colorado Discharge Permit System and the requirements for stormwater discharges for which permits are required.

CDOT was a Phase I MS4 entity and obtained their Colorado Discharge Permit System (CDPS) Permit for Municipal Separate Storm Sewer Systems, Permit No. COS-000005 on January 15, 2001. CDOT's permit covers "state and interstate highways and their right-of-ways within the jurisdictional boundary of CDOT served by, or otherwise contributing to discharges to state waters from, municipal separate storm sewers owned or operated by CDOT." As a requirement of the Permit (Part I.B.1.b), CDOT was required to "develop and implement a program that ensures that new highway projects and significant highway modifications are reviewed for the need to include permanent stormwater best management practices." Based on the "sensitive" water criteria for the New Development Program established by CDOT, the U.S. 24 West improvements project would need to be evaluated to determine which permanent best management practices should be utilized (CDOT 2004a).

The US 24 West improvement project traverses the jurisdictions of the City of Colorado Springs and El Paso County. The City of Colorado Springs is also a Phase I MS4 entity and obtained their CDPS Permit (No. COS-000004) for Municipal Separate Storm Sewer Systems in 1997. One of the requirements of the City's CDPS Permit was to develop a program to

reduce stormwater impacts associated with the development and redevelopment projects. Guidelines for stormwater management, reducing flows from development sites, and pollution control measures are outlined in the City's Drainage Criteria Manual, Volume II: Stormwater Quality Policies, Procedures and Best Management Practices (DCM2) (CCS 2008). The City has adopted permanent water quality BMPs and water quality capture volume (WQCV) design criteria similar to Urban Drainage Flood Control District Criteria to address stormwater quality issues and BMP requirements. El Paso County has adopted a new Engineering Criteria Manual (ECM) that combines the City of Colorado Springs Drainage Criteria Manual Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices, El Paso County Policy Plan, El Paso County Land Development Code, El Paso County Engineering Criteria Manual, and their successors, to form the basis for protecting surface water quality in the County by reducing exposure of stormwater runoff to contaminants (EPC 2008). The goal has been to maintain consistency between criteria used in the County and the City of Colorado Springs.

Senate Bill 40 Wildlife Certification

Senate Bill 40 (SB 40; 33-5-101, et seq., C.R.S., 1973) requires any state agency to obtain certification from the Colorado Division of Wildlife (CDOW) when the state agency plans construction in any stream, its banks, or tributaries. Emphasis in this legislation is on the protection of fishing waters in the state, but it also recognizes the importance of protecting the entire stream ecosystem, including wetlands and riparian areas.

In 1990, CDOT and CDOW signed an agreement intended to streamline the SB 40 certification process for transportation projects. The agreements established a series of thresholds that, below which, CDOT could proceed with the projects without going through the formal certification process. This is based on the assumption that most CDOT projects involve only minimal disturbance to streams, especially if CDOT adheres to a set of best management practices (BMPs) during construction. Projects with impacts in excess of the thresholds require formal certification from CDOW.

6.0 Existing Conditions

A strong correlation exists between the overall ecological health of the US 24 West corridor environment and the Fountain Creek watershed. Surface water, groundwater, and drinking water may be affected by the project. The US 24 expansion would be constructed along Fountain Creek, which provide habitat along the riparian corridor. Camp Creek, Sutherland Creek, and Williams Canyon, all tributaries to Fountain Creek, exist within the study area as well. The importance of this corridor is growing as the study area urbanizes, municipal water usage of Fountain Creek increases, and the availability of valuable habitat diminishes.

Water quality may be progressively reduced in urban environments as the proportion of impervious surfaces such as asphalt and concrete increases. Non-point sources of contamination may be introduced to the surface drainage system through increased storm runoff. There can be a general correlation between the amount of new pavement and reductions in water quality due to increased runoff (US 36 MP, 2007). Potential contaminants from transportation projects that may impact water resources are listed in Exhibit 2 below:

EXHIBIT 2
Potential Contaminants from Transportation Projects that may Impact Water Resources

Construction Phase	
Sources	**Pollutants**
Adhesives	Phenols, formadehydes, asbestos, benzene, naphthalene
Cleaners	Metals, acidity, alkalinity, chromium
Plumbing	Lead, copper, zinc, tin
Painting	VOCs, metals, phenolics, mineral spirits
Wood	Biological Oxygen Demand (BOD), formaldehyde, copper, creosote
Masonry/concrete	Acidity, sediment, metals, asbestos
Demolition	Asbestos, aluminum, zinc, dusts
Yard operations and maintenance	Oils, grease, coolants, benzene and derivatives, vinyl chloride, metals, BOD, sediment, disinfectants, sodium arsenate, dinitro compounds, redenticides, insecticides
Landscaping and earthmoving	Pesticides, herbicides, fertilizers, BOD, alkalinity, metals, sulfur, aluminum sulfate
Operation Phase	
Sources	**Pollutants**
Leaks, spills, accidents	Oil, gasoline, diesel, grease, VOCs, chemicals, and other potentially hazardous materials
Vehicle traffic	Oils, grease, gasoline, diesel, benzene and derivatives, aromatic hydrocarbons, coolants, rust (iron), heavy metals (lead, zinc, iron, chromium, cadmium, nickel, copper), rubber, asbestos
Winter sanding	Sediment
Deicing	Calcium, sodium, magnesium chloride
Landscape maintenance	Herbicides, pesticides, fertilizers, BOD, alkalinity, metals, sulfur, aluminum sulfate
Adhesives	Phenols, formaldehydes, asbestos, benzene, naphthalene
Cleaners	Metals, acidity, alkalinity, chromium
Painting	VOCs, metals, phenolics, mineral spirits

Source: CDOT (2008). CDOT NEPA Manual - Resource Considerations

Watershed

The project is located within Basin Division II, the Arkansas River Basin, which begins in the central mountains near Leadville and flows south and east to Kansas. The project is situated within the Fountain Creek watershed, and is just upstream of the Fountain Aquifer, as designated by the State Engineers Office (SEO, 2008). The Fountain Creek watershed occupies approximately 2,595 acres.

Fountain Creek and its tributaries (above the confluence with Monument Creek) are the primary water body of concern, found in USGS Cataloging Unit: 11020003. This stretch of Fountain Creek is called the Fountain Creek Headwaters Subwatershed in the Fountain Creek Watershed Plan (PPACG, 2003). The subwatershed divisions can be seen in Figure 1 in Appendix A. The CDPHE-designated stream segment of concern is "1a" of the Fountain Creek Basin, which includes the main stem of Fountain Creek, including all tributaries, lakes, wetlands and reservoirs, from the source to a point immediately above the confluence

with Monument Creek. Tributaries to Fountain Creek within the study area include Camp Creek, Sutherland Creek, and Williams Canyon.

According the National Wild and Scenic Rivers System Web Page, Fountain Creek is not considered a Wild and Scenic River. The only such designated river in Colorado is the Cache la Poudre River near Fort Collins (NWSRS, 2008). However, Fountain Creek is an important water resource.

Fountain Creek Characteristics

The mainstem of Fountain Creek is perennial through much of the Headwaters Subwatershed, but some reaches are intermittent where the streambed becomes sandy. Snowmelt, rainfall and springs are the primary sources of water for Fountain Creek (PPACG, 2003). Thunderstorms can stall over the headwaters of the creek, which creates the potential for localized flooding. Flash floods have resulted from these storms when conditions are right. Debris flows may occur in the subwatershed and may contribute large amounts of sediment during flood events (PPACG, 2003).

Sediment and flooding are the main problems along the creek, with large flood events most recently occurring in 1999 and 2000 (PPACG, 2003). Near Manitou Springs, these flooding and sediment problems are accentuated as the channel becomes more narrowly confined, limiting conveyance (PPACG, 2003). Conveyance is further limited in some reaches of the stream by encroachment of overgrown trees and scrub-shrub vegetation. Williams Canyon, a major tributary to Fountain Creek, also contributes a high amount of sediment to the stream channel (PPACG, 2003). While showing clear examples of high sediment contributions to the lower subwatersheds downstream, the Fountain Creek Headwaters subwatershed generally transports considerably less sediment than the Monument Creek portion of the watershed (PPACG, 2003).

Erosion is also a problem in the area, especially upstream of the project limits near Manitou Springs. High stream flows have caused gradual undercutting of some bank areas near Manitou Springs, and a few wall structures associated with buildings have also been undercut by eroding stream banks (PPACG, 2003). On the west end of the city, the channel is lined with concrete which has caused sedimentation downstream and a reduction of channel capacity.

The slope grade of the Fountain Creek Headwaters Subwatershed is variable, but is generally steeper higher in the watershed. The gradient of Fountain Creek is somewhat flatter below Manitou Springs than higher up in the watershed. For the most part, development along this reach is fairly old and the channel grade is relatively stable (PPACG, 2003). One exception is the Fountain Creek crossing under 21st Street, where recent channel improvements were necessary to stabilize the grade and repair severe damage that resulted from the 1999 flood.

Urban development continues to occur within the subwatershed, but much of the urbanization of the areas adjacent to Fountain Creek is well established. Some buildings and homes may be adjacent to or encroach upon the 100-year floodplain in the eastern portion of the subwatershed, but most have been in these locations for many years (PPACG, 2003).

Impervious Surfaces and Agricultural Land

Urbanization along the US 24 corridor has gradually increased the amount of impervious surface area within the Fountain Creek Headwaters Subwatershed. According to a map presented by the Fountain Creek Watershed Vision Task Force (FCWVTF), the study area contains an estimated 11 to 19% impervious surfaces, and this estimate is expected to remain stable in the future. In comparison, the City of Colorado Springs contains an estimated 37 to 45% impervious surfaces (FCWVTF, 2008). Currently, the study area portion of US 24 accounts for 62 acres of impervious area.

Agricultural land also has potential to effect on the subwatershed. Agriculture is not a primary land use within the subwatershed, so it would not be expected to be a primary contributor of water contaminants in the subwatershed. However, some minor agricultural areas are found in streamside areas in the upper half of the subwatershed (PPACG, 2003). Generally, these areas do not adversely impact the subwatershed.

Ongoing Restoration and Maintenance Efforts on Fountain Creek

To help address problems and issues within the watershed, the PPACG has developed a ranking system to identify and prioritize stream restoration and maintenance priorities. At the base of the subwatershed (the lower subwatershed through Manitou Springs and the west side of Colorado Springs) the issues are ranked as 1) flooding, 2) erosion and 3) sedimentation. Factors that contribute to the ranking system in this area include: erosion and flooding potential; constrained and inadequate conveyance capacity from channelizations; and sediment conveyance from upstream areas (PPACG, 2003).

The PPACG is working with the Army Corps of Engineers and the FCWVST to restore and sustainably manage the Fountain Creek Watershed from the upper reaches of the creek down to its confluence with the Arkansas River near Pueblo. More background and details on current restoration efforts can be found on the PPACG website. According to the PPACG, the final draft of the Fountain Creek Corridor Master Plan is scheduled to be completed in the fourth quarter of 2009 (PPACG, 2008).

Soils

The study area intersects with several different soil types, as indicated by the NRCS Web Soil Survey System. To evaluate the potential for erosion and/or deposition problems, soil erodibility (K_w factor erosion) and drainage classes within the study area were evaluated.

Erosion factor K_w indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat) (NRCS, 2008). Values of K range from 0.02 to 0.69, with the higher values meaning higher susceptibility to erosion. Soil values within the study area range from 0.15 to 0.37.

A GIS database was produced by PPACG in Partnership with URS Corp. for the Fountain Creek watershed. The Fountain Creek Watershed GIS Database (FCWGISD) provides soil erodiblity and soil classification data. This data that coincides with the study area can be

seen in Figure 3 in Appendix A. As indicated by the soil erosion categories used by URS Corp., the study area contains a relatively even distribution of slight (0.02-0.17 K_w), moderate (0.18-0.28 K_w), and severe (0.29-0.50 K_w) erosion factors (FCWGISD, 2008).

Drainage class refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil (NRCS, 2008). Drainage classes within the study area range from well drained to somewhat excessively drained.

Historic and Current Development

There is a history of various types of residential, industrial, and commercial development along Fountain Creek. Remains of past mining practices and road construction are two of the main causes for channel realignment east of Manitou Springs (PPACG, 2003).

Near the confluence of Fountain Creek and Monument Creek, , the Fountain Creek channel passes near the tailing deposits of a former gold milling site, and the channel is constrained between the tailings site and Highway 24 (PPACG, 2003). Some bank erosion and instability are evident along this reach of Fountain Creek. The Highway 24 road embankment and other development constrain the floodplain to a narrow area. A mobile home park is located within the floodplain and has experienced numerous flooding events, including a large flood in 1999 (PPACG, 2003).

Channel alignment along most of upper Fountain Creek has not changed greatly in the recent past because most of the channel is formed in bedrock. As the channel gradient flattens out below Manitou Springs, manipulation of the channel has occurred in the past over much of the reach down to the confluence with Monument Creek.

In the reach from Cascade to Manitou Springs, upper Fountain Creek is confined to a channel between the two lanes of Highway 24. Although this course approximates the original channel, the road embankments and riprap now constrain the channel to a narrower width. In the City of Manitou Springs, channelization and structures in the floodplain have straightened and confined the channel (PPACG, 2003).

Additional information on historic and current development near the project is contained in the Land Use Technical Memorandum.

WQCC Regulations

Surface Water Classification and Standards

As stated previously, the construction of the project has the potential to impact Fountain Creek. The Water Quality Control Commission (WQCC), which is part of CDPHE, has classified Fountain Creek for various uses as described in Regulation 32, "Classifications and Numeric Standards for Arkansas River Basin," dated July 15, 2008. The affected segment of the Arkansas River Basin is described in Exhibit 3. The numeric water quality standards that have been established to preserve the beneficial uses or improve the water quality of the stream are listed in Exhibit 4.

EXHIBIT 3
Affected Water Quality Segment

Stream	Segment	Segment Description	Designated Uses[A]
Fountain Creek (COARFO01a)	1a, Fountain Creek Basin	Mainstem of Fountain Creek, including all tributaries, lakes, wetlands and reservoirs, from the source to a point immediately above the confluence with Monument Creek, except for specific listings in segment 1b.	Aq Life Cold 1 Recreation E Water Supply Agriculture

[A]The designated uses are defined in Regulation 31, "The Basic Standards and Methodologies for Surface Water," amended 1/14/2008.

The Colorado WQCC is the rulemaking body responsible for the establishment of the acceptable water quality standards on all streams in Colorado. The Commission has broken down all water bodies in Colorado into various segments. Each of these segments has been assigned water quality levels known as "water quality standards," that will protect the uses of the waters. These uses are defined in "The Basic Standards and Methodologies for Surface Water" Regulation 31.

The Commission has set standards that are protective of these uses. The standards for these segments are found in "Classifications and Numeric Standards for Arkansas River Basin," Regulation 32 and are listed in Exhibit 4. The WQCC does not have the authority to establish water quality standards for ditches. It should be noted that discharges into ditches do require a NPDES permit. Limitations are established based on best available technology.

EXHIBIT 4
Water Quality Standards for Fountain Creek

Parameter	1a, Fountain Creek Basin
Dissolved Oxygen, mg/L	6.0
Dissolved Oxygen (sp), mg/L	7.0
pH, s.u.	6.5-9.0
Fecal Coliform, org/100 mL	Not Applicable
E. *coli*, org/100 mL	126
Unionized Ammonia, mg/L	TVS
Total Residual Chlorine, mg/L	0.019
Dissolved Sulfide, mg/L	0.002
Total Boron, mg/L	0.75
Total Nitrite, mg/L	0.05
Total Nitrate, mg/L	10
Total Chloride, mg/L	250
Free Cyanide, µg/L	0.005
Dissolved Sulfate, mg/L	WS

EXHIBIT 4
Water Quality Standards for Fountain Creek

Parameter	1a, Fountain Creek Basin
Total Recoverable Arsenic, µg/L	340
Total Recoverable Beryllium, µg/L	None
Dissolved Cadmium, µg/L	TVS
Trivalent Chromium, µg/L	50(Trec)
Hexavalent Chromium, µg/L	TVS
Dissolved Copper, µg/L	TVS
Dissolved Iron, µg/L	WS
Total Recoverable Iron, µg/L	1000
Dissolved Lead, µg/L	TVS
Dissolved Manganese, µg/L	TVS
Total Mercury, µg/L	0.01
Dissolved Nickel, µg/L	TVS
Dissolved Selenium, µg/L	TVS (8.7 temp.)
Dissolved Silver, µg/L	TVS
Dissolved Zinc, µg/L	TVS

Notes:

All standards are chronic unless otherwise stated.

"Chronic" means the level not to be exceeded by the concentration for either a single representative sample or calculated as an average of all samples collected during a thirty-day period.

"Acute" means the level not to be exceeded by the concentration in a single sample or calculated as an average of all samples collected during a one-day period.

"TVS" = Table value standards. It refers to equations found in Table III of the "Basic Standards and Methodologies for Surface Water" Regulation 31.

"WS" = Water supply. This means that the standard for these parameters is based on either the secondary drinking water standard for that parameter or the ambient water quality, whichever is higher.

Mg/L = milligram per liter

s.u. = standard unit

mL = milliliter

µg/L = microgram per liter

Additionally, the Water Quality Control Division (Division) of CDPHE is required through section 303(d) of the CWA to develop a list of water bodies within the state that are not meeting the water quality standards. The Division is then required to further evaluate the stream and develop a total maximum daily load (TMDL). The TMDL generally will lay out the amount of pollutants that each source, point and nonpoint, can discharge into the stream.

The Fountain Creek Basin Segment 1a has been included in the Division's 2008 303(d) list, and is detailed in Exhibit 5. The existing quality exceeds the underlying standard for dissolved selenium and *E. coli*.

EXHIBIT 5
Water-Quality-Limited Segments Requiring TMDLS[a]

Stream	Segment	Segment Description	Portion	Impairment
Fountain Creek (COARFO01a)	1a, Fountain Creek Basin	Fountain Creek and tributaries above Monument Creek	All	*E. coli* (High Priority); Selenium (Low Priority)

[a]The designated uses are defined in Regulation 93, "2004 Section 303(d) List Water-Quality-Limited Segments Requiring TMDLS," amended March 11, 2008.

Selenium Contamination

It should be noted that high selenium levels have been recorded in many locations around the state. The selenium sources are usually tied to fossil fuels, such as coal or oil, or the result of the natural weathering or irrigation of cretaceous marine shales and shale-derived soils (CDPHE, 2008b). Selenium is generally not a pollutant of concern associated with highway runoff.

E. coli Contamination

It is important to note that Fountain Creek is listed as impaired for *E. Coli* (high priority) and Selenium (low priority), but were not analyzed in this study because they are generally not pollutants of concern associated with highway runoff.

As indicated in a presentation by the Fountain Creek Watershed Vision Task Force, Upper and Lower Fountain Creek (Segments 1 and 2a) are currently 303(d) listed as impaired for *E. coli* because they are above the 126 CFU/100 mL stream standard for *E. coli* (FCWVTF, 2007). Fountain Creek in particular was listed as a high priority for *E. coli* by Regulation #93 of the CDPHE. *E.coli (Escherichia coli)* is a bacteria normally found in the human and animal gastrointestinal tracts, and it is a good indicator of the levels of other illness-causing bacteria and pathogens in waterways. Thus, the State is moving towards making *E. coli* the stream standard to protect recreational uses, rather than using fecal coliform as the current stream standard (FCWVTF, 2007).

A study that was performed from August 2005 to February 2007 revealed that *E. coli* background concentration generally averages about 100 CFU/100 mL in Fountain & Monument Creeks during lower flow periods in the winter months. *E. coli* concentrations and loading are elevated during the rest of the year, with an average concentration of about 450 CFU/100 mL in Fountain & Monument Creeks (FCWVTF, 2007). The Vision Task Force has concluded that wastewater return effluent from water treatment facilities does not account for the peaks in *E. coli* concentrations. However, the wastewater treatment facilities may contribute some *E. coli* to the creek. Other possible sources may be from septic systems, direct wild & domestic animals, and runoff from agricultural fields, parks, or other sources (FCWVTF, 2007).

Carol Baker, from Colorado Springs Utilities, indicated that there are four ongoing studies of *E. coli* contamination on Fountain Creek: a USGS genetic marker study to trace the origin of the contamination, a study by Colorado State University at Pueblo, a study by Colorado Springs Utilities, and a study by Pueblo County (Baker, pers. Comm., 2008).

Groundwater Classification and Standards

The WQCC has classified statewide groundwater standards for various uses as described in Regulation 41, "Basic Standards for Groundwater," amended 1/14/08, effective 5/31/08. Water quality standards for Colorado groundwater are listed in Exhibits 6 through 11 below:

EXHIBIT 6
Domestic Water Supply – Human Health Standards

Parameter		Standard[1]	
Biological			
Total Coliforms (30 day average)		2.2 a	org/100 ml
Total Coliforms (max in 30 days)		23	org/100 ml
Inorganic			
Antimony	(Sb)d, M	0.006	mg/l
Asbestos	M	7,000,000	fibers/Liter
Arsenic	(As)d, M	0.01	mg/l
Barium	(Ba)d, M	2.0	mg/l
Beryllium	(Be)d, M	0.004	mg/l
Cadmium	(Cd)d, M	0.005	mg/l
Chromium	(Cr)c, d, M	0.1	mg/l
Cyanide [Free]	(CN)M	0.2	mg/l
Fluoride	(F)d, M	4.0	mg/l
Lead	(Pb)d	0.05	mg/l
Mercury (inorganic)	(Hg)d,M	0.002	mg/l
Molybdenum	(Mo) d	0.035	mg/l
Nickel	(Ni)d	0.1	mg/l
Nitrate	(NO3)d, M	10.0	mg/l as N
Nitrite	(NO2)d, M	1.0	mg/l as N
Total Nitrate+Nitrite	(NO2+NO3-N)d, f	10.0	mg/l as N
Selenium	(Se)d, M	0.05	mg/l
Silver	(Ag)d	0.05	mg/l
Thallium	(Tl)d, M	0.002	mg/l
Uranium	(U) d, M	0.03	mg/l
Radiologicalb, d			
Gross Alpha Particle Activityi, M		15	pCi/l
Beta and Photon Emitterse		4	mrem/year

EXHIBIT 7

Domestic Water Supply – Drinking Water Standards

Parameter		Standard	
Chlorophenol		0.0002	mg/l
Chloride	(Cl)d	250	mg/l
Color		15	color units
Copper	(Cu)d	1	mg/l
Corrosivity	Noncorrosive		
Foaming Agents		0.5	mg/l
Iron	(Fe)d	0.3	mg/l
Manganese	(Mn)d	0.05	mg/l
Odor		3	threshold odor numbers
pH	6.5 - 8.5		
Phenol		0.3	mg/l
Sulfate	(SO4)d	250	mg/l
Zinc	(Zn)d	5	mg/l

EXHIBIT 8

Agricultural Standards

Parameter		Standard	
Aluminum	(Al)d, f	5	mg/l
Arsenic	(As)d	0.1	mg/l
Beryllium	(Be)d	0.1	mg/l
Boron	(B)d, g	0.75	mg/l
Cadmium	(Cd)d	0.01	mg/l
Chromium	(Cr)d	0.1	mg/l
Cobalt	(Co)d	0.05	mg/l
Copper	(Cu)d	0.2	mg/l
Fluoride	(F)d	2	mg/l
Iron	(Fe)d	5	mg/l
Lead	(Pb)d, f	0.1	mg/l
Lithium	(Li)d, h	2.5	mg/l
Manganese	(Mn)d, j	0.2	mg/l
Mercury	(Hg)d, f	0.01	mg/l
Nickel	(Ni)d	0.2	mg/l
Nitrite	(NO2-N)d, f	10	mg/l as N
Nitrite & Nitrate(NO2	+NO3-N)d, f	100	mg/l as N
Selenium	(Se)d	0.02	mg/l
Vanadium	(V)d	0.1	mg/l
Zinc	(Zn)d	2	mg/l
	pH	6.5 - 8.5	

EXHIBIT 9
TDS Water Quality Standards

Background TDS Value (mg/l)	Maximum Allowable TDS Concentrations
0 - 500	400 mg/l or 1.25 times the background level, whichever is least restrictive
501 - 10,000	1.25 times the background value
10,001 or greater	No limit

[1] Chronic or 30-day standard based on information contained in EPA's Integrated Risk Information System (IRIS) using a 10^{-6} incremental risk factor.

[a] When the Membrane Filter Technique is used for analysis, the average of all samples taken within thirty days must be less than 1 organism per 100 milliliters of sample. When the Multiple Tube Fermentation Method is used for analysis, the limit is less than 2.2 org/100 ml.

[b] If the identity and concentration of each radionuclide in a mixture are known, the limiting value would be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit specified. The sum of such ratios for all radionuclides in the mixture shall not exceed "1" (i.e. unity). A radionuclide may be considered as not present in a mixture if the ratio of the concentration to the limit does not exceed 1/10 and the sum of such ratios for all radionuclides considered as not present in the mixture does not exceed 1/4.

[c] The chromium standard is based on the total concentration of both trivalent and hexavalent forms of dissolved chromium.

[d] Measured as dissolved concentration. The sample water shall be filtered through a 0.45 micron membrane filter prior to preservation. The total concentration (not filtered) may be required on a case-by-case basis if deemed necessary to characterize the pollution caused by the activity.

[e] If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem per year. Except for Tritium and Strontium 90 the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burden and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69, as amended, August 1963, US Department of Commerce.

[f] These more stringent levels are necessary to protect livestock watering. Levels for parameters without this footnote are set to protect irrigated crops at the same level. Where a party can demonstrate that a livestock watering use of ground water is not reasonably expected, the applicable standard for lead is 5.0 mg/l.

[g] This level is set to protect the following plants in ascending order of sensitivity: Pecan, Black Walnut, Persian (English) Walnut, Jerusalem Artichoke, Navy Bean, American Elm, Plum, Pear, Apple, Grape (Sultanina and Malaga), Kadota Fig, Persimmon, Cherry, Peach, Apricot, Thornless Blackberry, Orange, Avocado, Grapefruit, Lemon. Where a party can demonstrate that a crop watering use of ground water is not reasonably expected, the applicable standard for boron is 5.0 mg/l.

[h] This level protects all crops, except citrus which do not grow in Colorado and therefore a more stringent level of protection is not required. [i]The Gross Alpha Activity standard excludes alpha activity due to Radon and Uranium.

[i] This standard is only appropriate where irrigation water is applied to soils with pH values lower than 6.0.

[j] Drinking water MCL.

EXHIBIT 10
Radioactive Materials Standards[1]

Parameter	Standard	
Americium[2]	0.15	pCi/l
Cesium 134	80	pCi/l
Plutonium 239[2] and 240[2]	0.15	pCi/l
Radium 226[2] and 228[2]	5	pCi/l
Strontium 90[2]	8	pCi/l
Thorium 230[2] and 232[2]	60	pCi/l
Tritium	20,000	pCi/l

pCi/l = Picocuries Per Liter
[1]Insite-specific cases, when it has been demonstrated that there are negligible differences between the results of dissolved (filtered) samples and total (unfiltered) samples, then dissolved results may be utilized for implementing the radioactive material standards.
[2]Radionuclide samples for these materials should be analyzed using unfiltered (total) samples.

EXHIBIT 11
Ground Water Organic Chemical Standards

Parameter	CAS No.	Standard[1] (micrograms per liter)
Acenaphthene	83-32-9	420
Acetochlor	34256-82-1	140
Acrolein	107-02-8	3.5
Acrylamide[C]	79-06-1	0.0078
Acrylonitrile[C]	107-13-1	0.065
Alachlor	15972-60-8	2.0[M]
Aldicarb	116-06-3	7.0[M]
Aldicarb Sulfone	1646-88-4	7.0[M]
Aldicarb Sulfoxide	1646-87-3	7.0[M]
Aldrin[C]	309-00-2	0.0021
Aniline[C]	62-53-3	6.1
Anthracene (PAH)	120-12-7	2100
Aramite[C]	140-57-8	1.4
Atrazine	1912-24-9	3.0[M]
Azobenzene[C]	103-33-3	0.32
Benzene[C,2]	71-43-2	5.0[M]
Benzidine[C]	92-87-5	0.00015
Benzo(a)anthracene (PAH)[C]	56-55-3	0.0048
Benzo(a)pyrene (PAH)[C, 6]	50-32-8	0.0048 to 0.2[M]
Benzo(b)fluoranthene (PAH)[C]	205-99-2	0.0048
Benzo(k)fluoranthene (PAH)[C]	207-08-9	0.0048
Benzotrichloride[C]	98-07-7	0.0027
Benzyl chloride[C]	100-44-7	0.21
Bis(chloromethyl)ether (BCME)[C]	542-88-1	0.00016

EXHIBIT 11
Ground Water Organic Chemical Standards

Parameter	CAS No.	Standard[1] (micrograms per liter)
Bromate[C]	15541-45-4	0.05
Bromodichloromethane (THM)[C, 7]	75-27-4	0.56
Bromoform (THM)[C, 7]	75-25-2	4
Butyl benzyl phthalate	85-68-7	1,400
Carbofuran[6]	1563-66-2	35 to 40[M]
Carbon tetrachloride[C, 6]	56-23-5	0.27 to 5[M]
Chlordane[C, 6]	57-74-9	0.10 to 2[M]
Chlorethyl ether (BIS-2)[C]	111-44-4	0.032
4-Chloro-3-methylphenol	59-50-7	210
Chlorobenzene	108-90-7	100[M]
Chloroform (THM)[C, 7]	67-66-3	3.5
Chloroisopropyl ether (BIS-2)	108-60-1	280
Chloronapthalene	91-58-7	560
Chlorophenol, 2-	95-57-8	35
Chlorphrifos	2921-88-2	21
Chrysene (PAH)[C]	218-01-9	0.0048
Dalapon	75-99-0	200[M]
DDD[C]	72-54-8	0.15
DDE[C]	72-55-9	0.1
DDT[C]	50-29-3	0.1
Di(2-ethylhexyl)adipate	103-23-1	400[M]
Dibenzo(a,h)anthracene (PAH)[C]	53-70-3	0.0048
1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	0.2[M]
Dibromochloromethane (THM)[3, 7]	124-48-1	14
Dicamba	1918-00-9	210
Dichloroacetic acid[C]	79-43-6	0.7
Dichlorobenzene 1,2	95-50-1	600[M]
Dichlorobenzene 1,3	541-73-1	94
Dichlorobenzene 1,4	106-46-7	75[M]
Dichloroethane 1,2[C, 6]	107-06-2	0.38 to 5[M]
Dichloroethylene 1,1	75-35-4	7[M]
Dichloroethylene 1,2-cis	156-59-2	70[M]
Dichloroethylene 1,2-trans	156-60-5	100[M]
Dichlorophenol 2,4	120-83-2	21
Dichlorophenoxyacetic acid (2,4-D)	94-75-7	70[M]
Dichloropropane 1,2[C, 6]	78-87-5	0.52 to 5[M]
Dichlorvos[C]	62-73-7	0.12
Diclorobenzidine[C]	91-94-1	0.078
Dieldrin[C]	60-57-1	0.002
Diethyl phthalate	84-66-2	5,600
Diisopropylmethylphosphonate (DIMP)[4]	1445-75-6	8

EXHIBIT 11
Ground Water Organic Chemical Standards

Parameter	CAS No.	Standard[1] (micrograms per liter)
Dimethylphenol 2,4	105-67-9	140
Di-n-butyl phthalate	84-74-2	700
Dinitro-o-cresol 4,6	534-52-1	0.27
Dinitrophenol 2,4	51-28-5	14
Dinitrotoluene 2,4[C]	121-14-2	0.11
Dinoseb	88-85-7	7[M]
Dioxane 1,4-[C]	123-91-1	6.1(effective through 3/21/2010)
Dioxane 1,4-[C]	123-91-1	3.2(effective 3/21/2010)
Dioxin (2,3,7,8 TCDD)[C, 6]	1746-01-6	2.2x10^{-7} to 3.0x10^{-5}, [M]
Diphenylhydrazine 1,2[C]	122-66-7	0.044
Diquat[6]	85-00-7	15 to 20[M]
Endosulfan	115-29-7	42
Endosulfan sulfate	1031-07-8	42
Endosulfan, alpha	959-98-8	42
Endosulfan, beta	33213-65-9	42
Endothall	145-73-3	100[M]
Endrin	72-20-8	2[M]
Endrin aldehyde	7421-93-4	2.1
Epichlorohydrin[C]	106-89-8	3.5
Ethylbenzene	100-41-4	700[M]
Ethylene Dibromide[C, 6] (1,2-dibromoehtane)	106-93-4	0.02 to 0.05[M]
Ethylhexyl phthalate (BIS-2)[C, 6](DEHP)	117-81-7	2.5 to 6[M]
Fluoranthene (PAH)	206-44-0	280
Fluorene (PAH)	86-73-7	280
Folpet[C]	133-07-3	10
Furmecyclox[C]	60568-05-0	1.2
Glyphosate	1071-83-6	700[M]
Heptachlor[C, 6]	76-44-8	0.008 to 0.4[M]
Heptachlor epoxide[C, 6]	1024-57-3	0.004 to 0.2[M]
Hexachlorobenzene[C, 6]	118-74-1	0.022 to 1.0[M]
Hexachlorobutadiene	87-68-3	0.45
Hexachlorocyclohexane, Alpha[C]	319-84-6	0.0056
Hexachlorocyclohexane, Gamma (Lindane)	58-89-9	0.2[M]
Hexachlorocyclopentadiene[6] 50[M]	77-47-4	42 to 50[M]
Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-hcdd)[C]	19408-74-3	5.60E-06
Hexachloroethane[3]	67-72-1	0.7
Hydrazine/Hydrazine sulfate[C]	302-01-2	0.012
Indeno (1,2,3-cd) pyrene (PAH)[C]	193-39-5	0.0048
Isophorone[3]	78-59-1	140

EXHIBIT 11
Ground Water Organic Chemical Standards

Parameter	CAS No.	Standard[1] (micrograms per liter)
Malathion	121-75-5	140
Methoxychlor[6]	72-43-5	35 to 40[M]
Methylene bis(N,N'-dimethyl)aniline 4,4'[C]	101-61-1	0.76
Methylene chloride[C, 6]	75-09-2	4.7 to 5[M]
Metribuzin	21087-64-9	180
Mirex	2385-85-5	1.4
Naphthalene (PAH)	91-20-3	140
Nitrobenzene	98-95-3	3.5
Nitrophenol 4	100-02-7	56
Nitrosodimethylamine N[C](NDMA)	62-75-9	0.00069
Nitrosodiphenylamine N[C]	86-30-6	7.1
N-Nitrosodiethanolamine[C]	1116-54-7	0.013
N-Nitrosodi-n-propylamine[C]	621-64-7	0.005
N-Nitroso-N-Methylethylamine[C]	10595-95-6	0.0016
Oxamyl (vydate)[6]	23135-22-0	175 to 200[M]
PCBs[C, 5, 6]	1336-36-3	0.0175 to 0.5[M]
Pentachlorobenzene	608-93-5	5.6
Pentachlorophenol[C, 6]	87-86-5	0.29 to 1.0[M]
Phenol	108-95-2	2,100
Picloram	1918-02-1	490
Prometon	1610-18-0	100
Propylene oxide[C]	75-56-9	0.15
Pyrene (PAH)	129-00-0	210
Quinoline[C]	91-22-5	0.012
Simazine	122-34-9	4[M]
Styrene	100-42-5	100[M]
Tetrachlorobenzene 1,2,4,5	95-94-3	2.1
Tetrachloroethane 1,1,2,2	79-34-5	0.18
Tetrachloroethylene (PCE)	127-18-4	5[M]
Toluene[6]	108-88-3	560 to 1,000[M]
Total Trihalomethanes (TTHMs)[7]	N/A	80[M]
Toxaphene[C, 6]	8001-35-2	0.032 to 3[M]
Trichlorobenzene 1,2,4	120-82-1	70[M]
Trichloroethane 1,1,1 (1,1,1-TCA)	71-55-6	200[M]
Trichloroethane 1,1,2[3, 6] (1,1,2-TCA)	79-00-5	2.8 to 5[M]
Trichloroethylene (TCE)	79-01-6	5[M]
Trichlorophenol 2,4,5	95-95-4	700
Trichlorophenol 2,4,6[C]	88-06-2	3.2
Trichlorophenoxyproprionic acid (2,4,5-tp) (Silvex)	93-72-1	50[M]

EXHIBIT 11
Ground Water Organic Chemical Standards

Parameter	CAS No.	Standard[1] (micrograms per liter)
Vinyl Chloride[C, 6]	75-01-4	0.023 to2[M]
Xylenes (total)[6]	1330-20-7	1,400 to 10,000[M]

[1]All standards are chronic or 30-day standards. They are based on information contained in EPA's Integrated Risk Information System (IRIS) and/or EPA lifetime health advisories for drinking water using a 10^{-6} incremental risk factor unless otherwise noted.

[2]The standard for Benzene has been established at the MCL (q.v. 41.17)

[3]Standards for Group C compounds that have both published toxicity and carcinogenic risk data are calculated based on toxicity data and then adjusted downward using an uncertainty factor of 10.

[4]The Diisopropylmethylphosphonate (DIMP) standard was adopted in 1993 (q.v. 41.16)

[5]PCBs are a class of chemicals that include aroclors, 1242, 1254, 1221, 1232, 1248, 1260, and 1016, CAS numbers 53469-21-9, 11097-69-1, 11104-28-2, 11141-16-5, 12672-29-6, 11096-82-5, and 12674-11-2 respectively. The human-health criteria apply to total PCBs, i.e. the sum of all congener or all isomer analyses.

[6]Whenever a range of standards is listed and referenced to this footnote, the first number in the range is a strictly health-based value, based on the Commission's established methodology for human health-based standards. The second number in the range is a maximum contaminant level, established under the federal Safe Drinking Water Act has been determined to be an acceptable level of this chemical in public water supplies, taking treatability and laboratory detection limits into account. The Commission intends that control requirements for this chemical be implemented to attain a level of ambient water quality that is at least equal to the first number in the range except as follows:

•Where ground water quality exceeds the first number in the range due to a release of contaminants that occurred prior to September 14, 2004, (regardless of the date of discovery or subsequent migration of such contaminants) clean-up levels for the entire contaminant plume shall be no more restrictive than the second number in the range or the ground water quality resulting from such release, whichever is more protective.

•Wherever the Commission has adopted alternative, site-specific standards for the chemical, the site-specific standards shall apply instead of these statewide standards.

The Commission does not intend the adoption of this range of standards to result in changes to clean-up requirements previously established by an implementing agency, unless such change is mandated by the implementing agency pursuant to its independent statutory authority.

[7]For aquifer storage and recovery facilities, if the source of this chemical in ground water is potable water provided by a drinking water system with a Colorado PWSID that meets all applicable federal Safe Drinking Water Act and corresponding State requirements at the time that it is utilized for aquifer storage and recovery or artificial recharge, then the separate total trihalomethane standard will apply to the ground water in question, rather than the individual standards for bromodichloromethane, bromoform, chloroform, and/or dibromochloromethane. For any parameter for which there is a Maximum Containment Level (MCL) established by the Safe Drinking Water Act, as identified in Table A with Footnote "M", the MCL shall apply as the standard for groundwater when potable water is used for ASR or artificial recharge.

N/A – not applicable

[C]Carcinogens classified by the EPA as A, B1, or B2.

[M]Drinking water MCL.

CAS No. - Chemical Abstracts Service Registry Number

THM - Halomethanes

Well Head Protection Areas

According to Brian Sutton, District 10 Water Commissioner for the City of Colorado Springs, it is not likely that there are any municipal wellhead protection areas designated within the study area (Sutton, pers. Comm. Oct. 23, 2008). Wellhead protection area information is classified due to security concerns, and is generally not available without a permit, according to Alisa Willard, Water Quality Database Supervisor for the CDPHE. (Willard, pers. Comm., Oct. 17, 2008). A permit has not been obtained for wellhead protection area data at this time.

Fish Habitat

Fountain Creek is not considered a Wild Trout Stream or a Gold Medal Trout Stream, according to the Colorado Fishing Network website. The nearest Wild Trout or Gold Medal Trout stream is the South Platte River (CFN, 2008).

The Fountain Creek watershed contains resident populations of both native and non-native fishes. During a 2006 study by Chadwick Ecological Consultants, Inc., for URS Corp, thirteen native species were collected from the Fountain Creek watershed. In addition, 16 species non-native species and one hybrid were collected. The Fountain Creek watershed includes the greenback cutthroat trout (federal and state threatened), the Arkansas darter (state threatened) and the flathead chub (a state species of special concern) (URS, 2006). However, brown trout and brook trout were the only species found within the study area.

Threatened and Endangered Species Habitat

Fountain Creek supports a riparian fringe along its banks. The riparian zone along Fountain Creek, as well as other types of habitats in the area, can be seen in Figure 4 in Appendix A. This riparian fringe may provide suitable habitat for Preble's meadow jumping mouse. However, a map produced on September 12, 2000 by Colorado Springs Utilities with U.S. Fish and Wildlife Service (FWS) data indicates that the entire study area has been surveyed in 2000 and no mice have been found (CSU, 2000).

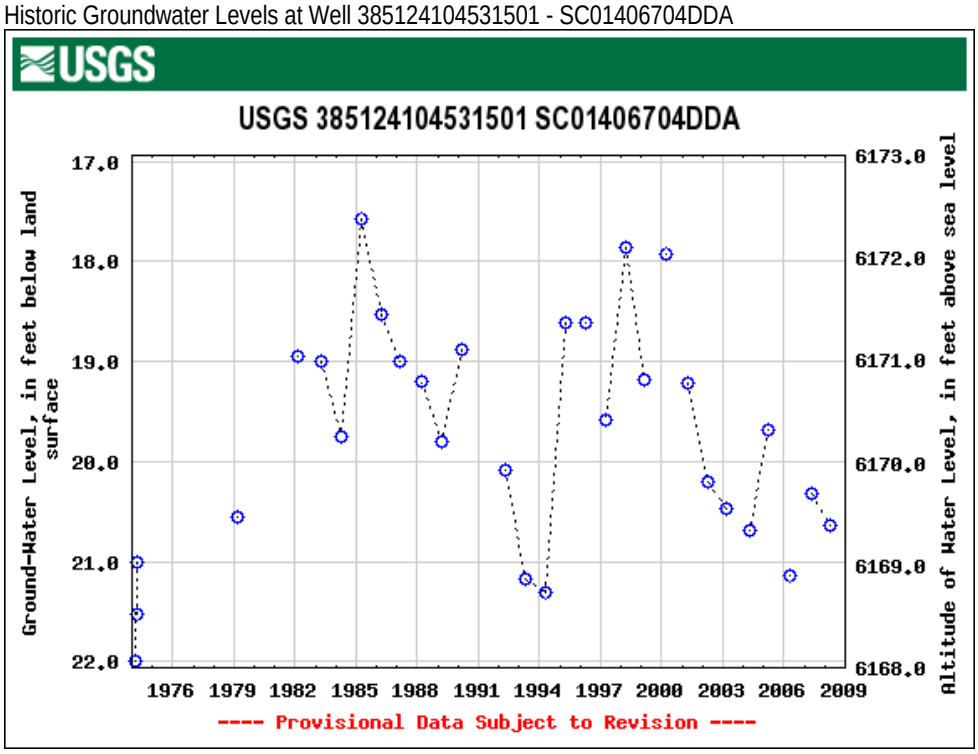
The FWS generally recommends Preble's meadow jumping mouse clearance surveys for all project sites within El Paso County that are below an elevation of 7600 feet. They also recommend surveys for projects occurring within 300 feet of FEMA-designated 100-year floodplains of stream channels and their tributaries (perennial and intermittent), riparian habitats, vegetated irrigation canals, ditches, and wetlands including wet meadows (both natural and those created by seeps from man-made structures such as dams, irrigation canals and ditches, etc.), and wet or mesic alfalfa or hay fields near streams. It should be noted that many drainages where suitable Preble's habitat may exist do not have FEMA-designated 100-year floodplains (FWS, 2008).

Groundwater

Groundwater Monitoring Data

Limited groundwater monitoring data were available for the study area. Of the 124 USGS monitoring wells identified in El Paso County, only one USGS well exists near the study area. This well is identified as 385124104531501 - SC01406704DDA and is located just east of Manitou Springs at Latitude 38°51'24", Longitude 104°53'15" (USGS, 2008). Data from this well is restricted to water depth. A chart of the recorded groundwater levels appears in Exhibit 12 below. From 1974 to 2008, groundwater levels below ground surface range from 17.5 to 22 feet (USGS, 2008).

EXHIBIT 12
Historic Groundwater Levels at Well 385124104531501 - SC01406704DDA



Source: USGS Ground Water Watch, 2008.

Aquifers

According to the Ground Water Atlas of Colorado, the study area is located within the "Precambrian crystalline rock aquifers" (GWA, 2008). These aquifers are formed within the fractures of geologically recent volcanic and igneous intrusive rocks, and supply much of the domestic water needs in the mountainous portion of the state (CWA, 2008).

The USGS does not have any specific name for the rock aquifer that coincides with the project. The nearest aquifer identified by the USGS is called the Valley-Fill Deposits (111VLFL) local aquifer (USGS, 2008). This aquifer is located at the downstream end of the project along Fountain Creek, starting at about the confluence with Monument Creek. The location of all of the above mentioned aquifers can be seen in Figure 5 in Appendix A.

Protected Groundwater Areas

A review of groundwater resources within El Paso County that are listed in WQCC Regulation 42 was performed. No protected groundwater areas exist near the project. The nearest protected groundwater area exists several miles to the southeast of the study area, and is labeled as: "City of Fountain, Security Water & Sanitation District, and Widefield Homes Water Company Wellfields in El Paso County" in the WQCC Regulation 42 Report. This protected area is designated for residential and agricultural use, and complies with the ground water quality standards included in Tables 1-4 of the "Basic Standards for Ground Water" 41.0 (5 CCR 1002-41) as listed in Regulation 42 (CDPHE, 2008). Protected groundwater areas can be seen in Figure 5 in Appendix A.

Surface Water Resources

Stream Water Quality Baseline Conditions

Fountain Creek and several of its tributaries have gages that record data such as flow, sediment load, and chemistry. USGS gage data were reviewed to determine the baseline conditions for Fountain Creek, its tributaries, and Monument Creek. The USGS maintains 14 active USGS monitoring stations on Fountain and Monument Creeks and major tributaries. Of these 14 gages, only one USGS monitoring gauge is located within the study area. It is also the only USGS gauge on segment 1 of Fountain Creek. This gage is identified as number 7103700 by the USGS. Selected water quality constituents for gage 7103700 are included in Appendix C. Sediment load data has not been collected at gage 7103700 since 2003, thus is not included in this study.

There are several other gauges that are potentially important for consideration of the baseline conditions at the site. Four other gages on streams in the surrounding area may provide additional useful information for. Many of the gages do not have a full suite of sediment and chemistry information, but all have flow data. These streams and the location of each gage described below can be seen in Figure 6 in Appendix A. Available data for mean annual and monthly streamflows within the last 5 years are listed in Exhibits 13 through 18 These streamflows are utilized in calculating the potential effects that the project will have on the quality of the water in the streams.

Detailed analysis of the waterways has not been conducted for this technical memo. Data analysis procedures developed by CDPHE and listed in *Guidance on Data Requirements and Data Interpretation Methods Used in Stream Standards and Classification Proceedings* should be followed at a later time to determine the existing water quality conditions in the study area in Segment 1a in the Fountain Creek watershed. Existing studies that provide some detailed baseline information are available from the Fountain Creek Watershed Vision Task Force, the PPACG, and other local organizations.

EXHIBIT 13
USGS Gage Summary – Stream Flow Discharge Yearly Mean (cubic feet per second)

	Gage Number and Location				
	7103700	**7103703**	**7105000**	**7104905**	**7105500**
	Fountain Creek Near Colorado Springs, CO	**Camp Creek at Garden of the Gods, CO**	**Bear Creek Near Colorado Springs, CO**	**Monument Creek at Bijou Street at Colorado Springs, CO**	**Fountain Creek at Colorado Springs, CO**
Year	**Discharge, cubic feet per second**				
2003	7.27	0.002	0.889	Not measured	31.5
2004	13.2	0.003	1.78	27.9	47.2
2005	12.7	0.001	1.51	31.4	48.5
2006	10.1	0.023	0.981	32.8	50.9
2007	27	0.491	2.81	70.5	111.9
2008	Not available	Not available	Not available	Not available	55.1

Source: USGS Surface Water Yearly Statistics for the Nation, 2008b.

EXHIBIT 14

USGS Gage 07103700 Fountain Creek Near Colorado Springs, CO: Stream Flow Discharge Monthly Mean (cubic feet per second)

	Monthly mean in cfs (Calculation Period: 2003-01-01 -> 2008-04-30) Period-of-record for statistical calculation restricted by user											
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2003	4.22	4.54	7.09	10.4	10.3	13.4	7.75	7.87	8.43	5.25	5.59	5.13
2004	5.28	5.32	7.03	18.2	16.0	10.4	21.8	39.5	18.8	14.7	10.9	9.26
2005	8.25	9.40	10.0	20.5	27.1	16.3	7.25	10.8	7.34	8.26	9.21	10.3
2006	9.31	8.91	9.52	9.29	7.18	5.33	14.5	13.8	15.6	14.9	13.8	13.5
2007	11.1	11.9	17.3	24.3	70.8	47.3	31.1	41.5	24.6	25.0	17.6	13.9
2008	15.5	14.2	14.6	16.6								
Mean of Monthly Discharge	8.9	9.0	11	17	26	19	16	23	15	14	11	10

** No Incomplete data have been used for statistical calculation

Source: USGS Surface Water Monthly Statistics for the Nation, 2008b.

EXHIBIT 15

USGS Gage 07103703 Camp Creek at Garden of the Gods, CO: Stream Flow Discharge Monthly Mean (cubic feet per second)

	Monthly mean in cfs (Calculation Period: 2002-01-01 -> 2007-09-30) Period-of-record for statistical calculation restricted by user											
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2002	0.000	0.000	0.001	0.000	0.004	0.000	0.002	0.000	0.002	0.002	0.000	0.000
2003	0.000	0.000	0.002	0.003	0.006	0.007	0.000	0.004	0.000	0.000	0.000	0.000
2004	0.000	0.000	0.001	0.008	0.003	0.005	0.011	0.011	0.000	0.001	0.000	0.000
2005	0.000	0.000	0.001	0.001	0.001	0.003	0.000	0.006	0.001	0.001	0.000	0.000
2006	0.000	0.000	0.000	0.000	0.000	0.006	0.245	0.013	0.011	0.012	0.000	0.000
2007	0.000	0.000	0.001	0.471	5.28	0.005	0.007	0.013	0.001			
Mean of Monthly Discharge	0.00	0.00	0.00	0.08	0.88	0.00	0.04	0.01	0.00	0.00	0.00	0.00

** No Incomplete data have been used for statistical calculation

Source: USGS Surface Water Monthly Statistics for the Nation, 2008b.

EXHIBIT 16

USGS Gage 07104905 Monument Creek at Bijou Street at Colorado Springs, CO: Stream Flow Discharge Monthly Mean (cubic feet per second)

Monthly mean in cfs (Calculation Period: 2003-04-01 -> 2007-11-30)
Period-of-record for statistical calculation restricted by user

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003				46.4	37.4	49.6	13.1	37.7	22.6	17.5	19.0	15.2
2004	13.1	14.6	17.5	37.3	21.1	33.0	69.9	55.0	21.2	18.3	20.2	17.3
2005	19.6	22.7	22.7	70.2	57.0	43.5	16.7	55.3	12.6	21.4	19.2	17.0
2006	19.5	17.5	16.8	15.0	16.0	23.3	107.7	52.6	66.1	52.6	39.9	26.3
2007	31.8	42.1	69.5	130.3	190.9	60.3	39.2	128.2	31.4	25.7	23.3	
Mean of Monthly Discharge	21	24	32	60	64	42	49	66	31	27	24	19

** No Incomplete data have been used for statistical calculation

Source: USGS Surface Water Monthly Statistics for the Nation, 2008b.

EXHIBIT 17

USGS Gage 07105000 Bear Creek Near Colorado Springs, CO: Stream Flow Discharge Monthly Mean (cubic feet per second)

Monthly mean in cfs (Calculation Period: 2003-01-01 -> 2008-05-30)
Period-of-record for statistical calculation restricted by user

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	0.565	0.670	1.06	1.86	1.36	1.48	0.596	0.685	0.628	0.596	0.710	0.568
2004	0.550	0.558	0.845	1.94	3.03	1.57	3.79	4.63	2.53	1.66	1.42	1.23
2005	1.12	1.13	1.27	2.73	2.42	1.84	1.23	1.17	0.903	0.939	0.927	0.797
2006	0.774	0.851	0.846	0.794	0.581	0.421	1.52	1.51	1.79	1.84	1.74	1.26
2007	1.09	1.30	2.47	3.57	8.27	4.91	3.03	2.97	1.17	1.26	1.10	1.15
2008	1.37	1.22	1.67	1.90	1.74							
Mean of Monthly Discharge	0.91	0.95	1.4	2.1	2.9	2.0	2.0	2.2	1.4	1.3	1.2	1.0

** No Incomplete data have been used for statistical calculation

Source: USGS Surface Water Monthly Statistics for the Nation, 2008b.

EXHIBIT 18
USGS Gage 07105500 Fountain Creek at Colorado Springs, CO: Stream Flow Discharge Monthly Mean (cubic feet per second)

	Monthly mean in cfs (Calculation Period: 2003-01-01 -> 2008-09-30) Period-of-record for statistical calculation restricted by user											
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2003	15.2	19.3	31.2	46.3	43.7	71.7	16.3	46.6	29.9	19.5	20.7	19.7
2004	17.6	17.8	19.7	59.4	45.4	63.6	128.1	115.1	37.4	29.8	29.1	21.8
2005	23.7	25.9	32.8	111.6	108.3	76.5	27.3	73.9	20.7	33.2	25.1	24.7
2006	23.2	23.1	23.8	17.3	16.3	28.5	196.4	102.5	92.6	75.6	58.0	44.1
2007	43.0	54.5	87.7	172.6	361.5	133.2	75.6	174.7	56.0	52.1	45.3	38.6
2008	39.8	38.2	47.2	60.2	58.9	36.1	26.7	133.0	84.7			
Mean of Monthly Discharge	27	30	40	78	106	68	78	108	54	42	36	30

** No Incomplete data have been used for statistical calculation

Source: USGS Surface Water Monthly Statistics for the Nation, 2008b.

Point Source Discharges

Data were gathered to determine the direct point source discharges that were in the study area and that could be potentially impacted by the highway expansion. No permitted point source discharges are found along the project. However, there are some downstream. According to the PPACG Water Quality Management Plan, there are eleven Municipal Wastewater Treatment Plant Dischargers in the Fountain Creek watershed (PPACG, 2003b).

Drinking Water Sources

Both cities of Manitou Springs and Colorado Springs get most of their drinking water from a collection of reservoirs higher up in the Arkansas River watershed above Fountain Creek, however, there are some important drinking water sources located near the project.

The City of Manitou Springs gets most of its water from the Manitou Springs Reservoir, several miles up the Fountain Creek sub-watershed, where it is treated and then piped down to the city for potable use (City of Manitou Springs Website, 2008). Colorado Springs treats and pipes in most of its drinking water from similar sources higher in the watershed.

Water Diversion Intakes

Within the study area, there is one drinking water diversion intake on Fountain Creek, which is near South 33rd Street along US 24. This water intake facility serves the City of Colorado Springs. According to Brian Sutton, District 10 Water Commissioner for the City of Colorado Springs, approximately 1.5 million gallons per day are piped from this location and delivered to the Mesa Treatment Facility, where it is treated and then piped to customers (Sutton, pers. Comm. Oct. 23, 2008). Wastewater from the Mesa Treatment Facility system is routed to the Las Vegas Wastewater Treatment Facility and is treated and released back to Fountain Creek downstream (Sutton, pers. Comm. Oct. 23, 2008). The location of the water diversion intake and the water treatment facilities can be seen in Figure 6 and Figure 7 in Appendix A.

Potential changes to Fountain Creek flows from the South 33rd Street diversion intake are measured by a flow gage at 8th Street (Sutton, pers. Comm. Oct. 23, 2008). No data was obtained from the 8th Street gage for this study.

Wells

There are 209 permitted wells within 1000 feet of the US 24 West study area that are recorded with the State Engineers Office (SEO, 2008). Most of these wells are monitoring wells at petroleum station locations and are not used for drinking. Of the 209 total wells, 168 are designated as monitoring wells, 36 are designated for residential use, three are designated for commercial use, one is designated for crop irrigation, and one is designated for a gravel pit. The location of all these permitted wells can be seen in Figure 7 in Appendix A. A table of all SEO wells within 1000 feet of the project is included in Appendix B.

Developed Mineral Springs

There are ten artesian mineral water springs that are used in the Manitou Springs area. Over the years, these springs have been developed into fountains and sculptures around town. The springs were historically touted for medicinal purposes, and several spas were operated at one time (Manitou Springs.org, 2008). The springs are being restored and spas will be returned to the area by the Mineral Springs Foundation. According to Dave Wolverton, President of the Mineral Springs Foundation, these springs are all located west of the intersection of US 24 and Manitou Springs Avenue, thus would not be affected by the project (Wolverton, pers. Comm. Oct. 23, 2008).

7.0 Environmental Consequences

Environmental consequences were considered that would result from the No Action Alternative as well as the Proposed Action. Details about the consequences from each alternative are discussed below.

No Action Alternative

The No Action Alternative would result in impacts such as continued increased highway congestion and would cause contaminant concentrations in the highway runoff to increase due to high average daily traffic (ADT) values. Because there are no BMPs currently in place to address existing and increasing future pollutant loadings from the existing road in, further water quality degradation would be anticipated to Fountain Creek, as well as the surrounding wetlands.

In general, cumulative impacts on the water quality can be expected to further degrade this urban watershed due to the continuous increase in imperviousness unless measures are taken to address these impacts and/or the water quality. Development densities are anticipated to increase within the study area. This increase in density is anticipated to increase urban runoff and, if unmitigated, would have a degrading effect on the water quality of Fountain Creek and other creeks in the surrounding area. If permanent BMPs are not implemented at central discharge points to the receiving water to collect existing and additional runoff from the new improvements, the water quality within Fountain Creek will continue to degrade substantially. The water quality degradation associated with the No

Action Alternative could consequently have a negative impact on the sensitive habitat areas in the study area as well.

Proposed Action

The Proposed Action would result in a reduction of contaminants reaching Fountain Creek due to the construction of ponds, swales, and other BMPS that would trap, treat, or remove contaminants before reaching the creek.

Ponds would generally be constructed adjacent to roadway intersections and along the US 24 ROW. Some properties along the road are proposed for purchase by CDOT, and could include the placement of ponds in design plans. Generally, the ponds will be placed outside of the floodplain to ensure that the ponds would still function as water quality BMPs during flood events. Typical pond sizes would be between 0.1 – 1.0 acre. Over 26 alternative pond locations are being considered, but no final designs have yet been determined. Some ponds will require pipe connections in areas that the US 24 ROW narrows considerably, such as along the section of cliffs between 31st St. and Ridge Rd.

In addition to the installation of ponds, swales may be built parallel to the roadway to further attenuate highway runoff contaminants from reaching Fountain Creek. The swales could be constructed with intermediate discharge points along the creek.

Channel realignments may be necessary where the road would be too close to the creek. Generally, the low-flow channel of Fountain Creek will not be horizontally adjusted unless necessary, but would be adjusted vertically with drop structures near bridge crossings to flatten out the flow profile and slow down the stream velocity to reduce erosion. These channel realignments would provide supplemental opportunities for placement of ponds and other BMPS that could further protect the creek from highway runoff contaminants.

CDOT may be required to purchase property to replace the roadway in some areas, especially near on/off ramps and near corners. These newly-purchased areas may provide additional opportunities for placement of BMPs.

All of the BMPs and road alignments that may affect water quality are preliminary and subject to review and comment by CDOT, the City of Manitou Springs, the City of Colorado Springs, El Paso County, and other interested stakeholders. Modifications to roadway alignment, bridge locations, and channel improvements may occur during final design. Several factors that could affect water quality in Fountain Creek are considered in the sections below.

Impervious Surface

The Proposed Action would increase the impervious surface area of the roadway when compared with the No Action Alternative. The Proposed Action would result in a 61 percent increase in impervious surface when compared to existing conditions. This 61 percent increase includes additional US 24 highway surface area, well as some surface area increases associated with roads that intersect US 24. Exhibit 19 shows the amount of impervious surface that would be present in either alternative.

EXHIBIT 19
Impervious Surface Totals

Alternative	Total Impervious Surface Area in the study area (square feet)	Increase from existing conditions (%)
No Action Alternative	3014788	0%
Proposed Action	4860425	61%

The potential for increased discharge velocities that may result from more impervious surface area would be mitigated by improving the channel configuration of Fountain Creek, as discussed below.

Stream Modifications

Drop Structures

Discharge velocities are expected to decrease within and downstream of the study area as a result of the Proposed Action. The stream elevation would be vertically adjusted at bridge crossings with the installation of a series of drop structures, as necessary. These drop structures would decrease the velocity of the water and would also flatten out the flow profile. Generally, the drop structures would be constructed within 200 feet of any bridge that spans the creek. However, where the existing grade of the creek is higher, such as along the section between 31st St. and Ridge Road, a longer series of drop structures would be necessary.

These drop structures would attenuate the potential for increased erosion of the streambed and drainage areas caused by the increased impervious area. The drop structures would also decrease the potential for sediment loading within the study area and further downstream.

Stream Relocation

Where the creek is positioned too close to the edge of the Proposed Action, the flow channel of Fountain Creek would be realigned to minimize the need for increased channelization and to attenuate flood concerns. Where channel changes are necessary, the channel would be flattened and widened to provide for increased capacity within the low-flow channel and would allow more flow through the floodplain without overtopping into neighboring properties. These channel realignments would preferentially take place within the highway ROW that is owned by CDOT.

Other Stream Modifications

In addition to modifications on Fountain Creek, small modifications will likely be necessary at the confluence with Monument Creek near the I-25 interchange, and also at Camp Creek, near 31st Street.

Stream Crossings

Within the study area, Fountain Creek is currently crossed twice by US 24. Listed from west to east, the first crossing is just east of 21st Street, and the second is east of 8th Street near I-25. Several major and minor roads intersecting US 24 also cross Fountain Creek within the

study area. The roads that currently cross Fountain Creek within the study area, from west to east, are Ridge Road, Timber Lodge access road, 31st Street, Golden Lane, 26th Street, 25th Street, 21st Street, and 8th Street. I-25 also crosses Fountain Creek just east of the US 24 interchange. All of the above-mentioned existing crossings would be upgraded for the project. Most of the replacement bridges would be widened to 160 feet, except for the US 24 Bridge (east of 8th Street), which would be 200 feet wide.

In addition to upgrades to existing bridges over Fountain Creek, there would be new bridges constructed as well. One new road crossings located at 15th Street would pass under US 24 and across the creek to the south. The other bridges would be onramps or offramps to I-25. The new bridge designs have not been finalized. These stream crossings would be constructed and upgraded in a fashion using similar criteria to those used for existing bridges. Modifications to roadway alignment, bridge locations, and channel improvements may occur during final design.

Channel improvements will occur generally 200 feet upstream and downstream of each road crossing. Rip-rap and drop structures would be placed within Fountain Creek to reduce the potential for erosion, with additional modifications to the channel where necessary.

Fish and Threatened and Endangered Species

Minimal or no effects are expected to fish and threatened and endangered species as a result of the Proposed Action. Fountain Creek is not a Gold Medal Trout Stream or a Wild Trout Water. However, as stated in the Affected Environment section, the Fountain Creek watershed includes the greenback cutthroat trout (federal and state threatened), the Arkansas darter (state threatened) and the flathead chub (a state species of special concern) (URS, 2006). Within the study area, only brown trout and brook trout were found.

A map produced on September 12, 2000 by Colorado Springs Utilities with U.S. Fish and Wildlife Service (USFWS) data indicates that the entire study area has been surveyed for Preble's meadow jumping mouse, and no mice have been found (CSU, 2000). However, the Preble's meadow jumping mouse would be the most likely threatened and endangered species to occur, as it has been found on Monument Creek. Coordination with the FWS is recommended to confirm or deny the presence of the Preble's meadow jumping mouse.

Drinking Water Supplies and Wastewater Treatment Plants

As stated in Section 6.0, the project coincides with a drinking water intake on Fountain Creek near South 33rd Ave. However, there will be no channel improvements along the creek in the vicinity of the water intake. There are no planned modifications to the diversion structure in that area as well. Therefore, pollutant levels within Fountain Creek drinking water supplies are not expected to be significantly changed as a result of the Proposed Action.

The approximately 1.5 million gallons per day of water that is piped from the intake at South 33rd Ave. is delivered to the Mesa Treatment Facility, where it is treated and then piped to customers (Sutton, pers. Comm. Oct. 23, 2008). Wastewater from the Mesa Treatment Facility system is routed to the Las Vegas Wastewater Treatment Facility and is treated and released back to Fountain Creek downstream (Sutton, pers. Comm. Oct. 23,

2008). Construction of the Proposed Action is not expected to significantly reduce water quality for water entering and leaving the Las Vegas Wastewater Treatment Facility.

Use Classifications, Impairment/Monitoring Status

Fountain Creek Use Classifications are not expected to change as a result of the Proposed Action. Impairment and monitoring status are also not expected to change, as increased amounts of the 303(d) listed TMDL contaminants on Segment 1a of Fountain Creek - *E. coli* and Selenium - would not be expected to enter Fountain Creek from highway runoff in significant amounts. Other pollutants may possibly be increased from the increase in total impervious surface area, but would be largely attenuated by the numerous BMPs and ponds that would capture highway runoff before entering the creek.

Water Quality Analysis

Under the direction of CDOT and FHWA, a water quality analysis was performed to understand potential effects of the Proposed Action on Fountain Creek. A mass-balance equation was developed to attempt to quantify contaminant concentrations for several selected contaminants, as discussed in the Methods section.

Using the mass-balance equation, it was determined that the increased runoff associated with the Proposed Action would not cause a significant increase in pollutant loading into Fountain Creek when compared to Current Conditions. Exhibit 20 shows that all pollutants would fall well below the water quality standard (WQS) for Fountain Creek, other than Arsenic and Mercury. Arsenic and Mercury levels currently appear to be elevated above the WQS, as indicated by the data collected at USGS station 07013700 over the last 5 years. The project would not likely contribute significant amounts of either metal to Fountain Creek, as indicated by the mass-balance equation. All other metals analyzed in the mass-balance equation were significantly below the WQS in both the Current Condition and the Proposed Condition.

There are currently no WQS or USGS measurements for oil & grease, diesel, gasoline, or heavy oil in Fountain Creek, but they were still included in the model for consideration. Even though contamination concentrations from these sources are expected to roughly double with the Proposed Action, it is expected that they would not cause a significant harmful effect to Fountain Creek, but no further analysis has been done at this time. These data also come from the CALTRANS report and special considerations should be made when drawing conclusions from the CALTRANS dataset.

EXHIBIT 20
Mass-balance Analysis Results

Parameter	Water Quality Standard (µg/L)	Current Condition Downstream Calculated Concentration (µg/L)	Proposed Condition Downstream Calculated Concentration (µg/L)	Average In-stream Background Pollutant Concentrations (µg/L)*	Average Annual Upstream Volume (cubic feet)**	CALTRANS Mean Concentration Data for Runoff (µg/L)***	Current Condition Annual Runoff Volume (cubic feet)	Proposed Condition Annual Runoff Volume (cubic feet)	Current Condition Annual Downstream Volume (cubic feet)	Proposed Condition Annual Downstream Volume (cubic feet)
	WQS	*M3 - current*	*M3 - proposed*	*M1*	*Q1*	*M2*	*Q2 - current*	*Q2 - proposed*	*Q3 - current*	*Q3 - proposed*
As, total	0.02	3.08	3.07	3.08	443206944	2.7	4371442	7047616	447578386	450254560
Cd, dissolved	0.41	0.04	0.04	0.04	443206944	0.24	4371442	7047616	447578386	450254560
Cr (VI), dissolved	11.0	0.11	0.13	0.08	443206944	3.3	4371442	7047616	447578386	450254560
Cr (III), total	50.0	0.16	0.21	0.08	443206944	8.6	4371442	7047616	447578386	450254560
Cu, dissolved	9.11	1.40	1.48	1.27	443206944	14.9	4371442	7047616	447578386	450254560
Hg, total	0.01	0.02	0.02	0.018	443206944	0.0367	4371442	7047616	447578386	450254560
Ni, dissolved	52.9	1.96	1.98	1.93	443206944	4.9	4371442	7047616	447578386	450254560
Pb, dissolved	2.57	0.15	0.20	0.08	443206944	7.6	4371442	7047616	447578386	450254560
Zn, dissolved	126	2.96	3.35	2.31	443206944	68.8	4371442	7047616	447578386	450254560
Oil & Grease	No Standard	48.35	77.48	0	443206944	4950	4371442	7047616	447578386	450254560
TPH (Diesel)	No Standard	36.33	58.23	0	443206944	3720	4371442	7047616	447578386	450254560
TPH (Gasoline)	No Standard	0.00	0.00	0	443206944	0	4371442	7047616	447578386	450254560
TPH (Heavy Oil)	No Standard	26.47	42.42	0	443206944	2710	4371442	7047616	447578386	450254560

Monitoring Needs

Water quality monitoring has not been performed at this time. If the RPEM determines that this is necessary, the data can be used in a new water quality model. BMPs associated with the Proposed Action are expected to attenuate highway runoff contamination from entering Fountain Creek when compared with the No Action Alternative, so monitoring may not be necessary. TMDL concentrations in Fountain Creek are not expected to be affected by the Proposed Action.

Construction Area

The total acres of disturbance for the Proposed Action are not yet available, as changes are still being made to the design. Total acres of disturbance will be determined at a later time. Because there are no other alternatives proposed, no noticeable differences in disturbance acreage can be determined at this time.

Winter Maintenance

There will be no major differences in winter maintenance practices for the Proposed Action versus the No Action Alternative.

Conclusion

The Proposed Action is expected to provide an overall improvement to water quality when compared with the No Action Alternative. An increase in impervious surface area would result in an increase in the total amount of highway runoff that has to be managed. However, an improvement to water quality is expected because of the installation of ponds, swales, and other BMPs that will prevent some of the highway runoff contaminants from reaching Fountain Creek. Creek realignments and drop structures are intended to locally reduce problems with erosion, sediment loading, and flooding.

It is important to note that Fountain Creek is listed as impaired for *E. Coli* (high priority) and Selenium (low priority), but were not analyzed in this study because they are generally not pollutants of concern associated with highway runoff. As such, the Proposed Action is not expected to contribute to increased levels of TMDLs for E. coli and Selenium, and is not expected to significantly affect drinking water quality, fish and threatened and endangered species habitat.

8.0 Mitigation

As stated in Section 7.0, the construction of ponds, swales, and other BMPs associated with the Proposed Action would have a positive effect on water quality. Every effort would be made to minimize both temporary and permanent impacts to water quality to ensure the Proposed Action would not affect the wildlife, fish, and vegetation dependent upon the water.

The goal of the BMP selection process is to provide 100% of the Water Quality Capture Volume or 80% of total suspended solids removal for the entire study area. Both permanent and construction BMPs need to be implemented for the project to reach these goals. BMPs must adhere to the guidelines set forth by the Drainage Design Manual (CDOT 2004), the

CDOT Erosion Control and Stormwater Quality Guide, as amended (CDOT 2002), and the Urban Storm Drainage Criteria Manual (Urban Drainage and Flood Control District, June 2001 and Sept. 1999).

For stream crossings outside of the CDOT ROW along US-24, the project must also follow guidelines set forth by the Drainage Criteria Manual from the City of Colorado Springs and the Engineering Criteria Manual from El Paso County, as the project is within both of their jurisdictions.

As indicated by the Water Quality Section of the CDOT NEPA Manual, exact locations and design details should be provided in the Final Office Review (FOR) plans and prior to RPEM signature of Form 128 if required.

Permanent BMPs

Permanent BMPs would be an important component of the overall project. Permanent BMPs that should be implemented with the goal of providing 100% of the Water Quality Capture Volume or 80% of total suspended solids removal for the entire study area. The Water Quality Capture Volume should be determined at a later planning stage to determine the appropriate size and types of BMPs to be used. Permanent BMPs will follow the CDOT Erosion Control and Stormwater Quality Guide, as amended (CDOT, 2002).The guidelines in Exhibit 21 below offer approaches that should be considered when designing the permanent BMPs.

EXHIBIT 21
Suggested Permanent BMPs

Impact	Impact Type	Mitigation Measure[1]
Increased runoff from expanded impervious surfaces	Permanent	Employ runoff reduction practices. This means reducing, wherever possible, the amount of paved surfaces and non permeable surfaces like sidewalks and slope paving. These impermeable areas block the infiltration of rain into the ground and produce runoff.
Drainage degradation from increased runoff	Permanent	Stabilize drainageways by providing improvements such as grade control, vegetation, and embankment stabilization such that the drainageways may convey runoff without suffering degradation.
Untreated stormwater runoff entering surface water after construction	Permanent	Provide detention for Water Quality Capture Volume (WQCV). A simplified explanation of the WQCV is that one of the primary mechanisms for improving stormwater runoff quality is by providing a proscribed volume for detention of runoff to reduce degrading constituents such as sediments, floating and dissolved contaminates from entering the creek.

[1]Mitigation Measures guidance is from the New Development and Redevelopment Stormwater Management Program Section of the Drainage Design Manual (CDOT 2004b).

Construction BMPs

Construction BMPs and a Stormwater Management Plan are required for all projects within CDOT ROWs. Construction BMPs will follow the CDOT Erosion Control and Stormwater Quality Guide, as amended (CDOT, 2002). The project will also require a CDPS construction permit from the WQCD. As requested in the Water Quality Section of the CDOT NEPA

Manual, temporary BMPs will be included in the final design phase of the project. The following temporary construction BMPs in Exhibit 22 should be implemented as part of the final design of project:

EXHIBIT 22
Suggested Construction BMPS

Impact	Impact Type	Mitigation Measure[1]
Destruction of riparian vegetation	Construction	Temporary BMPs for construction, including re-establishment of native vegetation will be installed and implemented.
Untreated stormwater runoff entering surface waterway during construction	Construction	NPDES guidelines for stormwater quality, including obtaining a stormwater construction permit, will be followed. All work performed on the project within CDOT right of way will conform to Section 107.25 (Water Quality), and Section 208 (Erosion Control) of the CDOT Standard Specifications for Road and Bridge Construction (CDOT 2005) Develop a Stormwater Management Plan that will detail the BMPs to be used for construction. Plan construction access to the site to minimize or avoid impacts to sensitive habitats. Temporary stream crossings and diversions will be designed to minimize water quality and habitat impacts. Adequate storm drainage systems for the existing and proposed improvements will be developed to prevent high levels of sediment and pollutants from entering wetlands, natural drainageways, and irrigation ditches. Construction BMPs such as silt fences, diversion berms, good housekeeping practices, vehicle tracking controls, inlet and outlet protection, street sweeping, and concrete washout locations should be established as appropriate.

[1]Mitigation Measures guidance is from the US 36 Corridor Draft Environmental Impact Statement/ Draft Section 4(f) Evaluation – Volume 1 (US 36 MP, 2007).

Winter Maintenance

Winter maintenance activities for the Proposed Action are expected to be similar to those currently used. Interviews with CDOT personnel may be useful to determine current standard practices. Winter maintenance practices have not been reviewed in detail at this time.

Senate Bill 40 Certification

Mitigation designs for SB 40 impacts have not been completed at this time. The project is required to create, restore, and/or enhance riparian areas that are impacted by project activities, according to the CDOT NEPA Manual. A signed certification from the CDOW is required, and then the CDOT RPEM can sign Form 128. A conceptual mitigation plan is expected to be completed for the SB 40 application during the final design stage. Approximately 61 acres of riparian habitat exists within 1000 feet of the project centerline.

Of those 61 acres, it is estimated that 17 acres of riparian areas exist within the proposed parcel ROW for US 24 and could be potentially impacted. It is expected that most impacts to riparian areas would concentrated within 200 feet upstream and downstream of each bridge crossing.

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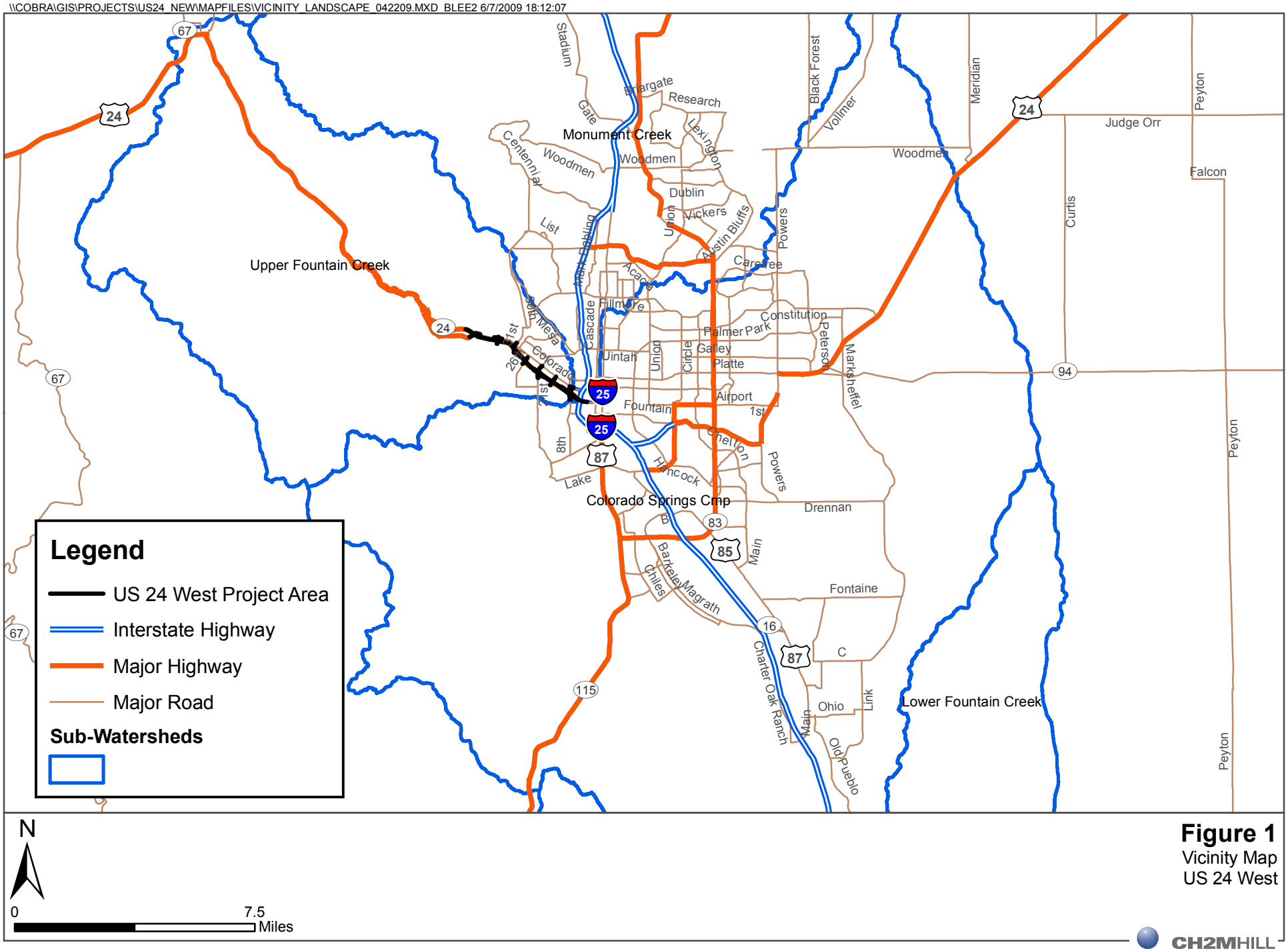
APPENDIX A

Figures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Legend
US 24 West Project Area
Interstate Highway
Major Highway
Major Road
Sub-Watersheds
Upper Fountain Creek
Monument Creek
Colorado Springs Cmp
Lower Fountain Creek
Stadium
Briargate
Research
Gate
Centennial
Woodmen
Lexington
Dublin
Vickers
Austin Bluffs
Union
List
Powers
Carefree
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Cascade
Constitution
Palmer Park
Galley
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Fountain
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Falcon
Curtis
Peyton
67
24
25
87
83
85
16
115
94
N
0
7.5
Miles
Figure 1
Vicinity Map
US 24 West
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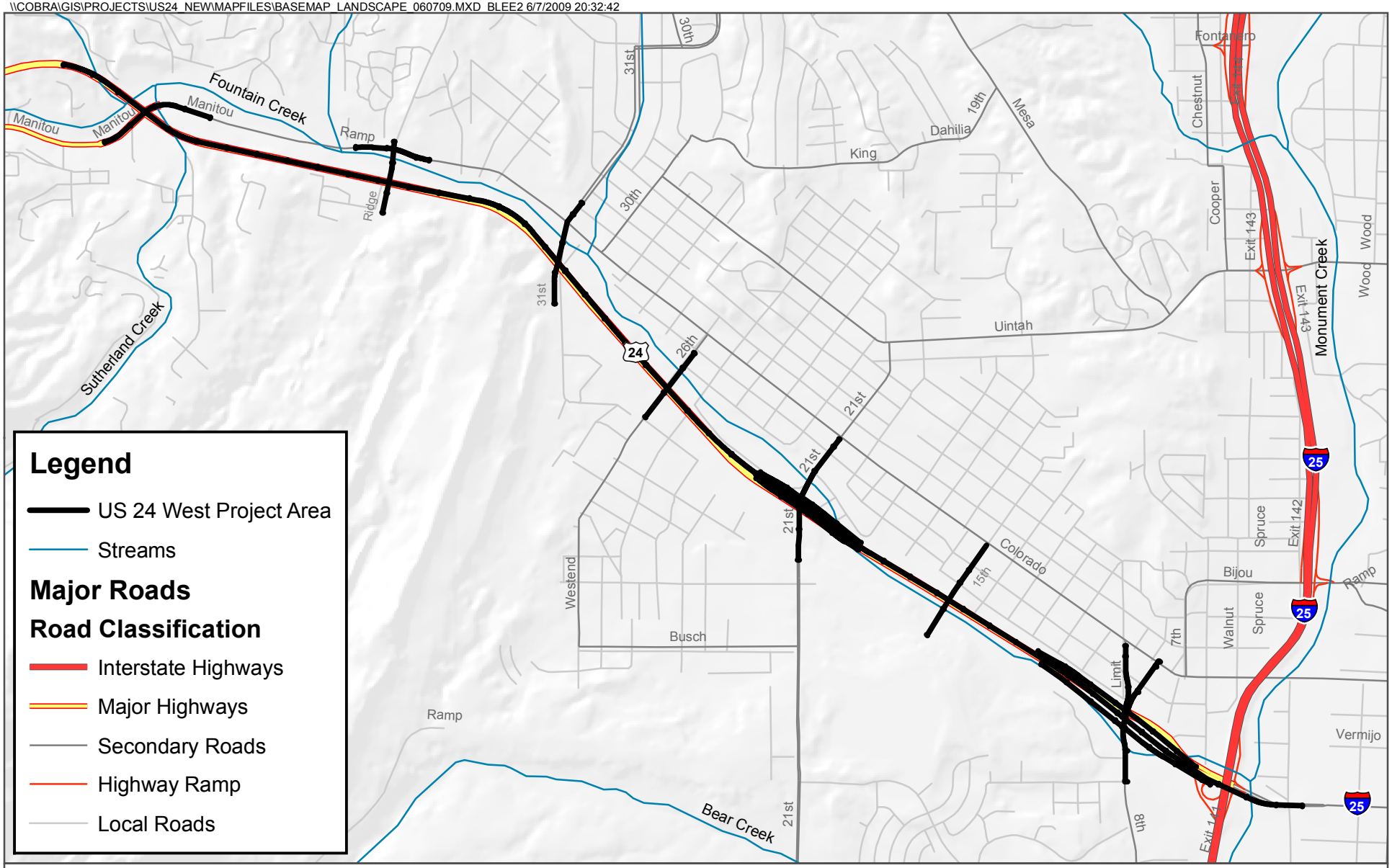

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0 1,000 2,000 Feet

Figure 2
Basemap
US 24 West

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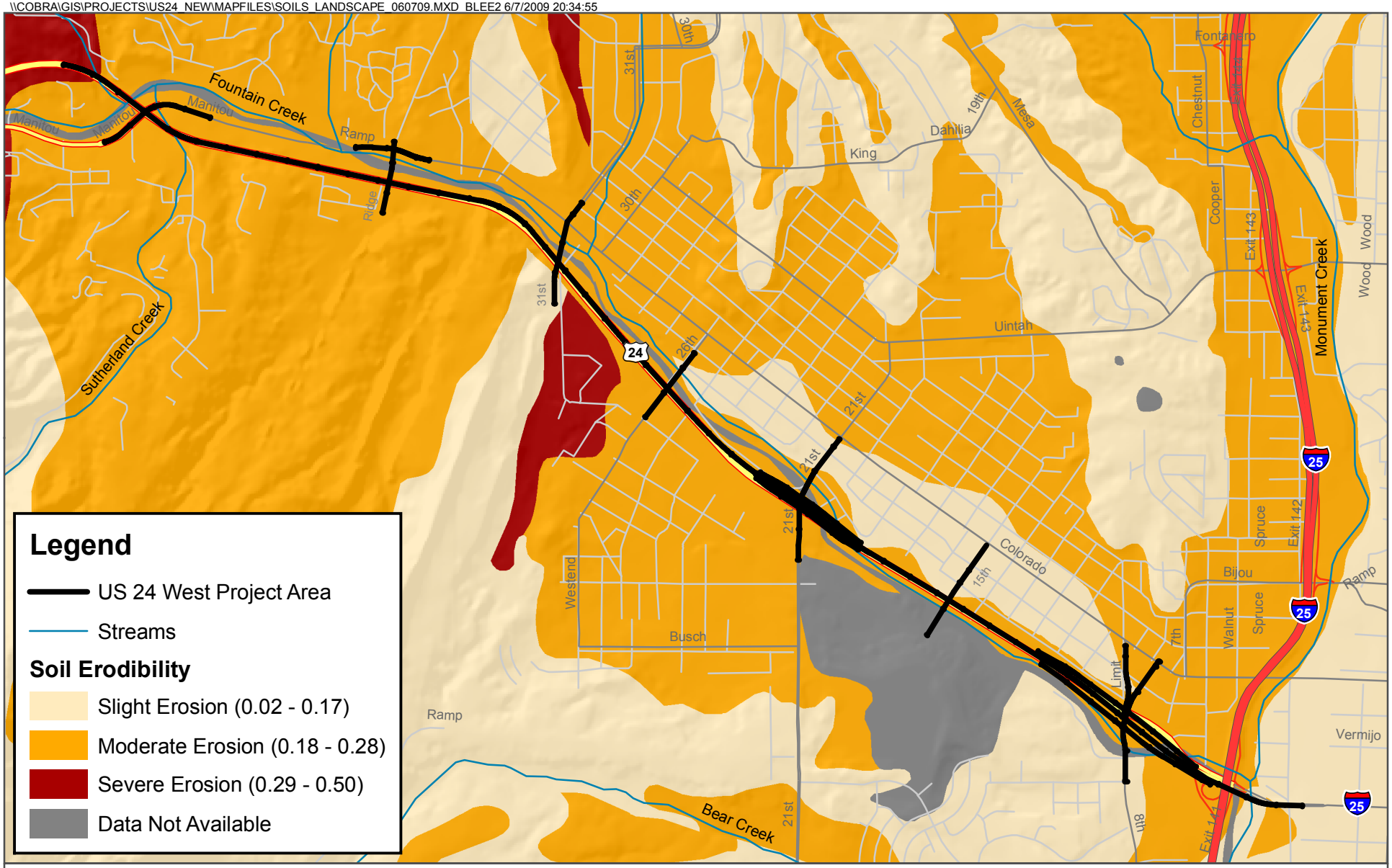

Figure 3
Soil Erodbility Map
US 24 West

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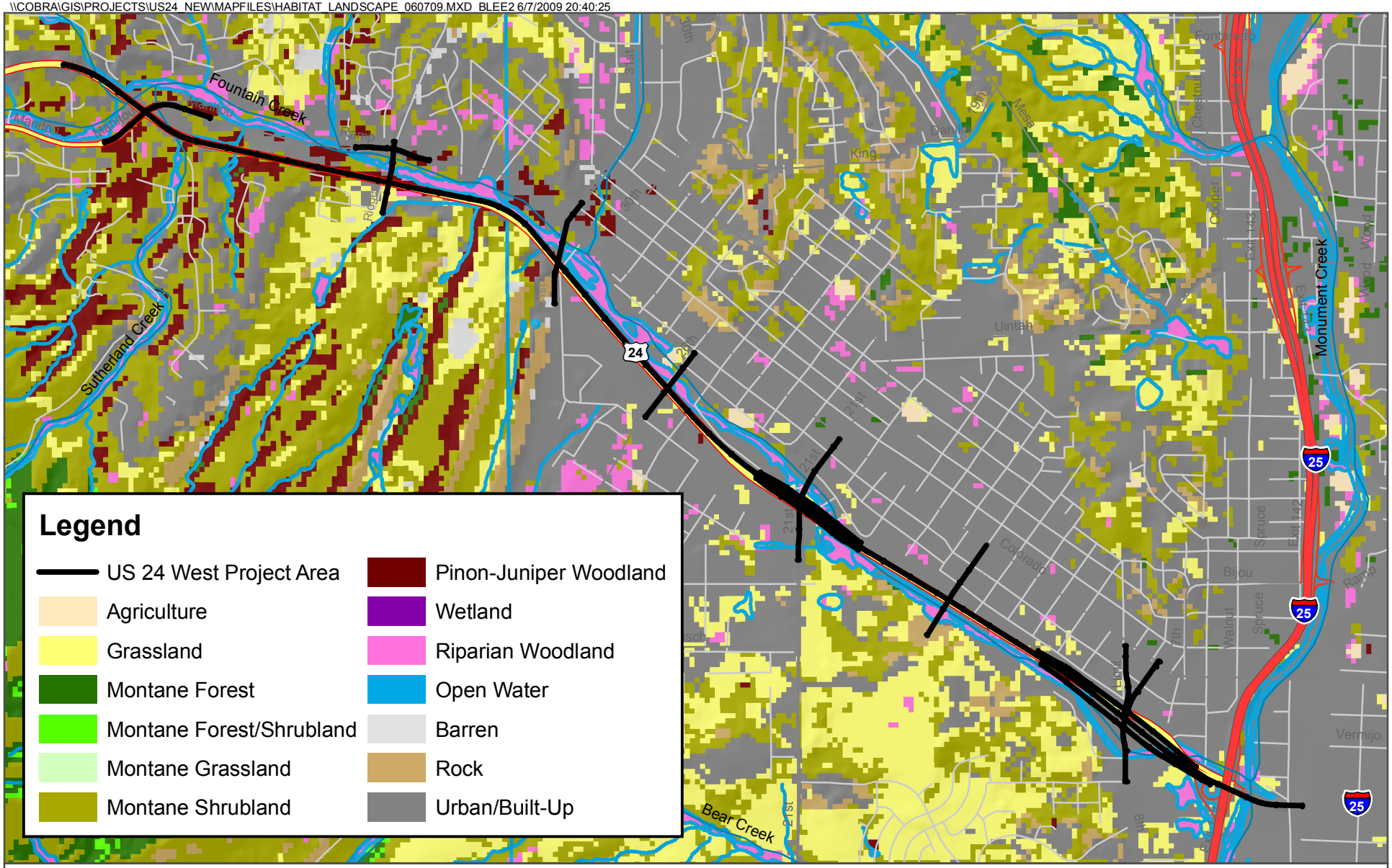

Figure 4
Habitat Map
US 24 West

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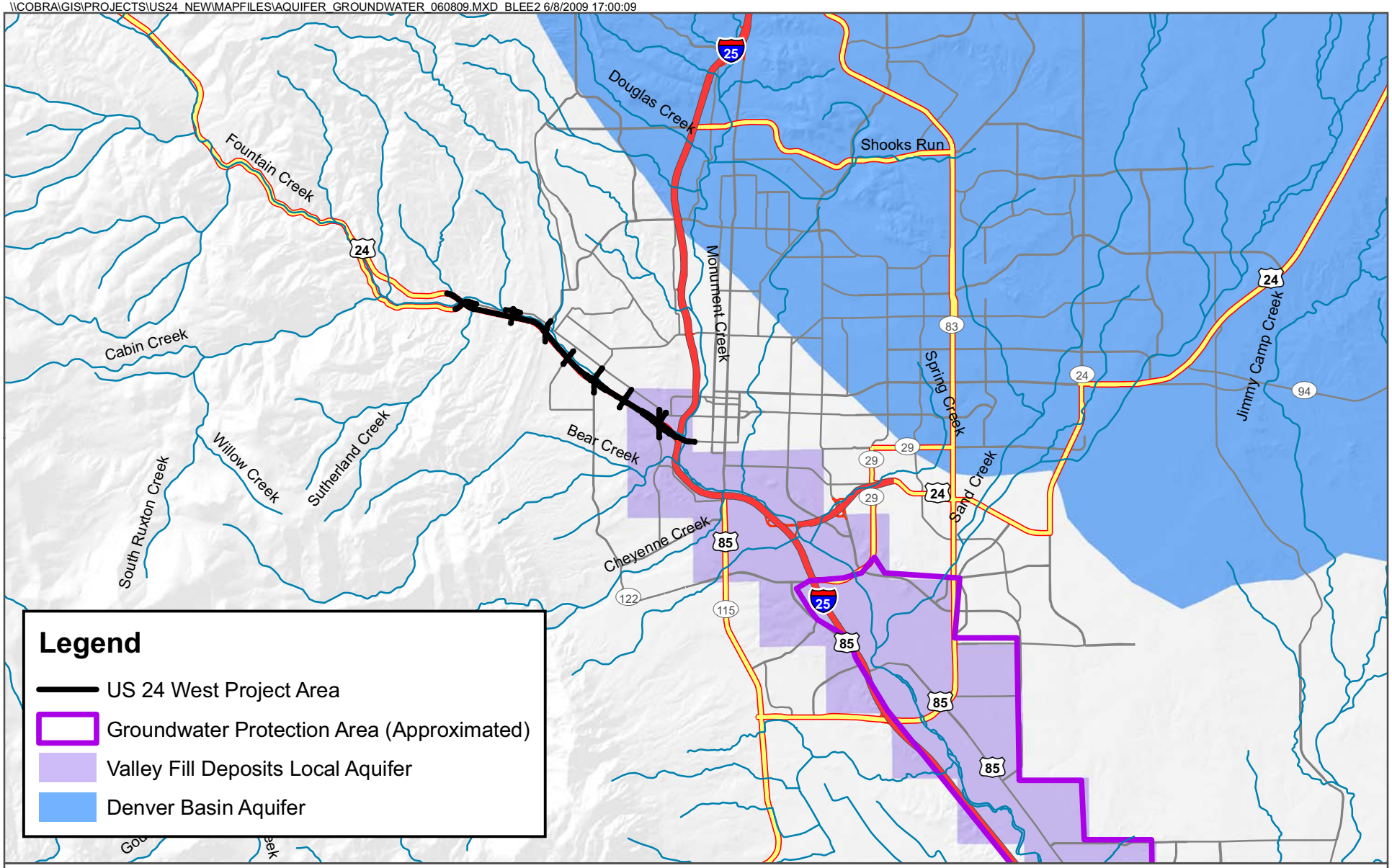

Figure 5
Aquifer and Groundwater Map
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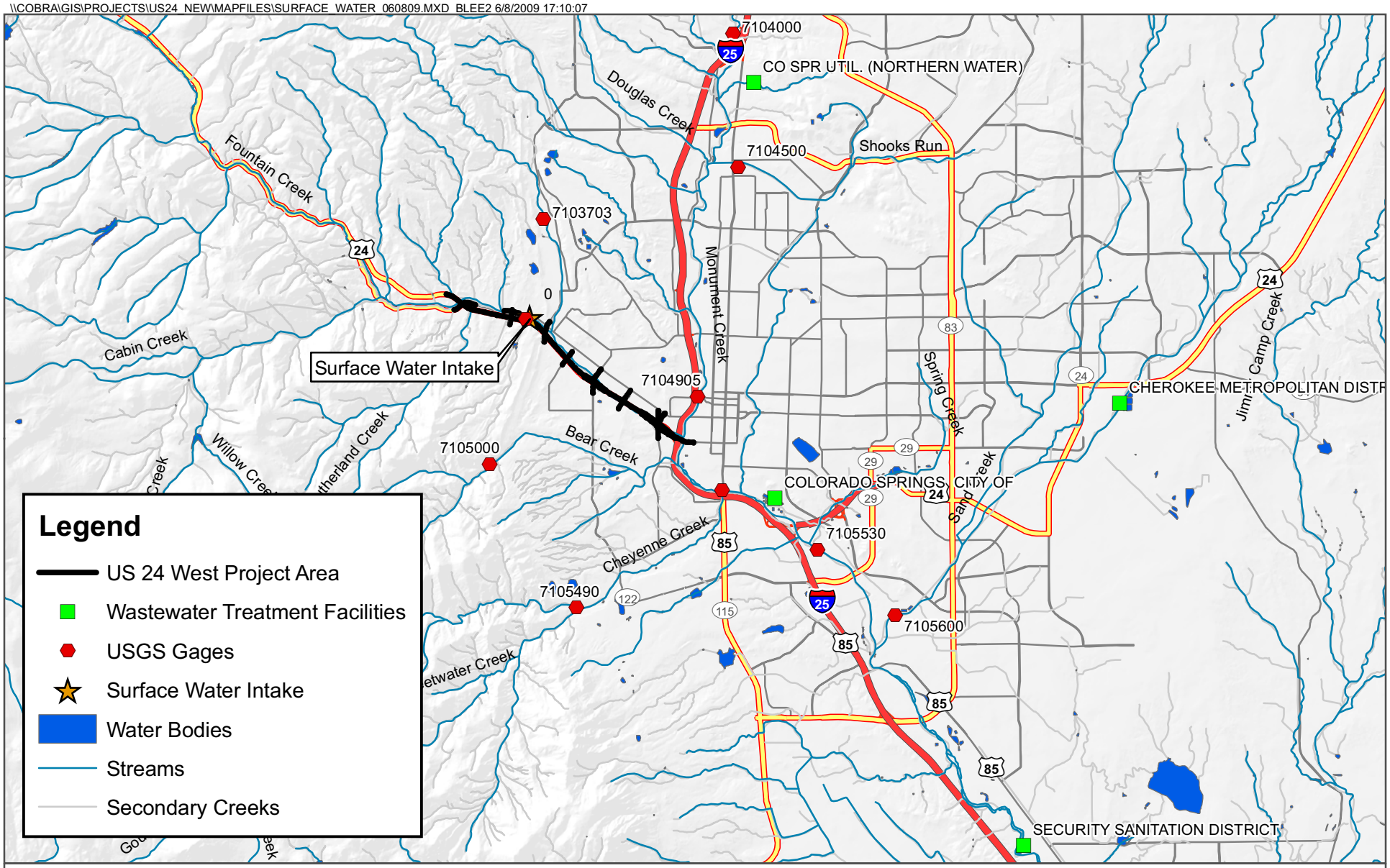

Figure 6
Surface Water Map
US 24 West

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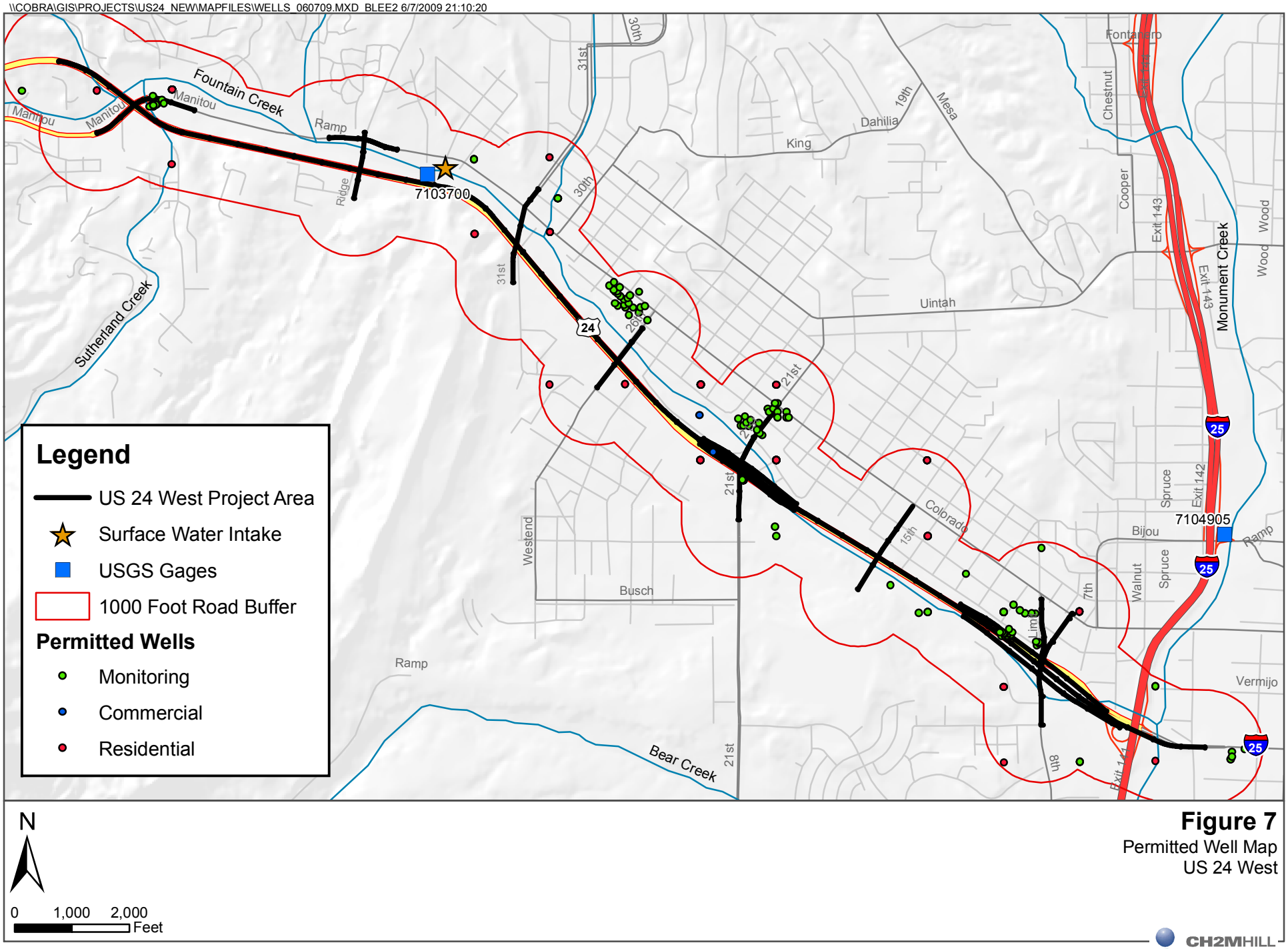
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US 24 West Project Area
Surface Water Intake
USGS Gages
1000 Foot Road Buffer
Permitted Wells
Monitoring
Commercial
Residential
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7104905
Fountain Creek
Manitou
Ramp
Ridge
Sutherland Creek
30th
31st
King
Dahlia
19th
Mesa
Fontanero
Chestnut
Cooper
Exit 143
Monument Creek
Wood
Uintah
24
26th
21st
Colorado
15th
Westend
Busch
Bijou
Spruce
Exit 142
Walnut
7th
Limit
8th
Vermijo
Bear Creek
25
N
0
1,000
2,000
Feet
Figure 7
Permitted Well Map
US 24 West
CH2MHILL

APPENDIX B

Well Data

TABLE B-1

Wells within 1000 Feet of the Study Area

Permit Number	Date Received	Water Dist.	Name	Use	Yield (GPM)	Depth (feet)	Level (feet)	Elev. (feet)	UTM X (Meters)	UTM Y (Meters)
0		10	GOODSON AND ASSOCIATES INC	Monitoring	0.00	33	0	0	510832.1	4300739.6
0		10	NGUYEN QUAN VAN	Monitoring	0.00	34	0	0	514033.8	4298319.6
5	10/24/2005	10	WASHINGTON ELEMETARY	Gravel Pit	0.00	300	0	0	513835.9	4298659.5
1262		10	BOCK JOHN	Residential	10.00	20	0	0	510832.4	4300343.1
1263		10	BOCK JOHN	Residential	5.00	200	0	0	510832.4	4300343.1
1805		10	PRATT VIRGIL	Residential	17.00	46	14	0	513630.2	4297921.1
6306	10/14/1958	10	DOLEZAL KISA N	Crop Irrigation	10.00	24	19	0	513230.8	4299126.1
8139		10	MC CLURG ROY C.	Monitoring	0.00	0	0	0	508433.0	4301115.0
8546		10	DIGMAN JAMES W	Residential	8.00	30	12	0	511234.0	4300746.1
11328	12/2/1966	10	BREWER F	Commercial	10.00	30	12	0	512022.5	4299374.1
14956		10	WASHAM FRANK	Residential	8.00	27	9	0	511233.9	4300349.6
17039		10	BRITZMAN HELEN	Residential	5.00	59	47	0	512430.8	4299533.1
18361		10	COOL HOWARD	Residential	2.00	50	20	0	513230.8	4299126.1
18485	12/5/1991	10	LEISURE TIME MANAGEMENT	Monitoring	0.00	0	0	0	514031.5	4297523.6
18585	1/14/1992	10	AMOCO OIL CO	Monitoring	0.00	0	0	0	511233.9	4300349.6
18720		10	HUMANE SOCIETY OF PIKES P	Residential	8.00	33	14	0	514433.9	4297526.1
19263		10	PIERCE SILVA L & RUTH A	Residential	0.00	120	0	0	513229.8	4298725.6
19580		10	STEVENSON JOHN	Residential	5.00	50	25	0	511233.9	4300349.6
19618		10	GROVES THEODORE	Residential	15.00	10	0	0	508831.1	4301116.5
19950	10/23/1992	10	TEXACO REFINING & MARKETING	Monitoring	0.00	0	0	0	512427.6	4299133.1
19996		10	BEHRNS E D	Residential	0.00	53	0	0	513230.8	4299126.1
20210		10	PANICCO ARTHUR F	Residential	6.00	40	32	0	514033.8	4298319.6
20244		10	ELLISON VIDA F	Residential	10.00	150	18	0	509229.2	4301118.1
20645	5/4/1993	10	STONEBRIDGE MIDLAND LTD	Monitoring	0.00	14	0	0	513432.3	4298522.6
20867	6/16/1993	10	AMOCO OIL COMPANY	Monitoring	0.00	0	0	0	511233.9	4300349.6
20956	6/24/1993	10	DIAMOND SHAMROCK	Monitoring	0.00	0	0	0	511631.8	4299946.1
21174		10	STAMMEN JOE F	Residential	5.00	33	16	0	511234.0	4300746.1
21705	10/14/1993	10	SCHOENTHALER DARELL & HELEN	Monitoring	0.00	15	0	6220	509229.2	4301118.1
22323		10	KNOX GEORGE & SONS INC	Residential	6.00	30	9	0	512029.4	4299538.1
22670	3/30/1994	10	FARMCREST MILK STORES	Monitoring	0.00	27	21	6060	512430.8	4299533.1
22831		10	HISKEY HAROLD F	Residential	3.00	31	21	0	512029.4	4299538.1
23489		10	WISEMAN MAUDE	Residential	3.00	50	29	0	513629.2	4297521.1
23720		10	LUCUS JOHN	Residential	3.00	50	16	0	512029.4	4299538.1
23721		10	LUCUS GEORGE	Residential	3.00	50	10	0	512430.8	4299533.1
23854		10	ROBINSON GWENDOLYN P	Residential	0.00	75	0	0	513230.8	4299126.1
23855		10	DULAPA JOHN J	Residential	0.00	105	0	0	513230.8	4299126.1
25129	2/2/1995	10	AMOCO OIL CO STATION 5494	Monitoring	0.00	0	0	0	511233.9	4300349.6
26223		10	SCHROYER JOHN & WILSON W	Residential	15.00	60	12	0	512025.8	4299136.1
26223	12/14/1983	10	BORCHERT/GRIFF	Residential	0.00	0	0	0	512029.4	4299538.1
27456	2/22/1996	10	POWER RENTAL SOUTH	Monitoring	0.00	52	44	0	514832.3	4297532.6
28579	6/28/1996	10	COOK PETER/BANC COMMERCIAL	Monitoring	0.00	0	0	0	514031.5	4297523.6
28848		10	RICHTER ORVILLE	Residential	5.00	34	30	0	511627.9	4299542.6
29083		10	REED CARL J	Residential	1.00	105	12	0	509225.0	4300722.0
30061	2/13/1997	10	COLORADO SPRINGS CITY OF	Monitoring	0.00	35	23	6020	514031.5	4297523.6
30084		10	SCIONEAUX EDWIN	Residential	0.00	40	0	0	513229.8	4298725.6
30265		10	PORTER DAVID L	Residential	8.00	63	21	0	514033.8	4298319.6
30380		10	GOFFE WILKINS MARINE CO	Residential	8.00	38	10	0	512025.8	4299136.1
30620	5/6/1997	10	COLO SPRINGS CITY OF	Monitoring	0.00	0	0	0	511631.8	4299946.1
30701		10	WALTERS RALPH	Residential	14.00	50	25	0	511627.9	4299542.6
30772	5/27/1997	10	COLORADO SPRINGS CITY OF	Monitoring	0.00	49	0	5980	514832.3	4297532.6
31341		10	STAG LUMBER CO	Residential	10.00	57	28	0	511227.8	4299542.1
31673	9/11/1997	10	VANNGUYEN QUAN	Monitoring	0.00	0	0	0	514033.8	4298319.6
32761	2/19/1998	10	BILLS TOOL RENTAL	Monitoring	0.00	14	10	5970	514033.8	4298319.6
33295		10	APACHE CAMPING CENTER	Residential	6.00	38	10	0	512025.8	4299136.1
33547	5/29/1998	10	SINCLSIR OIL CORP	Monitoring	0.00	14	6	6230	508831.1	4301116.5
33917	7/14/1998	10	COLORADO SPRINGS CITY OF	Monitoring	0.00	0	0	0	514435.1	4297921.6
34325	11/3/1988	10	ENSR	Monitoring	0.00	0	0	0	512418.5	4298780.6
34326	11/3/1988	10	ENSR	Monitoring	0.00	0	0	0	513179.4	4298317.6
35373	12/22/1998	10	GOLD HILL MESA JV LLC	Monitoring	10.00	22	0	6018	513228.8	4298323.1
35785	3/12/1999	10	212 CORPORATION	Monitoring	0.00	19	13	6090	512427.6	4299133.1
36476	6/28/1999	10	KOSCOVE MARVIN & SUE ELLEN	Monitoring	0.00	18	9	5950	514033.8	4298319.6
36667	7/26/1999	10	AP HARLEY LTD	Monitoring	0.00	15	0	5960	514435.1	4297921.6
36717	8/4/1999	10	HIGH COUNTRY HOLDINGS	Monitoring	0.00	0	0	0	511233.9	4300349.6
36987		10	HOOGEBOOM CONST CO	Residential	10.00	210	140	0	513229.8	4298725.6
Permit Number	**Date Received**	**Water Dist.**	**Name**	**Use**	**Yield (GPM)**	**Depth (feet)**	**Level (feet)**	**Elev. (feet)**	**UTM X (Meters)**	**UTM Y (Meters)**
37372	11/15/1999	10	212 CORPORATION	Monitoring	0.00	18	12	6090	512427.6	4299133.1
38015	4/3/2000	10	ERSH LLC	Monitoring	0.00	25	11	5998	513228.8	4298323.1
38016	4/3/2000	10	ERSH LLC	Monitoring	0.00	40	21	6075	512425.2	4298730.6
38143	11/5/1990	10	WOODWARD-CLYDE CONSULTANTS	Monitoring	0.00	0	0	0	514939.3	4297581.1

TABLE B-1

Wells within 1000 Feet of the Study Area

Permit Number	Date Received	Water Dist.	Name	Use	Yield (GPM)	Depth (feet)	Level (feet)	Elev. (feet)	UTM X (Meters)	UTM Y (Meters)
38380	5/19/2000	10	CHIEF PETROLEUM	Monitoring	0.00	19	6	5985	513631.3	4298321.1
39026	11/15/2000	10	CYSTAL HILLS SERVICE CENTER	Monitoring	0.00	0	0	0	509229.2	4301118.1
39276	2/7/2001	10	CHIEF PETROLEUM	Monitoring	0.00	20	8	5983	513631.3	4298321.1
39307	4/15/1991	10	WOODWARD-CLYDE CONSULTANTS	Monitoring	0.00	0	0	0	514907.4	4297585.1
39308	4/15/1991	10	WOODWARD-CLYDE CONSULTANTS	Monitoring	0.00	0	0	0	514838.7	4297569.6
39309	4/15/1991	10	WOODWARD-CLYDE CONSULTANTS	Monitoring	0.00	0	0	0	514838.7	4297545.1
39547	4/5/2001	10	KOSCOVE CAROL & JACK	Monitoring	0.00	0	0	0	513631.3	4298321.1
39677	5/4/2001	10	WORLD MAXX INC	Monitoring	0.00	25	17	0	512427.6	4299133.1
40415	1/8/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	8	0	513631.3	4298321.1
40612	3/11/2002	10	CO DEPT OF TRANSPORTATION	Monitoring	0.00	10	5	0	509146.0	4301040.0
41127	8/15/2002	10	CYRSTAL HILLS SERVICE CENTER	Monitoring	0.00	0	0	0	509229.2	4301118.1
41569	12/4/2002	10	CHIEF PETROLEUM	Monitoring	0.00	0	0	0	513631.3	4298321.1
42042	4/15/2003	10	SHELL OIL PRODUCTS US	Monitoring	0.00	31	0	0	512427.6	4299133.1
42082	4/28/2003	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	0	0	0	509229.2	4301118.0
42083	4/28/2003	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	0	0	0	509229.2	4301118.0
42465	8/19/2003	10	AUTO MAX	Monitoring	0.00	0	0	0	512427.6	4299133.1
42710	10/16/2003	10	CRYSTAL HILLS ERVICE CENTER	Monitoring	0.00	0	0	0	509229.2	4301118.0
42887	11/20/2003	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	0	0	0	509229.2	4301118.1
43207	5/15/2003	10	CONOCO PHILLIPS COMPANY	Monitoring	0.00	0	0	0	514031.5	4297523.5
43470	5/4/2004	10	JFRCO LLC	Monitoring	0.00	15	0	0	510832.1	4300739.5
43782	7/13/2004	10	SHELL OIL PRODUCTS US	Monitoring	0.00	0	0	0	512427.6	4299133.0
44059	9/9/2004	10	JOSEPH FELIX REALTY CO	Monitoring	0.00	0	0	0	510832.1	4300739.5
44937	5/2/2005	10	JFRCO INC	Monitoring	0.00	0	0	0	510832.1	4300740.0
46062	3/28/2006	10	ICELAND INVESTMENTS TRUST LLC	Monitoring	0.00	24	20	0	513630.3	4297921.0
46196	5/12/2006	10	ZIZ CORPORATION	Monitoring	0.00	17130	0	5	512336.3	4299331.0
46329	6/7/1971	10	COLORADO BUGGY BUILDERS INC	Residential	0.00	0	0	0	512427.6	4299133.1
47598	12/28/2007	10	CO DEPARTMENT OF AGRICULTURE	Monitoring	0.00	0	0	0	513230.8	4299126.0
49842		10	WILLSON W P	Residential	0.00	0	0	0	512029.4	4299538.1
50588	1/5/1972	10	CHURCH BYRON	Residential	15.00	50	15	0	512025.8	4299136.1
132364	8/4/1983	10	MCLAUGHLIN G M	Commercial	0.00	0	0	0	513630.2	4297921.1
168141	12/31/1992	10	IBEW LOCAL UNION 113	Commercial	20.00	50	15	0	512093.8	4299178.6
168195	12/17/1992	10	TEXACO	Monitoring	0.00	32	0	0	512251.9	4299025.1
168196	12/17/1992	10	TEXACO	Monitoring	0.00	32	0	0	512251.9	4299025.1
168197	12/17/1992	10	TEXACO	Monitoring	0.00	33	0	0	512251.9	4299025.1
168198	12/17/1992	10	TEXACO	Monitoring	0.00	30	0	0	512251.9	4299025.1
168199	12/17/1992	10	TEXACO	Monitoring	0.00	32	0	0	512251.9	4299025.1
168200	12/17/1992	10	TEXACO	Monitoring	0.00	31	0	0	512251.9	4299025.1
177767	4/29/1994	10	AMOCO OIL COMANY STATION #5494	Monitoring	0.00	15	0	0	511275.2	4300530.1
177768	4/29/1994	10	AMOCO OIL COMANY STATION #5494	Monitoring	0.00	15	0	0	511275.2	4300530.1
177769	4/29/1994	10	AMOCO OIL COMANY STATION #5494	Monitoring	0.00	13	0	0	511275.2	4300530.1
177770	4/29/1994	10	AMOCO OIL COMANY STATION #5494	Monitoring	0.00	19	0	0	511275.2	4300530.1
177771	4/29/1994	10	AMOCO OIL COMANY STATION #5494	Monitoring	0.00	19	0	0	511275.2	4300530.1
177772	4/29/1994	10	AMOCO OIL COMANY STATION #5494	Monitoring	0.00	20	0	0	511275.2	4300530.1
181774	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	22	0	511571.2	4300084.1
181775	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	29	23	0	511579.5	4300032.1
181776	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	30	22	0	511591.3	4300022.1
181777	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	23	0	511600.5	4300055.6
181778	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	22	0	511568.9	4300041.6
181779	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	29	23	0	511587.2	4300036.1
181780	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	19	0	511591.0	4299958.1
181781	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	27	19	0	511576.5	4299970.6
181782	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	27	22	0	511605.8	4300007.6
Permit Number	**Date Received**	**Water Dist.**	**Name**	**Use**	**Yield (GPM)**	**Depth (feet)**	**Level (feet)**	**Elev. (feet)**	**UTM X (Meters)**	**UTM Y (Meters)**
181783	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	20	0	511623.9	4299991.6
181784	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	20	0	511643.2	4299998.1
181785	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	19	0	511625.4	4299960.6
181786	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	18	0	511648.1	4299970.1

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Wells within 1000 Feet of the Study Area

Permit Number	Date Received	Water Dist.	Name	Use	Yield (GPM)	Depth (feet)	Level (feet)	Elev. (feet)	UTM X (Meters)	UTM Y (Meters)
181787	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	27	18	0	511672.9	4299948.1
181788	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	25	21	0	511654.6	4300012.1
181789	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	0	0	511712.5	4299948.1
181790	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	19	0	511701.9	4299922.6
181791	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	26	17	0	511649.9	4299907.6
181792	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	20	0	511747.8	4299881.1
181793	8/30/1994	10	DIAMOND SHAMROCK	Monitoring	0.00	28	23	0	511547.5	4300065.1
184889	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	22	0	512414.4	4299405.1
184890	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	23	0	512414.4	4299405.1
184891	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	21	0	512414.4	4299405.1
184892	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	21	0	512414.4	4299405.1
184893	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	21	0	512414.4	4299405.1
184894	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	21	0	512414.4	4299405.1
184895	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	23	0	512414.4	4299405.1
184896	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	30	21	0	512414.4	4299405.1
184897	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	25	19	0	512384.0	4299405.6
184898	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	24	18	0	512391.5	4299390.1
184899	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	25	20	0	512422.0	4299397.6
184900	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	27	21	0	512414.4	4299405.1
184901	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	27	21	0	512437.2	4299390.1
184902	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	29	22	0	512490.4	4299359.1
184903	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	29	21	0	512482.9	4299389.6
184904	1/23/1995	10	FARM CREST MILK STORES	Monitoring	23.00	30	0	0	512437.5	4299435.6
184905	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	25	19	0	512437.0	4299359.6
184906	1/23/1995	10	FARM CREST MILK STORES	Monitoring	0.00	29	23	0	512422.3	4299435.6
192526	10/13/1995	10	SCHOENTHALER HELEN & DARRELL	Monitoring	0.00	0	0	0	509125.3	4301040.5
192527	10/13/1995	10	SCHOENTHALER HELEN & DARRELL	Monitoring	0.00	0	0	0	509125.3	4301040.5
192528	10/13/1995	10	SCHOENTHALER HELEN & DARRELL	Monitoring	0.00	0	0	0	509125.3	4301040.5
192529	10/13/1995	10	SCHOENTHALER HELEN & DARRELL	Monitoring	0.00	0	0	0	509125.3	4301040.5
192530	10/13/1995	10	SCHOENTHALER HELEN & DARRELL	Monitoring	0.00	0	0	0	509125.3	4301040.5
193541	1/31/1996	10	FARMCREST MILK STORES	Monitoring	0.00	28	21	0	512494.9	4299359.1
193542	1/31/1996	10	FARMCREST MILK STORES	Monitoring	0.00	28	21	0	512482.7	4299359.1
201306	1/29/1997	10	POWER RENTAL SOUTH	Monitoring	0.00	49	0	0	514939.5	4297642.1
201307	1/29/1997	10	POWER RENTAL SOUTH	Monitoring	0.00	53	0	0	514939.5	4297642.1
201308	1/29/1997	10	POWER RENTAL SOUTH	Monitoring	0.00	49	0	0	514939.5	4297642.1
209527	4/17/1998	10	DIAMOND SHAMROCK REFINING/MARKETING	Monitoring	0.00	0	0	0	511706.0	4300031.6
209528	4/17/1998	10	DIAMOND SHAMROCK REFINING/MARKETING	Monitoring	0.00	0	0	0	511735.7	4299954.6
213719	8/19/1998	10	POWER RENTAL SOUTH	Monitoring	0.00	49	0	0	514924.3	4297641.6
215677	2/9/1999	10	GOLD HILL MESA % DAMES & MOORE	Monitoring	0.00	22	10	6018	513031.9	4298466.1
227714	7/20/2000	10	AUTO MAX	Monitoring	0.00	19	13	0	512270.7	4299334.6
227715	7/20/2000	10	AUTO MAX	Monitoring	0.00	19	13	0	512241.7	4299318.1
227716	7/20/2000	10	AUTO MAX	Monitoring	0.00	19	17	0	512281.3	4299317.6
227717	7/20/2000	10	AUTO MAX	Monitoring	0.00	0	0	0	512264.5	4299365.1
227718	7/20/2000	10	AUTO MAX	Monitoring	0.00	0	0	0	512325.9	4299294.6
228831	9/14/2000	10	AUTO MAX	Monitoring	0.00	20	11	6090	512340.1	4299277.1
228832	9/14/2000	10	AUTO MAX	Monitoring	0.00	20	15	6090	512227.6	4299354.1
230835	12/20/2000	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	20	0	6225	509153.4	4301044.5
230836	12/20/2000	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	14	11	6225	509129.3	4301030.5
230837	12/20/2000	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	11	0	6225	509130.5	4301029.0
230838	12/20/2000	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	11	3	6225	509109.2	4301027.5
230839	12/20/2000	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	24	0	0	509127.1	4301084.0
231994	3/1/2001	10	CHIEF PETROLEUM	Monitoring	0.00	14	6	0	513819.9	4298148.6
231995	3/1/2001	10	CHIEF PETROLEUM	Monitoring	0.00	14	7	0	513803.8	4298160.1
232154	3/1/2001	10	CHIEF PETROLEUM	Monitoring	0.00	20	6	0	513683.9	4298358.1
Permit Number	**Date Received**	**Water Dist.**	**Name**	**Use**	**Yield (GPM)**	**Depth (feet)**	**Level (feet)**	**Elev. (feet)**	**UTM X (Meters)**	**UTM Y (Meters)**
232155	3/1/2001	10	CHIEF PETROLEUM	Monitoring	0.00	15	8	0	513718.3	4298328.1
232156	3/1/2001	10	CHIEF PETROLEUM	Monitoring	5.00	8	0	0	513745.4	4298313.1
233579	5/11/2001	10	CHIEF PETROLEUM	Monitoring	0.00	15	8	5984	513801.7	4298311.1
233580	5/11/2001	10	CHIEF PETROLEUM	Monitoring	0.00	15	8	5984	513780.1	4298312.6
234552	7/5/2001	10	AUTO MAX	Monitoring	0.00	25	17	0	512354.4	4299265.1

TABLE B-1
Wells within 1000 Feet of the Study Area

Permit Number	Date Received	Water Dist.	Name	Use	Yield (GPM)	Depth (feet)	Level (feet)	Elev. (feet)	UTM X (Meters)	UTM Y (Meters)
239227	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	11	0	513807.1	4298143.6
239228	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	10	0	513819.0	4298159.6
239764	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	8	0	513660.6	4298189.6
239765	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	9	0	513648.4	4298195.6
239766	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	8	0	513630.2	4298208.1
239767	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	9	0	513660.7	4298229.1
239768	2/25/2002	10	CHIEF PETROLEUM	Monitoring	0.00	16	9	0	513675.9	4298210.6
240962	4/8/2002	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	9	7	0	509135.4	4301039.5
240963	4/8/2002	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	10	6	0	509153.9	4301049.5
240964	4/8/2002	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	10	5	0	509146.0	4301040.0
244642	9/26/2002	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	10	3	0	509130.2	4301034.5
247121	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513672.5	4298200.1
247122	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513655.5	4298205.6
247123	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513657.6	4298194.1
247124	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513639.3	4298206.6
247125	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513637.8	4298194.6
247126	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513622.6	4298210.6
247127	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513619.8	4298193.6
247128	1/10/2003	10	CHIEF PETROLEUM	Monitoring	0.00	20	0	0	513610.1	4298211.1
254471	11/3/2003	10	AUTO MAX	Monitoring	0.00	20	0	0	512284.3	4299314.6
254472	11/3/2003	10	AUTO MAX	Monitoring	0.00	19	0	0	512255.4	4299318.6
254473	11/3/2003	10	AUTO MAX	Monitoring	0.00	15	0	0	512294.3	4299347.6
254707	1/9/2004	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	10	0	0	509174.9	4301063.5
254708	1/9/2004	10	CRYSTAL HILLS SERVICE CENTER	Monitoring	0.00	8	0	0	509185.9	4301047.0
260036	9/2/2004	10	SHELL OIL PRODUCTS US	Monitoring	0.00	32	0	0	512250.8	4299027.0
260037	9/2/2004	10	SHELL OIL PRODUCTS US	Monitoring	0.00	27	0	0	512247.8	4299030.0

APPENDIX C

United States Geological Survey Water Quality Data

TABLE C-1
Summary Statistics for Selected Water Quality Constituents at USGS Station Number 7103700, Fountain Creek

Constituent	Units	Number of Values	Period of Record (month/ year)	Mean	Minimum	Median	Maximum	85th Percentile (for Dissolved WQS)	50th Percentile (for Total WQS)
Stream Width	ft	160	02/03-10/08	19.3	7	20	29	21.02	20
Instantaneous Discharge, water	ft^3/s	173	02/03-10/08	16.9	3.2	11	20	25.2	11
Water Temperature	°C	172	02/03-10/08	9.0	0	9.3	20	15.5	9.25
Specific Conductance, water, unfiltered	µS/cm	161	02/03-10/08	338.9	152	344	624	431	344
Dissolved Oxygen, water, unfiltered	mg/L	35	02/03-10/08	8.7	6.8	8.3	11.9	10.29	8.3
pH, water, unfiltered	Standard	38	02/03-10/08	8.1	7.6	8.1	8.6	8.4	8.15
Fecal Coliform Bacteria, m-TEC MF method, water	Colonies/ 100mL	93	02/03-10/08	2102. 5	30	200	54000	652	200
Ammonia as Nitrogen, water, filtered	mg/L	8	02/03-10/08	0.12	0.02	0.14	0.22	0.19	0.14
Nitrite Plus Nitrate as Nitrogen, water, filtered	mg/L	35	02/03-10/08	0.66	0.28	0.67	1.25	0.86	0.67
Phosphorus, water, unfiltered	mg/L	10	02/03-10/08	0.53	0.04	0.16	1.5	1.26	0.16
Sulfate, water, filtered	mg/L	28	02/03-10/08	13.88	6.13	13.1	22.4	18.96	13.1
Hardness as Calcium Carbonate	mg/L	28	02/03-10/08	102	47	105	170	149.5	105
Chromium, water, filtered	µg/L	1	02/03	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Iron, water, filtered	µg/L	1	02/03	17	17	17	17	17	17
Lead, water, filtered	µg/L	1	02/03	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Nickel, water, filtered	µg/L	1	02/03	1.95	1.95	1.95	1.95	1.95	1.95
Cadmium, water, filtered	µg/L	1	02/03	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Manganese, water, filtered	µg/L	34	02/03-10/08	18.4	2.7	17.4	44.9	26.89	17.4
Selenium, water, filtered	µg/L	19	02/03-10/08	0.24	0.09	0.18	0.7	0.44	0.18

Abbreviations: ft^3/s, cubic feet per second; µS/cm, microsiemens/cm at 25 °C; mg/L, milligrams per liter; µg/L, micrograms per liter; µg/L, micrograms per liter

APPENDIX D

BMP Pollutant Removal Ranges for Stormwater Runoff and Most Probable Range for BMPs

TABLE SQ-6

BMP Pollutant Removal Ranges for Stormwater Runoff and Most Probable Range for BMPs Recommended in Volume 3

Ref: Bell et al. (1996), Colorado (1990), Harper & Herr (1992), Lakatos & McNemer (1987), Schueler (1987), Southwest (1995), Strecker et al. (1990), USGS (1986), US EPA (1983), Veenhuis et al. (1989), Whipple and Hunter (1981), Urbonas (1997)

Type of BMP	(1)	TSS	TP	TN	TZ	TPb	BOD	Bacteria
Grass Buffer	LRR:	10-50	0-30	0-10	0-10	N/A	N/A	N/A
	EPR	**10-20**	**0-10**	**0-10**	**0-10**	N/A	N/A	N/A
Grass Swale	LRR:	20-60	0-40	0-30	0-40	N/A	N/A	N/A
	EPR	**20-40**	**0-15**	**0-15**	**0-20**	N/A	N/A	N/A
Modular Block Porous Pavement	LRR:	80-95	65	75-85	98	80	80	N/A
	EPR	**70-90**	**40-55**	**10-20**	**40-80**	**60-70**	N/A	N/A
Porous Pavement Detention	LRR:	8-96	5-92	-130-85	10-98	60-80	60-80	N/A
	EPR	**70-90**	**40-55**	**10-20**	**40-80**	**60-70**	N/A	N/A
Porous Landscape Detention	LRR:	8-96	5-92	-100-85	10-98	60-90	60-80	N/A
	EPR	**70-90**	**40-55**	**20-55**	**50-80**	**60-80**	N/A	N/A
Extended Detention Basin	LRR:	50-70	10-20	10-20	30-60	75-90	N/A	50-90
	EPR	**55-75**	**45-55**	**10-20**	**30-60**	**55-80**	N/A	N/A
Constructed Wetland Basin	LRR:	40-94	-4-90	21	-29-82	27-94	18	N/A
	EPR	**50-60**	**40-80**	**20-50**	**30-60**	**40-80**	N/A	N/A
Retention Pond	LRR:	70-91	0-79	0-80	0-71	9-95	0-69	N/A
	EPR	**80-90**	**45-70**	**20-60**	**20-60**	**60-80**	N/A	N/A
Sand Filter Extended Detention	LRR:	8-96	5-92	-129-84	10-98	60-80	60-80	N/A
	EPR	**80-90**	**45-55**	**35-55**	**50-80**	**60-80**	**60-80**	N/A
Constructed Wetland Channel*	LRR:	20-60	0-40	0-30	0-40	N/A	N/A	N/A
	EPR	**30-50**	**20-40**	**10-30**	**20-40**	**20-40**	N/A	N/A

(1) LRR Literature reported range, **EPR**— expected probable range of annual performance by Volume 3BMPs.
N/A Insufficient data to make an assessment.

***The EPR rates for a Constructed Wetland Channel assume the wetland surface area is equal or greater than 0.5% of the tributary total impervious area.**

APPENDIX E

Stormwater Quality Treatment Requirements and Recommendations

US 24 – Stormwater Quality Treatment Requirements and Recommendations

PREPARED FOR: Dirk Draper

PREPARED BY: Tyler Popp

COPIES: Doug Stewart

DATE: October 14, 2009

PROJECT NUMBER: 187824.06.EN.EN.WQ

The following is a discussion of CH2M HILL's analysis of the future drainage conditions and recommended water quality basin locations along the US 24 corridor from I-25 to Crystal Hill Blvd. The roadway features included in this analysis are a combination of roadway improvements to be constructed by CDOT and roadway improvements to be constructed by others. The recommendations provided assume both sets of roadway improvements.

See also CH2M HILL's Technical Memorandum "*US 24 West Environmental Assessment: Water Quality*," updated October 5, 2009, for additional information.

1. **Proposed US 24 Corridor Description**
   a. Proposed US 24 corridor improvements include new pavement widening, new ramp and bridge construction, new interchanges and overpasses, and intersection improvements. The area of proposed improvements extends from I-25 to approximately Crystal Hill Blvd. including interchanges at I-25, 8th Street, 15th Street, and 21st Street, and Ridge Road.
2. **Water Quality Requirements**
   a. Runoff from all paved surfaces will require stormwater quality treatment in the form of basins, swales, proprietary structures, or other approved treatment facilities to be constructed throughout the corridor. The proposed project is not funded for construction currently and likely would not be designed and built for several years. This analysis assumes current technologies for water quality treatment; other approaches may emerge prior to final design that would require consideration and may modify these recommendations.

   b. Right-of-way, embankment slopes, collection area, outfall conditions, and impacts to Fountain Creek must all be considered in selecting and placing the recommended water quality facilities.

3. At this preliminary level of analysis, it is assumed that all water quality treatment facilities will be basins, which are the most conservative treatment measures in terms of area required. In this manner, we are able to determine whether there is sufficient area within the CDOT right-of-way for the basins or if additional property is required. Future

analyses will determine whether alternative water quality treatment measures can be used to reduce the area impacted.

4. **Treatment Areas, Recommended Basin Locations, and Outfalls:**

Sta. 690+00-740+00

Multiple locations near the US 24 and I-25 interchange. Due to the large treatment area it is recommended that multiple locations be utilized to meet water quality capture requirements. These locations require minimum outfall piping due the close proximity of Fountain Creek and Monument Creek.

Sta. 660+00-690+00

Multiple locations parallel to US 24 on the north side of the highway. Due to the narrow width of the right-of-way on the north side of US 24 it is recommended that multiple locations be used within this segment to ensure required capacity can be met. The outfalls of any ponds designed within this segment would require a piped outfall south under US 24 to Fountain Creek.

Sta. 650+00-660+00

The proposed right of way within this segment provides areas north of US 24 for pond locations. This option is preferred due to limited right-of-way on the south side of US 24. Outfalls from the recommended area will require piping south under US 24 to Fountain Creek.

Sta. 620+00-650+00

Multiple locations north of US 24 are available within the large area of proposed right-of-way. These locations require minimal outfall piping to the north due to the close proximity of Fountain Creek. It is recommended that the area southeast of the US 24 – 21st Street interchange also be considered due to the possible piping scenario created by the complex interchange and side street improvements.

Sta. 595+00-620+00

There are limited locations available for stormwater quality treatment within this segment due to limited right-of-way and the close proximity of Fountain Creek to the roadway. A detailed study should be made within this area during final design to determine if the areas shown on the exhibit can fully contain the required water quality volume within basins. Other measures such as swales or proprietary systems may be required within this segment.

Sta. 565+00-595+00

Basin locations near the US 24 and 31st Street intersection are recommended due to the limited right of way south of US 24 and the close proximity of Fountain Creek to the north. These conditions restrict available area within the segment. The proposed basin locations will require outfall piping north to Fountain Creek.

Sta. 532+00-565+00

The Ridge Road - US 24 interchange layout provides four suitable areas for basin construction. It is recommended that these areas be considered not only for the treatment of the flows within the segment but also flows in adjoining segments that may require added capacity or alternative basin areas due to future design changes.

5. **Required Basin Volume**
   a. The exhibit for Stormwater Quality Treatment Areas shows shaded areas where water quality facilities could most feasibly be installed. The numbers adjacent to the triangles in Table 1 represent segments along the roadway that are tributary to the proposed treatment areas. The required volume of stormwater runoff to be treated was calculated within each segment. Exact locations for stormwater treatment facilities could be located anywhere within the shaded areas and will need to be refined and designed in future design phases of the project. Table 1 below shows an estimated volume of runoff to be treated within the designated segments along the US 24 corridor. The volume calculations are based on the equation $WQCV=a*(0.91i^3-1.19i^2+0.78i)$, which can be found in Volume 3 of the UDFCD Drainage Criteria Manual.

TABLE 1
Stormwater Treatment Volumes

US 24 Segment	Required Water Quality Basin Volume (cubic feet)
1. Sta. 690+00-740+00	57,000
2. Sta. 660+00-690+00	27,000
3. Sta. 650+00-660+00	6,500
4. Sta. 620+00-650+00	19,500
5. Sta. 595+00-620+00	16,250
6. Sta. 565+00-595+00	19,500
7. Sta. 532+00-565+00	21,450

6. **Design Summary and Conclusion**
   Stormwater runoff must be treated for sediment both during and after completion of construction. This technical memorandum presents possible permanent water quality measures, identifies locations throughout the corridor for their placement, and their estimated volume based on preliminary design assumptions.
   Dry water quality basins were chosen as the primary stormwater runoff treatment measure since they create a conservative estimate of the area required for their construction. Other measures can be selected to reduce the impact area of the facility.

   Possible basin locations were identified based on available space and constructability within the CDOT right-of-way. It will be up to future design efforts to identify the exact location of the water quality ponds or other water quality systems and their outfalls.