6.0 FORMULATION OF ALTERNATIVES

6.0 Formulation of Alternatives

6.1 Vision for Monument Creek Corridor

As part of the public information and involvement process for the study, an initial public meeting was held to solicit input and to provide direction for the project. At this public meeting, individuals from the City, resource agencies, and the public at large expressed their "vision," or ideal view of what the creek corridor could look like in the future. The result was a description of a healthy stream system providing a wide range of functions related to safe conveyance of floods, provision of favorable habitat for terrestrial and aquatic species, and maintenance of water quality. Other aspects of the vision included the preservation of existing riparian woodlands and wetland vegetation, the provision of access trails other recreational features, and the promotion of compatible adjacent land uses.

The vision for the Monument Creek corridor was translated into goals and objectives at several of the initial Study Group meetings. A list was developed of 39 specific objectives under the headings of eight general project goals. The list of project goals and objectives is presented in the following subsections.

6.1.1 General Goal No. 1

Assure Public Safety and Welfare

Specific Objectives

1. Minimize private property damage that could result from flooding and stream erosion.

2. Protect urban infrastructure components such as utility and road crossings.

3. Decrease potential for loss of life or injury as a result of flooding and/or channel erosion.

6.1.2 General Goal No. 2

Provide Recreational and Social Benefits

Specific Objectives

1. Develop multiuse trails in corridors which:

    - Provide access to the creek corridors for the enjoyment and appreciation by the public, including persons with physical disabilities

- Provide access to and from connecting trails, parks, and other recreational amenities
- Are in harmony with aquatic, riparian, and upland ecosystems
- Are mutually supportive of flood control improvements, stream stabilization, utility crossings, and urban infrastructure
- Serve the regional and local transportation needs of bicyclists and pedestrians

2. Protect and enhance significant natural features of the corridor including stream, riparian zone, and upland ecosystems.

3. Provide vehicular and nonvehicular access to the corridor (for example, parking areas and trail heads).

4. Educate the public about stream corridor environments, urban wildlife, natural geomorphologic processes, water quality, and their relationships to urban development.

5. Provide areas for appropriate active recreational purposes.

6.1.3 General Goal No. 3

Protect and Enhance Aquatic and Adjacent Ecosystems

Specific Objectives

1. Improve aquatic habitat and water quality by promoting adequate streamflow, appropriate levels of nutrient input, and water quality.

2. Promote diversity of vegetation along the corridor for wildlife cover, food, nesting, stream shading, and aesthetic/experiential values.

3. Promote preservation and enhancement of riparian and upland ecosystems along the corridor.

4. Protect groundwater recharge capability.

5. Utilize construction and maintenance techniques that are sensitive to ecological impact.

6.1.4 General Goal No. 4

Maintain a High Level of Benefit to Cost

Specific Objectives

1. Use planning, design, and management criteria and standards that maximize return from funding invested in the corridor.

2. Protect public investment in infrastructure such as road overpasses, utilities, and recreational amenities.

3. Include the value of protecting environmental and aesthetic quality of the corridor in the benefit-cost assessment.

4. Include the short- and long-term operations and maintenance costs in the benefit-cost assessment.

6.1.5 General Goal No. 5

Aid in Control of Pollution/Enhance Water Quality

Specific Objectives

1. Reduce sedimentation to acceptable levels consistent with flood control structures, adjacent riparian/vegetation zones, and a healthy aquatic environment.

2. Manage water quality from a watershed perspective.

3. Reduce point and nonpoint source chemical, biological, and sediment-borne pollution.

6.1.6 General Goal No. 6

Promote Community Development

Specific Objectives

1. Promote the stream corridors as a community asset.

2. Promote corridor improvements that are supportive of quality development in adjacent areas, including the downtown area.

3. Promote adjacent land uses that are compatible with, and supportive of the stream corridor as a major social, economic, and environmental asset to the entire community.

4. Promote development that is compatible with locations and structures that are of historical and cultural value.

5. Accommodate the placement of needed utility improvements across and through the corridor.

6.1.7 General Goal No. 7

Maintain and Enhance the Natural Beauty and Quality of the Constructed Environment

Specific Objectives

1. Implement physical improvements using quality design standards, durable materials, and construction techniques that promote visual attractiveness and compatibility with their surroundings.

2. Provide landscaping and other physical improvements that enhance visual relationships and foster corridor-wide attractiveness.

3. Provide amenities that promote a multi-sensory experience along the corridor.

4. Establish buffer zones in and adjacent to the corridor through development setbacks, open space easements, private investment in corridor amenity enhancement, and other techniques.

5. Prevent inappropriate actions in the corridor such as development in the floodplain, point source and nonpoint source pollution, and bank dumping.

6. Maximize visual compatibility between I-25 and the recreational amenities within the corridor.

6.1.8 General Goal No. 8

Promote Project Implementation

Specific Objectives

1. Build a base of community support
2. Identify the costs of phased implementation
3. Recommend funding mechanisms that are innovative and equitable

6.2 Summary of Problems and Opportunities

As the description of the study area and the hydrologic, hydraulic, and stability analyses documented in Sections 2 through 5 attest, there is a gap between the existing physical character of Monument Creek and the expressed vision for the study reach. The potential exists for the gap to widen further as changes in future sediment supply exacerbate channel erosion and possible development projects encroach on remaining open floodplain areas.

On the other hand, an opportunity exists to close the gap between current corridor conditions and the future vision. This study, along with the companion Fountain Creek DBPS and Pikes Peak Greenway Study, is an important first step in closing the gap.

The gap between current corridor conditions and the future vision for the study reach can be understood by summarizing the existing problems noted in Sections 2 through 5 of this report. These problems are highlighted below:

- Much of the historic floodplain channel has been filled, raising flood levels, reducing riparian vegetation, and increasing flood velocities and bank erosion risk.

- High sediment loads supplied to the study reach downstream of Woodmen Road have created a wide, braided base flow channel, reducing riparian vegetation and impairing aquatic habitat and water quality.

- Dumping trash and rubble down the banks of the channel in the area upstream and downstream of Garden of the Gods Road poses a concern regarding public safety, water quality, and aesthetics.

- Storm runoff is expected to increase in peak discharge, volume, and frequency as the Monument Creek watershed continues to develop, increasing flooding potential and erosion problems.

- Out-of-channel flooding of a number of industrial and residential structures upstream of Polk and Fillmore Streets is predicted for 100-year future development conditions.

- The potential exists for significant downcutting of the Monument Creek channel as sediment supply to the study reach decreases in the future.

Even with the problems described above, the existing Monument Creek corridor serves as an extremely valuable resource. The continuous streamflows and the large areas of remaining riparian vegetation provide important habitat for a diverse array of mammals, amphibians, reptiles, and birds. The portion of the study reach upstream of Woodmen Road still has a relatively natural, undisturbed physical geometry that provides productive aquatic and terrestrial habitat and an unconstricted floodplain. Finally, access to and enjoyment of the Monument Creek corridor is increasing as new trails and recreational areas are constructed.

6.3 Development of Alternative Plans

Considering the existing problems and opportunities along the corridor and the goals and objectives shown in Section 6.1, the project team, with input from the Study Group, developed a series of alternative stream improvement plans. Opportunities and constraints are summarized in Table 6-1.

The first step in developing alternatives was to prepare a comprehensive listing of possible alternative concepts. The concepts were listed under various headings pertaining to flood control strategies, stabilization measures, trails, and the like. The concepts are shown in Table 6-2. These alternative concepts are shown graphically on Sheets 15 through 17 of Volume II. These drawings are entitled "Icon Details" because each generalized section view of an alternative concept is shown in reduced "icon" form on the stream improvement alternative plans. The listing of concepts and their graphical depiction served as the "menu" from which to make selections during the development of alternative plans.

The stream improvement alternative plans developed for the Monument Creek study reach are described in matrix form in Table 6-3. The alternative plans are shown on Sheets 18 through 21 of Volume II. The plans depict the location, extent, and size of the proposed improvement measures represented by the icons. A pictorial summary of icon details showing proposed improvement measures and representative channel conditions for each alternative is included on the sheets.

In order to analyze alternatives, it was necessary to develop composite cross section views for each study segment illustrating the main emphasis of the particular alternative. Composite cross-sectional drawings of the alternatives are shown in Sheets 22 through 28 of Volume II. The drawings show proposed improvement measures and channel

Downtown Reach- M1 (Confluence to Bijou Street)

Summary: Reach is developed urban/industrial with narrow riparian area. There is an existing trail which passes under Bijou and over Fountain Creek, continuing south. There are views into corridor from I-25 and bridges which are not aesthetically pleasing. Access to corridor from downtown restricted by railroad and private industrial development. There are no existing flooding problems. Downtown Action Plan proposes development of Confluence Park north of Cimmaron, the "park ring", trail development on east side of creek and pedestrian crossing of RR from Vermijon to Conejos and another just north of Depot, and re-development north of Colorado into "artisans district".

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) Abandoned RR crossing of Monument Creek north of Fountain confluence 2) Part of "Park Ring" concept area 3) Connection to west up Fountain Creek. 5) Concept for Confluence Park	6) Overall access to corridor from downtown limited.	1-6) Work with recommendations per the Downtown Action Plan to provide recreational ammenities within corridor and adequate trail connections to downtown and to west part of City.
Land-Use/Ownership	1) Much of creek channel on west side wither owned by City or CDOT.	2) Industrial land-use exerts aesthetic and environmental influence on nature of creek corridor.	I) Observe recommendations made within the DAP.
Environmental	1) 2)	1) Degrading state of creek bed.	1) Utilize riffle drops to control degradation of creek bed and other recommendations made by Drainage Study.

Downtown Reach- M1 (Confluence to Bijou Street)

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	1) Denver and Rio Grande Railroad Depot 2) Antlers Park 3) Trestle Bldg. south of Colorado St. 4) Downtown residential Historic District.	1) Surrounding industry and RR yard exerts strong influence on aesthetic character of corridor.	1) Promote re-development as recommended per the DAP. 2-4) Highlight along trail with directional and interpretive signs where appropriate.
Existing Infrastructure	1) Low water bridge crossing creek south of Bijou. 2) Abandoned RR crossing btw. Colorado and Cimmaron. 3) Abandoned Rail line to west from crossing.		1) May be upgraded/combined with grade control. 2-3) Monitor long-term use for possibilities of pedestrian crossing and trail and/or transit system to connection to west part of City.
Channel Geomorphology and Hydrology		1) Degradation of creek bed.	1) Utilize riffle drops to minimize further degradation.

Monument Valley Park Reach- M2 (Bijou Street to Van Buren Street)

Summary: Reach character dominated by Monument Valley Park. City Service Yard on west side of creek has proposed redevelopment plan for more park-like features including trail on west bank top. There is adequate flood protection throughout with some limited overbank flooding north of pedestrian bridge and south of Uintah on west bank, but this does not threaten any structures. WPA flat stonework along banks has aesthetic and historic appeal. Channel bank walls limit access to channel where there is an existing foot path. Riparian vegetation is limited to ribbon willow stands which have been recently cut. Increased vegetation in channel would alter flood regime. Therefore, vegetation enhancement should be accomplished with vegetation should be that which will lay down during flood occurrences.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) Monument Valley Park and existing trail system out of channel. 2) Connection to West via Mesa Valley along Fontanero St. (existing I-25 underpass). - I-25 take zone on west side of ROW. - Existing ped. overpass for RR and I-25. - Sonderman Park west of I-25. 3) On-street bike routes 4) Foot path along channel.	1) Connection to trail through Private prop. 2) Crossing of Monument Creek from east to west and on-street routing. I-25 crossing may be removed with I-25 widening. 4) In floodway and difficult access from TOB.	1) Acquire easement or section of private property. 2) Provide pedestrian crossing from north-central portion of park to west side with trail connection to new underpass beneath I-25. 4) Design/develop access node from MVP to creek maintaining aesthetics and stone flatwork, to enhance existing access at bridge in Park.
Land-Use/Ownership	1) City owned along most of creek corridor 2) Historic residential districts on east side of corridor. 3) I-25 take zone west of Interstate. 4) City Service Yard on west side of channel.	1) Private property btw. MVP and Rock Island RR, and Van Buren St. Bridge. 3) Access across creek, RR, and Interstate.	1) Acquire easement of section of private property. 3) Provide pedestrian crossing from north-central portion of park to west side with trail connection to new underpass beneath I-25. 4) Promote development of tral land recreational/park ammenities with future re-development.
Environmental	1) "Ribbon" wetlands along creek 2) Seepage through stone embankment creates hydrology for wetland development at base of wall.	1) Future of hydrology of creek with degradational nature existing.	1) Remedy degradation of channel with riffle drops and vegetation enhancement. 2) Allow wetland to succeed without alteration unless problems develop with flooding regime.

Monument Valley Park Reach- M2 (Bijou Street to Van Buren Street)

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	**1)** Monument Valley Park Historic District encompasses park. **2)** Several historically significant features including few on Nat'l Historic Register, eligible for Register, and locally significant including neighborhoods and Colorado College.		**1-2)** Highlight significance with signage, trail alignment/surfacing, and on-street/ off-street connections.
Existing Infrastructure	**1)** Abandoned Van Buren St. Bridge. **2)** Stone underpass in Park - for access to channel bottom foot trail. **3)** Ped. underpass beneath Uintah St. **4)** Existing ped. overpass near Historic Gardens. **5)** On-street parking for Park. **6)** Ped. overpass over I-25. **7)** Stone flatwork wall along channel banks	**1)** Proposed re-opening for crossing by both autos and pedestrians. **2)** Relatively unused, could be a safety hazard. **5)** Capacity if Park used as major access point for Trail. **6)** Removal during I-25 widening? **7)** Limits access to channel bottom foot trail.	**1)** Utilize for pedestrian crossing with adequate safety provisions. **2)** Evaluate design to open up and develop as trail/creek access as well as a trail node/rest stop.
Channel Geomorphology and Hydrology		**1)** Channel degradation exposing utility crossings and failing check structures.	**1)** Control degradation with riffle drops.

Roswell Park Reach- M3 (Van Buren Street to Fillmore Street)

Summary: Reach extends through private, residential development on east side of creek and private, light industrial on west side. Reach has the highest problem of overbank and threatening flooding in the vicinity of Polk St. - overbank flooding of 100 yr. flood occurs on both banks, predominantly on west side. A crusher-fine trail exists along the west side with a pedestrian crossing to east at south end of reach where trail passes through wetland area on boardwalk. The existing trail presently end on Beacon Street where an on-street route must be taken to Monument Valley Park. The City is currently working with priivate property owners along the creek to acquire a connection directly to MVP.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) Roswell Park 2) Existing trail beginning at Fillmore on west side of Creek. 3) Quiet residential streets to east - on-street connections 4) Connection to east via RR when abandoned	 2) Connection to south - around/under RR. - Trail presently ends at Tremont St. cul-de-sac 4) Need ROW and access to RR for trail.	1) Provide a safe connection to/from trail. 2-3) Provide on-street connection until access can be provide through private property. 4) Continue to monitor for future trail development.
Land-Use/Ownership	 2) I-25 take zone to west begins 3) Private residential on east side and industrial "lay-down" yards on west side within 100 yr. flood limits. 4) Unbuilt property north of Polk St. on west side of creek.	1) Dumping on private property west side north of Polk St. 3-4) Privately owned	1) Promote clean-up by private property owners. Possible implement ordinance to alleviate future problems. 2) Promote aesthetic re-development and adequate connections to creek corridor. 3) Promote private re-development for compatible use or acquire for re-dev. as park. 4) Monitor and evaluate for acquisition or easements for public use.
Environmental	1) Wetlands through which trail runs - interpretive 2) Bank vegetation restoration	 3) Bank dumping on east bank north of Polk St.	1) Provide interpretive signs along trail. 3) Promote clean-up by private property owners.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	1) Old town of Roswell - used to be horse track and gambling area. 4) El Paso canal/irrigation ditch crossing- abutments existing.	2) Industrial character of west side of creek. 3) Dumping north of Polk on east bank.	1) Interpret with signage. 2) Provide aesthetic/enviro. buffers between trail, channel, and private property 3) Promote clean-up. 4) Interpret with signage.
Existing Infrastructure	1) Existing trail with crossing of creek 2) at grade trail crossing of Polk St.	2) Could be safety issue/conflict between non-motorized trail users and car/truck traffic.	1) Utilize for spine trail. 2) Provide adequate signage and striping for both users at intersection.
Channel Geomorphology and Hydrology	1) 100 Yr. flood limit extends out of channel east and west into residential and industrial private property.	1) 100 Yr. flood limit extends out of channel east and west into residential and industrial private property. 2) Degrading channel bed.	1) Propose alternatives for future use and private re-development. Also monitor for possible public acquisition for park/open space connection between MVP and "Youth Sports Complex". 2) Develop riffle drops for channel restoration.

"T-Gap" Reach- M4 (Fillmore Street to Templeton Gap Floodway)

Summary: Almost entire reach directly adjacent to creek is in the process of being acquired by the City for recreational purposes; a "youth sports complex". A temporary trail on the west side of the creek has been constructed. Flooding of 100 yr. storm is contained within the channel and poses no immediate threat to public property. There is significant bank erosion which should be treated along with stream degradation.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) Connection to east up T-Gap. 2) Connection to west along S. Douglas Creek - Sinton Trail to Wilson Ranch Trail and Foothills trail to west. 3) Existing On-street bike routes along M. Dabbling Blvd., and Sinton Rd. (N-S), Fillmore (E-W), and Ellston (West under I-25) 4) Douglas Creek Park west of I-25 via Ellston St. 5) City has purchased property on west side of creek for Youth Sports Complex.	1) Trail in the process of being developed - crossing will be needed.	1) Work with designers/engineers to assure proper location and access from all trails. 2-4) Continue to monitor future development and develop primary trail node with appropriate ammenties at intersection. 5) Monitor design and develoment to assure proper alignment of spine trail and relationship btw. complex and adjoining trails. Also develop intermodal access to trail within complex
Land-Use/Ownership	1) Finch property south of Pikeview Res. In process of negotiation for purchase by City. 2) Property on west side of creek- Interstate Commerce Center has been purchased by City Parks and Rec. 3) Pikeview #2 reservoir on east side of creek owned by City	1) Asking price 3) Adjacent property privately owned	1) Continue to monitor and negotiate, purchase when feasible. 2) Develop per Park & Rec. specifications, but recommend adequate buffers btw. complex and creek. 3) Continue to monitor and negotiate, purchase when feasible for park/trail/ riparian ecotone development.
Environmental	1) Sinton Pond.	1) Privately owned. 2) Development of Youth Sports Complex.	1) Continue to monitor and negotiate, purchase when feasible. 2) Develop per Park and REc. specs. with provisions for adequate buffers between fields, creek, and trail for environmental and aesthetic purposes.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	1) Abandoned Cascade St. Bridge		1) Determine if future use as a pedestrian crossing is feasible, and/or if it is of historic significance. If neither, remove.
Existing Infrastructure	1) Abandoned Cascade St. Bridge	1) Structural integrity for pedestrian bridge and location	1) Determine if future use as a pedestrian crossing is feasible, and/or if it is of historic significance. If neither, remove.
Channel Geomorphology and Hydrology	1) Confluence of Templeton Gap Floodway	2) This reach of the channel has the steepest gradient and is rapidly degrading and causing significant erosion.	1) Modify outfall as necessary at confluence and as recommended by Drainage Study. 2) Utilize rip-rap existing throughout property to construct riffle drops and incorporate with bio-engineering for bank protection. This reach could serve as model for channel, riaprian, and upland restoration/conservation.

Reservoir Reach- M5 (Southern Section - Templeton Gap to Garden of the Gods Road) Table 6-1, Page 9 of 14

Summary: Reach contains extensive cottonwood stands south of Garden of the Gods and I-25, providing excellent wildlife habitat and riparian vegetation stands. Flood limits pose no threat to existing development. The majority of the land other than Pikeview reservoir, is privately owned with some having easement dedications for trail and recreational use. Sewer main easements may also provide trail alignment access if surface rights can be acquired. Extensive dumping north and south of G/G Rd. must be addressed in some fashion for flood conveyance, environmental, and aesthetic reasons.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) Pikeview Reservoir for trailhead and park 2) T-Gap floodway trail to east.	**2)** Need pedestrian crossing from east to west.	**1)** Develop Pikeview Reservoir as a recreational area with "Barrier-Free" access for fishing and water contact. Also provide intermodal access to reservoir and trail system. **2)** Crossing being planned in the vicinity of South Douglas creek.
Land-Use/Ownership	1) Pikeview Reservoir property in City ownership **2)** Finch property south of Pikeview Reservoir. In process of being purchased by City.	**2)** Asking price **3)** Private/industrial property on high bank on east side of corridor dumping debris in to floodplain.	**1)** Develop Pikeview Reservoir as a recreational area with "Barrier-Free" access for fishing and water contact. Also provide intermodal access to reservoir and trail system. **2)** Purchase when feasible. **3)** Acquire land in floodplain if possible to halt/reduce dumping and conserve riparian ecosystem.
Environmental	**1)** Extensive natural riparian zone below Pikeview Res. along Creek - interpretive trail/conservation/enhancement opportunities. **2)** Pikeview reservoir is one of few large bodies of surface water in region.	**1)** Mostly in privately ownership.	**1)** Acquire or obtain conservation easements to conserve. **2)** highlight with intermodal access, "barrier-free" water access, and trails.

Reservoir Reach- M5 (Southern Section - Templeton Gap to Garden of the Gods Road)

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	1) Natural area below Pikeview Reservoir. 2) Past location of AMF Industries - used to make movies and build airplanes in existing quanset huts just west of Nevada.	1) Private ownership limits access and jeopardizes future.	
Existing Infrastructure			
Channel Geomorphology and Hydrology	1) Confluence of Templeton Gap Floodway.	1) Present outfall design could prove to be safety hazard. 2) Degrading creek bed.	1) Modify outfall as necessary at confluence and as recommended by Drainage Study. 2) Install riffle drops at necessary points as defined by Drainage Study.

Reservoir Reach - M5 (Northern section - Garden of the Gods Road to "Pikeview" Bridge) Table 6-1, Page 11 of 14

Summary: Reach contains extensive cottonwood stands south of Garden of the Gods and I-25, providing excellent wildlife habitat and riparian vegetation stands. Flood limits pose no threat to existing development. The majority of the land other than Pikeview reservoir, is privately owned with some having easement dedications for trail and recreational use. Sewer main easements may also provide trail alignment access if surface rights can be acquired. Extensive dumping north and south of G/G Rd. must be addressed in some fashion for flood conveyance, environmental, and aesthetic reasons. ISTEA money has been allotted to the development of the trail and several crossings along this reach and alternatives for these are currently being evaluated.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) 12' Trail easement through Pike Peak Research Park. 2) Wastewater easement on east side of creek through middle of reach. 3) Connection to west - Ute Valley Trail 4) 4-Diamonds Sports complex east of Nevada	1) Too narrow on TOB with wetlands and riparian zone adj. to channel. 2) Need surface rights to access for trail. 3) Getting under M. Dabbling, RR, and I-25. 4) Connection and access across/under Nevada. 5) Limited trail development opportunity out of floodway.	1) Work w/ research park to widen trail on TOB or provide boardwalk through wetlands and incorporate trail with bank treatment in channel. 3) Underpass to be provided through I-25 reconstruction. 4) Utilize T-Gap Trail. 5) Utilize boardwalks through wetlands and develop comprehensive maintenance plan for trail surfaces.
Land-Use/Ownership	1) Park/Rec. Trail easement from TOB to CL of Creek from along apartment complex on east side of creek. 2) City owned property east and west to north of dam. 3) Bank dumping along east side of creek may be leverage for access. 4) Good area for trail development below mobile home park.	1) Limited space for trail development. 2) Wetlands on west side. 3) Aesthetically not pleasing - environmental degradation. 4) access	1) Develop trail on west side. 2) Develop trail on east side. 3) Acquire easements or floodplain portions of property - revegetate banks. 4) Obtain access through easements/acquisition.
Environmental	1) City owned wetlands north of dam. 2) Opportunities for wetland/riparian ecosystem enhancement in and adjacent to channel. 3) Interpretive value of coal seam outcrop at base of steep eroded bank below apts.	2) Degrading creek bed. 4) Dumping on east side of bank north of Garden of the Gods Road.	1) Conserve 2) Enhance with emplacement of riffle drops and riparian vegetation planting. 3) Interpret with signage. 4) Obtain access through easements/acquisition.

	OPPORTUNITIES	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	1) Character of dam and sandbar below it. 2) View of Pulpit Rock with bedrock bluff below apts. in foreground. Bluff has outcrop of coal seam which may be part of the same formation mined at "Klondike Mine" to the north.	1) Will change over time 3) Dumping on east side of bank.	2) Highlight along trail with overlook or rest stop and interpretive sign(s).
Existing Infrastructure	1) Water Dept. dam - need to upgrade - possibility for grade control and trail crossing. 3) Sewer main and maintenance road along east side of channel (in floodway).	2) Garden of the Gods Road overpass.	1) Work with wastewater dept. to determine opportunities relative to trail and environment. 2) Provide underpass for trail. 3) May be used for trail alignment.
Channel Geomorphology and Hydrology		1) Degrading creek bed.	1) Utilize riffle drops to control creek bed degradation and maintain groundwater levels to allow succession of riparian vegetation.

High Plains Reach - M6 ("Pikeview" Bridge to Woodmen Road)

Summary: Reach is presently being developed and the channel has been modified for commercial use which is planned for the area. It is unique to the corridor due to its present "open" character, thus the name "high plains". The city has been deeded most of the creek channel and is in the process of widening the easement to include a bench which runs atop the eastern bank which is ideal for trail alignment. Access to the existing park-n-ride lot may provide an ideal trail head and parking area. Existing bridge abutments may provide for a pedestrian crossing - "Pikeview Bridge". The channel provides adequate flood conveyance but will need to be modified for grade control and for better wildlife habitat and riparian/wetland vegetation. Reach also has historic significance of coal mine underlying the area, an Indian battle of 1858-59, the town of "Pikeview", and whistle stops along RR. Cottonwood Creek entering Monument from the east brings abundant sediment into the creek. Amounts should decline in the future.

	OPPORTUNITIES/ HIGHLIGHTS	CONSTRAINTS	RECOMMENDATIONS
Recreation/Trails	1) Trail head at "Park-n-Ride" Lot 2) Existing bench cut on east side - top of bank for trail development. 3) On- street bike lane on Mark Dabbling Blvd. 4) Connection to west up Dry Creek and Rockrimmon 5) Connection to east up Cottonwood Creek 6) Crossing Monument on existing bridge abutments.	1) At-grade crossing of Mark Dabbling Blvd. 2) Bank erosion north of Cottonwood Creek • crossing Cottonwood creek • intermittent drainage crossings 4-6) Private property access . 7) Need of underpass beneath Woodmen Rd. for trail connection to north.	1) Develop as Intermodal Access Point. 2) a. Develop trail on bench b. Treat bank with bioengineering/drainage control. 4-6) Work with property owners. 7) Do design develop. for ramp to channel.
Land-Use/Ownership	1) Tract "A" of Corporate Centre dedicated to City Parks and Recreation. 2) Wastewater easement/maintenance road 3) Limited existing development on adjacent lands.	1) Tract "A" in channel and does not include bench on top of bank. 2) need to acquire surface rights to easement. 3) Buildings/development will degrade quality of environment and current aesthetics/viewshed. 4) Rockrimmon Cliffs property north of I-25 currently in bankruptcy.	1) Obtain widened easement to include bench. 2) Work with wastewater to obtain use rights. 3) Promote "office/campus" development of adjacent properties with focus on creek/ greenway. 4) Continue monitoring of ownership status.
Environmental	1) Wetland/riparian and vegetation enhancement possibilities in channel and along banks 2) Wildlife migration corridor 3) Bedrock outcrops in channel - waterfall	1) Existing Channel Geomorphology and Hydrology and geomorphic state of channel. 2) Increased development on adjacent properties.	1) Utilize riffle drops to alter/maintain grade. Plant wetland vegetation on bars and riparian vegetation along banks. 2) Establish and maintain vegetation on banks. Establish buffer along top of bank within 50' building setbacks. 3) Highlight as aesthetic amenity. 4) Create wetland in southernmost intermittent drainage.

	OPPORTUNITIES/ HIGHLIGHTS	CONSTRAINTS	RECOMMENDATIONS
Aesthetic/Historic Significance	1) "High Plains" character and viewshed to Pikes Peak and Pulpit Rock and viewshed from I-25 into corridor. 2) Historic significance of: •coal mines "Pikeview" and "Klondike" in area •mine town of "Pikeview" (1902-57) • Indian battle (1858-59) 3) Whistle stops along reach. 4) Outcrops in channel creating waterfall.	1) May be significantly impacted by future development on adjacent properties.	1) Establish and maintain buffers between development and corridor. 2 - 3) Highlight with interpretive signs along trail. 4) Highligh along trail with overlook or rest stop.
Existing Infrastructure	1) Park-n-Ride parking lot for possible trail head. 2) Temporary crossing of Cottonwood Creek over existing road bridge. 3) On-street use of Corporate Centre Dr. 4) Existing Bridge abutments for pedestrian crossing 5) Wastewater maintenance roads 6) Mark Dabbling Blvd. for on-street bikeway	1) Need permission from regional transportation agency 2) Increased traffic with development 3) Increased traffic with development 4) Property ownership 5) Need surface rights to access 6) width of paved area and ROW.	1) Utilize for Intermodal Access point. 2) Provide warning signs for motorists and defined bike/ped. lane. 3) Provide warning signs for motorists. 4) Study possibility of use. Evaluate versus new crossing in same area. 5) Work with City Wastewater to obtain access. 6) Provide signs and bike lane if possible.
Channel Geomorphology and Hydrology	1) Confluence with Cottonwood Creek.	1) Excess amounts of sediment entering creek. 2) Intermittent tributaries on east and west side	1) Continue to monitor. 2) Cross east side tribs. with pedestrian bridges. Highligh west side trib. as natural feature.

Table 6-2 Comprehensive Listing of Alternative Concepts	Page 1 of 2
Stormwater Conveyance	
1.	No action
2.	Status Quo/Continuation of existing trends
3.	Enhanced regulations
4.	Maintain current capacity, stabilize bed and banks
5.	One hundred-year protection, with detention
6.	One hundred-year protection through expanded conveyance
7.	One hundred-year protection through floodplain preservation
Grade Control	
1.	No action
2.	Vertical concrete drop 4 to 10 feet
3.	Sloping grouted boulder (UDFCD) 4 to 10 feet
4.	Riffle drop 1 to 3 feet
High Bank Stabilization	
1.	No action
2.	Excavate to flatter slope, revegetate
3.	Fill at flatter slope, relocate channel, add conveyance area, revegetate
4.	Retaining wall
Active-Channel Stabilization	
1.	No action
2.	Regrade and revegetate
3.	Bioengineering
4.	Rock toe protection plus revegetation
Trails	
1.	Locate outside of corridor a. On-street b. Off-street
2.	Locate on top of bank
3.	Locate in floodway/floodplain a. At-grade/minimal disturbance b. Fill c. Boardwalk

Table 6-2 Comprehensive Listing of Alternative Concepts		Page 2 of 2
Non-Motorized, Pedestrian Creek Crossings		
1.	Utilize existing roadway crossings and pedestrian bridges	
2.	Locate outside 100-year floodplain (large span)	
3.	Develop low water crossings	
4.	Develop crossings with recommended grade control/drop structures	
Environmentally Sensitive Areas (Including Wetlands need Sensitive Wildlife Habitat) and Significant Natural Features		
1.	Complete avoidance–do not disturb	
2.	Enhance/restore–avoid	
3.	Minimal impact/access and mitigation (onsite)	
4.	Complete access/alteration–mitigation (onsite)	
Property Ownership/Land Acquisition		
1.	Avoid	
2.	Acquire trail/recreational easement	
3.	Acquire portion in channel/floodway	
4.	Purchase entire parcel	
Adjacent Land-Use Compatible with Goals of Plan		
1.	Status quo, continue present policies	
2.	Screen from view	
3.	Land-us regulation–clean up	
4.	Purchase out-right–clean up	
5.	Promote grass-roots efforts for clean up	
Aesthetic and Historic Features		
1.	Conserve as is	
2.	Interpret to public	
3.	Enhance and highlight to public	
Road Crossings–Underpasses		
1.	Avoid with on-street alternative routes away from conflict points	
2.	Provide at-grade crossings (traffic control at crossings)	
3.	Provide continuity of trails through grade separation	

Alternative Development for Reach M1 - Confluence to Bijou Street - "Downtown" Reach

SUMMARY:
Reach is developed urban/industrial with narrow riparian area. There is an existing trail which passes under Bijou and over Fountain Creek, continuing south. There are views into corridor from I-25 and bridges which are not aesthetically pleasing. Access to corridor from downtown restricted by railroad and private industrial development. There are no existing flooding problems. Downtown Action Plan proposes development of Confluence Park north of Cimarron, the "park ring", trail development on east side of creek and pedestrian crossing of RR from Vermijon to Conejos and another just north of Depot, and re-development north of Colorado into "artisans district".

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Maintain existing.	Large drop structures (5-10') located downstream of bridges and major utility crossings	Maintain existing.	Maintain existing.	Maintain existing.	Maintain existing trail on west side of creek.	Recognize plan for Confluence Park, and Park Ring.	CDOT Private	Continue industrial development.		Maintain/ recognize Antlers Park as historic site.	
Alternative 3	Maintain existing.	Riffle drop structures (1-3')	Maintain existing.	Regrading/re-vegetation of vertical, eroded banks.	Increase wetland and riparian vegetation at waters edge.	Additional trail on east bank. Improve low water crossing. Utilize existing, abandoned rail crossing.	Promote Confluence Park & coordinate with park ring and spine trail. Stress downtown connectivity.	Promote, educate, existing landowners of Plan. Acquire recreation/flood easements.	Promote redevelopment of area, e.g. "artisans district" and waterfront business dist.	Conserve existing RR crossing. Incorporate future sewer plans.	Enhance viewshed out-of and into corridor from roadways.	
Alternative 4	Maintain existing.	Riffle drop structures with Boat chutes (1-3')	Planting pockets, other improvements to enhance visual appearance.	Rock toe stabilization to confine flows for boating.	Increase wetland vegetation at waters edge and in riparian areas.	Additional trail on east bank. Improve low water crossing. Utilize existing, abandoned rail crossing.	Promote Confluence Park, park ring and spine trail. Stress downtown connectivity. Boating Improvements	Acquire land for Confluence Park and other areas of re-development.	Promote redevelopment of area, e.g. "artisans district". Promote creation of "water feature" attraction.	Conserve existing RR crossing for use as trail and/or light rail to west. Incorporate future sewer plans.	Enhance viewshed out-of and into corridor from roadways.	
Alternative 5												

SUMMARY:

Reach character dominated by Monument Valley Park. City Service Yard on west side of creek has proposed redevelopment plan for more park-like features including trail on west bank top. There is adequate flood protection throughout with some limited overbank flooding north of pedestrian bridge and south of Uintah on west bank, but this does not threaten any structures. The channel bed is degrading which has resulted in the failing of small check structures and the exposure of utility crossings. WPA flat stonework along banks has aesthetic and historic appeal. Channel bank walls limit access to channel where there is an existing foot path. Riparian vegetation is limited to ribbon willow stands which have been recently cut. Increased vegetation in channel would alter flood regime. Therefore, any recommended increase in vegetation would be specified as that which would remain rooted, yet would lay down with the force of flood waters.

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Maintain Existing	Large drop structures (5-10') located downstream of bridges and major utility crossings.	Maintain existing	Maintain existing	Existing policy defined by Corps	Maintain existing trail system and access to channel.	Continue existing plans for MVP and Service Yard.	Continue existing attempts to purchase private property btw. MVP and Van Buren.	Maintain existing.	Protect existing.	Protect existing.	
Alternative 3	Maintain exsiting.	Riffle drop structures (1-3')	Conserve stone flatwork	Regrading/ revegetation of eroded banks within flood limitations	Increase wetlands, wildlife habitat, and enhance water quality within flood limitations.	Provide crossing to west bank to connect to Mesa Valley Trail & linear park of I-25 "take area". Increase access	Provide trail head/access. Increase interpretive areas for enviro./historic. Evaluate boating potential.	Acquire private property btw. MVP and Van Buren	Maintain existing. Enhance connections btw. west & east side of I-25.	Protect existing. Open Van Buren Bridge to non-truck or ped. traffic.	Protect existing. Enahnce education and interpretation.	
Alternative 4												
Alternative 5												

SUMMARY:

Reach extends through private, residential development on east side of creek and private light industrial on west side. Reach has highest problem of overbank and threatening flooding of residential property on east side of channel and industrial property on west side, both in the vicinity of Polk St. Bridge during 100 yr. storm. Crusher-fine trail exists along west side of creek with pedestrian crossing to east. Proposed connection of Steel St. to Mark Dabbling should be evaluated further.

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Educate adjacent prop. owners of existing flood potential	Grade control as needed to protect existing infrastructure.	Maintain to provide best conveyance.	Maintain to provide best conveyance.	Maintain existing emergent wetland through which, trail passes	Maintain existing and provide on-street routing to MVP trail system.	Maintain existing	Maintain existing	Maintain existing	Protect existing	Maintain existing	
Alternative 3	Channel/bridge modifications to eliminate out-of-bank flooding and increase develop-able area	Grouted boulder drop structures (5-10')	Maintain to provide best conveyance.	Regrading/re-vegetation of vertical, eroded banks.	Increase wetland vegetation at waters edge within flood limitations.	Enhance trail ammenities, e.g. interpretation of wetlands. Signs to Roswell park as Trail head	Obtain wider rec. easements- west side. Allow max. development w/in flood limitations. Promote road realignment."	Maintain light indus. use and provide max. potential.	Educate private owners about necessity to not dump along banks. Provide aesthetic buffers to trail.	Protect and up-grade existing to provide necessary conveyance.	Promote clean-up of banks	
Alternative 4	Non-structural approaches to mitigating damages from out-of-bank flooding.	Riffle drop structures (1-3')	Maintain with bioengineering to prevent erosion.	Rock toe stabiliza-tion with wetland/ riparian vegetation enhancement where possible.	Increase wetland vegetation at waters edge and in riparian areas within flood limitations.	Acquire land within existing 100 yr. flood limits for park/ recreationand flood capacity. Signs to Roswell as Trail head.	Promote natural area/public use of adjacent land within flood limit.	Re-develop area w/ in flood limits to open space/rec. use.	Motivate private owners to stop and clean bank dumping. Provide aes-thetic buffers to trail.	Protect and up-grade existing to provide necessary conveyance.	Motivate private owners to stop and clean bank dumping. Provide aes-thetic buffers to trail.	
Alternative 5												

SUMMARY:

Property adjacent to creek on west side of channel has been acquired by the City for a "Youth Sports Complex". Abandoned "Pikeview" reservoir II on the east side of the creek is also owned by the City. The City is negotiating the purchase of other property on the east side adjacent to the reservoir and Templeton Gap. A temporary trail on the west side of the creek has constructed, but the portion just to the north of Fillmore is threatened by bank erosion. Flooding of 100 yr. storm is contained within the channel and poses no immediate threat to public property. There is significant bank erosion which should be treated along with stream degradation. With the use of existing rip-rap found throughout the adjacent City property, this reach may be considered as a pilot project for channel and riparian zone restoration.

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Maintain existing	Grade control as needed to protect existing infrastructure.	Protect from erosion with structural and non-structural techniques	Rock toe stabilization on outside of bends	Maintain riparian vegetation	Develop trail as proposed on west side of creek.	Develop newly purchased lands as proposed by Parks & Rec.	City owned	Recreational	Work with future sewer main upgrades	Provide adequate buffers btw. creek and rec. facilities.	
Alternative 3	Maintain existing. Utilize non-structural approaches to mitigating damages from out-of-bank flooding.	Riffle drop structures (1-3') with rock toe to enhance wetlands	Utilize bio-engineering to stabilize and enhance wildlife hbaitat	Creation of wetland bench on inside of bends.	Increased riparian vegetation on created benches. Enhance wildlife habitat and mitigate storm runoff from fields.	Develop spine trail and spurs connecting both sides of creek, trail head/ access at park. Connect to Sinton and T-Gap trail.	Develop newly purchased lands as proposed by Parks & Rec.. Promote environmental education.	City owned	Promote recreational with enviro. enhancement, education, interpretation.	Work with future sewer upgrades	Provide adequate buffers btw. creek, riparian enviro. and rec. facilities maintianing wildlife habitat.	
Alternative 4												
Alternative 5												

SUMMARY:

Reach contains extensive cottonwood stands south of Garden of the Gods and I-25, providing excellant wildlife habitat and riparian vegetation stands. Flood limits pose no threat to existing devlopment. The majority of the land other than Pikeview reservoir, is privately ownedwith some having easement dedications for trail and recreational use. Sewer main easements may also provide trail alignment access if surface rights can be acquired. Extensive dumping north and south of G/G Rd. must be addressed in some fashion for flood conveyance, environmental, and aesthetic reasons. ISTEA money has been alloted to the development of the trail and several crossings along this reach and alternatives for these are currently being evaluated.

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Maintain existing.	Large drop structures (5-10') to protect bridges and major utility crossings.	Continue policy on private property owners dumping along banks	Treat as necessary	Treat as necessary	Continue as currently proposed	Continue as currently proposed	Continued private with trail easement.	Status Quo.	Maintain existing.	Status Quo.	Status Quo.
Alternative 3	Channel modifications to increase developable area.	Grouted boulder drop structures (5-10')	Removal of rubble or covering of it and revegetation by private property owners.	Regrading/ revegetation of vertical eroded banks	Increase wetland vegetation at waters edge.	Provide crossings which are most cost effective.	Public recreation and access confined to trail easement size.	Acquire more trail easements on boths sides of creek and for channel modification maintenance access.	Apply strict regulations to discourage bank dumping.	Upgrade existing as necessary.	Discourage bank dumping on private property.	Enhance views to Pikes Peak, Pulpit Rock.
Alternative 4	Channel modifications to enhance riparian and wetland vegetation development.	Riffle drop structures (1-3') with toe protection and vegetation enhancement.	Acquire easements or floodplain portion of private parcels and revegetate/cover banks.	Rock toe stabilization to confine active channel in braided areas. Creation of wetland benches	Increase native vegetation and wildlife habitat oncreated benches and in riparian zone.	Provide crossings which do not impact flood limits, wetlands, or riparian habitat.	Increase easement width or acquire land to create rest areas/ park nodes along trail.	Acquire more trail easements on boths sides of creek plus additional width for buffers, flood conveyance, and enviro. restoration.	Strict regulation and acquisition where possible to increase public use and access.	Upgrade existing and combine with trail crossings and grade control shere applicable.	Discourage bank dumping on private property.	Enhance views to Pikes Peak, Pulpit Rock, and rock outcrops.
Alternative 5												

Alternative Development for Reach M6 - Pikeview Bridge to Woodmen Road - "High Plains" Reach

SUMMARY:

Reach is presently being developed and the channel has been modified for commercial use which is planned for the area. It is unique to the corridor due to its present "open" character, thus the name "high plains". The city has been deeded most of the creek channel and is in the process of widening the easement to include a bench which runs atop the eastern bank which is ideal for trail alignment. Access to the existing park-n-ride lot may provide an ideal trail head and parking area. Existing bridge abutments may provide for a pedestrian crossing - "Pikeview Bridge". The channel provides adequate flood conveyance but will need to be modified for grade control and for better wildlife habitat and riparian/wetland vegetation. Reach also has historic significance of coal mine underlying area, an Indian battle of 1858-59, town of "Pikeview", and whistle stops along RR. Cottonwood Creek entering Monument from the east brings abundant sediment into the creek. Amounts should decline in the future.

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Maintain existing.	Large drop structures located downstream of road crossings and major utility crossings (5-10')	Maintain and prevent further erosion.	Maintain and prevent further erosion.	Maintain existing riparian vegetation an bank vegetation	Develop as proposed with ISTEA money.	Develop as proposed with ISTEA money.	Private with city owenership of channel and trail easements.	Commercial	As existing with upgrades as necessary.	Try to maintain viewsheds into and out of corridor. Interpret historic character of area.	
Alternative 3	Maintain existing & modify when necessary with channel alterations.	Riffle drop structures (1-3')	Regrading/ revegetation of isolated eroded areas.	Increase wetland vegetation along waters edge.	Increase wetlands and riparian zone vegetation. Enhance wetlands in areas of sw runoff/intermittent tribs.	Develop as proposed with possible increased easement widths for rest areas and small park nodes	Have developer provide for conservation and recreational open space.	Commercial development with open space and recreation provisions	Commercial with compatible use and minimal impact to character of corridor and channel.	Combined grade control with sewer line main upgrades.	Try to maintain viewsheds into and out of corridor. Interpret historic character of area.	
Alternative 4												
Alternative 5												

SUMMARY:

This reach is the only remaining segment of Monument Creek in the study area which has not been significantly altered by adjacent development. However, the owners plan to develop, and inturn, channelize portions of the creek. In the master plan a trail easement has been dedicated and would provide a connection to the Air Force Academy trails to the north. The 100 yr. flood limits are relatively wide, and if taken into condiseration by developer, they would provide a significant limitation to developable land w/o channelization. Pine Creek joins Monument from the east and may provide an opportunity for future trails. Historic significance should be noted of the area to the west which was once a major tourist attraction to the sandstone "mushroom" formations. There is also an existing stone foundation which may be a historic homestead.

Alternative Actions/Policies:

	Stormwater/ Flood Plain	Grade Control	Outer (high) bank treatment	Channel (low) bank treatment	Environmental	Trails/Crossings	Recreation	Property Ownership	Land Use	Infrastructure	Cultural/Historic/ Aesthetics	Special Features
Alternative 1 No Action												
Alternative 2	Restriction of flood limits through channelization as shown in existing Master Plan.	Large drop structures (5-10') located downstream of bridges and major utility crossings	Protect from erosion per owners specifications and needs.	Regrade and revegetate as erosion persists.	As directed by owner and platting restrictions.	As dedicated by developer when platted.	As dedicated by developer when platted.	Private	Commercial/ residential	Protect existing as needed.	As defined by owners.	
Alternative 3	Restrict flows to allow maximum development potential as desired by owners	Large drop structures (5-10') located downstream of bridges and major utility crossings	Protect from erosion utilizing vegetation where possible.	Regrade and revegetate as erosion persists.	Maintenance of existing where possible.	Utilize dedicated trail easement and utility maintenance access where possible.	Utilize dedicated trail easement and utility maintenance access where possible. Try to get open space dedication.	Private.	Commercial/ residential	Protect existing as needed. Incorporate new crossings with grade control.	As defined by owners.	
Alternative 4	Maintainfuture flood limits as predicted in "existing/natural" state	Riffle drop structures (1-3') with wetland enhancements.	Protect from erosion of vertical banks when necessary with bioengineering.	Maintain as existing. Regrade and Revegetate vertical high banks where necessary.	Maintain as existing. Enhance riparian and wetlands in conjunction with riffle drops	Obtain sufficient easements to develop trail in best possible location(s) within enviro. constraints.	Attempt to get dedication for flood limits as open space/ conservation zone.	Private outside of flood limits. Public within flood limits.	Commercial, residential, open space.	Protect existing as needed. Incorporate new with grade control. Limit crossings and disturbance to environment.	Highlight cultural/historic features along trail.	
Alternative 5												

conditions representative of each alternative. To increase their utility, the cross sections represent the character of an entire reach, rather than just one specific location within a reach.
The study reach was divided into seven planning segments according to similarities in stream characteristics. Using input from the Study Group, alternatives were identified for each of the seven different reaches. Three or four alternatives were developed for each reach.

It was agreed that Alternative 1 would consistently represent a no-action alternative. This alternative allowed the Study Group to evaluate future ramifications, assuming no improvements were made to the creek. The purpose of Alternative 1 was to provide a baseline condition with which to compare other alternatives.

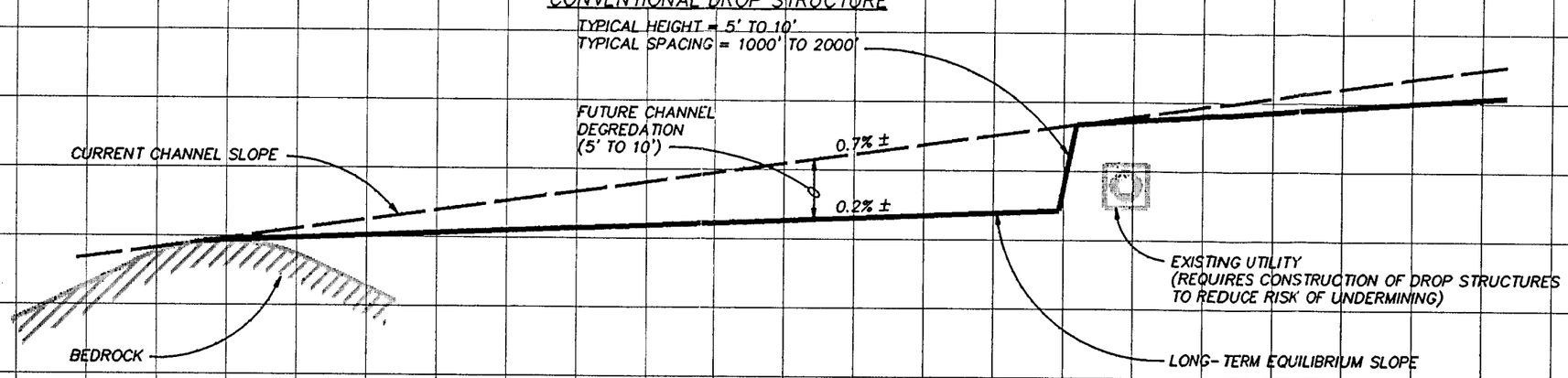
Alternative 2 generally represented a reactive strategy, similar to past practices related to Monument Creek. In the reactive strategy, action would be oriented toward protecting existing infrastructure. For instance, drop structures would be constructed downstream of bridges and utility crossings to protect the structures from failure and adverse impacts of bed degradation. Because these drops would likely not be built until degradation presented an urgent problem, the drop structures would be large (5 to 10 feet high). It was assumed that the drops would be sloping grouted boulder structures. In the reactive strategy, no drops would be constructed at locations between infrastructure crossings even if stream degradation lowered the channel bed between crossings.

Alternative 2 in Reach M7, rather than representing a reactive strategy, is consistent with the master plan for the Tudor site dated January 1987. This plan shows some filling of the floodplain and a realignment of a major meander bend. No grade control structures are proposed in the plan to limit channel degradation.

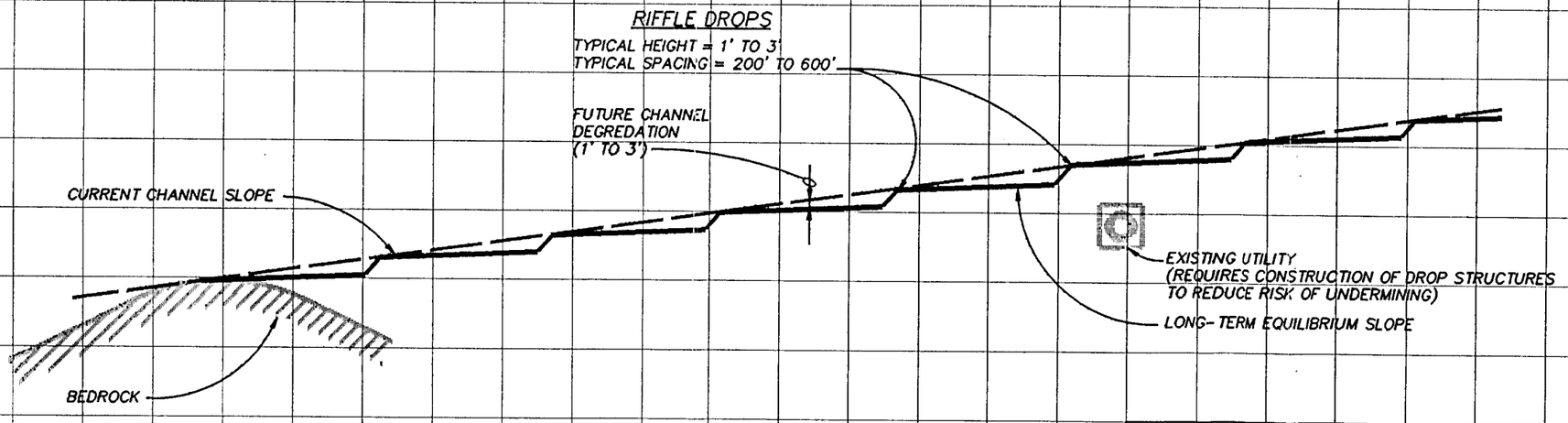
Alternative 3 in reaches M3, M5, and M7 feature stabilization over each reach using conventional drop structures and bank channelization. The drop structures are assumed to be 5 to 10 feet high sloping grouted boulder structures. The channelization work would be designed to increase flood capacity and confine the 100-year future development condition floodplain to the area between the top of the channel banks, eliminating overbank flooding.

Alternative 3 in the other portions of the creek (in Reaches M1, M2, M4, and M6) use "riffle drops" and enhanced riparian vegetation to stabilize the channel against degradation. Alternative 4 in Reaches M3, M5, and M7 also use this concept. Riffle drops are small (1 to 3 feet high) cobble (rock) drops frequently spaced along the streambed. The riffle drop would be gently sloping, dropping approximately 1.5 feet over a distance of 15 feet. This configuration requires less structural support and provides greater ease of movement for fish than a straight, vertical drop. It also provides less of a barrier for boating or tubing.

Riffle drops are shown schematically in Figure 6-1 in comparison to larger conventional drop structures. Figure 6-2 shows a perspective view of a riffle drop. The riffle drops



CONCEPT A



CONCEPT B

FIGURE 6-1

GRADE CONTROL CONCEPTS

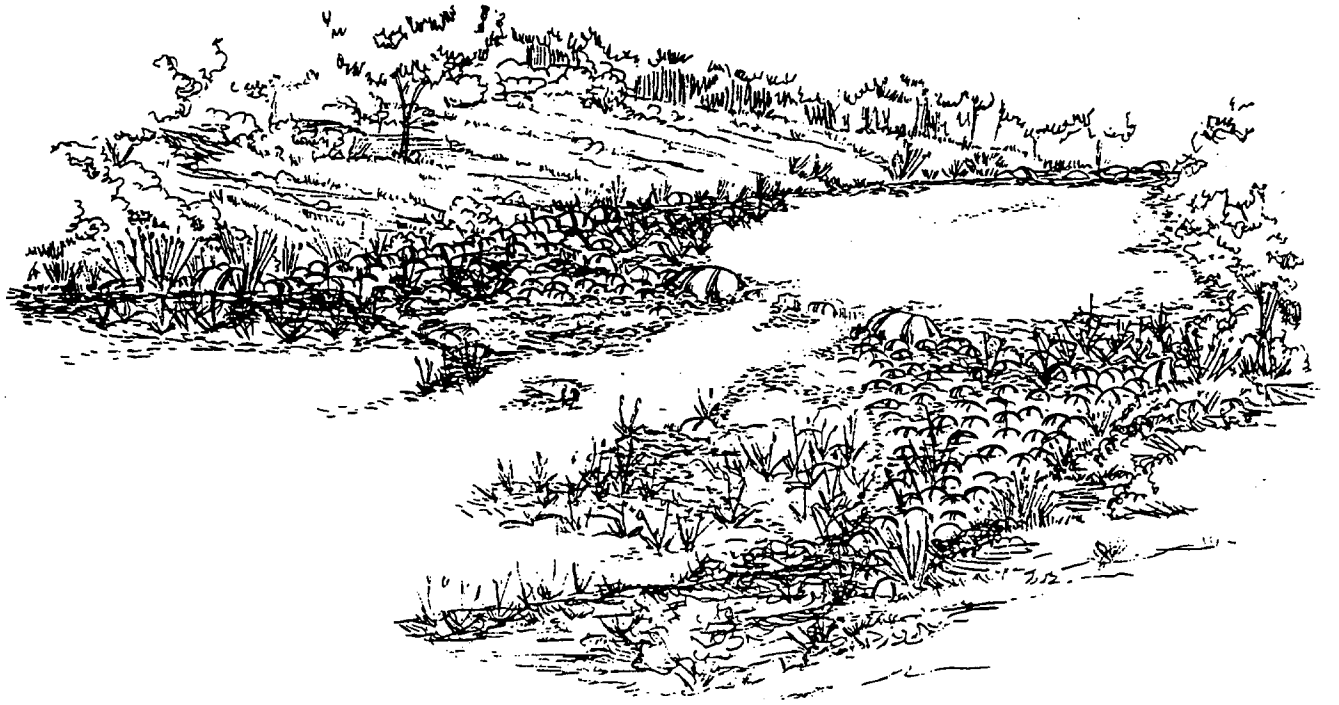


Figure 6-2
Typical Riffle Drop

would be designed to emulate the riffle/pool sequence found in many natural streams and would control downcutting of the channel as the equilibrium slope decreases over time. The drops could be used to promote a narrower, meandering base flow channel geometry as the expected long-term decrease in sediment supply enables this shift in regime to take place.

Overbank flooding in the riffle drop alternatives is assumed to be addressed through a nonstructural strategy of floodplain acquisition and flood proofing. This generally pertains to the area upstream of Polk and Fillmore Streets. Use of vegetative or site specific rock erosion control measures will be required in overbank areas where velocities are locally high.

None of the stream improvement alternatives identified will eliminate the risk of property damage due to lateral bank erosion during extreme floods. This would require hard-lining the length of Monument Creek or significantly widening the flood-plain channel downstream of Woodmen Road. The riffle drop alternatives have the best chance of reducing the risk of lateral bank erosion.

Although not specifically called out in these alternatives, opportunities would be sought where land uses allowed to remove some of the fill material that has been placed adjacent to the channel, especially in areas where bank dumping has occurred. This would open up a wider floodplain and enable riparian vegetation to be increased, decreasing flood velocities and lateral bank erosion.

Section 7.5 provides a detailed, reach-by-reach description and evaluation of alternative stream improvement plans.

6.4 Effects of Regional Detention

The effect of regionalized detention upon the peak discharges of Monument Creek was evaluated. Flood hydrographs reflecting regional detention were input to the Monument Creek future condition HEC-1 computer model in order to ascertain whether or not detaining developed runoff to existing levels within major urbanized east bank tributaries would in fact lower the peak 100-year discharges for the reaches of Monument Creek below the Cottonwood Creek confluence. Detained hydrographs were input for the Cottonwood, Black Forrest, Jackson, Pine, Smith, and Monument Branch basins. A detained hydrograph was developed for each of these basins by modifying future condition hydrographs so that the peak flow rates corresponded to the existing development condition peak discharges. The future condition runoff volume was accounted for in the modified hydrographs. The result of this analysis is shown in Table 6-4.

As shown in Table 6-4, regional detention on major tributaries to Monument Creek would not provide a significant reduction in peak discharges on mainstream Monument Creek. Detention on Monument Creek itself is not judged to be feasible because of the

massive storage volume necessary to provide measurable benefit. Therefore, the alternative improvement plans were prepared and evaluated based on the estimated discharge for future development conditions, without the use of detention.

Table 6-4
Effects of Regional Detention

Location	100-year Existing (cfs)	100-year Future (cfs)	100-year Detained (cfs)
Confluence with Fountain Creek	27,900	32,800	32,200
Confluence with Cottonwood Creek	26,300	29,800	29,500
South USAFA Boundary	24,000	26,000	25,900

However, the use of detention facilities is generally recommended in tributary watersheds (i.e., Cottonwood Creek, Pine Creek, etc.) to provide reduction in peak flows benefitting properties downstream of the facilities. The use of detention facilities in such cases can have a significant impact on the size of improvements downstream of the facilities. Unfortunately, it will not have a significant impact on the peak discharges along Monument Creek, as noted in Table 6-4.

Detention facilities can also provide water quality enhancement benefits in both tributary streams and in mainstem Monument Creek and Fountain Creek.

7.0 EVALUATION OF ALTERNATIVE PLANS

7.0 Evaluation of Alternative Plans

7.1 Basis of Evaluation

The alternative stream improvement plans were evaluated based on how well they fulfilled the project goals and objectives. The list of goals and objectives is shown in Section 6.1. This list of 8 general goals and 39 specific objectives is comprehensive; therefore, the alternatives were evaluated based on a wide range of considerations from public safety and community development to habitat and recreation.

One of the general goals of the project is to maintain a high level of benefit to cost. To use this goal as a basis of evaluation, opinions of probable costs associated with each alternative were developed. Probable capital costs and operations and maintenance costs were identified, then used in a present value analysis to compare alternatives.

7.2 Costs of Alternative Plans

7.2.1 Probable Capital Costs

Capital costs are the costs associated with the actual physical construction of stream improvement alternatives. For the purposes of the current study, capital costs include the actual construction costs as well as land costs, engineering and landscape design, permitting, administration, and legal costs, and project contingencies.

Base construction costs were estimated for each alternative using a series of unit cost relationships. The unit cost relationships were prepared for a range of possible stream improvement measures as shown on Drawings 15 through 17 of Volume II. These relationships are shown in Table 7-1. Each relationship is expressed in terms of the length, width, and height of the proposed improvement.

The stream improvement alternative plans (Sheets 18 through 21 of Volume II) indicate the length, width, and height of the improvement measures proposed for each alternative; therefore, the probable cost of each alternative was determined by applying the unit cost relationships to the sizes shown and summing them by reach. These calculations are shown in Appendix G. The unit costs were increased by a factor of 50 percent to account for mobilization, control of water and erosion, unlisted items, and construction contingencies. A 25 percent cost allowance was added to the total construction cost for engineering and landscape design, permitting, administration and legal costs. Land acquisition costs were also added. The resulting capital costs for Alternative 2, 3, and 4 are shown in Table 7-2. No capital costs are shown for Alternative 1 because it consistently represents "no action," or no capital expenditure.

Table 7-1
Monument Creek Drainage Basin Planning Study
Cost Equations

Improvement	Variable(s)	Equation
Vertical Structural Drop	Height, crest length	Cost ($) = (6 × H + 60) × (L + 60) × (2.5/27) × ($110) + (3 × H) × (6 × H + 60) × ($250/27) + ($10,000 × H)
Sloping Boulder Drop	Height, crest length	Cost ($) = (7 × H + 60) × (L + 60) × 2.5/27 × ($110) + ($10,000 × H)
Baffled Drop	Height, crest length	Cost ($) = 7,834 × (H^0.195) × (L^0.492)
Riffle Drop	Height, crest length	Cost ($) = (18 + 12 × H) × 2.5 × (L + 20)/27 × ($45) + (34 + 12 × H) × (L + 20) × ($0.75)
Riprap Bank Protection	Height, length	Cost ($) = [(H + 2) × 2 × 2 + (7 × 2/2)]/27 × ($45) × L
Concrete Bank Protection	Height, length	Cost ($) = [(H + 3) × 2 × 0.5/27 × ($250) + 10.5 × 3/2/27 × ($45)] × L
Eroding Bank Stabilization (Concrete Wall)	Height, length	Cost ($) = H × L × ($45)
Vertical Bank Loading (X5)	Height, length	Cost ($) = [(H^2) × 3/2/27 × ($5) + (3 × H + 10) × ($0.50)] × L
Levee	Height, length	Cost ($) = [((H^2) × 3 + 15 × H)/27 × ($5) + (2 × 3 × H + 15 + 20) × ($0.50)] × L
Enhancement of Riparian Vegetation	Length, width	Cost ($) = L × W × ($0.50)
Screening Vegetation	Length, width	Cost ($) = L × W × ($1)
Pedestrian Bridge	Length, width	Cost ($) = L × W × ($50)
Road Bridge	Length, width	Cost ($) = L × W × ($70)
Utility Relocation (major)	Length	Cost ($) = L × ($250)
Utility Relocation (minor)	Length	Cost ($) = L × ($100)
Thalweg Grading (X2)	Length, width	Cost ($) = L × W × 1/27 × ($5)
Channel Excavation	Height, length, width	Cost ($) = H × L × W/27 × ($5) + L × W × ($0.75)
Remove/Cover Bank Dumping	Length, width	Cost ($) = L × W × [5/27 × ($10) + ($0.50)]

Table 7-2 Probable Capital Costs of Alternatives (millions of dollars)			
Reach	**Alternative 2**	**Alternative 3**	**Alternative 4**
M1	2.56	1.36	2.94
M2	1.47	3.63	N/A
M3	2.36	4.99	1.79
M4	2.35	3.03	N/A
M5	3.17	11.13	5.49
M6	0.10	2.20	N/A
M7	1.28	5.73	3.77

At this early stage in project conceptualization, the costs identified are approximate. The costs are suitable for the comparison of alternatives, but will need to be revised and refined in subsequent design stages. The costs generally reflect improvements constructed to provide drainage and flood control benefits (trails, pedestrian bridges, interpretive signage, and creekside park improvements were accounted for in the Pikes Peak Greenway Master Plan). However, some aspects of the improvements shown in this study provide clear benefits outside the areas of drainage and flood control. For example, grade control improvements provide protection for bridges (streets and highways) and utilities, and riffle drops, channel shaping, and vegetation plantings can restore terrestrial and aquatic habitat, enhance water quality, and provide boating passage.

Some improvements benefit adjacent private landowners, and may be constructed as part of development activities, or partially funded through the granting of easements. Other improvement activities and land acquisition may be delayed or precluded because they do not represent a sufficiently high priority to the private landowners or the City, relative to other needs. Therefore, actual costs expended for improvements may be allocated among a number of benefitted public and private entities and may vary from the costs shown in Table 7-2.

The final costs of the project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project costs will vary from the opinions of probable cost presented herein. Project feasibility, benefit/cost ratios, risks, and funding must be carefully reviewed before making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding.

7.2.2 Operations and Maintenance Costs

Average annual operations and maintenance (O&M) costs were estimated for each stream improvement alternative. O&M costs per linear foot were based on records kept by the Maintenance Division of the Denver area Urban Drainage and Flood Control District.

Annual O&M costs for natural floodplain areas (Primarily for debris clearing and litter removal) were assumed to be approximately $1 per lineal foot. These costs were applied to the relatively stable "riffle drop" alternative plans. Annual O&M costs for the channelized areas (including occasional mowing for weed control) were assumed to be approximately $2 per linear foot. These costs were applied to the channelization alternatives.

The Alternative 2 plans, which featured drop structures located to protect existing utility crossings and bridge foundations, were assumed to require the expenditure of $150 per linear foot over a 50-year period for the repair of eroding channel banks between infrastructure crossings, in addition to $1 per linear foot per year for debris control. These costs equate to an average annual O&M cost of $4 per linear foot. The Alternative 1, or "no action" plans (including Alternative 2 in Reach M7), were assumed to required, over a period of 50 years, the construction of the Alternative 2 drop structures protecting existing infrastructure, in addition to the Alternative 2 O&M costs of $4 per lineal foot.

The O&M costs for the alternatives are shown in Table 7-3. The O&M costs for the "no action" alternatives (Alternative 1) are significantly greater than for the "action" alternatives. This is because they include capital costs associated with constructing drop structures to protect infrastructure as a necessary part of long-term maintenance.

Table 7-3
Probable O&M Costs of Alternatives
(dollars per lineal feet)

Reach	Alternative 1	Alternative 2	Alternative 3	Alternative 4
M1	18.31	5.00	1.25	1.25
M2	7.46	5.00	1.25	N/A
M3	16.75	5.00	2.50	1.25
M4	12.04	5.00	1.25	N/A
M5	10.33	5.00	2.50	1.25
M6	5.67	5.00	1.25	N/A
M7	12.89	12.89	2.50	1.25

7.2.3 Present Value Analysis

To provide an equitable basis for comparing the costs of alternatives, a number of present value analyses were conducted. The present value analyses factored in both capital cost expenditures (over an assumed implementation period) and O&M costs (over a period of 50 years) and expressed the costs in terms of a single present value for each alternative. In this manner, comparisons could be made between low capital/high O&M alternatives and high capital/low O&M alternatives.

For the purpose of the present value analyses, the various stream improvement alternatives were regrouped into four scenarios. These four scenarios had common themes, so one scenario for all seven reaches of Monument Creek could be compared to other scenarios. The scenarios are described below:

- Scenario 1 represents no action and is the same as Alternative 1 for the seven reaches

- Scenario 2 represents the reactive strategy (drop structures located downstream of infrastructure crossings) and is the same as Alternative 2 for the seven reaches

- Scenario 3 represents stabilization over the entire study reach length using conventional drop structures and bank channelization (Alternative 3 for Reaches M3, M5, and M7 plus Alternative 2 in the other reaches modified to include additional drops between infrastructure crossings)

- Scenario 4 represents stabilization over the entire study reach length using riffle drops and enhanced riparian vegetation (Alternative 3 for Reaches M2, M4, and M6 and Alternative 4 for M3, M5, and M7 plus Alternative 4 without the kayak course for Reach M1)

Six different capital cost funding strategies were used for the present worth analyses. The funding strategies were based on implementation periods ranging from 10 years starting in 1993 (most aggressive funding strategy) to 20 years starting in 1998 (least aggressive funding strategy).

The present value analyses are based on an assumed discount rate. A discount rate is an interest rate which, when compounded for the appropriate number of periods, yields the present value of a future cost. It is called a discount rate, rather than an interest rate, as a convention to demonstrate that it is being used to determine the present value of a future cost; an interest rate allows one to determine the future value of a present value. There is less risk of uncertainty associated with a real discount rate and constant dollar analysis than there is with a nominal interest rate and future cost analysis.

Present value calculations for each of the six funding strategies are shown in Appendix G. The results of the analyses are shown in Table 7-4.

The present value of Scenario 1 consists entirely of O&M costs so it is insensitive to variations in capital cost funding strategies. Scenarios 2, 3 and 4 all require significant capital expenditures and thus are sensitive to variations in funding strategies. Scenarios 3 and 4 are most sensitive to funding variations because their O&M costs are the lowest.

In all of the funding strategies, Scenario 4 has the lowest present value of any of the action scenarios (Scenarios 2, 3, and 4). For all but the first, most aggressive funding strategy, Scenario 4 has a lower present value than the no action scenario (Scenario 1). **This shows that it is generally more economical to implement a proactive improvement plan that provides full stabilization (and a variety of other benefits) than to do nothing and try to fix problems after they occur.**

7.3 Vegetation Impacts of Alternative Plans

Besides identifying probable costs, one other approach was used to compare alternatives quantitatively. This approach identified areal impacts of the alternatives on existing riparian vegetation.

Three types of impacts were quantified. The first impact is negative, pertaining to riparian vegetation disturbed during construction and not replaced. The second impact still negative, but to a lesser degree. It pertains to riparian vegetation disturbed during construction but replaced in kind. The third impact is positive, pertaining to riparian vegetation created as part of the alternative implementation where none currently exists.

Table 7-5 shows acreage estimates of the three types of impacts for each action alternative. The estimates indicate that the riffle drop alternatives (Alternative 3 for Reaches M2, M4, and M6 and Alternative 4 for Reaches M1, M3, M5, and M7) have the smallest negative and greatest positive impact of the action alternatives. **The riffle drop alternatives are estimated to create 28 more acres of riparian vegetation than currently exist.**

7.4 Qualitative Evaluation of Alternative Plans

In addition to quantitative comparisons based on cost and areal impacts to riparian vegetation, the alternatives were also evaluated qualitatively. The qualitative evaluation was conducted by the project team based on how well alternatives were perceived to accomplish a representative set of the corridor goals and objectives (listed in Section 6.1). The evaluation is depicted graphically in Figure 7-1.

Three different symbols were used to rate the alternatives. A closed circle indicates that the alternative achieves an objective well. A half-closed circle indicates that the alternative

Table 7-4
Present Value of Stream Improvement Scenarios

Funding Analysis	Scenario 1 No Action	Scenario 2 Reactive Strategy	Scenario 3 Conventional Drops and Channelization	Scenario 4 Riffle Drops and Enhanced Vegetation
1. Capital expenditures in all reaches over 10 years from 1993 to 2002	$14,445,204	$19,483,638	$30,316,601	$19,634,586
2. Capital expenditures in all reaches over 20 years from 1993 to 2012	$14,445,204	$13,922,442	$16,862,897	$10,669,592
3. Capital expenditures phased to complete one reach every 2 years starting with Reach M1 in 1993	$14,445,204	$19,050,798	$25,986,023	$16,980,829
4. One million in capital expenditures every year starting with Reach M1 in 1993	$14,445,204	$16,844,966	$15,628,073	$13,187,334
5. Capital expenditures in all reaches over 20 years from 1998 to 2017	$14,445,204	$12,019,639	$11,813,568	$8,124,186
6. One million in capital expenditures every year starting with Reach M1 in 1998	$14,445,204	$16,762,277	$14,490,233	$13,877,440

Table 7-5
Impacts of Alternative Plans on Riparian Vegetation

Reach	Type of Impact	Number of Acres		
		Alternative 2	Alternative 3	Alternative 4
M1	**Type A**—Disturbed during construction and not replaced	2.5	0.0	0.0
	Type B—Disturbed during construction and replaced in kind	2.5	2.0	2.0
	Type C—Created where none currently exists	0.0	1.7	1.7
	Type C-A—**Net increase in wetlands**	-2.5	1.7	1.7
M2	**Type A**—Disturbed during construction and not replaced	1.5	0.0	N/A
	Type B—Disturbed during construction and replaced in kind	0.0	5.2	N/A
	Type C—Created where none currently exists	0.0	6.6	N/A
	Type C-A—**Net increase in wetlands**	-1.5	6.6	N/A
M3	**Type A**—Disturbed during construction and not replaced	2.5	2.5	0.0
	Type B—Disturbed during construction and replaced in kind	2.8	12.0	4.0
	Type C—Created where none currently exists	0.0	0.0	2.2
	Type C-A—**Net increase in wetlands**	-2.5	-2.5	2.2
M4	**Type A**—Disturbed during construction and not replaced	2.0	0.0	N/A
	Type B—Disturbed during construction and replaced in kind	3.2	4.5	N/A
	Type C—Created where none currently exists	0.0	6.2	N/A
	Type C-A—**Net increase in wetlands**	-2.0	6.2	N/A
M5	**Type A**—Disturbed during construction and not replaced	3.1	3.1	0.6
	Type B—Disturbed during construction and replaced in kind	2.8	6.6	6.3
	Type C—Created where none currently exists	0.0	0.0	5.4
	Type C-A—**Net increase in wetlands**	-3.1	-3.1	4.8
M6	**Type A**—Disturbed during construction and not replaced	0.5	0.5	N/A
	Type B—Disturbed during construction and replaced in kind	0.0	4.0	N/A
	Type C—Created where none currently exists	0.0	4.0	N/A
	Type C-A—**Net increase in wetlands**	-0.5	3.5	N/A
M7	**Type A**—Disturbed during construction and not replaced	6.7	9.3	0.9
	Type B—Disturbed during construction and replaced in kind	4.4	7.0	3.8
	Type C—Created where none currently exists	0.0	0.0	3.5
	Type C-A—**Net increase in wetlands**	-6.7	-9.3	2.6

	ALT 1	ALT 2	ALT 3	ALT 4
PUBLIC SAFETY				
Minimizes Flood Damage to Private Property	●	●	●	●
Minimizes Flood Damage to Public Property	●	●	●	●
Minimizes Bank Erosion & Bank Sloughing	○	◒	●	●
Minimizes Loss of Life & Injury	◒	◒	●	●
Minimizes Safety Hazard — Water Contact	◒	◒	●	●
RECREATION				
Provides Multi-Use Trail	●	●	●	●
Provides Active Recreation Area	○	○	◒	●
Provides Education/Interpretive Opportunities	◒	◒	●	●
Provides Access to Corridor	◒	●	●	●
AESTHETICS				
Utilizes Quality & Compatible Materials	○	◒	●	●
Provides Beautification	◒	◒	●	●
Provides Passive Recreation	◒	◒	●	●
Establishes Buffer Zones	◒	◒	●	●
Cleans-Up/Deters Bank Dumping	○	○	◒	◒
Preserves/Enhances I-25/Creek Visual Compatibility	○	◒	◒	●
ENVIRONMENT				
Stabilizes Channel	○	◒	●	●
Preserves/Enhances Aquatic Habitat	○	◒	●	●
Preserves/Enhances Riparian Habitat	◒	◒	●	●
Preserves/Enhances Upland Habitat	◒	◒	◒	●
Protects Groundwater Level	○	◒	●	●
Minimizes Construction & Maintenance Impacts	◒	◒	●	●
COMMUNITY DEVELOPMENT				
Promotes Development & Redevelopment	○	○	○	○
Supports Desirable Adjacent Land Uses	◒	◒	●	●
Preserves/Enhances Historic/Cultural Features	○	○	◒	●
Provides Utility Improvements Opportunities	○	○	●	●
Promotes Community Pride & Stewardship	○	◒	◒	●
Preserves/Enhances Neighborhoods	○	○	◒	●
PROPERTY				
Minimizes Acquisition of Private Property	●	◒	○	○
Preserves/Enhances Property Value	○	○	◒	●
COST				
Minimizes Capital Cost	**$0 M**	**$2.6 M**	**$1.4 M**	**$2.9M**
Minimizes Operations & Maintenance Cost	○	◒	●	●
RECOMMENDATION				

ALTERNATIVE 4, MODIFIED TO DELETE KAYAK COURSE. RECOMMENDED ALTERNATIVE COST: $1.7M ($460/L.F.)

Figure 7-1 (1 of 7)
EVALUATION RATINGS FOR REACH M1—CONFLUENCE TO BIJOU STREET

	ALT 1	ALT 2	ALT 3
PUBLIC SAFETY			
Minimizes Flood Damage to Private Property	●	●	●
Minimizes Flood Damage to Public Property	●	●	●
Minimizes Bank Erosion & Bank Sloughing	○	◒	●
Minimizes Loss of Life & Injury	◒	◒	●
Minimizes Safety Hazard — Water Contact	◒	◒	●
RECREATION			
Provides Multi-Use Trail	●	●	●
Provides Active Recreation Area	○	○	◒
Provides Education/Interpretive Opportunities	◒	◒	●
Provides Access to Corridor	◒	◒	●
AESTHETICS			
Utilizes Quality & Compatible Materials	○	◒	◒
Provides Beautification	◒	◒	◒
Provides Passive Recreation	◒	◒	◒
Establishes Buffer Zones	○	○	◒
Cleans-Up/Deters Bank Dumping	◒	◒	◒
Preserves/Enhances I-25/Creek Visual Compatibility	○	◒	◒
ENVIRONMENT			
Stabilizes Channel	○	◒	●
Preserves/Enhances Aquatic Habitat	○	◒	●
Preserves/Enhances Riparian Habitat	◒	◒	●
Preserves/Enhances Upland Habitat	◒	◒	●
Protects Groundwater Level	○	◒	●
Minimizes Construction & Maintenance Impacts	◒	◒	●
COMMUNITY DEVELOPMENT			
Promotes Development & Redevelopment	○	○	○
Supports Desirable Adjacent Land Uses	◒	◒	●
Preserves/Enhances Historic/Cultural Features	◒	◒	●
Provides Utility Improvements Opportunities	○	○	●
Promotes Community Pride & Stewardship	○	◒	●
Preserves/Enhances Neighborhoods	○	○	●
PROPERTY			
Minimizes Acquisition of Private Property	●	●	●
Preserves/Enhances Property Value	○	○	●
COST			
Minimizes Capital Cost	**$0 M**	**$1.5 M**	**$3.6M**
Minimizes Operations & Maintenance Cost	○	◒	●
RECOMMENDATION			

ALTERNATIVE 3. RECOMMENDED ALTERNATIVE COST: $3.6M ($300/L.F.)

Figure 7-1 (2of 7)
REACH M2 — BIJOU STREET TO VAN BUREN STREET

	ALT 1	ALT 2	ALT3	ALT4
PUBLIC SAFETY				
Minimizes Flood Damage to Private Property	○	○	●	●
Minimizes Flood Damage to Public Property	○	○	●	●
Minimizes Bank Erosion & Bank Sloughing	○	◒	●	●
Minimizes Loss of Life & Injury	○	◒	●	●
Minimizes Safety Hazard — Water Contact	◒	◒	◒	●
RECREATION				
Provides Multi-Use Trail	●	●	●	●
Provides Active Recreation Area	○	○	○	●
Provides Education/Interpretive Opportunities	◒	◒	◒	●
Provides Access to Corridor	◒	●	●	●
AESTHETICS				
Utilizes Quality & Compatible Materials	○	◒	◒	●
Provides Beautification	◒	◒	◒	●
Provides Passive Recreation	◒	◒	◒	●
Establishes Buffer Zones	◒	◒	◒	●
Cleans-Up/Deters Bank Dumping	○	◒	◒	◒
Preserves/Enhances I-25/Creek Visual Compatibility	○	○	○	●
ENVIRONMENT				
Stabilizes Channel	○	◒	◒	●
Preserves/Enhances Aquatic Habitat	○	◒	◒	●
Preserves/Enhances Riparian Habitat	◒	◒	◒	●
Preserves/Enhances Upland Habitat	◒	◒	◒	●
Protects Groundwater Level	○	◒	◒	●
Minimizes Construction & Maintenance Impacts	◒	◒	○	●
COMMUNITY DEVELOPMENT				
Promotes Development & Redevelopment	○	○	●	○
Supports Desirable Adjacent Land Uses	○	○	●	●
Preserves/Enhances Historic/Cultural Features	◒	◒	◒	◒
Provides Utility Improvements Opportunities	○	○	○	●
Promotes Community Pride & Stewardship	◒	◒	◒	●
Preserves/Enhances Neighborhoods	◒	◒	◒	◒
PROPERTY				
Minimizes Acquisition of Private Property	●	◒	◒	○
Preserves/Enhances Property Value	◒	◒	●	◒
COST				
Minimizes Capital Cost	**$0 M**	**$2.4M**	**$5.0M**	**$1.8M**
Minimizes Operations & Maintenance Cost	○	◒	◒	●
RECOMMENDATION				

ALTERNATIVE 4. RECOMMENDED ALTERNATIVE COST $1.8M ($450/L.F.)

Figure 7-1 (3 of 7)
REACH M3 — VAN BUREN STREET TO FILLMORE STREET

	ALT 1	ALT 2	ALT3
PUBLIC SAFETY			
Minimizes Flood Damage to Private Property	○	○	◖
Minimizes Flood Damage to Public Property	○	○	●
Minimizes Bank Erosion & Bank Sloughing	○	◒	◖
Minimizes Loss of Life & Injury	○	◒	●
Minimizes Safety Hazard — Water Contact	◒	◒	◖
RECREATION			
Provides Multi-Use Trail	●	●	●
Provides Active Recreation Area	○	○	◖
Provides Education/Interpretive Opportunities	◒	◒	●
Provides Access to Corridor	●	●	◖
AESTHETICS			
Utilizes Quality & Compatible Materials	○	◒	●
Provides Beautification	◒	◒	◖
Provides Passive Recreation	◒	◒	●
Establishes Buffer Zones	○	◒	◖
Cleans-Up/Deters Bank Dumping	○	◒	◖
Preserves/Enhances I-25/Creek Visual Compatibility	○	○	○
ENVIRONMENT			
Stabilizes Channel	○	◒	●
Preserves/Enhances Aquatic Habitat	○	◒	◖
Preserves/Enhances Riparian Habitat	◒	◒	◖
Preserves/Enhances Upland Habitat	◒	◒	●
Protects Groundwater Level	○	◒	◖
Minimizes Construction & Maintenance Impacts	◒	◒	●
COMMUNITY DEVELOPMENT			
Promotes Development & Redevelopment	◒	◒	○
Supports Desirable Adjacent Land Uses	◒	◒	●
Preserves/Enhances Historic/Cultural Features	○	○	○
Provides Utility Improvements Opportunities	○	○	◖
Promotes Community Pride & Stewardship	◒	◒	●
Preserves/Enhances Neighborhoods	○	○	◖
PROPERTY			
Minimizes Acquisition of Private Property	●	◒	○
Preserves/Enhances Property Value	○	○	◒
COST			
Minimizes Capital Cost	**$0M**	**$2.4M**	**$3.0**
Minimizes Operations & Maintenance Cost	○	◒	●
RECOMMENDATION			

ALTERNATIVE 3. RECOMMENDED ALTERNATIVE COST $3.0M ($460/L.F.)

Figure 7-1 (4 of 7)
REACH M4 — FILLMORE STREET TO TEMPLETON GAP FLOODWAY

	ALT 1	ALT 2	ALT3	ALT4
PUBLIC SAFETY				
Minimizes Flood Damage to Private Property	●	●	●	●
Minimizes Flood Damage to Public Property	●	●	●	●
Minimizes Bank Erosion & Bank Sloughing	○	◒	●	●
Minimizes Loss of Life & Injury	○	○	◒	●
Minimizes Safety Hazard — Water Contact	◒	◒	◒	●
RECREATION				
Provides Multi-Use Trail	○	●	●	●
Provides Active Recreation Area	○	○	○	●
Provides Education/Interpretive Opportunities	◒	◒	◒	●
Provides Access to Corridor	○	●	●	●
AESTHETICS				
Utilizes Quality & Compatible Materials	○	◒	◒	●
Provides Beautification	◒	◒	◒	●
Provides Passive Recreation	◒	◒	◒	●
Establishes Buffer Zones	◒	◒	◒	●
Cleans-Up/Deters Bank Dumping	○	○	●	●
Preserves/Enhances I-25/Creek Visual Compatibility	◒	◒	◒	○
ENVIRONMENT				
Stabilizes Channel	○	◒	◒	●
Preserves/Enhances Aquatic Habitat	○	◒	◒	●
Preserves/Enhances Riparian Habitat	◒	◒	◒	●
Preserves/Enhances Upland Habitat	○	○	◒	●
Protects Groundwater Level	○	◒	◒	●
Minimizes Construction & Maintenance Impacts	◒	◒	○	●
COMMUNITY DEVELOPMENT				
Promotes Development & Redevelopment	○	○	●	○
Supports Desirable Adjacent Land Uses	◒	◒	●	●
Preserves/Enhances Historic/Cultural Features	◒	◒	◒	◒
Provides Utility Improvements Opportunities	○	○	○	●
Promotes Community Pride & Stewardship	◒	◒	◒	●
Preserves/Enhances Neighborhoods	◒	◒	◒	●
PROPERTY				
Minimizes Acquisition of Private Property	●	◒	◒	○
Preserves/Enhances Property Value	◒	◒	●	◒
COST				
Minimizes Capital Cost	**$0M**	**$3.2M**	**$11.1M**	**$5.5M**
Minimizes Operations & Maintenance Cost	○	◒	◒	●
RECOMMENDATION				

ALTERNATIVE 4. RECOMMENDED ALTERNATIVE COST $5.5M ($470/L.F.)

Figure 7-1 (5 of 7)
REACH M5 — TEMPLETON GAP FLOODWAY TO PIKEVIEW BRIDGE

	ALT 1	ALT 2	ALT3
PUBLIC SAFETY			
Minimizes Flood Damage to Private Property	●	●	●
Minimizes Flood Damage to Public Property	●	●	●
Minimizes Bank Erosion & Bank Sloughing	○	○	◕
Minimizes Loss of Life & Injury	○	○	●
Minimizes Safety Hazard — Water Contact	◒	◒	○
RECREATION			
Provides Multi-Use Trail	○	●	●
Provides Active Recreation Area	○	○	○
Provides Education/Interpretive Opportunities	◒	◒	●
Provides Access to Corridor	○	●	◕
AESTHETICS			
Utilizes Quality & Compatible Materials	○	○	●
Provides Beautification	◒	◒	◕
Provides Passive Recreation	◒	◒	●
Establishes Buffer Zones	◒	◒	◕
Cleans-Up/Deters Bank Dumping	◒	◒	◕
Preserves/Enhances I-25/Creek Visual Compatibility	◒	◒	●
ENVIRONMENT			
Stabilizes Channel	◒	◒	◕
Preserves/Enhances Aquatic Habitat	◒	◒	◕
Preserves/Enhances Riparian Habitat	◒	◒	◕
Preserves/Enhances Upland Habitat	◒	◒	◕
Protects Groundwater Level	○	○	◕
Minimizes Construction & Maintenance Impacts	◒	◒	◕
COMMUNITY DEVELOPMENT			
Promotes Development & Redevelopment	●	●	●
Supports Desirable Adjacent Land Uses	◒	◒	●
Preserves/Enhances Historic/Cultural Features	◒	◒	○
Provides Utility Improvements Opportunities	○	○	◕
Promotes Community Pride & Stewardship	◒	◒	◕
Preserves/Enhances Neighborhoods			
PROPERTY			
Minimizes Acquisition of Private Property	●	●	●
Preserves/Enhances Property Value	◒	○	◒
COST			
Minimizes Capital Cost	**$0M**	**$0.2M**	**$2.2**
Minimizes Operations & Maintenance Cost	○	◒	●
RECOMMENDATION			

ALTERNATIVE 3. RECOMMENDED ALTERNATIVE COST $2.2M ($310/L.F.)

Figure 7-1 (6 of 7)
REACH M6 — PIKEVIEW BRIDGE TO WOODMEN ROAD

PUBLIC SAFETY	**ALT 1**	**ALT 2**	**ALT3**	**ALT4**
Minimizes Flood Damage to Private Property	○	◒	●	●
Minimizes Flood Damage to Public Property	○	◒	●	●
Minimizes Bank Erosion & Bank Sloughing	○	○	◒	●
Minimizes Loss of Life & Injury	○	◒	◒	●
Minimizes Safety Hazard — Water Contact	◒	◒	◒	●
RECREATION				
Provides Multi-Use Trail	○	●	●	●
Provides Active Recreation Area	○	○	○	●
Provides Education/Interpretive Opportunities	◒	◒	◒	●
Provides Access to Corridor	○	●	●	●
AESTHETICS				
Utilizes Quality & Compatible Materials	○	◒	◒	●
Provides Beautification	◒	◒	◒	●
Provides Passive Recreation	◒	◒	◒	●
Establishes Buffer Zones	◒	◒	◒	●
Cleans-Up/Deters Bank Dumping	◒	●	●	●
Preserves/Enhances I-25/Creek Visual Compatibility	○	○	○	○
ENVIRONMENT				
Stabilizes Channel	○	◒	◒	●
Preserves/Enhances Aquatic Habitat	○	◒	◒	●
Preserves/Enhances Riparian Habitat	◒	◒	◒	●
Preserves/Enhances Upland Habitat	◒	◒	◒	●
Protects Groundwater Level	○	◒	◒	●
Minimizes Construction & Maintenance Impacts	◒	◒	○	●
COMMUNITY DEVELOPMENT				
Promotes Development & Redevelopment	○	●	●	○
Supports Desirable Adjacent Land Uses	○	◒	●	●
Preserves/Enhances Historic/Cultural Features	◒	◒	○	●
Provides Utility Improvements Opportunities	○	○	○	●
Promotes Community Pride & Stewardship	◒	◒	◒	●
Preserves/Enhances Neighborhoods	◒	◒	◒	●
PROPERTY				
Minimizes Acquisition of Private Property	●	●	●	○
Preserves/Enhances Property Value	◒	●	●	◒
COST				
Minimizes Capital Cost	**$0M**	**$1.3M**	**$5.7M**	**$3.8M**
Minimizes Operations & Maintenance Cost	○	◒	◒	●
RECOMMENDATION				

ALTERNATIVE 4. RECOMMENDED ALTERNATIVE COST $3.8M ($500/L.F.)

Figure 7-1 (7 of 7)
REACH M7 — WOODMEN ROAD TO UPSTREAM STUDY LIMIT

somewhat achieves the objective. An open circle indicates that the alternative does not achieve the objective.

In general, the no action and reactive strategy alternatives (Alternatives 1 and 2) were not perceived to achieve corridor objectives well. The alternatives representing Scenarios 3 and 4, providing full channel stabilization, were perceived to achieve objectives more completely than Alternatives 1 and 2. Of these, the riffle drop alternatives representing Scenario 4 were clearly rated the highest overall in achieving corridor objectives.

The riffle drop alternatives were rated highest in all of the evaluation categories related to environmental enhancement, aesthetics, interpretive opportunities, water safety, active recreation, and allowance for utility improvements. The riffle drop alternatives rated high for environmental enhancement, aesthetics and interpretive opportunities because the improvements most emulate a natural stream system. Water safety was highly rated because the low riffle drops would provide for boating passage. High ratings for active recreation were due to the alternatives' nonstructural strategy of passive floodplain acquisition, enabling additional corridor land to be dedicated for recreation activities.

The riffle drop alternatives were rated highest in allowing utility improvements because they would best facilitate the construction of the additional wastewater gravity main proposed for the creek corridor. This pipeline is being planned by the City's Department of Utilities to provide for increased wastewater flows as the Monument Creek service area continues to expand.

Riffle drops are more compatible with the proposed wastewater pipeline construction than conventional large drop structures for two reasons. First, the cobbles and boulders associated with riffle drops could be removed and set aside before pipeline trenching and replaced after trench backfilling with relative ease. The structural concrete or grouted boulder mass associated with conventional large drop structures would be very difficult to penetrate with a new pipeline and it is unfeasible to provide properly located penetrations during the initial construction of drop structures.

Second, the frequently spaced, low riffle drops would enable the pipeline design to be based on the existing 0.7 percent grade of Monument Creek. Conventional large drop structures would force the pipeline design to be based on the long-term equilibrium slope between drop structures (estimated to be 0.2 percent). This means that the riffle drops would enable a smaller pipe diameter than conventional large drop structures. Also, the riffle drops would not need the vertical bends in the pipeline that may be required at conventional drops. The overall effect of the riffle drop alternatives would be to considerably reduce pipeline construction costs compared to the alternatives featuring conventional drop structures.

The riffle drop alternatives were not rated highest in every evaluation category. Because of the alternatives' floodplain acquisition component and lack of channelization, lower ratings were given for promoting development and minimizing acquisition of private property.

7.5 Detailed Reach Evaluations and Recommendations

7.5.1 Reach M1, Confluence with Fountain Creek to Bijou Street

Alternative 1, the "no action" alternative, could, if degradation continues in the future, eventually lead to undermining and damage of bridges and utilities in the reach. These bridges and utilities include the abandoned DRGRR bridge, Colorado Avenue, the pedestrian low-water crossing, and Bijou Street, as well two sanitary sewer crossings. Alternative 1 could require significant expenditure of maintenance funds to address infrastructure problems that develop, and would leave this reach in a degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 proposes the installation of five grouted-boulder drop structures, ranging in height from 3 to 6 feet, to provide protection for the bridge foundations and utilities. Actively planning for these improvements would significantly reduce the risk of infrastructure damage and would relieve a substantial burden on maintenance programs to monitor and address infrastructure problems. However, Alternative 2 would still leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The large drop structures would likely comprise a barrier to boaters and fish, and are estimated to create a net loss of about 2.5 acres of existing riparian vegetation.

Alternative 3 proposes approximately twenty 1-foot-high riffle drops in this reach to control the grade of the stream and to provide protection for infrastructure. The riffle drops could be installed using a phased approach, constructing approximately 20 percent of the drops (every fifth drop) by the time the average equilibrium slope on Monument Creek decreases from 0.7 to 0.6 percent. Another 20 percent of the riffle drops would be required for each 0.1 percent reduction in the equilibrium slope until the long-term estimated slope of 0.2 percent is reached. The riffle drops would only need to be constructed at the actual pace of degradation in Monument Creek, and if the equilibrium slope stabilized at a grade steeper than 0.2 percent, fewer drops would be required than the number shown herein.

Riffle drops would provide greater environmental and aesthetic benefits than the larger drop structures of Alternative 2. The riffle drops would be designed to emulate a natural riffle/pool sequence found in undisturbed streams and provide for boat and fish passage. The riffle drops would also promote the uptake of dissolved oxygen by stream flows and the establishment of riparian vegetation within and adjacent to the drops. By incorporating some channel shaping and vegetation planting in addition to the riffle drops, Alternative 3 would narrow the unvegetated width of the channel. Over time, as upstream sediment inflow decreases, Alternative 3 could promote a channel regime resembling the narrower, deeper, cooler—in short, "healthier"—regime found presently near the USAFA. Alternative 3 is estimated to create a net increase of approximately 1.7 acres of riparian vegetation in this reach.

Alternative 3 would also recognize a link with a proposed park at the confluence of Monument Creek and Fountain Creek, located generally on the east bank on the north side of Cimarron Avenue. The link with the park would be passive in Alternative 3, providing simply for views of the creek and access to the creek bank.

Alternative 4 in this reach would be identical to Alternative 3, except that the proposed link with Confluence Park would be more active, featuring a boating/kayaking course in Monument Creek and promoting the creek as more of a pronounced water feature of the park. Alternative 4 would also provide for additional screening vegetation to soften the appearance of the existing rock flatwork and concrete lining on the upper channel banks in the reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 3. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 3 provides the most favorable combination of reduced maintenance costs and low capital costs.

During Study Group discussions, Alternatives 3 and 4 were strongly preferred over Alternatives 1 and 2. Alternative 4 was initially the most preferred; however, concerns arose regarding the cost and feasibility of the boating facilities, especially in light of relatively low base flow rates in Monument Creek. As a result, the recommended alternative for Reach M1 was Alternative 4, modified to delete the boating facilities adjacent to Confluence Park. This alternative would provide about the same capital costs and present value as Alternative 3. This alternative would provide all the benefits mentioned above for Alternative 3, plus additional aesthetic benefits associated with the screening vegetation on the upper channel banks.

7.5.2 Reach M2, Bijou Street to Van Buren Street

Alternative 1, the "no action" alternative, could, if degradation continues in the future, eventually lead to undermining of and damage to bridges and utilities in the reach. These bridges and utilities include the DRGRR bridge, the pedestrian crossing, Mesa Road, Uintah Street, and Van Buren Street, as well three sanitary sewer crossings and one water line. Alternative 1 could require significant expenditure of maintenance funds to address infrastructure problems that develop, and would leave this reach in a degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 proposes the installation of three grouted-boulder drop structures, ranging in height from 3 to 5 feet, to provide protection for the bridge foundations and utilities. Alternative 2 also proposes the construction of approximately 300 lineal feet of riprap bank protection. The bank protection would be installed at a location upstream of Uintah Street to protect the exposed toe of some existing stone slope protection. Actively planning for these improvements would significantly reduce the risk of infrastructure damage and would relieve a substantial burden on maintenance programs to monitor and address infrastructure

problems. However, Alternative 2 would still leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The large drop structures would likely comprise a barrier to boaters and fish, and are estimated to create a net loss of about 1.5 acres of existing riparian vegetation.

Alternative 3 proposes approximately forty-three 1-foot-high riffle drops in this reach to control the grade of the stream and to provide protection for infrastructure. The riffle drops would provide greater environmental and aesthetic benefits than the larger drop structures of Alternative 2, as described for Reach M1. Alternative 3 would provide channel shaping at a number of steep eroded banks and increase riparian vegetation adjacent to the channel and screening vegetation to soften the existing stone slope protection on the upper channel banks. Over time, as upstream sediment inflow decreases, Alternative 3 could promote a channel regime resembling the narrower, deeper stream regime found presently in Monument Creek farther upstream, near the USAFA. Alternative 3 is estimated to create a net increase of approximately 6.6 acres of riparian vegetation in this reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 3. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 3, provides the most favorable combination of reduced maintenance costs and low capital costs.

Because it addressed existing problems in this reach in the most comprehensive manner, and provided superior environmental, aesthetic, and maintenance benefits, Alternative 3 was selected as the preferred alternative in Reach M2.

7.5.3 Reach M3, Van Buren Street to Fillmore Street

Alternative 1, the "no action" alternative would not address the significant overbank flooding hazard that exists in this reach. Also, if degradation continues in the future, Alternative 1 bridges and utilities could eventually lead to undermining and damage of bridges and utilities in the reach. These include the DRGRR bridge, the Dilly pedestrian crossing, and Polk Street, as well four sanitary sewer crossings. Alternative 1 could require a significant expenditure of maintenance funds to address infrastructure problems that develop, and would leave this reach in a degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 proposes the installation of five grouted-boulder drop structures, ranging in height from 4 to 6 feet, to provide protection for the bridge foundations and utilities that exist in the reach. Alternative 2 also proposes the construction of approximately 400 lineal feet of riprap bank protection. The bank protection would be installed upstream of the DRGRR bridge to replace a failed gabion retaining wall structure. Actively planning for these improvements would significantly reduce the risk of infrastructure damage and would relieve a substantial burden on maintenance programs to monitor and address infrastructure

problems. However, Alternative 2 would not address the overbank flooding situation and would leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The large drop structures of Alternative 2 would likely comprise a barrier to boaters and fish, and are estimated to create a net loss of about 2.5 acres of existing riparian vegetation.

Alternative 3 would provide the same drop structure and bank protection improvements as Alternative 2 to protect existing infrastructure, but also proposes channelization and bridge work to increase the capacity of the reach and confine the floodplain to the area between the top of the channel banks. This would require the enlargement of both the Dilly pedestrian bridge and the Polk Street bridge, and land acquisition and channel widening. Alternative 3 would remove all existing residential and commercial/industrial buildings from the floodplain in this reach. However, the capital costs associated with Alternative 3 is high ($5.0 million compared to $2.4 million for Alternative 2). Also, Alternative 3 would leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The channelization work is estimated to disturb approximately 14.5 acres of existing riparian vegetation and create a net loss of about 2.5 acres.

Alternative 4 proposes approximately 43 1-foot-high riffle drops in this reach to control the grade of the stream and to provide protection for infrastructure. The riffle drops would provide greater environmental and aesthetic benefits than the larger drop structures of Alternative 2 and 3. Alternative 4 would address overbank flooding in this reach using a nonstructural approach consisting of flood insurance, flood proofing, and passive floodplain acquisition. Alternative 4 also proposes the construction the 400 lineal feet of riprap bank protection to replace the failed gabion retaining wall structure. Moreover, Alternative 4 would provide channel shaping of several steep eroded banks and increase riparian vegetation adjacent to the channel. Over time, as upstream sediment inflow decreases, Alternative 4 could promote a channel regime resembling the narrower, deeper stream regime found presently in Monument Creek farther upstream, near the USAFA. Alternative 4 is estimated to create a net increase of approximately 2.2 acres of riparian vegetation in this reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 4. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 4, provides the most favorable combination of reduced maintenance costs and low capital costs.

It was expressed during Study Group discussions that, while reducing overbank flooding through channelization (Alternative 3) would be desirable, the overbank flooding could be addressed for a substantially lower cost using the nonstructural strategies of Alternative 4. This consideration, plus the associated benefits of the riffle drop improvements, led the Study Group to select Alternative 4 as the preferred alternative in Reach M3.

7.5.4 Reach M4, Fillmore Street to Templeton Gap Floodway

As in the previous reaches, Alternative 1, the "no action" alternative, could eventually lead to undermining of and damage to bridges and utilities in the reach. These bridges and utilities include the Fillmore Street bridge and six sanitary sewer crossings. Alternative 1 could require significant expenditure of maintenance funds to address infrastructure problems that develop, and would leave this reach in a degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 proposes the installation of four grouted-boulder drop structures, ranging in height from 5 to 6 feet, to provide protection for the bridge foundations and utilities. Alternative 2 also proposes the construction of baffle-chute drop structure at the outfall of the Templeton Gap Floodway channel to mitigate the erosion damage at that location. Also, approximately 800 lineal feet of riprap bank protection would be installed at the outside of a channel bend about 2,000 feet upstream of Fillmore Street. Additional bank protection work is necessary at this location to repair an existing riprap installation that is failing. Approximately 1,150 feet of steep, eroding channel banks upstream of Fillmore Street would be regraded in Alternative 2 to mitigate potential damage to the existing trail along the creek. Actively planning for the improvements described above would significantly reduce the risk of infrastructure damage and would relieve a substantial burden on maintenance programs to monitor and address infrastructure problems. However, Alternative 2 would still leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The large drop structures would likely comprise a barrier to boaters and fish, and are estimated to create a net loss of about 2.0 acres of existing riparian vegetation.

Alternative 3 proposes approximately thirty-three 1-foot-high riffle drops in this reach to control the grade of the stream and to provide protection for infrastructure. The riffle drops would provide greater environmental and aesthetic benefits than the larger drop structures of Alternative 2, as described for Reach M1. Alternative 3 would address the existing overbank flooding upstream of Fillmore Street using a nonstructural strategy of flood insurance, flood proofing, and passive floodplain acquisition. Alternative 3 would include the Templeton Gap drop structure, provide for additional channel shaping at steep eroded banks, and increase riparian vegetation adjacent to the channel. Over time, as upstream sediment inflow decreases, Alternative 3 could promote a channel regime resembling the narrower, deeper stream regime found presently in Monument Creek farther upstream, near the USAFA. Alternative 3 is estimated to create a net increase of approximately 6.2 acres of riparian vegetation in this reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 3. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 3, provides the most favorable combination of reduced maintenance costs and low capital costs.

Because it addressed existing problems in this reach in the most comprehensive manner, and provided superior environmental, aesthetic, and maintenance benefits, Alternative 3 was selected as the preferred alternative in Reach M4.

7.5.5 Reach M5, Templeton Gap Floodway to I-25

Alternative 1, the "no action" alternative would not address the stream stability and overbank dumping problems that exist in this reach. If degradation continues in the future, Alternative 1 could eventually lead to undermining of and damage to bridges and utilities in the reach. These bridges and utilities include the Garden of the Gods Road bridge and the I-25 bridges, as well five sanitary sewer crossings and the Pikeview Diversion Dam. Scour downstream of the Pikeview Diversion Dam has lowered the channel bed approximately 2 feet in the last 2 years and has exposed the piling foundation under the dam. Alternative 1 could require significant expenditure of maintenance funds to address infrastructure problems that develop, and would leave this reach in a degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 proposes the installation of four grouted-boulder drop structures, ranging in height from 4 to 6 feet, to provide protection for the bridge foundations and utilities that exist in the reach. In addition, the Pikeview Diversion Dam is proposed to be rehabilitated to address scour and undermining potential downstream of the structure. Alternative 2 proposes the construction of approximately 800 lineal feet of riprap bank protection to stabilize the outside of a channel bend about 3,500 feet downstream of I-25. Actively planning for these improvements would significantly reduce the risk of infrastructure damage and would relieve a substantial burden on maintenance programs to monitor and address infrastructure problems. However, Alternative 2 would leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The large drop structures of Alternative 2 would likely comprise a barrier to boaters and fish, and are estimated to create a net loss of about 3.1 acres of existing riparian vegetation.

Alternative 3 would provide the same drop structure and bank protection improvements as Alternative 2 to protect existing infrastructure, but also proposes channelization to increase developable land adjacent to the creek. Significant bank filling and dumping on the creek banks has taken place along this reach in recent years as adjacent landowners have increased their developable land. Alternative 3 represents a continuation of these bank filling practices, although in a manner that provides for necessary flow capacity in the creek and cleans up existing dump areas. However, the capital cost associated with Alternative 3 is high ($11.1 million compared to $3.2 million for Alternative 2). Also, Alternative 3 would leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The channelization work is estimated to disturb approximately 9.7 acres of existing riparian vegetation and create a net loss of about 3.1 acres.

Alternative 4 proposes approximately sixty 1-foot-high riffle drops in this reach to control the grade of the stream and to provide protection for infrastructure. The riffle drops would

provide greater environmental and aesthetic benefits than the larger drop structures of Alternatives 2 and 3. Alternative 4 would provide for regrading and revegetating existing dump areas. Alternative 4 includes the same riprap bank protection as Alternatives 2 and 3. Also, Alternative 4 would provide channel shaping of several steep eroded banks and increase riparian vegetation adjacent to the channel. As in the previous reaches, Alternative 4 could promote, over time, a channel regime resembling the narrower, deeper stream regime found presently in Monument Creek farther upstream, near the USAFA. Alternative 4 is estimated to create a net increase of approximately 4.8 acres of riparian vegetation in this reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 4. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 4, provides the most favorable combination of reduced maintenance costs and low capital costs.

Study Group discussions focused on the difficulty involved in justifying the high cost of constructing channelization improvements (Alternative 3) in this reach. There was general agreement that the remaining riparian resources at the bottom of the filled banks should be retained, if at all possible. These considerations, plus the associated benefits of the riffle drop improvements, led the Study Group to select Alternative 4 as the preferred alternative in Reach M5.

7.5.6 Reach M6, I-25 to Woodmen Road

This reach has been channelized in the vicinity of Mark Dabling Boulevard and Woodmen Road; therefore, most infrastructure in this reach has been provided with some protection. However, Alternative 1 would leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 proposes the installation of a path for maintenance access along the reach; otherwise, Alternative 2 does not differ from Alternative 1. Alternative 2 would still leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 3 proposes approximately twenty-seven 1-foot-high riffle drops in this reach to control the grade of the stream and limit bank erosion. The riffle drops would provide greater environmental and aesthetic benefits than the larger drop structures of Alternative 2, as described for Reach M1. Alternative 3 would provide for additional channel shaping at steep eroded banks, and increase riparian vegetation adjacent to the channel. Over time, as upstream sediment inflow from Cottonwood Creek decreases, Alternative 3 could promote a channel regime resembling the narrower, deeper stream regime found presently in Monument Creek farther upstream near the USAFA. Alternative 3 is estimated to create a net increase of approximately 3.5 acres of riparian vegetation in this reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 3. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 3, provides the most favorable combination of reduced maintenance costs and low capital costs.

Because it provided superior environmental, aesthetic, and maintenance benefits, Alternative 3 was selected as the preferred alternative in Reach M6.

7.5.7 Reach M7, Woodmen Road to South Boundary of USAFA

Alternative 1, the "no action" alternative, could result in significant degradation to the relatively high physical quality of this reach. Over time, channel erosion could result in loss of riparian vegetation and aquatic habitat, reduction in water quality, and possible undermining of and damage to seven existing utility crossings. Moreover, Alternative 1 could require significant expenditure of maintenance funds to address infrastructure problems that develop, and would leave this reach in a degraded condition with respect to stream vegetation, physical and biological character, and aesthetics.

Alternative 2 in this reach represents the master development plan for the Tudor site dated January 1987. This plan, in general, shows the existing creek channel as being left undisturbed, with some floodplain filling to increase developable land adjacent to the channel. One major stream modification is shown in the master plan. Approximately 1,400 lineal feet of Monument Creek adjacent to the DNRGRR is proposed to be relocated to the east to make room for the main access roadway for the development. No grade control structures are proposed in the plan to limit channel degradation.

While generally retaining the natural channel character of this reach, Alternative 2 would not address the impacts of degradation. Like the "no action" alternative, Alternative 2 would lead, over time, to a loss of riparian vegetation and aquatic habitat, reduction in water quality, and possible undermining and damage of the seven existing utility crossings. In addition, the proposed creek relocation, besides disturbing a significant length of natural channel, would locally increase the channel gradient by more than 50 percent by shortening a meander bend. Without one or more drop structures at this location, the increase in slope would result in erosion and increased channel degradation upstream and sedimentation and channel bed disturbance downstream. Alternative 2 is estimated to disturb approximately 16 acres of existing riparian vegetation, with a net loss of approximately 9.3 acres.

Alternative 3 proposes the installation of six grouted-boulder drop structures, ranging in height from 5 to 6 feet, to provide protection for the seven utility crossings. Alternative 3 also proposes the same channel relocation identified as part of Alternative 2, but would mitigate the increase in channel gradient with drop structures. Alternative 3 would allow for some floodplain filling to increase developable land adjacent to the creek. Actively planning for these improvements would significantly reduce the risk of infrastructure damage and

would relieve a substantial burden on maintenance programs to monitor and address infrastructure problems. However, Alternative 2 would still leave this reach in a somewhat degraded condition with respect to stream vegetation, physical and biological character, and aesthetics. The large drop structures would likely comprise a barrier to boaters and fish, and are estimated to create a net loss of about 6.7 acres of existing riparian vegetation.

Alternative 4 proposes approximately thirty-eight 1-foot-high riffle drops in this reach to control the grade of the stream and to provide protection for infrastructure. The riffle drops would provide greater environmental and aesthetic benefits than the larger drop structures of Alternative 3, as described for Reach M1. The channel relocation identified in Alternatives 2 and 3 is not included in this alternative, but some floodplain filling could occur to increase developable land adjacent to the creek. Alternative 4 would provide channel shaping at a number of steep eroded banks and increase riparian vegetation adjacent to the channel. Alternative 4 is estimated to create a net increase of approximately 2.6 acres of riparian vegetation in this reach.

The capital cost and present value of capital and maintenance expenditures, discussed in Sections 7.2.1 through 7.2.3, is lowest for Alternative 4. For all but the most aggressive funding scenarios, Alternative 1, the no action alternative, has the highest present value due to high projected maintenance costs. Alternative 4, provides the most favorable combination of reduced maintenance costs and low capital costs.

Because it addressed existing problems in this reach in a more cost-effective manner than Alternative 3, and provided superior environmental, aesthetic, and maintenance benefits, Alternative 4 was selected as the preferred alternative in Reach M7.

7.6 Summary of Recommendations

Table 7-6 summarizes the alternatives that were selected by the Study Group for refinement during the preliminary design phase of the study. These alternatives were determined to best achieve the goals and objectives identified for Monument Creek and also offer the lowest present value cost. The alternatives comprise the riffle drop alternatives represented by Scenario 4 of the present value analyses.

One aspect of the riffle drop alternatives to be refined in preliminary design relates to the amount of new riparian vegetation that can be added without adversely impacting Monument Creek's flood conveyance capacity. It will be beneficial to look for opportunities to remove some of the fill material that has been placed in the natural floodplain channel in the past. Removing fill will increase the cross-sectional area of the channel which, in conjunction with enhanced riparian vegetation, will provide for slower flood velocities. This, in turn, will reduce the risk of property damage due to lateral bank erosion.

Table 7-6 Recommended Alternative Plans	
Reach	**Recommended Plan**
M1	Alternative 4, without boating facilities
M2	Alternative 3
M3	Alternative 4
M4	Alternative 3
M5	Alternative 4
M6	Alternative 3
M7	Alternative 4

In addition to identifying the riffle drop alternatives as the preferred stream improvement plan, a number of other action items are recommended for consideration during the preliminary design phase. These recommendations pertain to the implementation of the selected stream improvement plan. The recommendations, based on principles of comprehensive watershed management, are highlighted below:

- Promote a clear public identity for the Monument Creek/Fountain Creek corridor resources
- Consider regular mailings of a newsletter specifically pertaining to the Monument Creek/Fountain Creek watershed and its corridor resources
- Foster a sense of public stewardship and pride for the resources of the watershed corridors
- Show pictorial examples of the best the corridor has to offer and the worst areas of neglect
- Educate watershed residents how they are both part of the problem (anyone living under a roof or driving on paved streets contributes to the increased runoff that starts the stream degradation process) and can be part of the solution (through proper household waste disposal, not over-fertilizing, assisting in volunteer efforts, etc.)
- Include farming/ranching community located in outlying areas of the watershed
- Tap enthusiasm of the public for protecting/enhancing watershed corridor resources
- Consider volunteer monitoring of water quality

- Consider volunteer work days (planting vegetation, clearing litter and debris, etc.)

- Provide notice of upcoming City improvement projects in corridor

- Show "before" and "after" pictures of City improvement projects to let watershed residents know of tangible progress

- Fulfill City NPDES stormwater regulations using a watershed framework (relate public education, new development criteria, and other programs to tangible improvements benefiting Monument Creek/Fountain Creek watershed resources)

- Establish a non-profit foundation (Pikes Peak Greenway Foundation) to foster support for the funding of corridor improvements based on public ownership of the problem, public pride in the resources, and the clear economic benefit of a proactive versus a reactive program

The selected stream improvement plan for Monument Creek, based on the recommendations provided herein, is described in Section 8.

8.0 PRELIMINARY PLAN

8.0 Preliminary Plan

8.1 General Plan Components

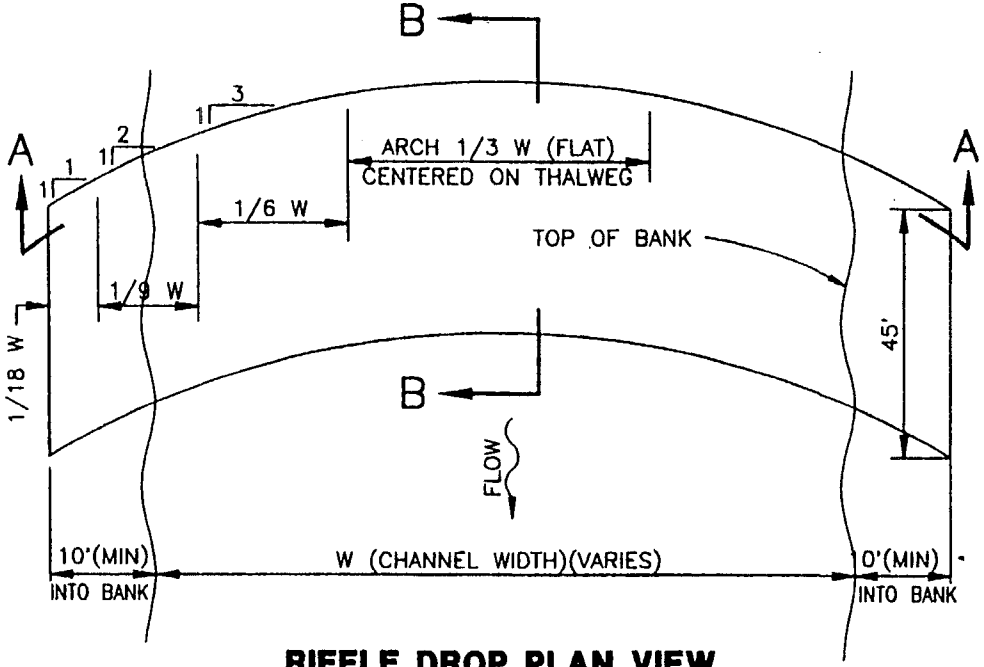
The selected alternatives described in Section 7 were refined during the development of the preliminary plan. The preliminary plan features the same general stream improvement components as were identified in Section 7; however, additional detail was provided and in some cases minor modifications were made. The stream improvement components, as refined, are described in the following subsections.

8.1.1 Riffle Drops

Riffle drops are gently sloping boulder and cobble structures designed to control the vertical grade of the creek and limit downcutting of the channel bed. The riffle drops allow the creek to assume a gentle "stairstep" pattern, as the equilibrium slope of Monument Creek decreases from about 0.7 percent to an estimated long-term slope approaching 0.2 percent. As discussed in Section 7.5, the riffle drops could be installed using a phased approach, based on the actual rate of degradation in Monument Creek. By the time the average slope of the creek decreases from approximately 0.7 percent to 0.6 percent, it is recommended that about 20 percent of the total number of riffle drops shown in the plan (every fifth drop) be constructed. Another 20 percent of the riffle drops would be required for each additional 0.1 percent reduction in the average slope. If the equilibrium slope of Monument Creek stabilizes at a grade steeper than 0.2 percent, fewer drops would be required than the number shown in the plan.

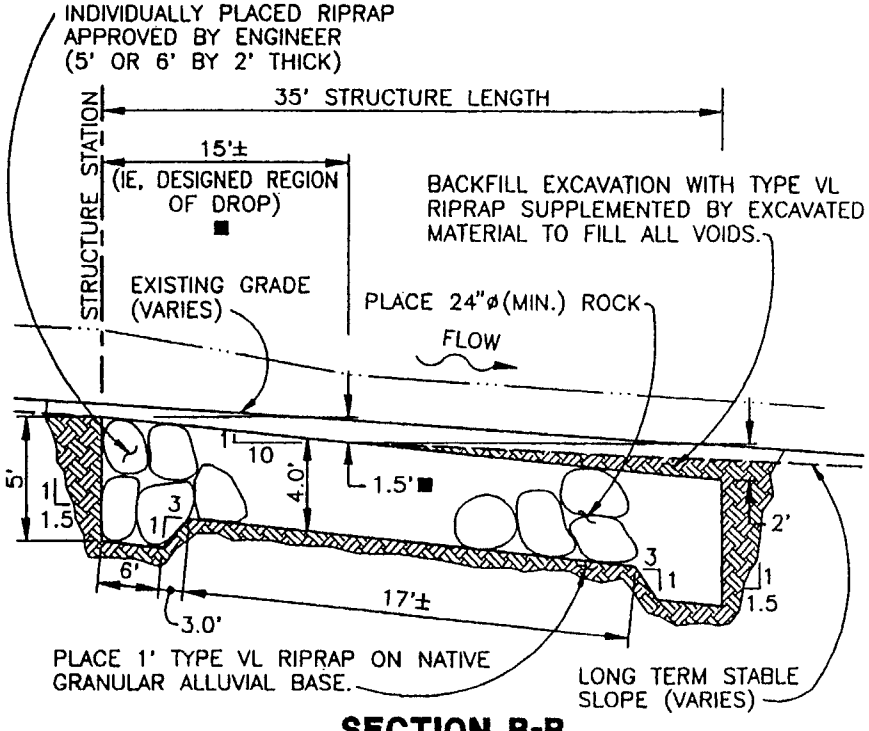
Riffle drops are designed to create a physical stream character that emulates the natural riffle/pool sequence found in many undisturbed streams. The riffles are comprised of coarse, stable material (boulders and cobbles), which is beneficial to the aquatic ecosystem. The coarse substrate provides habitat for bacteria, algae, and macroinvertebrates, and, in turn, for fish and higher-order wildlife that feed on the lower-order organisms. The riffle drops also promote the uptake of dissolve oxygen by stream flows and the establishment of riparian vegetation upstream and downstream, and also within the fringe areas of the drops.

The typical geometry of the riffle drops identified in the preliminary plan is depicted in Figure 8-1. Each structure is assumed to allow for a drop in the channel bed elevation of 1.5 feet. This drop in elevation was revised slightly from the drop of 1 foot assumed for each structure in Section 7. The width of each riffle drop is shown to vary on the basis of the width of the Monument Creek channel. In general, the drops were tied into channel banks at locations where the banks were about 4 feet higher than the crest of the structure.



RIFFLE DROP PLAN VIEW

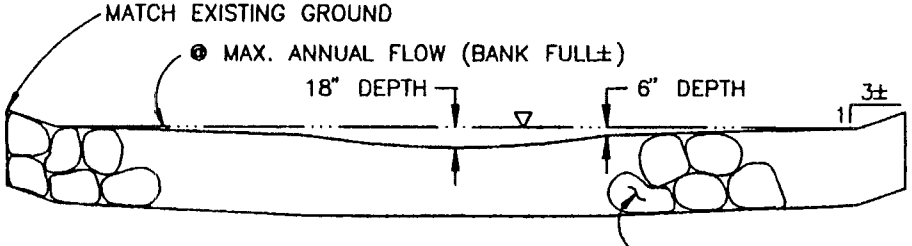
N.T.S.



SECTION B-B

N.T.S.

■ IE, STANDARD DROP ON 10:1 SLOPE OF 1.5' OCCURS IN FIRST 15 FEET OF STRUCTURE



SECTION A-A

N.T.S.

Figure 8-1
Riffle Drop Geometry

8.1.2 Vegetated Benches

The selected alternatives described in Section 7 provided for enhanced riparian vegetation along the creek channel. In the preliminary plan, specific areas are called out for the creation of these vegetated benches. The vegetated benches are proposed to be similar in form and function to existing benches along the creek. In many areas, dense, hardy vegetation is growing on shallow benches of sandy material bed material adjacent to the active baseflow channel. These existing benches, covered with grasses, herbaceous vegetation, and willows, function to slow velocities during moderate and high-flow events. The locally slower flow velocities promote sedimentation of fine sands and silts within the bench area, adding material and nutrients to the bench. This, in turn, provides water quality and habitat benefits and reduces the potential for erosion of the adjacent outer channel bank.

Erosion control fabrics, such as jute netting, would provide some stability to newly vegetated bench areas until vegetation could become established. In areas where the upstream channel alignment would provide an angle of attack against new bench areas, rock toe protection is called out at the interface between the bench and the baseflow channel. Figures 8-2 and 8-3 show cross section views of a typical vegetated bench and rock toe protection.

8.1.3 Regrading Steep Eroding Banks

A number of steep, eroding channel banks, some measuring as high as 50 vertical feet, are shown in the plan as requiring regrading and revegetating. This work is proposed to provide for improved public safety and reduce sediment contributions to the creek from bank sloughing. Wherever possible, steep slopes should be laid back by excavating the top portion of the bank, rather than balancing cut and fill, to reverse the historic practice of filling in the channel. Final slopes should be 3 (horizontal) to 1 (vertical) or flatter. Figure 8-4 shows a cross section view of a typical regraded steep bank.

8.1.4 Grouted Rock Energy Dissipators

In several locations, steep dropoffs and scour holes exist where concrete tributary channels terminate at an elevation above Monument Creek. In these cases, grouted rock energy dissipators are called out in the preliminary plan. The purpose of the energy dissipators would be to convey tributary flows to the bottom of the Monument Creek channel in a controlled manner and eliminate the steep banks and scour holes. Figure 8-5 depicts section views of a typical grouted rock energy dissipator.

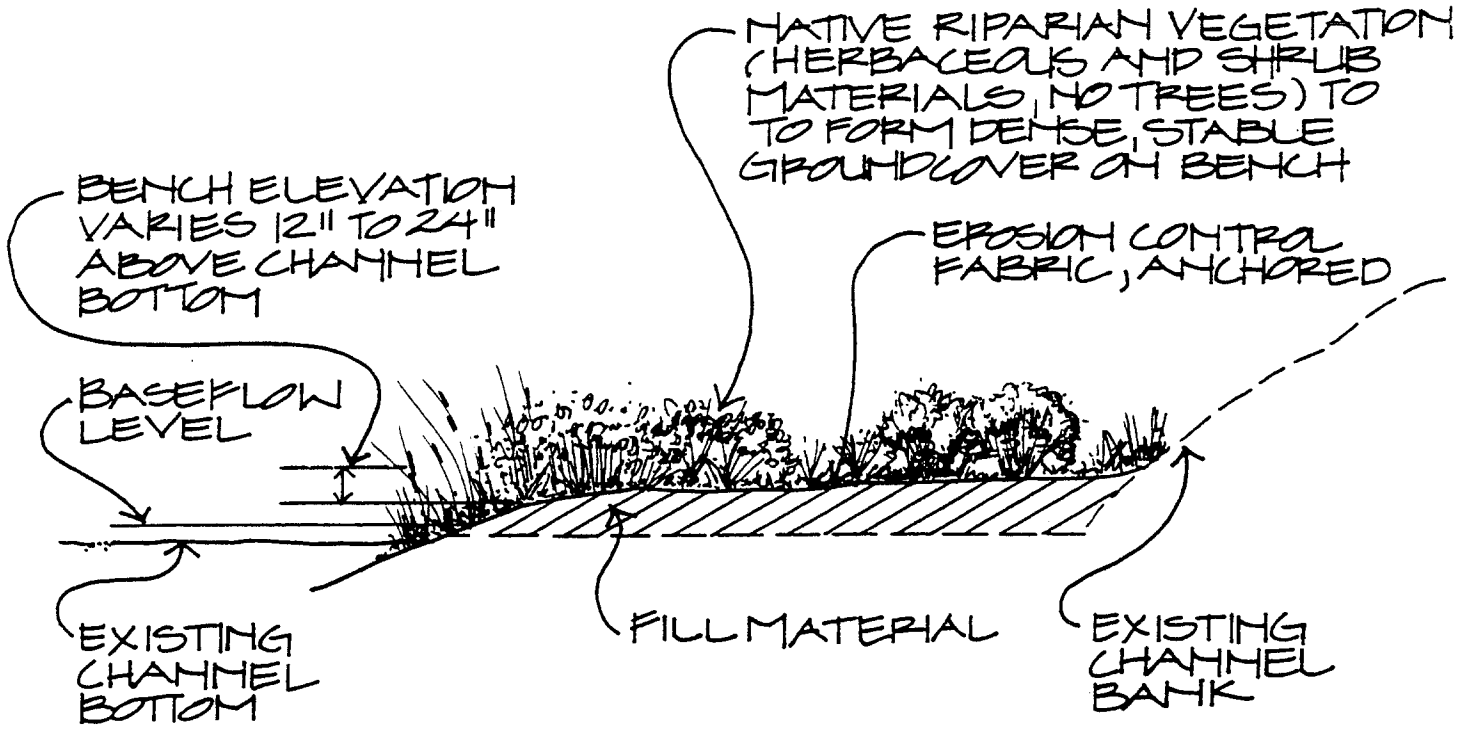


Figure 8-2
TYPICAL VEGETATED BENCH

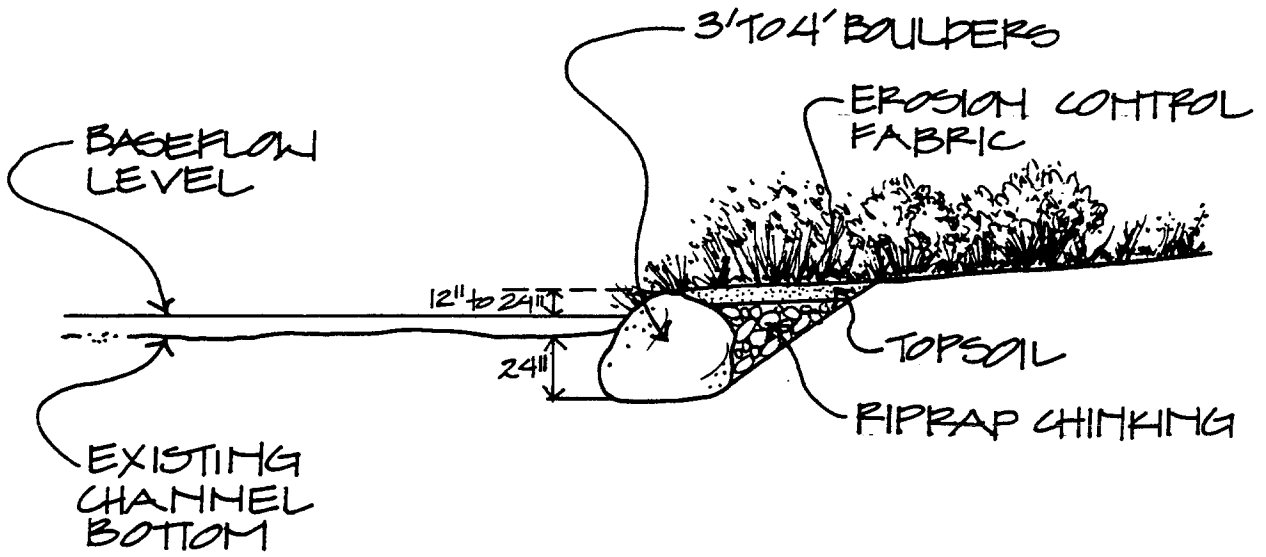


Figure 8-3
TYPICAL ROCK TOE PROTECTION

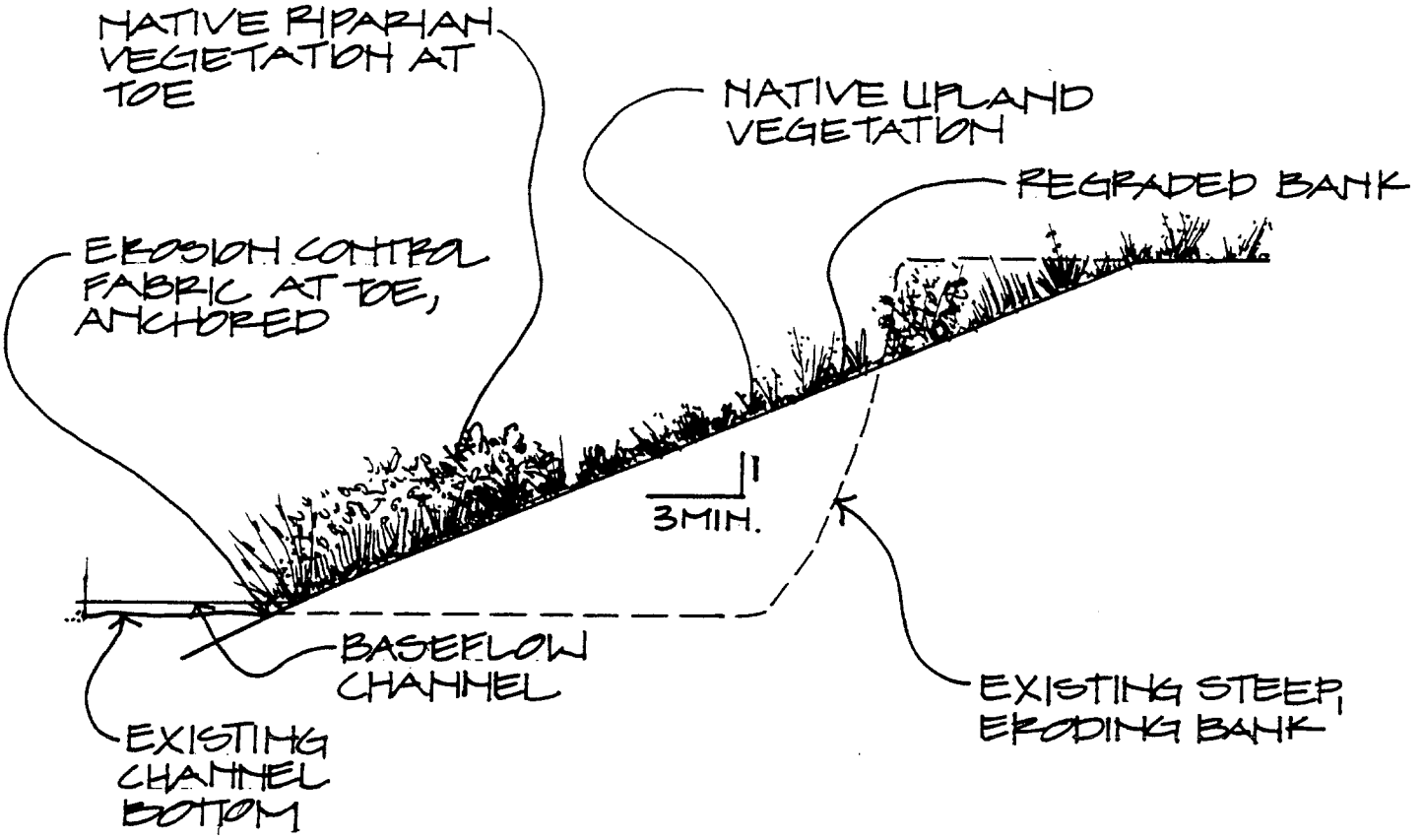
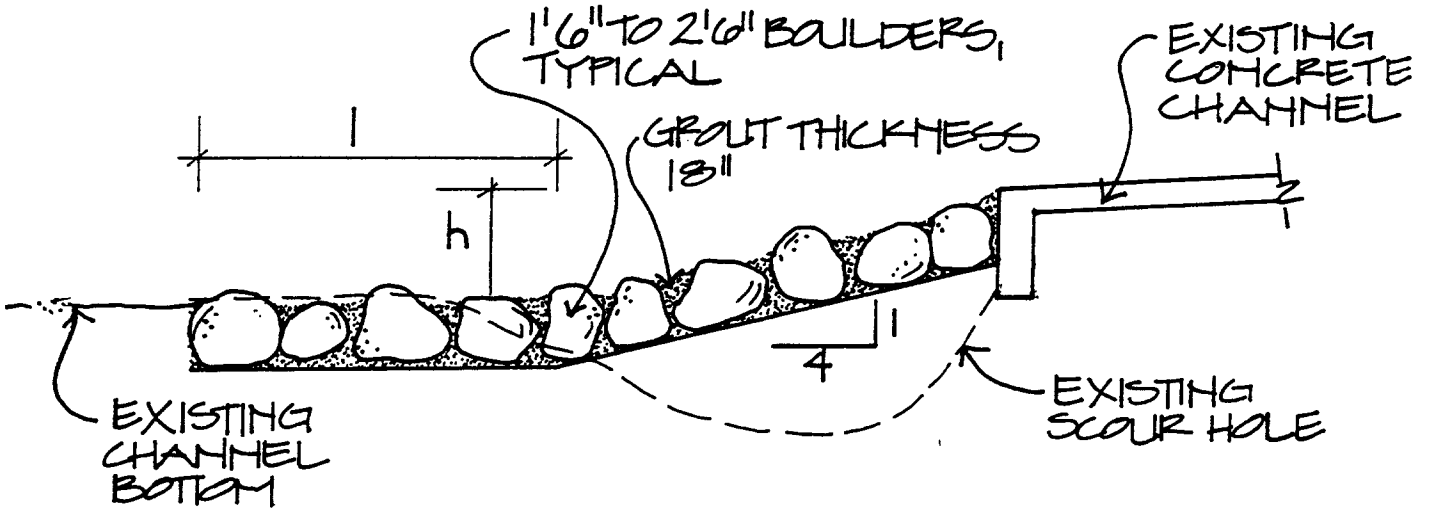
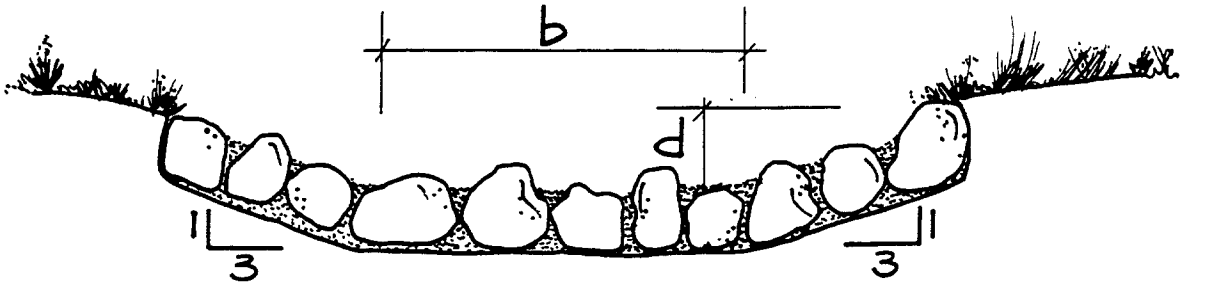


Figure 8-4
TYPICAL REGRADED STEEP BANK



LONGITUDINAL SECTION



CROSS SECTION

NOTE:
h, l, b, AND d ARE TO BE DETERMINED FOR INDIVIDUAL SITE HYDRAULIC CONDITIONS

Figure 8-5
TYPICAL GROUTED ROCK ENERGY DISSIPATOR

8.2 Preliminary Plan Drawings

The preliminary plan of selected stream improvements for Monument Creek is shown on Sheets 29 through 41 of Volume II. Both plan view and profile drawings are provided.

8.2.1 Plan View Drawings

The proposed improvements are shown in plan view at a scale of 1-inch equals 200-feet on Sheets 29 through 36. The base mapping consists of FIMS 2-foot contour interval topographic mapping supplied by the City (based on aerial photography, dated November, 1989). The improvements are shown along with delineations of the floodplain for existing and future development conditions in the Monument Creek watershed. Locations of existing sanitary sewer crossings of Monument Creek are also shown.

8.2.2 Profile Drawings

The preliminary plan is illustrated in profile on Sheets 37 through 41. The profile drawings depict the following information:

- Channel invert profile based on FIMS mapping
- Future channel invert profile showing riffle drops and long-term equilibrium slope of 0.2 percent
- Riffle drop station locations, crest elevations, and widths
- 100-year water surface for existing development conditions
- 100-year water surface for future development conditions
- Existing bridge deck locations
- Existing sanitary sewer and check dam locations
- Locations of HEC-2 cross sections

The profile drawings have a horizontal scale of 1-inch equals 200-feet (the same as the plan view drawings) and a vertical scale of 1-inch equals 10-feet.

8.2.3 Tabulated Quantity Information

Specific locations and quantities of preliminary plan improvements are summarized reach by reach in Tables 8-1 through 8-7.

Table 8-1
Preliminary Plan Quantities
Reach M1, Fountain Creek to Bijou Street

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach)	Entire Reach M1			114.2	12
Rock Toe Protection	36+00 to 38+50		250		
Regrade/Revegetate Steep Eroding Bank	0+90 to 3+90	12.5	300		
Vegetated Bench	9+10 to 12+20		310	20	
	22+30 to 34+20		1,190	25	
	36+20 to 34+20		230	15	
Regrade Baseflow Channel	35+30 to 38+50		320	30	
Add Bank Vegetation	34+10 to 38+10		400	45	

Table 8-2
Preliminary Plan Quantities
Reach M2, Bijou Street to Van Buren Street

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach)	Entire Reach M2			122.1	42
Rock Toe Protection	38+50 to 43+20		470		
Regrade/Revegetate Steep Eroding Bank	44+60 to 53+70	4	910		
	99+80 to 113+90	4	1,410		
	103+50 to 116+90	4	1,340		
	136+80 to 140+30	4	350		
	139+50 to 144+20	4	470		
	145+70 to 149+70	4	400		
	150+50 to 157+50	4	700		
Vegetated Bench	38+50 to 43+10		460	35	
	55+50 to 60+20		470	25	
Regrade Baseflow Channel	38+50 to 42+70		420	50	
Add Bank Vegetation	64+70 to 67+60		290	55	

Table 8-3
Preliminary Plan Quantities
Reach M3, Van Buren Street to Fillmore Street

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach)	Entire Reach M3			78.2	11
Riprap Bank Protection (install buried riprap)	159+40 to 162+80	17.5	340		
	165+80 to 168+30	22.5	250		
Regrade/Revegetate Steep Eroding Bank	159+40 to 162+80	17.5	340		
	165+80 to 168+30	22.5	250		
	169+00 to 170+90	17.5	190		
	174+90 to 177+60	22.5	270		
	178+60 to 182+70	7.5	410		
	188+90 to 191+80	27.5	290		
	192+20 to 194+30	4	210		
Vegetated Bench	187+20 to 196+90		970	15	
Regrade Baseflow Channel	159+70 to 163+30		360	45	
Grout Rock Energy Dissipator	159+50		60	50	
Fence	171+00 to 197+00		2,600		

Table 8-4
Preliminary Plan Quantities
Reach M4, Fillmore Street to Templeton Gap Floodway

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach	Entire Reach M4			109.2	24
Rock Toe Protection	203+90 to 209+60		570		
	212+00 to 219+70		770		
	241+20 to 253+10		1,100		
	253+40 to 257+60		410		
Riprap Bank Protection (install buried riprap)	211+50 to 219+40	4	790		
Regrade/Revegetate Steep Eroding Bank	198+60 to 207+50	15	890		
	220+20 to 222+90	45	270		
	241+60 to 252+50	22.5	1,090		
	253+40 to 256+70	12.5	400		
	259+20 to 263+00	22.5	450		
Vegetated Bench	197+90 to 209+50		1,160	25	
	197+90 to 219+50		2,160	29	
	219+80 to 224+10		430	15	
	241+50 to 252+70		1,120	50	
	255+50 to 257+50		200	35	
Regrade Baseflow Channel	209+50 to 219+80		1,030	45	
	254+80 to 257+60		180	50	
Grouted Rock Energy Dissipator	263+00		130	70	

Table 8-5
Preliminary Plan Quantities
Reach M5, Templeton Gap Floodway to I-25

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach	Entire Reach M5			152.9	35
Rock Toe Protection	263+00 to 265+70		340		
	272+90 to 275+80		300		
	280+60 to 282+70		230		
	297+50 to 299+50		220		
	325+30 to 327+80		310		
	325+30 to 327+80		325		
Riprap Bank Protection (install buried riprap)	324+50 to 325+20		220	55	
	325+30 to 327+80		320	40	
	352+90 to 355+70	6	290		
Regrade/Revegetate Steep Eroding Bank	263+00 to 301+50	40	3,930	90	
	270+30 to 275+80	17.5	580		
	286+10 to 288+70	17.5	260		
	296+00 to 299+50	7.5	340		
	304+00 to 318+60	35	2,430	100	
	319+30 to 321+60	17.5	230		
	335+20 to 343+40	12.5	850		
	344+70 to 350+80	27.5	650		
Vegetated Bench	317+50 to 334+70		1,720	70	
	325+30 to 345+60		2,060	50	
	368+10 to 378+20		1,010	70	
Regrade Baseflow Channel	368+90 to 371+50		260	35	
Fence	344+50 to 360+00		1,670		

Table 8-6
Preliminary Plan Quantities
Reach M6, I-25 to Woodmen Road

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach	Entire Reach M6			93.5	23
Vegetated Bench	382+60 to 397+60		1,440	50	
	390+40 to 398+20		920	40	
	397+70 to 404+50		680	30	
	406+40 to 408+10		190	40	
	409+00 to 410+30		130	35	
	416+00 to 425+50		950	40	
	447+50 to 448+90		140	60	
Construct Riprap Rundown	435+70		70	35	
Repair Riprap Rundown	392+20		80	50	
Remove Existing Construction Slope Paving/Revegetation	448+90 to 454+20	35	550	70	
	447+50 to 448+90	35	440	70	

Table 8-7
Preliminary Plan Quantities
Reach M7, Woodmen Road to Upstream Study Limit

Impoundment	Location (sta)	Height	Length	Width	Quantity
Riffle Drops (based on average width for reach	Entire Reach M7			86.5	20
Rock Toe Protection	458+00 to 460+00		200		
	474+90 to 476+80		170		
	504+90 to 507+20		210		
Riprap Bank Protection (install buried riprap)	456+00 to 459+40	8	340		
Regrade/Revegetate Steep Eroding Bank	460+60 to 470+30	22.5	970		
	473+40 to 476+20	22.5	300		
	488+70 to 490+40	22.5	210		
	491+80 to 493+60	22.5	180		
	496+70 to 497+90	22.5	120		
	504+30 to 507+30	22.5	300		
	516+10 to 518+30	22.5	220		
	524+20 to 527+20	17.5	300		
	527+60 to 529+80	17.5	220		
Vegetated Bench	456+00 to 460+00		400	40	
	460+60 to 471+00		1,040	40	
	472+70 to 476+80		410	40	
	482+50 to 486+80		430	30	
	487+60 to 503+00		1,540	40	
	503+80 to 507+10		330	35	
	513+40 to 520+90		750	30	
	521+60 to 522+90		130	35	
	523+90 to 527+50		360	30	
	527+50 to 530+00		250	20	
Regrade Baseflow Channel	456+00 to 471+10		1,510	45	
	473+00 to 477+00		400	40	
	482+50 to 487+30		480	40	
	487+60 to 503+00		1,540	40	
	504+20 to 507+30		310	40	
	513+80 to 521+10		730	40	
	523+50 to 530+00		650	35	
Fence	482+90 to 486+40		470		
	498+50 to 500+80		230		
	513+70 to 516+10		250		

8.3 Detailed Description of Preliminary Plan

8.3.1 Reach M1, Fountain Creek to Bijou Street

The preliminary plan in this reach consists of 12 riffle drops for grade control and infrastructure protection. The drops have an average width of 114 feet and are spaced from 200 to 500 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of two or three drops. The following stations represent the highest priority riffle drop locations:

- **Station 1+80**—This riffle drop is to be located at the Fountain Creek confluence, upstream of Cimarron Street and immediately downstream of the exposed sanitary sewer encasement. The riffle drop would be constructed to restore the grade of the channel to its former elevation above the top of the sewer encasement, protecting and concealing the encasement. This drop would be constructed somewhat above grade; therefore, one or more riffle drops would need to be constructed downstream, as indicated in the companion Fountain Creek DBPS.

- **Station 32+50**—This riffle drop would be located about 600 feet downstream of Bijou Street, to provide protection for an exposed sanitary sewer encasement. The drop would provide some limited, interim grade control for the Bijou Street bridge foundation, until the point in time when the drop immediately downstream of Bijou Street is constructed.

- **Station 19+20**—The riffle drop located at this station would provide some control against degradation for the Colorado Avenue bridge foundation.

The preliminary plan provides for the creation of three vegetated bench areas in this reach. The benches are shown on the west bank at Bijou Street, downstream of the abandoned DRGWRR bridge, and on the east bank upstream of Colorado Avenue. The vegetated benches are necessary to provide some protection against erosion that is occurring at the toe of the outside channel banks in these locations.

In addition, the preliminary plan calls for regrading and revegetating a 10- to 15-feet high steep eroding bank on the east side of the creek at the confluence with Fountain Creek. This area is to be sloped back into the Confluence Park area, as proposed in the Pikes Peak Greenway Master Plan. Enhanced bank vegetation is called out on the east side of the creek in the area downstream of Bijou Street. The vegetation would screen the existing concrete and stone slope protection to soften the appearance of this area and improve aesthetics.

The 100-year floodplain is shown within the top of the channel banks in this reach; however, the historic filling of natural channel overbank areas has created the potential for high flow velocities during flood events. This means that land, buildings and utilities located adjacent to Monument Creek are subject to damage from flood erosion and lateral migration of the stream channel. For example, channel bank movements of more than 100 feet occurred in the Castle Rock, Colorado area during the flood of 1965 on Plum Creek, which caused significant damage to buildings, highways, and other infrastructure.

It is recommended that landowners adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks.

8.3.2 Reach M2, Bijou Street to Van Buren Street

The preliminary plan in this reach consists of 42 riffle drops for grade control and infrastructure protection. The drops have an average width of 122 feet and are spaced from 200 to 550 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of eight to 10 drops. The following stations represent the highest priority riffle drop locations:

- **Station 119+30**—This riffle drop is to be located adjacent to Monument Valley Park, opposite Del Norte Street, immediately downstream of the exposed sanitary sewer encasement. The riffle drop would be constructed to restore the grade of the channel to its former elevation above the top of the sewer encasement, thus protecting and concealing the encasement. The drop would also provide some protection for the exposed toe well supporting the stone flatwork on the wet channel bank. This drop would be constructed somewhat above grade; therefore, one or more riffle drops would need to be constructed downstream, such as at Station 114+80 and Station 111+00.

- **Station 45+60**—This riffle drop would be located just upstream of the DRGWRR bridge, to provide protection for an exposed sanitary sewer encasement.

- **Station 74+95**—This riffle drop would be located just downstream of the Mesa Road bridge, to provide grade control downstream of the bridge foundation.

- **Station 157+70**—This riffle drop would be located just downstream of the Van Buren Street and DRGWRR bridges, to provide grade control downstream of the bridge foundations.

- **Station 93+00**—This riffle drop would be located just downstream of the Uintah Street bridge, to provide grade control downstream of the bridge foundation.

- **Station 58+15**—This riffle drop would provide an interim level of grade control, as the Monument Creek equilibrium slope starts to decrease.

- **Station 105+30**—This riffle drop would provide an interim level of grade control.

- **Station 145+10**—This riffle drop would provide an interim level of grade control.

The preliminary plan provides for the creation of vegetated bench areas in two locations. The benches are shown on the west bank immediately upstream and about 1,700 feet upstream of Bijou Street. The vegetated benches are necessary to provide some protection against erosion that is occurring at the toe of the outside channel banks in these locations.

In addition, the preliminary plan calls for regrading and revegetating seven different areas of steep eroding channel banks, including several eroding areas on the west bank adjacent to the City yards north of Fontanero Street. Enhanced bank vegetation is called out on the east side of the creek in an area near Colorado College. The vegetation would screen the existing concrete protection to soften the appearance of this area and improve aesthetics.

The 100-year floodplain is shown generally within the top of the channel banks in this reach; however, the historic filling of natural channel overbank areas has created the potential for high flow velocities during flood events. This means that land, buildings and utilities located adjacent to Monument Creek are subject to damage from flood erosion and lateral migration of the stream channel. It is recommended that landowners adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks. Fortunately, much of this reach is flanked by Monument Park, which provides a buffer against damage to buildings as a result of bank movement.

8.3.3 Reach M3, Van Buren Street to Fillmore Street

The preliminary plan in this reach consists of 11 riffle drops for grade control and infrastructure protection. The drops have an average width of 78 feet and are spaced from 200 to 550 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of two or three drops. The following stations represent the highest priority riffle drop locations:

- **Station 197+00**—This riffle drop would be located just downstream of the Fillmore Street bridge, to provide grade control downstream of the bridge foundation.

- **Station 182+45**—This riffle drop would be located just downstream of the Polk Street bridge, to provide grade control downstream of the bridge foundation.

- **Station 166+80**—This riffle drop would be located just downstream of the Dilly pedestrian bridge, to provide grade control downstream of the bridge.

The preliminary plan provides for the creation of a vegetated bench areas on the east bank downstream of Fillmore Street. The vegetated benches are necessary to provide some protection against erosion that is occurring at the toe of the outside channel banks in this location.

In addition, the preliminary plan calls for regrading and revegetating seven different areas of steep eroding channel banks. Riprap bank protection is called out on the east side of the creek immediately upstream of the DRGWRR bridge (to repair a failing gabion wall) and downstream of the Dilly pedestrian bridge. A grouted-rock energy dissipator is proposed at the tributary channel outfall on the east side of the creek upstream of the DRGWRR. This tributary channel drains an area north of the DRGWRR and east of Monument Creek. The concrete lined channel runs along the northside of the railroad and terminates at an elevation several feet above the bottom of Monument Creek, creating a steep dropoff and scour hole. The energy dissipator will be constructed on the end of the concrete channel and will eliminate the dropoff and scour hole.

The 100-year floodplain in this reach is not contained within the top of the channel banks; industrial land uses on the west side of the creek and some residential areas on the west side are shown to be within the 100-year future development floodplain. The preliminary plan addresses overbank flooding using a nonstructural strategy of floodplain management. It is recommended that the purchase of flood insurance and/or flood proofing of buildings be considered by property owners located within the floodplain. In addition, it is recommended that a strategy of passive floodplain acquisition be followed. In other words, when an opportunity to transfer ownership of property within the floodplain arises, the City could consider acquiring the property and retaining it for uses compatible with being located in a floodplain, such as park development.

As in the downstream reaches, historic filling of overbank areas has created the potential for high flow velocities during flood events. This means that land, buildings and utilities located adjacent to Monument Creek are subject to damage from flood erosion and lateral migration of the stream channel. It is recommended that landowners adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks.

8.3.4 Reach M4, Fillmore Street to Templeton Gap Floodway

The preliminary plan in this reach consists of 24 riffle drops for grade control and infrastructure protection. The drops have an average width of 109 feet and are spaced from 200 to 450 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of eight to drops. The following stations represent the highest priority riffle drop locations:

- **Station 207+80**—This riffle drop, along with the next drop downstream, would be located at a major bend to the left (looking downstream) in the channel about 1000 feet upstream of Fillmore Street. The drops would be constructed in conjunction with creating vegetated benches, installing rock toe protection, and regrading a steep eroding bank to stabilize and rehabilitate the channel bend.

- **Station 216+70**—This riffle drop, along with the next drop downstream, would be located at a major bend to the right in the channel about 1,800 feet upstream of Fillmore Street. The drops would be constructed in conjunction with creating vegetated benches, installing rock toe protection and buried riprap, and regrading a steep eroding bank to stabilize and rehabilitate the channel bend.

- **Station 229+30**—This riffle drop would be located just downstream of the exposed sanitary sewer encasement to provide grade control downstream of the encasement.

- **Station 249+60**—This riffle drop, along with the next drop downstream, would be located at a major bend to the right in the channel about 1200 feet downstream of the Templeton Gap Floodway. The drops would be constructed in conjunction with creating vegetated benches, installing rock toe protection, and regrading a steep eroding bank to stabilize and rehabilitate the channel bend.

- **Station 257+60**—This riffle drop, along with the next drop downstream, would be located at a major bend to the left in the channel about 600 feet downstream of the Templeton Gap Floodway. The drops would be constructed in conjunction with regrading the baseflow channel, creating vegetated benches, installing rock toe protection, and regrading a steep eroding bank to stabilize and rehabilitate the channel bend.

Additional creation of a vegetated bench areas and regrading of steep eroded banks, besides the work described above, is called out in the preliminary plan. A grouted-rock

energy dissipator is proposed at the Templeton Gap Floodway outfall on the east side of the creek.

The 100-year floodplain is shown generally within the top of the channel banks in this reach; however, the historic filling of natural channel overbank areas has created the potential for high flow velocities during flood events. This means that land, buildings, and utilities located adjacent to Monument Creek are subject to damage from flood erosion and lateral migration of the stream channel. It is recommended that landowners adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks.

8.3.5 Reach M5, Templeton Gap Floodway to I-25

The preliminary plan in this reach consists of 35 riffle drops for grade control and infrastructure protection. The drops have an average width of 153 feet and are spaced from 200 to 500 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of eight to ten drops. The following stations represent the highest priority riffle drop locations:

- **Station 323+05**—This riffle drop is to be located about 2,000 feet upstream of Garden of the Gods Road, immediately downstream of the Pikeview Diversion Dam. The riffle drop would be constructed to restore the grade of the channel to its former elevation above the piling foundation supporting the dam. The piling under the concrete dam structure has been exposed because of scour and degradation in recent years. The riffle drop would be designed to provide protection against undermining of the dam. This drop would be constructed somewhat above grade; therefore, one or more riffle drops would need to be constructed downstream, such as at Station 319+25 and Station 315+45. The drops would be constructed in conjunction with installing rock erosion protection at the dam, creating a large vegetated bench on the east side of the creek, and regrading a steep eroding bank on the west by the dam access road. The improvements would be designed to stabilize and rehabilitate the diversion dam and the channel area downstream of the dam.

- **Station 327+95**—This riffle drop would be located about 300 feet upstream of the Pikeview Diversion Dam. A rock-lined channel 40 to 60 feet wide would be constructed between the drop and the diversion dam. The rock-lined channel would resist scour during sediment sluicing operations at the dam and would reduce disturbance to the creek bed upstream of the dam. Vegetated benches would be created on both sides of the rock-lined channel and would extend upstream for a distance of almost

2,000 feet, thus stabilizing and rehabilitating the creek channel in the area upstream of the dam.

- **Station 371+00**—This riffle drop is to be located about 300 feet downstream of I-25, immediately downstream of the exposed sanitary sewer encasement. The riffle drop would be constructed to restore the grade of the channel to its former elevation above the top of the sewer encasement, protecting and concealing the encasement. Because this drop would be constructed somewhat above grade, one or more riffle drops would need to be constructed downstream, such as at Station 367+00 and Station 362+30.

- **Station 275+30**—This riffle drop, along with the next drop downstream, would be located at a major bend to the left in the channel about 1,200 feet upstream of the Templeton Gap Floodway. The drops would be constructed in conjunction with regrading the base flow channel, installing rock toe protection, and regrading a steep eroding bank to stabilize and rehabilitate the channel bend.

- **Station 302+10**—This riffle drop would be located at a major bend to the right in the channel, about 400 feet downstream of Garden of the Gods Road. The drop would be constructed in conjunction with installing rock toe protection and regrading a steep eroding bank to stabilize and rehabilitate the channel bend, and to provide interim grade control until the point in time when the drop immediately downstream of Garden of the Gods Road is constructed.

The preliminary plan provides for the creation of vegetated bench areas in three locations and regrading and revegetating eight different steep eroding channel banks. The plan calls for major regrading/revegetation work on the entire east bank from Templeton Gap Floodway to a point about 1,600 feet north of Garden of the Gods Road. Most of this bank has undergone substantial filling with trash, debris, rubble, and unstable fill material in recent years. The regrading work is necessary to clean up the unsightly, unsafe rubble, remove encroachments on the flood channel, and create flatter, stable slopes.

Approximately 1,700 lineal feet of fencing is called out at the top of a steep bedrock bank on the east side of the creek. The fence is located adjacent to the apartment complex about one half mile south of I-25, and is to improve safety conditions at the top of the bank.

The 100-year floodplain is shown generally within the top of the channel banks in this reach; however, the historic filling of natural channel overbank areas has created the potential for high flow velocities during flood events. This means that land, buildings, and utilities located adjacent to Monument Creek are subject to damage from flood erosion and lateral migration of the stream channel. It is recommended that landowners

adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks.

8.3.6 Reach M6, I-25 to Woodmen Road

The preliminary plan in this reach consists of 23 riffle drops for grade control and infrastructure protection. The drops have an average width of 94 feet and are spaced from 200 to 550 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of four to five drops. The following stations represent the highest priority riffle drop locations:

- **Station 410+30**—This riffle drop is to be located immediately downstream of an exposed sanitary sewer encasement (the sewer has been abandoned). The riffle drop would be constructed to restore the grade of the channel to its former elevation above the top of the sewer encasement, thus protecting and concealing the encasement.

- **Station 395+05**—This riffle drop, along with the next drop downstream, would be located at a major bend to the right in the channel about 2,000 feet upstream of I-25. The drops would be constructed in conjunction with creating vegetated bench areas on both sides of the creek to stabilize and rehabilitate the channel bend.

- **Station 421+75**—This riffle drop, along with the next drop downstream, would be located at a major bend to the right in the channel about 1,000 feet downstream of the Cottonwood Creek confluence. The drops would be constructed in conjunction with rehabilitating existing riprap bank protection to stabilize the channel bend.

The preliminary plan provides for the creation of vegetated bench areas in a total of seven locations. The plan calls for removing, in time, the existing concrete slope paving between Mark Dabling Road and Woodmen Road. This slope paving is about 35 feet high, has a slope of 2 (horizontal) to 1 (vertical), and was constructed with a concrete trail at the bottom. The slope paving has become an "attractive nuisance" and a safety hazard. A common local practice is to toss beer bottles onto the concrete surface, resulting in broken glass covering the slope and the trail below. The plan calls for regrading the banks to a slope of approximately 3 to 1 and revegetating with grasses and shrubs. This would provide for a safer, more natural channel bank configuration that is more in character with the remainder of Monument Creek.

The 100-year floodplain is shown generally within the top of the channel banks in this reach; however, the historic filling of natural channel overbank areas has created the potential for high flow velocities during flood events. This means that land, buildings,

and utilities located adjacent to Monument Creek are subject to damage from flood erosion and lateral migration of the stream channel. It is recommended that landowners adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks.

8.3.7 Reach M7, Woodmen Road to Upstream Study Limit

The preliminary plan in this reach consists of 20 riffle drops for grade control and infrastructure protection. The drops have an average width of 874 feet and are spaced from 200 to 750 feet apart. As stated previously, the riffle drops can be constructed using a phased approach, with the schedule of construction based on the actual rate of degradation in Monument Creek. An initial construction phase in the reach would most likely consist of six or seven drops. The following stations represent the highest priority riffle drop locations:

- **Station 462+00**—This riffle drop is to be located immediately downstream of an exposed sanitary sewer encasement. The riffle drop would be constructed to restore the grade of the channel to its former elevation above the top of the sewer encasement, thus protecting and concealing the encasement.

- **Station 473+10**—This riffle drop is to be located immediately downstream of another exposed sanitary sewer encasement. The riffle drop would be constructed to restore the grade of the channel to its former elevation above the top of the sewer encasement, thus protecting and concealing the encasement. Because this drop would be constructed somewhat above grade, at least one riffle drop would need to be constructed downstream, such as at Station 469+30.

- **Station 487+70**—This riffle drop is to be located immediately downstream of an exposed sanitary sewer encasement, thus protecting and concealing the encasement. This drop would be constructed somewhat above grade; therefore, at least one riffle drop would need to be constructed downstream, such as at Station 483+70.

- **Station 503+50**—This riffle drop is to be located immediately downstream of another exposed sanitary sewer encasement, protecting and concealing the encasement. This drop would be constructed somewhat above grade; therefore, at least one riffle drop would need to be constructed downstream, such as at Station 499+50.

- **Station 395+05**—This riffle drop, along with the next drop downstream, would be located at a major bend to the right in the channel about 2,000 feet upstream of I-25. The drops would be constructed in

conjunction with creating vegetated bench areas on both sides of the creek to stabilize and rehabilitate the channel bend.

- **Station 421+75**—This riffle drop, along with the next drop downstream, would be located at a major bend to the right in the channel about 1,000 feet downstream of the Cottonwood Creek confluence. The drops would be constructed in conjunction with rehabilitating existing riprap bank protection to stabilize the channel bend.

The preliminary plan provides for the creation of vegetated bench areas in a total of ten locations and regrading steep, eroded banks in nine locations. As indicated in the plan, some of this work would be in conjunction with regrading the base flow channel and installing rock toe protection, to stabilize and rehabilitate a number of major channel bends. The plan also calls out fencing at the top of several steep bedrock banks.

The 100-year floodplain in this reach has not yet experienced the type of filling of natural channel overbank areas that characterizes the downstream reaches. It would be preferable to retain the unencroached condition of the floodplain in this reach. This would preclude the increase in flood velocities that would take place with significant floodplain filling, and retain the unique natural character of the riparian corridor. One exception to this recommendation against filling is in an ineffective flow area on the west bank just upstream of Woodmen Road. This area could be filled without impacting flood velocities or special habitat. Even without filling the floodplain, however, it is recommended that landowners adjacent to Monument Creek consider the risk of bank erosion when planning and maintaining structures near the creek banks.

8.4 Probable Costs of Preliminary Plan

Probable costs associated with constructing the preliminary plan improvements are shown in Table 8-1. For the most part, probable costs were calculated using the unit cost relationships shown in Table 7-1. On the basis of the information in Figure 8-1, a revised cost relationship was developed for riffle drops. A 25 percent allowance was added to the base construction cost to account for mobilization, water control, clearing and grubbing, demolition, and unlisted items. A 25 percent allowance was added to this subtotal as a construction contingency. No allowance was added for engineering, landscape design, permitting, administration, and legal costs.

Table 8-8 Probable Costs of Preliminary Plan			
Reach	Probable Construction Cost (in millions)	Probable Cost per Lineal Foot	Probable Right-of-Way Cost (in millions)
M1	$1.4	$380	$0.08
M2	$5.1	$420	0
M3	$1.6	$400	$0.19
M4	$3.9	$590	$0.21
M5	$8.3	$710	$0.53
M6	$2.7	$360	0
M7	$2.8	$380	$1.60
Average		$490	
Total	**$25.8**		**$2.61**

The final costs of the project, and resulting feasibility, will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, and other variable factors. These factors, as well as project feasibility, benefit/cost ratios, risks, and funding, must be carefully reviewed before specific financial decisions are made or project budgets are established. Such a review will help ensure proper project evaluation and adequate funding.

The right-of-way costs shown in Table 8-8 are based on the acquisition of the entire area between the tops of the channel banks along the length of the study reach, plus all over-bank areas within the 100-year future development floodplain.

8.5 Funding and Implementation of Plan

It was the original intent that as part of this study, a funding strategy would be developed to implement the improvements outlined in the preliminary plan. The funding strategy was to be developed in accordance and in coordination with the "Colorado Springs Stormwater-Environmental Program Study" (CH2M HILL, Inc., 1992).

The study referenced above outlines several alternative funding strategies that attempt to address the relative benefits to the population as a whole (economic, recreation, wildlife, flood protection safety, and open space), benefits related to potential land development and/or restoration that may result from the improvement, and benefits to the land in

tributary drainage basins. The strategies also address the benefits and responsibility of specific parties, including both private and public.

It was determined that, prior to developing a funding strategy for the Monument Creek DBP5 as well as the companion Fountain Creek DBP5, the next phase of the City's overall stormwater funding study would need to be completed, or at least substantially complete to assure that the recommended strategy is consistent with the overall stormwater funding program.

Therefore, this study does not outline a funding strategy or implementation plan for the improvements outlined in the preliminary plan. This study will be used to guide the improvement to be constructed along Monument Creek. Until such time as the stormwater funding study identifies a strategy to be followed, funding aspects of improvements will be addressed by the City Engineering Division on an individual or case-by-case basis in accordance with existing ordinances, regulations, policies, and criteria.

9.0 REFERENCES

9.0 References

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