3.3.4 Water Quality

Federal water quality requirements were first instituted by the Federal Water Pollution Control Act (FWPCA) in 1972. Title IV of the FWPCA created the system for permitting wastewater discharges known as the National Pollutant Discharge Elimination System (NPDES) permit program. These permits place limits on the amount of pollutants that may be discharged to waters of the U.S. The limits are set at levels to protect aquatic life in the waters that receive the discharge, and human health. The first NPDES permits required non-municipal industrial facilities with point source discharges to meet technology-based limits (based on the ability of dischargers in the same industrial category to treat wastewater) or water quality-based limits (if technology-based limits are not sufficient to provide protection of the water body). Best available water quality technologies and cost were considered to form the basis of permit compliance. In 1977, legal challenges forced the reorganization of the FWPCA into what is now known as the Clean Water Act (CWA). These acts established water quality standards that tend to consist of three primary elements:

- Determination of the designated beneficial use or uses of a water body or section of a water body
- Determination of the water quality criteria necessary to protect the use or uses of that particular water body
- Determination of an anti-degradation policy

Many aspects of existing bodies of water are considered including naturally occurring pollutants, low-flow levels, and hydrologic modification.

The NPDES is currently contained under Section 402 of the CWA. Under the current NPDES program, all facilities that discharge pollutants from any point source into waters of the U.S. are required to obtain an NPDES permit. The State of Colorado was granted authority from the EPA to issue these permits and manage the NPDES program through the Colorado Department of Public Health and Environment's (CDPHE) Water Quality Control Division (WQCD). In Colorado, NPDES requirements are implemented through Colorado Regulation 61, Colorado Discharge Permit System Regulations (CDPS).

Development and implementation of a storm-water management plan (SWMP) is one of the main permit requirements. The SWMP contains structural and non-structural BMPs, which are an important component of the CDPS permit. Inclusion of BMPs on construction sites prevents most projects from exceeding state and federal sedimentation and water quality standards.

Another recently enacted permit requirement requires operators of regulated small municipal separate storm sewer systems (MS4) to obtain a CDPS permit and develop a SWMP designed to prevent harmful pollutants from being washed by stormwater runoff into the MS4 (or from being dumped directly into the MS4) and then discharged from the MS4 into local water bodies. The SWMP must address discharges during construction and after a facility is constructed. This permit requirement set forth immediate and stringent controls on construction activity discharges by requiring construction projects one acre or larger in size to secure a CDPS permit for stormwater discharges during construction.

Colorado Regulation Number 93, 2004 Section 303(d) List Water-Quality-Limited Segments Requiring Total Maximum Daily Loads, fulfills section 303(d) of the federal Clean Water Act and requires the WQCD to submit to the EPA a list of those state waters (or state water segments) for which technology-based effluent limitations and other required controls are not stringent enough to implement water quality standards set for use classifications under Regulation 31.

The total maximum daily load (TMDL) process is designed by the Federal Water Pollution Control Act (Clean Water Act) to ensure that all sources

of pollutant loading are accounted for when developing strategies to meet water quality standards. The TMDL itself is an estimate of the greatest amount of a specific pollutant that a water body or stream segment can receive without violating water quality standards. This amount includes a margin of safety, waste load allocation (for point sources), and a load allocation (for non-point sources and natural background). The TMDL process analyzes pollution sources and allocates responsibility among those sources.

Section 303(d) of the Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards with technology-based controls alone. This identification of water quality-limited waters is presented in a document called the 303(d) list, updated biennially. The 303(d) list identifies specific components (such as nitrate, copper, or sediment) and further identifies the specific water quality problem for that segment. TMDLs are required for all components listed for each stream segment on the 303(d) list.

Implementation of the TMDL process is the final step. The TMDL requires participation from all the stakeholders, as TMDLs are not self implementing. The Waste Load Allocation portion of the TMDL can be implemented through effluent limits in discharge permits. In the case of non-point sources, voluntary controls or locally enacted controls are necessary to implement the load allocations. The state must rely on authority already granted by the Clean Water Act to implement TMDLs.

3.3.4.1 Affected Environment

The South Platte River originates in the mountainous region of central Colorado at altitudes greater than 14,000 feet above sea level and flows generally eastward for 270 miles through the Front Range, the C-470 project area, and across Colorado's eastern plains. Numerous tributaries join the South Platte as it flows north and eastward toward the plains. The South Platte River basin covers over 23,900 square miles.

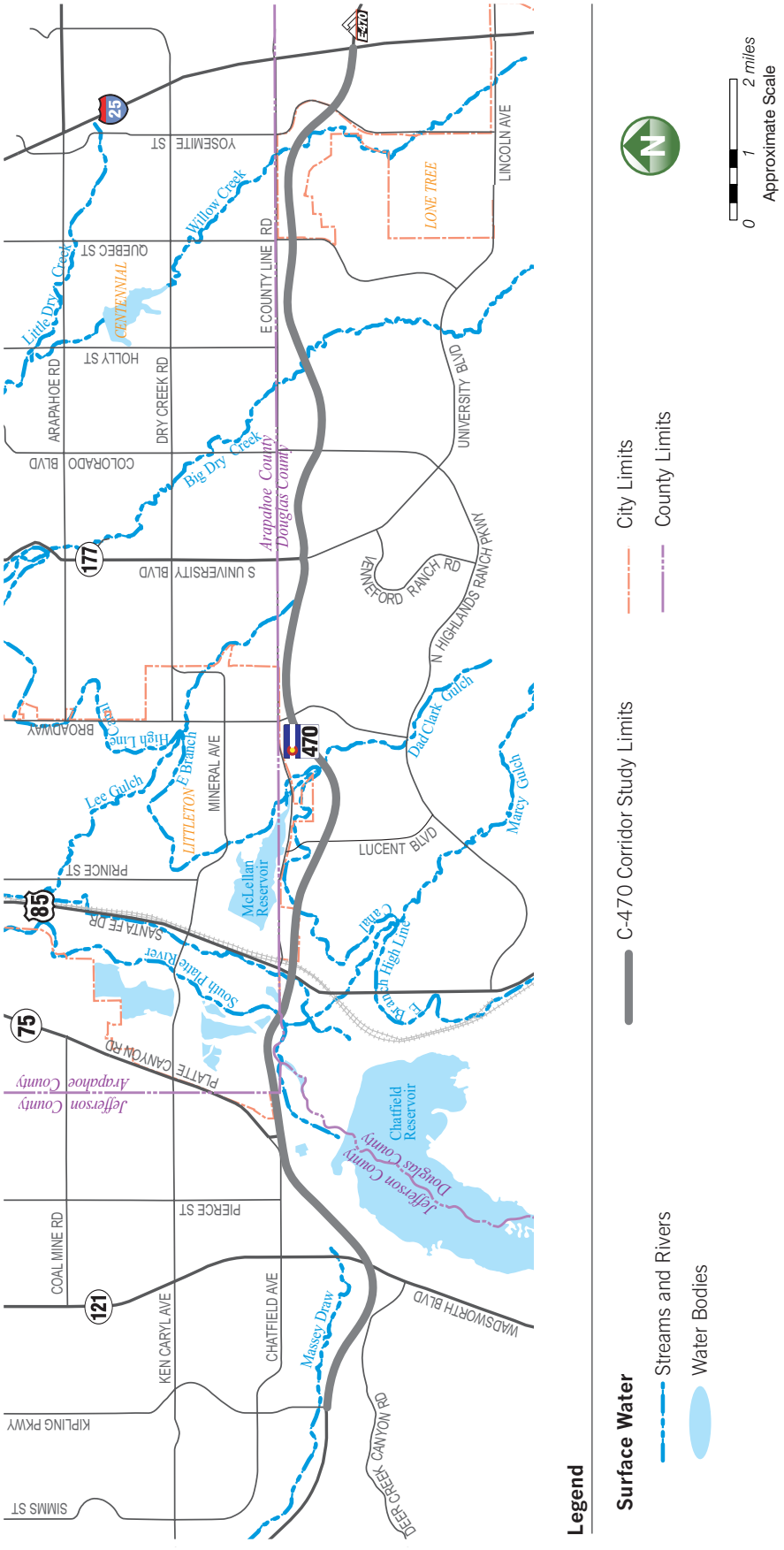
The C-470 project area is located in the Upper South Platte watershed. This watershed is characterized by high plains and rolling foothills, with elevations ranging from approximately 4,800 feet to 8,300 feet above mean sea level. The watershed is highly urbanized with little natural ground cover. The ground cover that does exist is mainly grass with some forested areas. Existing drainages can be characterized as sandy washes that flow intermittently, in response to spring snowmelt or high-intensity precipitation events. Permanent water flows in the South Platte River are a result of upstream dams.

Water quality conditions were investigated for the surface water resources in the project area including Massey Draw, South Platte River, Marcy Gulch, Chatfield Reservoir, McClellan Reservoir, Big Dry Creek, Dad Clark Gulch, and Willow Creek. Surface waters within the project area are shown in **Figure 3-18**. None of the surface water resources in the project area were listed as having water quality impairments based on the most recent CDPHE listing of impaired waters as of May 31, 2004. However, the South Platte River segment from Bowles Avenue to Burlington Ditch is on Colorado's Monitoring and Evaluation List for copper. This segment is located immediately downstream of segment 6c with the project area.

Surface Waters

Chatfield Reservoir is owned and operated by the USACE. It was built as a flood control reservoir on the South Platte in response to the floods of 1965 that caused millions of dollars of damage in the Denver area. The land surrounding Chatfield Reservoir is leased to the Colorado State Parks, which operates the Chatfield State Park Recreation Area. Denver Water uses its own water rights to fill and maintain water in Chatfield. Pursuant to an agreement with the State of Colorado, Denver Water manages its water to supply water for municipal needs, while also maintaining water levels for recreation.

Figure 3-18
Surface Water Resources



Source: U.S. Geological Survey

McClellan Reservoir is a man-made water storage facility located north of C-470 between Santa Fe Drive and Broadway. The reservoir acts as a drinking water supply for the City of Englewood and Highlands Ranch. The City of Englewood and Centennial Water and Sanitation District pump water directly from McClellan Reservoir to supply water to Highlands Ranch.

Chatfield Reservoir, the South Platte River, and McClellan Reservoir are classified by the CDPHE as Aquatic Life Cold Water 1, Recreation 1a, Water Supply, and Agriculture, as discussed in the following sections.

AQUATIC LIFE COLD WATER 1. These are waters that are currently capable of sustaining a wide variety of cold water biota, including sensitive species, or that could sustain such biota but for correctable water quality conditions. Waters shall be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.

RECREATION 1a. Recreation surface waters are those suitable for or intended to become suitable for recreational activities in or on the water when the ingestion of small quantities of water is likely to occur. Such waters include but are not limited to those used for swimming, rafting, kayaking, and water skiing.

WATER SUPPLY. Water supply surface waters are those suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent), these waters would meet Colorado drinking water regulations.

AGRICULTURE. Agriculture surface waters are those suitable for or intended to become suitable for crop irrigation. These water sources are not considered hazardous for livestock.

Massey Draw, Marcy Gulch, Dad Clark Gulch, Big Dry Creek, and Willow Creek originate from snow melt and high precipitation events and possess the characteristics (meandering, reduced velocity, intermittent flows, and sandy substrate) of a high plains stream. These streams are tributaries to the South Platte River and are classified by the CDPHE as Aquatic Life Warm Water 2, Recreation 1a, and Agriculture. The Aquatic Life Warm Water 2 category consists of waters that are not capable of sustaining a wide variety of warm water biota due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species. The recreation and agriculture categories are the same as discussed in previous sections.

Several irrigation ditches and canals are also located in the project area. These waterways are not considered drainage ways and are not subject to the same water quality standards as natural surface waters. The High Line Canal supplies water to several metropolitan parks and lakes. It is also used as irrigation water. Nevada Ditch is used for irrigation only.

The Centennial Water and Sanitation District plans to construct the Centennial Reservoir north of C-470 between Platte Canyon Road and the South Platte River. The site is currently being mined as an aggregate quarry to create the reservoir. The reservoir is anticipated to contain 6,400 acre-feet of storage. Mining of the quarry is expected to cease upon expiration of the lease at the end of 2006. Other site improvements and filling the reservoir continues in 2007, and all construction is estimated to be complete in 2007.

Groundwater Resources

Groundwater is water that flows or seeps downward and saturates soil or rock, supplying springs and wells. According to the U.S. Geological Survey (USGS), the primary source of groundwater for the Denver metro area is

supplied by the Denver Basin aquifer system. No groundwater well head protection areas are located in the project area.

Much of the project area is contained within the Willows and Centennial groundwater classification area in Arapahoe and Douglas Counties. This area contains the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers and is used for both domestic drinking and agricultural uses.

Domestic Drinking Water Systems

The Centennial Water and Sanitation District provides water to most of the C-470 project area. The water is supplied through a conjunctive system (both surface and groundwater). Water supplies in the northern portion of the project area are provided by both Denver and Aurora Water, which primarily gain water through surface waters located outside of the project area. No water from the South Platte River below Chatfield Reservoir is used for drinking water supply.

3.3.4.2 Environmental Consequences

Potential effect to water resources from all of the action alternatives would occur from bridge reconstruction, culvert extensions, and overall increases in highway runoff. Direct effects are most likely to occur during construction activities. These potential effects would be reduced by the implementation of permanent and temporary BMPs as specifically described in the following sections.

No-Action Alternative

The No-Action Alternative would neither improve nor degrade current water quality conditions in the C-470 project area. Current streams and their courses would not be altered. The amount of impervious surface would remain the same, at 135 acres. However, the No-Action Alternative would not involve actions to improve water quality.

General Purpose Lanes Alternative

Impervious surface area would increase from 135 acres to 300 acres. The increase in impervious surface from the highway widening would cause greater volumes of water to runoff into receiving waters. Average daily traffic on C-470 will increase with the GPL Alternative from an existing range of 54,000 to 104,000 to about 78,000 to 175,000 in 2025. Chemical pollutants resulting from increased impervious surface and traffic would wash into water quality facilities. However, these facilities would be effective in preventing chemicals from entering the receiving waters within the project area.

The GPL Alternative includes water quality ponds to meet MS4 requirements. These ponds would collect the "first flush" of storm runoff and thus improve water quality as compared to existing conditions. These water quality ponds will settle out the total suspended solids (TSS) and improve water quality. The ponds are proposed along the entire length of C-470 to provide a detention time of 40 hours for the water quality capture volume (WQCV) for the roadway. Pond locations are illustrated for both action alternatives in **Appendix D**. The surface runoff would exit the ponds through an outlet structure and small storm sewer to a roadside ditch that conveys the runoff to the ultimate receiving waters.

None of the surface waters in the project area are listed as impaired. However, the South Platte River stream segment from Bowles Avenue to Burlington Ditch (downstream from the project area) is on Colorado's Monitoring and Evaluation List for copper. Copper is a common pollutant of roadway runoff, but effects related to copper are not expected. Water quality ponds will be effective at holding copper in stormwater runoff and preventing it from entering streams and groundwater. Pond maintenance will include routine sediment disposal in a landfill, as necessary.

Express Lanes Alternative (Preferred Alternative)

As discussed under the GPL Alternative, none of the surface waters in the project area are listed as impaired. However, the South Platte River stream segment from Bowles Avenue to Burlington Ditch (downstream from the project area) is on Colorado's Monitoring and Evaluation List for copper. The EL alternative is not expected to result in runoff that would contribute to elevated copper levels in surface waters. Because the water quality ponds included in the EL Alternative are similarly designed to those in the GPL Alternative, they will also be effective at retaining copper in the first flush of stormwater runoff and preventing it from entering streams and groundwater. Pond maintenance will include routine sediment disposal in a landfill, as necessary.

The EL Alternative includes water quality ponds to meet MS4 requirements. These ponds would collect the "first flush" of storm runoff and thus improve water quality as compared to existing conditions. These water quality ponds will settle out the total suspended solids (TSS) and improve water quality. The ponds are proposed along the entire length of C-470 to provide a detention time of 40 hours for the water quality capture volume (WQCV) for the roadway. The surface runoff would exit the ponds through an outlet structure and small storm sewer to a roadside ditch that conveys the runoff to the ultimate receiving waters. Impervious surface area would increase from 135 acres to 322 acres. The increase in impervious surface from the highway widening would cause greater volumes of water to runoff into receiving waters. Average daily traffic on C-470 will increase with the EL Alternative from an existing range of 54,000 to 104,000 to about 85,000 to 171,500 in 2025. Chemical pollutants resulting from increased impervious surface and traffic would wash into water quality facilities. However, these facilities would be effective in preventing chemicals from entering the receiving waters within the project area.

3.3.4.3 Mitigation

To meet the MS4 Permit requirements, BMPs were evaluated and recommended for each of the action alternatives. A number of possible options were examined for the action alternatives. The CDOT MS4 Permit Program was consulted to identify and evaluate alternative BMPs to meet the water quality requirements.

Grassed swales and vegetated filter strips would be used for pretreatment wherever possible along the highway. Since the swales or strips would not be relied on to achieve the requirements of the MS4 permit, these water quality BMPs can be accomplished by seeding the shoulders of the road. The swales would be used to carry runoff from the roadway to the water quality ponds and carry the outfall from the water quality ponds to the receiving waters. Although dense grass or vegetation would not likely occur in the grassed swales and filter strips, the vegetation that does grow would help to slow down the runoff and give more time for settling out particulates, even before the runoff reaches the water quality ponds. This BMP would provide a benefit to water quality and should also save project costs.

Extended detention basins (water quality ponds) would also be incorporated into both the GPL and EL Alternatives to meet the MS4 requirements of the EPA. Fifty-three water quality ponds would be placed along C-470 at strategic locations. These water quality ponds would settle out a minimum of 80 percent TSS. This meets the requirements of the MS4. Likewise, it is important for improving water quality because smaller elements in the water, such as heavy metals, attach to suspended particulate matter and settle out of the runoff before entering the main water course. The ponds are proposed along the entire length of C-470 to provide a detention time of 40 hours for the Water Quality Capture Volume (WQCV) from an average storm event for the roadway. A closed storm sewer system with curb, gutter, and inlets would also be implemented in areas where water quality ponds cannot fit in the ROW or be

accommodated due to adverse effects to other environmental resources. Detail on the specific locations of these water quality ponds is in the *Water Quality Technical Report* (July 2005) and shown in **Appendix D**. Efforts would be made during final design to match the pond shapes to existing contour lines as much as possible to achieve a natural appearance.

Large ponds were recommended for use along the entire length of C-470 except through Chatfield State Park. The larger basins would limit the number of ponds that require maintenance. This would allow for easier and more timely removal of sediments from the water quality ponds, which is an important consideration when determining the effectiveness of the BMP. Smaller ponds were recommended through Chatfield State Park. These smaller ponds would be used through this area to stay completely within the existing CDOT easement across USACE property, thus avoiding the need for acquiring property at Chatfield State Park. These small ponds would be located closer to the roadway to allow easier maintenance access, and would provide the same benefit as the larger ponds. Additional details on the screening process for MS4 BMPs and their inclusion in the alternatives can be found in the *Water Quality Technical Report* (July 2005).

In addition to these structural BMPs that would be implemented for either of the action alternatives, other non-structural BMPs are currently being regularly employed by CDOT in an attempt to minimize degradation of water quality system-wide. These strategies include limiting the use of deicer, discontinuing the use of fertilizer, and timely sweeping of roadways after snow events. These strategies would continue and become a part of all three alternatives.

3.3.5 Hydrology and Hydraulics

Hydrologic and hydraulic analysis for the study consisted of two elements: regional hydrology and cross culverts carrying regional drainages under C-470, and roadway drainage carrying storm runoff from the roadway itself. The regional assessment was conducted to check cross culverts for adequate hydraulic capacity and, in some cases, for other considerations such as roadway profile changes, trail underpasses, and wildlife passage. The roadway storm drainage system was designed at a conceptual level to assess their affect on the conceptual water quality pond design and to identify their potential cost.

3.3.5.1 Affected Environment

The major streams and drainages in the project area include Massey Draw, South Platte River, Marcy Gulch, Dad Clark Gulch, Big Dry Creek, and Willow Creek, as shown previously in **Figure 3-18**. Massey Draw flows through a double box culvert under C-470 between Wadsworth Boulevard and Santa Fe Drive. The existing bridge at the South Platte River is a three-span bridge. Marcy Gulch joins the South Platte upstream of the project area. Dad Clark Gulch crosses C-470 through an existing water quality detention outlet structure. A bridge carries C-470 across Big Dry Creek. Willow Creek crosses under C-470 in an existing box culvert. Flows in existing culverts are shown in **Table 3-35**. Detail on stream flows is in the *Hydrology/Hydraulics Technical Report* (March 2005).

One area of hydraulic importance is the South Platte River crossing, just west of Santa Fe Drive. This crossing is immediately downstream of the Chatfield Reservoir dam and spillway. The Chatfield Dam outlet permits a maximum flow of 8,000 cfs, but the actual discharge permitted is currently limited to 5,000 cfs by state statute. However, the USACE is currently conducting a reallocation study for Chatfield Reservoir to increase its storage capacity. That study is anticipated to propose an increase in the maximum allowable discharge rate to 7,000 cfs. While the reallocation study is not yet complete, indications from the USACE are that it will be approved. If this change occurs, then the water surface elevation would rise as a result of the additional 2,000 cfs in the river. No other

changes are being considered that would affect the downstream channel crossing C-470.

The existing 72-inch culvert east of Spring Creek is undersized and cannot pass the 100-year storm. It can only pass 336 cfs at a headwater to diameter ratio of 1.5, but needs to pass 490 cfs for the 100-year storm. Roadway improvements over Spring Creek would require a larger culvert to meet Corridor design standards, and to pass the 100-year storm.

Currently, ditches handle all existing roadway storm drainage. Therefore, no storm sewers are present except at low points that require outlets to the roadside ditches or receiving water-courses.

3.3.5.2 Environmental Consequences

No-Action Alternative

No changes to the existing hydrology or hydraulics would result from the No-Action Alternative.

General Purpose Lanes Alternative

HYDROLOGY AND MAJOR DRAINAGEWAY CROSSINGS. The cross drainages were analyzed using master plans and drainage studies that cover the project area and by delineating basins that contribute runoff to culverts that are 48 inches in diameter and larger. Basins were analyzed further if no published information was available on the basin and/or culvert crossing. The culverts were then sized for

Table 3-35
Existing Cross Culvert Design Flows

Drainageway	Location	Structure No.	Structure Type*	100-year Design Flow (cfs)	Dimensions - Layout			Comments
					Span/ Width Diameter (ft)	Height (ft)	Cells/ Piers	
Massey Draw	100 ft. west of Kipling	F-16-ST	RCP		5			Outside study limits
Massey Draw	2500 ft. east of Wadsworth	F-16-HY	CBC	3,799	12	10	2	Restoration of low flow conveyance capacity
South Platte River	2200 ft west of Santa Fe	F-16-HV	Bridge	7,000	70		2	Bridge replacement for trail
City Ditch	730 ft. west of Santa Fe		HERCP	-	-	-		36” x 58” HERCP
Local drainage	200 ft. west of Santa Fe		HERCP	141	-	-		36” x 60” HERCP
Local drainage	1800 ft. east of Santa Fe		RCP	255	5			
Outfall local detention	1200 ft. west of Lucent		RCP	155	4.5			
High Line Canal	3200 ft. east of Santa Fe	F-16-KP	CBC	-	20	8		
Outfall local detention	800 ft. west of Lucent		RCP	126	3		2	

Table 3-35
Existing Cross Culvert Design Flows (continued)

Drain-ageway	Location	Structure No.	Structure Type*	100-year Design Flow (cfs)	Dimensions - Layout			Comments
					Span/ Width Diameter (ft)	Height (ft)	Cells/ Piers	
Local drainage	1300 ft. east of Lucent		RCP	1,129	6.5		2	
Dad Clark Gulch	2900 ft. west of Broadway		CBC	3,881	6	6		Existing water quality outlet structure to remain
Lee Gulch	2800 ft. west of University		RCP	158	4.5			
Local drainage	900 ft. west of University		RCP	274	4			
Local drainage	700 ft. west of University		RCP	274	3.5			
Local drainage	2400 ft. east of University		RCP	76	3.5			
Big Dry tributary	1600 ft. west of Colorado		RCP	171	4.5			
Big Dry tributary	1100 ft. west of Colorado		RCP	334	5.5			
Big Dry tributary	1500 ft. east of Colorado		CBC	666	8	8		
Local drainage	4400 ft. east of Colorado		CBC	255	6	5		
Big Dry Creek	4900 ft. east of Colorado	F-17-HT	Bridge	3,477	50			Use existing bridge
Local drainage	2700 ft. west of Quebec		RCP	117	4			
Spring Creek	1200 ft. west of Quebec		CBC	1,150	6	8	2	
Local drainage	680 ft. east of Acres Green		RCP	490	7			Replace existing
Local drainage	1700 ft. east of Acres Green		HECMP	65	-	-		58” x 36” CMP
Local drainage	3100 ft. west of Yosemite		CMP	142	5			
Willow Creek	2700 ft. west of Yosemite	F-17-IC	CBC	3,900	12	12	3	

** RCP – reinforced concrete pipe; CBC – concrete box culvert; HERCP – horizontal elliptical reinforced concrete pipe; HECMP – horizontal elliptical corrugated metal pipe; CMP – corrugated metal pipe*

capacity using Haestad Methods Culvert Master to determine whether they could pass the peak 100-year design storm event. Bridge openings have been sized with open channel hydraulics principles using Manning's equation to determine the flow conditions through the proposed bridge openings. For simplicity, a trapezoidal channel was selected as the typical cross section through the bridges.

With the exception of Spring Creek, all existing cross culverts would be retained with this alternative. An existing 72-inch-diameter corrugated steel culvert east of Spring Creek would be replaced with an 84-inch-diameter reinforced concrete pipe culvert to allow for adequate passage of the estimated 100-year frequency design flows. Most culverts along C-470 would be extended to accommodate the wider typical section. The outlets are generally still within the existing ROW, but in cases where they would not fit, additional ROW would be acquired as part of the alternative.

Culvert headwater depths have been calculated to determine if the culverts along C-470 have adequate capacity to pass the 100-year storm event and meet CDOT criteria for this project. These calculations were also used, along with the topographic maps and aerials to determine if any structures might be at risk from lengthening the cross culverts. Based on this initial review no existing buildings would be impacted by any changes in headwater elevations at the culvert crossings.

The existing bridge over the South Platte River would be replaced to improve the horizontal and vertical geometry of the crossing. This replacement would also provide increased flow capacity, improved trail geometry, and enhanced wildlife movement under the bridge. The waterway would have a 100-foot-wide channel bottom. The bridge opening has been sized to pass 7,000 cfs, in accordance with the expected approval of the Chatfield Reservoir Reallocation Study.

There would be no direct effects to Marcy Gulch, as the confluence of Marcy Gulch and the South Platte River is upstream of the study improvements. Dad Clark Gulch would continue to flow under C-470 in the existing water quality detention outlet structure that would remain in place. The bridges over Big Dry Creek would simply be widened while no changes would be made to the channel. The box culvert carrying Willow Creek under C-470 would be extended on the south side to accommodate the wider highway.

ROADWAY STORM DRAINAGE.

The GPL Alternative consists of paving the existing open median and installing a center concrete barrier between directions of travel (the roadway is also widened to the outside). Although generally a storm drainage system would not be required for the majority of the corridor, it would be necessary in a few locations where the horizontal curvature of the highway pavement would be sloped toward the center barrier. The closed storm drainage system would then discharge to roadside ditches to be carried to the nearest watercourse.

With the GPL Alternative, the impervious area increases from 135 acres to 300 acres. This change from pervious to impervious surface would result in increased runoff volume and peak flow rates from the highway. The flow rate increases may cause erosion along ditches and downstream drainageways and could impact water quality.

Express Lanes Alternative (Preferred Alternative)

The analysis of the hydrologic and hydraulic capacity for the EL Alternative was the same as for the GPL Alternative. The existing 72-inch-

diameter corrugated steel culvert east of Spring Creek would be replaced with an 84-inch-diameter reinforced concrete pipe culvert to allow for adequate passage of the estimated 100-year frequency design flows. The existing bridge over the South Platte River would be replaced to improve both horizontal and vertical geometry of the crossing.

With the EL Alternative, the impervious area increases from 135 acres to 322 acres. This change from pervious to impervious will result in an increase of runoff, both in volume and peak flow rates. This increase will result in increased surface water runoff from the site. The increase is not large in regard to the receiving waters. These increases in flow may result in additional erosion along ditches, and downstream drainageways and could impact water quality.

3.3.5.3 Mitigation

To correct the flooding that occurs at the culvert east of Spring Creek, the culvert would be replaced with an 84-inch-diameter reinforced concrete pipe culvert to allow for adequate passage of the estimated 100-year frequency design flows.

Water quality ponds are included in the alternative as permanent BMPs to improve water quality of storm runoff, as discussed in **Section 3.3.4**.

3.3.6 Floodplains

Executive Order 11988, Floodplain Management, requires federal agencies to avoid direct or indirect support of floodplain development whenever a practicable alternative exists. The base flood (100-year flood) is the regulatory standard used by federal agencies and most states to administer floodplain management programs. Flood insurance rate maps (FIRM) from the Federal Emergency Management Agency (FEMA) were used to identify drainages with 100-year floodplains within the C-470 project area.

3.3.6.1 Affected Environment

C-470 intersects five drainages with 100-year floodplains including Massey Draw, the South Platte River, Dad Clark Gulch, Big Dry Creek, and Willow Creek. Flood Hazard Area Delineations (FHAD), Master Plans, and Outfall Planning Studies are available for these drainages and their tributaries through the Urban Drainage and Flood Control District (UDFCD). The floodplains have regulated flood-water elevations (base flood elevations) and regulations on development established by FEMA. Flood insurance rates apply in those areas. Locations of the floodplains are shown in relation to C-470 in **Figure 3-19**.

Flooding in the C-470 project area is typically due to short-duration, high-intensity events from May to September. Since Chatfield Reservoir is immediately upstream of C-470 on the South Platte River, the flow rates passing under the C-470 bridge are controlled by the Chatfield Dam outlet works.

3.3.6.2 Environmental Consequences

No-Action Alternative

The No-Action Alternative results in no effects to the regulated 100-year floodplains within the project area.

General Purpose Lanes Alternative

Based on the evaluations undertaken, and with proper hydraulic design, effects to the floodplains crossing C-470 would be within acceptable limits, meaning that the flood elevation would not rise or fall more than one foot above or below existing elevations. These changes would not likely change insurance rates for properties within the flood zone near the project area.

Willow Creek has the potential for the water surface to rise as a result of improvements included in the GPL Alternative. The creek runs parallel to the roadway for approximately 1,500 feet upstream of the crossing. Retaining walls are designed into the alternative to minimize encroachment into the floodplain. However,