MASTER DEVELOPMENT DRAINAGE PLAN

FOR THE

MILL STREET PRESERVATION AREA

COLORADO SPRINGS, COLORADO

Prepared for:

City of Colorado Springs

Contact: Robin Kidder

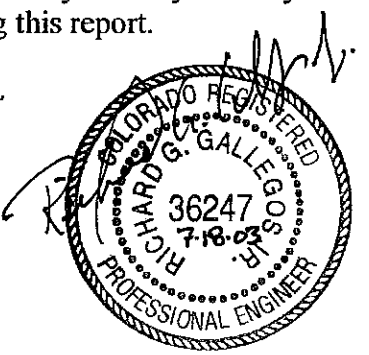
Prepared by:

Matrix Design Group

Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

SEAL



Richard G. Gallegos, Jr.
Registered Professional Engineer
State of Colorado
No. 36247

City of Colorado Springs:

Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

City Engineer

7/22/03
Date

Conditions:

MASTER DEVELOPMENT DRAINAGE PLAN
FOR THE
MILL STREET PRESERVATION AREA
COLORADO SPRINGS, COLORADO

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I. INTRODUCTION

Matrix Design Group, Inc., has been retained by the City of Colorado Springs to conduct a Master Development Drainage Plan (MDDP) for the Mill Street Preservation Area to evaluate existing drainage patterns in the area, and propose improvements to upgrade the existing drainage system. This study will identify areas of localized drainage problems, and provide a list of priorities of required drainage infrastructure to mitigate localized flooding. Matrix has worked with area residents, commercial owners, the Mill Street Neighborhood Association, and the City of Colorado Springs to receive input on areas of concern and propose viable solutions to relieve the areas of localize flooding.

The Mill Street Neighborhood is a historic residential development located immediately south of downtown Colorado Springs with many homes and structures dating as far back as the late 1800's. The current limits of the Mill Street Neighborhood were originally platted as part of two subdivisions divided by the existing railroad line that bisects the neighborhood. The area to the north of the railroad line was originally platted as ***Addition No. 3 to Colorado Springs***, approved and recorded in 1888. The area to the south of the railroad line was platted in 1897 as the ***South End Addition to the City of Colorado Springs.*** Subsequent replats have been completed within this area. The railroad line bisecting the neighborhood was originally owned and operated by the Denver and Rio Grande Railroad. The same line is now operated as part of the Union Pacific Railroad system.

In an effort to preserve the historic nature of the area, a Preservation Plan for the neighborhood was put into motion in 1998. In late 2000, a request was formally made by the City of Colorado Springs Neighborhood Redevelopment Unit on behalf of the neighborhood group to designate the area as a Strategy Area. In 2001 the Colorado Springs City Council approved the designation.

Mill Street, looking east

Initial funding for the Preservation Area has been obtained from the Department of Housing and Urban Development (HUD) in the form of a Community Development Block Grant (CDBG). The federal grant is distributed annually and managed by the City of Colorado Springs Neighborhood Services Department. The monies can be used to fund construction of public improvements in the area including sidewalks, curb and gutter, roadway improvements, streetlights, utilities, drainage improvements, etc. To help coordinate the improvements in the area, Matrix has prepared this MDDP to provide a complete picture of the drainage infrastructure needed to meet current City drainage criteria. This drainage study for stormwater improvements will capitalize on other opportunities to integrate drainage into other improvements, such as roadways. The roadways will be used as a drainage conveyance mechanism, as well as providing better access for residents. The streets will be upgraded to current City of Colorado Springs criteria where possible. The study will also provide a better understanding for required improvements such as storm sewers to avoid conflicts with other construction. This master planning will enable the City and neighborhood group to maximize the construction dollars spent by incorporating multiple improvements together rather than constructing improvements in a piecemeal fashion.

A. General Project Location

The Mill Street Neighborhood encompasses approximately 60 acres of mostly single-family residential lots south of the downtown region of Colorado Springs, Colorado. See Vicinity Map, Figure 1. Some industrial developments exist along the southern portions of the area along East Las Vegas Street, and commercial sites along the eastern fringes along Tejon Street. More specifically, the Mill Street Neighborhood location is as follows:

General Location. The northeast ¼ of Section 19, Township 14 South, Range 66 West of the 6th PM in the City of Colorado Springs, County of El Paso, State of Colorado.

Surrounding Streets. The Mill Street Preservation Area is bounded on the north by Fountain Boulevard, on the west by Conejos Street, on the south by Las Vegas Street, and on the east by Tejon Street. See Mill Street Redevelopment Area Map, Figure 2.

Off site flows enter the study reach from the north. The off site sub-basins extend from Conejos Street to the west, Cimarron Street to the north, and Tejon Street to the east during the 5-year storm event. A small amount of spill over runoff comes from as far north as Pikes Peak Avenue during the 100-year storm event. The additional runoff from the 100-year storm event comes from the Shooks Run drainage basin.

Fountain Creek, just west of Las Vegas Street

Major Drainageways. Fountain Creek is located to the west and south of the Mill Street Preservation Area.

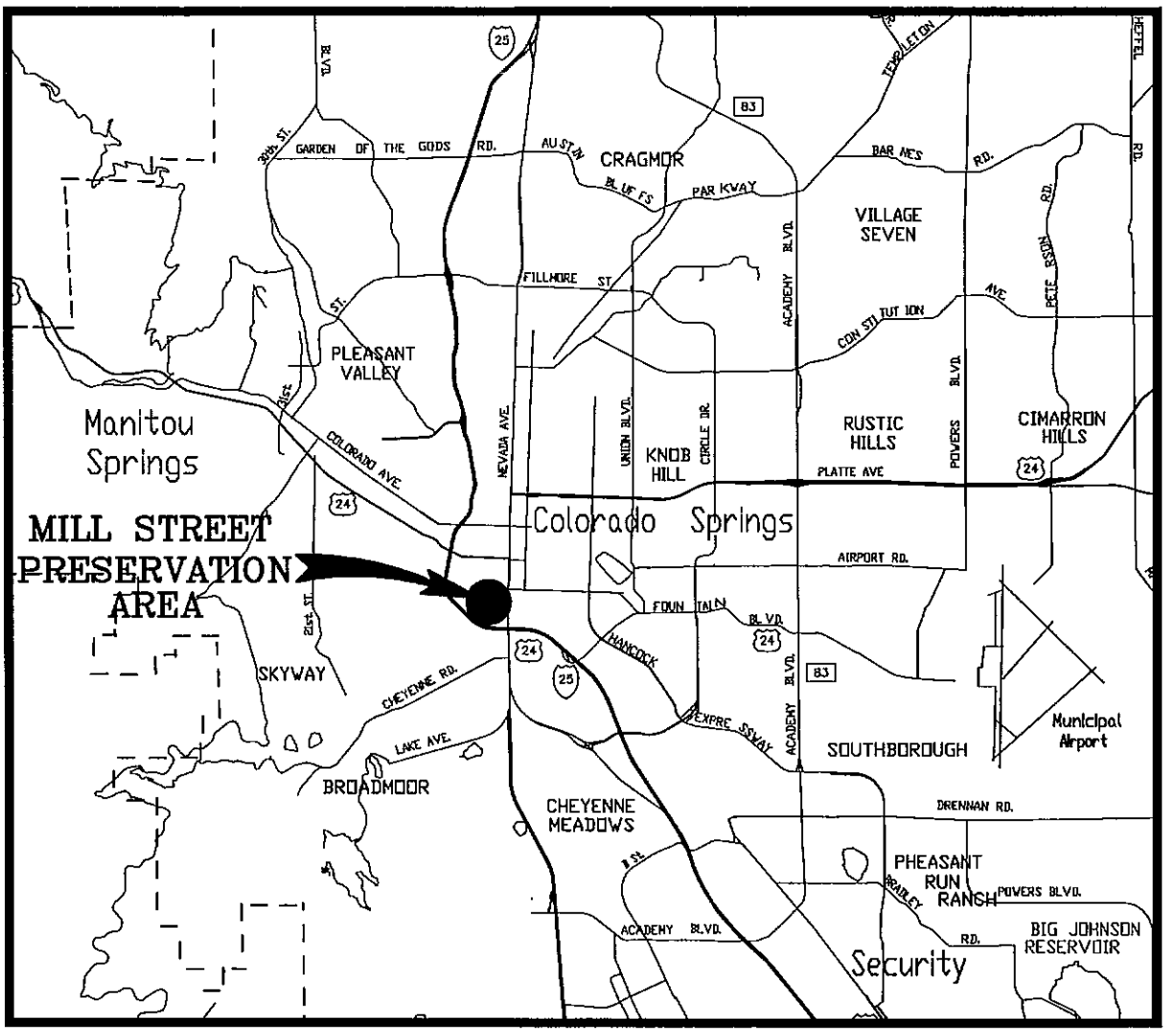
Surrounding Developments. The Mill Street Preservation Area is located within a mostly developed urban area south of the City of Colorado Springs downtown district. In general, the following uses are located around the study area:

East: Commercial lots dominate the land use to the east of the site along both sides of Tejon Street. A significant number of commercial lots have been converted from single-family residential dwellings into business in this area. A few single-family residential lots exist in this area.

South: A mixed industrial/commercial use exists along the southern limits of the Preservation Area along Las Vegas Street.

West: The Colorado Springs Utilities Department (CSU) owns the Martin Drake Power Plant along the entire western boundary of the Mill Street Preservation Area. A recently constructed railroad spur was completed in 2002 at the southern portion of the power plant.

North: To the northwest of the Mill Street Neighborhood, a mixture of commercial and industrial developments dominate the land use. Commercial parcels exist to the northeast, and single-family residential lots exist along the northern property line.



VICINITY MAP

NORTH
N.T.S.

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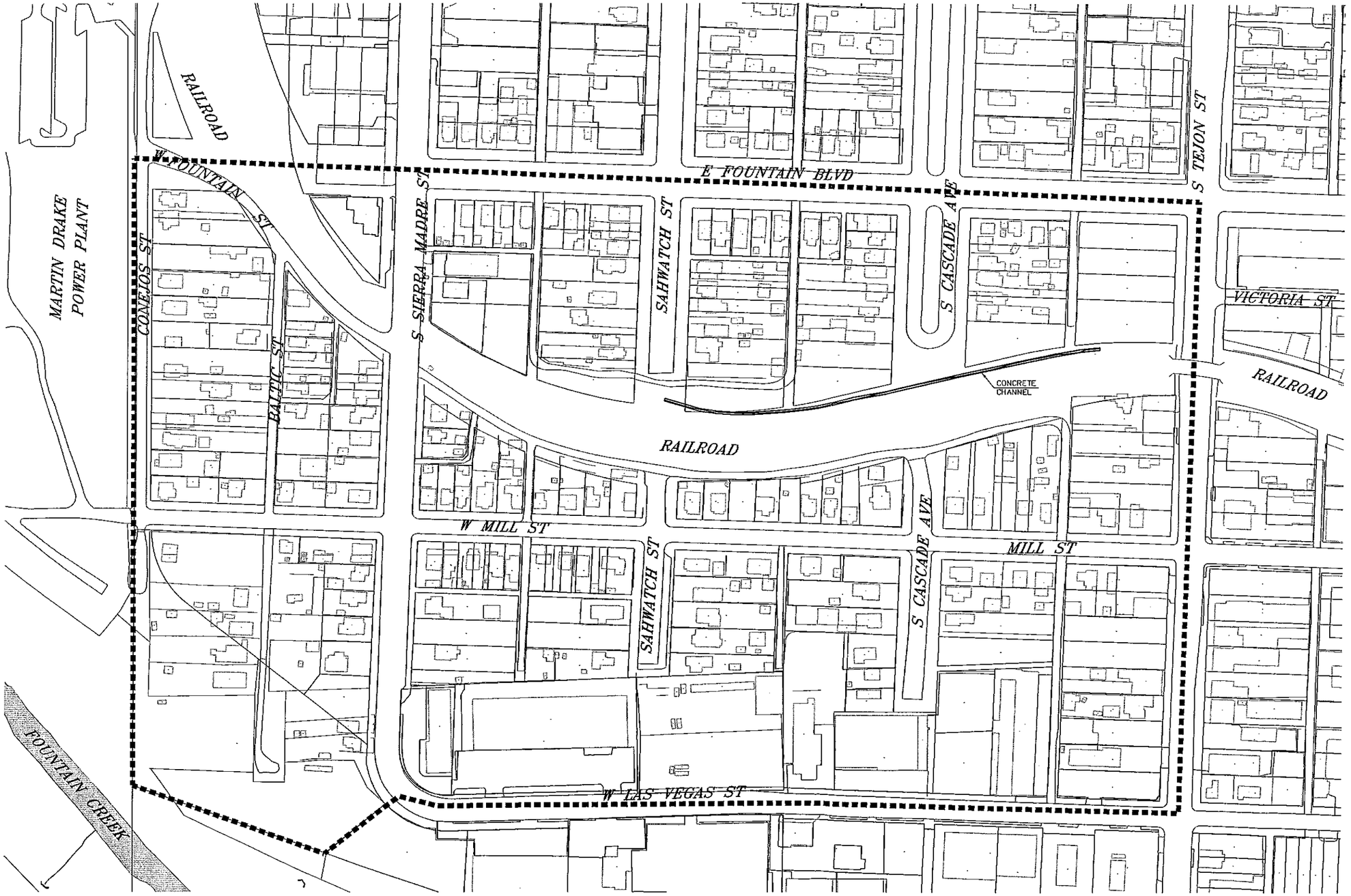
FIG. 1



LEGEND

Proposed Mill St. Redevelopment Area

N

GRAPHIC SCALE

200 0 100 200 400

(IN FEET)
Original Scale
1 inch = 200 ft.

REVISIONS

NO.	DATE	BY	DESCRIPTION	APPROVED BY:	DATE

Drawing name: S:\02.069.003(MillStreet)\dwg\Drainage Study\MS03.dwg

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

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MILL STREET NEIGHBORHOOD

DRAINAGE BASIN PLANNING STUDY

MILL STREET REDEVELOPMENT AREA

DESIGNED BY:	RGG	SCALE		DATE ISSUED:	APRIL 2003
DRAWN BY:	MEM	HORIZ:	1"=200'		
CHECKED BY:	RGG	VERT:	N/A	MDG PROJECT NO.:	02.069.003

FIG 2

B. Existing Area Development

The Mill Street Preservation Area is a mostly developed urban area, with very few vacant, in-fill lots remaining to be developed. The study area covers approximately 60 acres consisting of commercial, industrial and residential uses. An additional 112 acres of upstream tributary area consisting largely of urban development contribute stormwater to the site from the north.

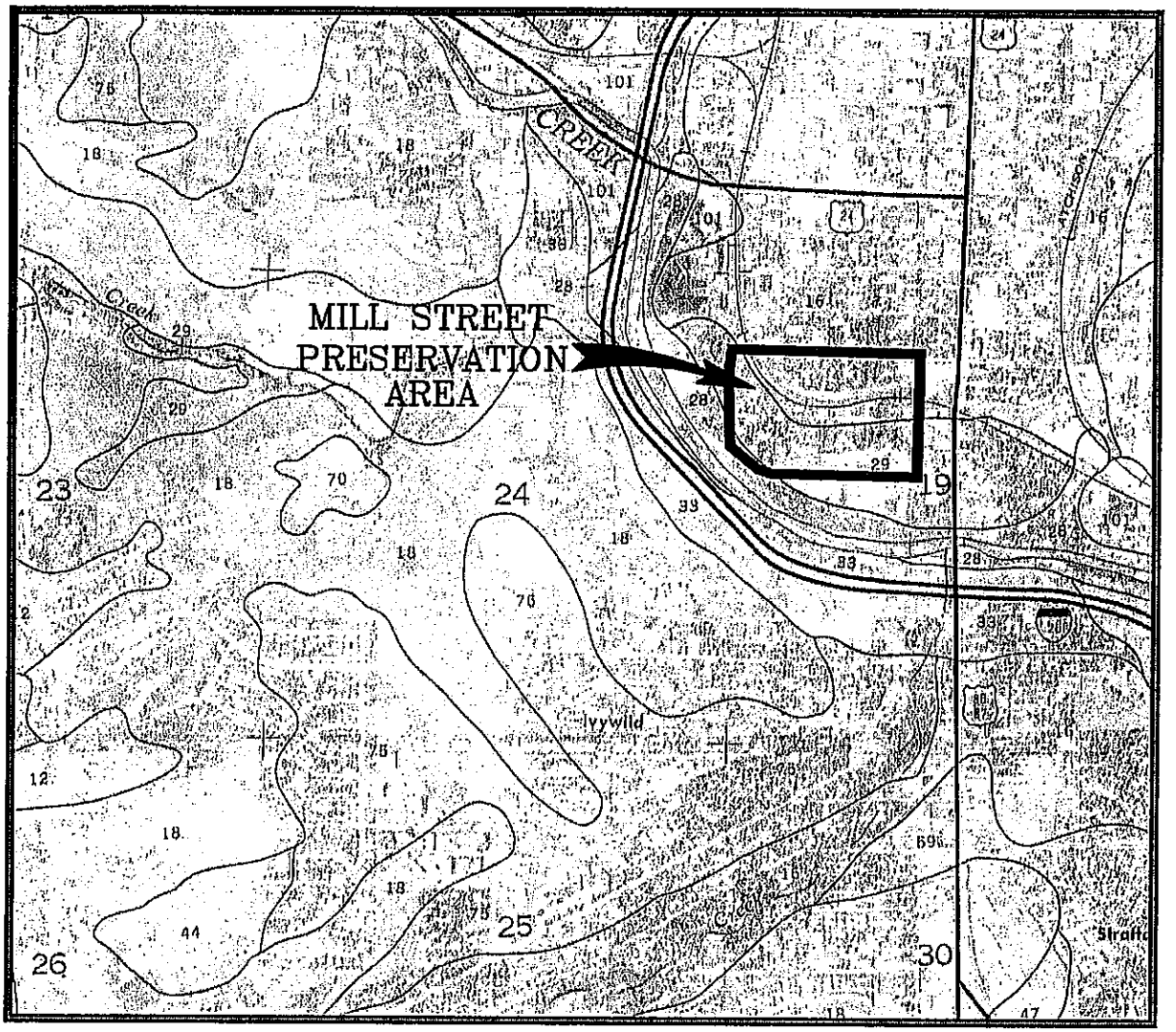
1. Study Area Description. The entire study area is approximately 83% of impervious ground consisting of developed commercial, residential, and industrial uses in a mature urban setting. The region generally drains to the south at grades ranging from 0.5% - 10.0%. A railroad spur aligned east-west bisects the Preservation Area. Roadways aligned east-west have grades that are typically very flat.

   The area along East Las Vegas Street is also known to have a high ground water table. The City of Colorado Springs installed an underdrain system in 2002 under East Las Vegas Street. The underdrain system was sized to provide outfall points for foundation drains for adjacent commercial property owners. The system drains to the east and outfalls to an existing inlet at the intersection of Tejon Street and East Las Vegas Street.

2. General Soil Conditions. The *Soil Survey of El Paso County Area, Colorado* published by the United States Department of Agriculture, dated November 1991, has been utilized to investigate the existing soil types within and tributary to the area impacting the Mill Street Preservation Area. The soils within the study reach are typical of those found in alluvial fans and floodplains. Four different soil types can be commonly found within the study reach:

ID No.	*Soil*	*Hydrologic Classification*	*Permability*	*Erosion Hazard*
16	Chaseville gravelly sandy loam	A	Rapid	Moderate to High
28	Ellicott loamy coarse sand	A	Rapid	High
29	Fluvaquentic Haplaquolls	B/D	Moderate	Slight
101	Ustic Torrifluvents loamy	B	Moderate	Moderate to High

Soils can be classified in four different hydrologic groups, A, B, C, or D to predict stormwater runoff. Hydrologic group "A" is characterized by deep, well-drained course-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. For the purposes of this Master Development Drainage Plan, it has been assumed that hydrologic group "B" soil characteristics exists across the study reach.



SOILS MAP

NORTH
N.T.S.

LEGEND

ID	SOIL NAME	HYD. GROUP
16	CHASEVILLE GRAVELLY SANDY LOAM	A
28	ELLICOTT LOAMY COURSE SAND	A
29	FLUVAQUENTIC HAPLAQUOLLS	B/D
101	USTIC TORRIFLUVENTS LOAMY	B

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FIG. 3

3. Floodplain Statement. Per the Flood Insurance Rate Map Panel 729, effective date March 17, 1997, portions of the Mill Street Preservation Area are located within the Fountain Creek designated 100-year floodplain boundary. The portion of the study reach located within the floodplain is a backwater area along East Las Vegas Street. See Floodplain Map, Figure 4. No other areas in the Mill Street Preservation Area are located within a designated floodplain.

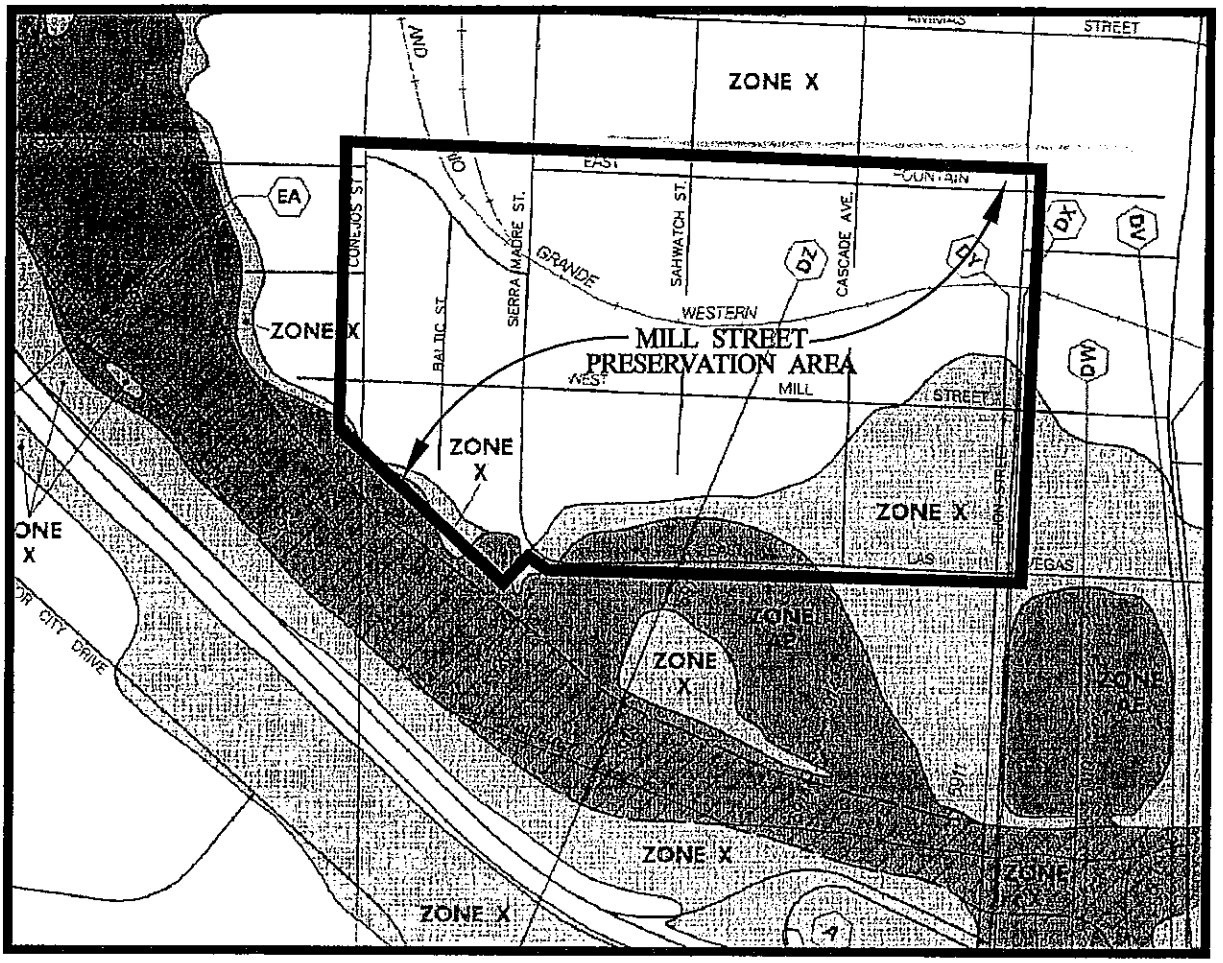
4. Existing Utilities. The majority of the utility corridors in the study reach are located within roadways, or alleys. Municipal facilities owned and operated by Colorado Springs Utilities (CSU) include water mains, sanitary sewers, gas lines, overhead and underground electric lines. In addition, streetlights and existing storm facilities are maintained by the City of Colorado Springs.

   In general, it is anticipated that the proposed storm sewer system planned will encounter conflicts mainly with water and gas lines due to the typically shallow depths of these utilities. Electric lines are primarily located overhead. Due to the age of the area, a significant portion of the utility infrastructure has been poorly documented. Sufficient planning of each area prior to construction should take place to avoid conflicts with existing utilities, or provide solutions for any conflicts. It is assumed that the sanitary sewer will be of sufficient depth to avoid the proposed storm sewer systems. Based upon interviews with City and CSU staff, there have been historic problems associated with the sanitary sewer when any work conducted on, or around the sewer is done. Sanitary sewers consist of older vitrified clay pipe (VCP) that has a tendency to crack when it is not properly protected. In addition, any regrading and construction to the existing streets needs to consider the depth of cover provided to all utilities.

   Roadway widening will also create some conflicts with existing light poles, and overhead electric line poles. A number of poles will have to be worked around, or relocated as part of the proposed improvements. In general, the poles should be at least 3' from the edge of pavement or from the back of curb and gutter.

5. Proposed Improvements. The proposed improvements within this MDDP will address the drainage concerns through the Mill Street Preservation Area. To help maximize the benefits of the proposed construction, the drainage system has been incorporated with other improvements. For example, upgrading roadway cross sections will more effectively convey traffic and provide improved access, as well as providing drainage benefits. Additional improvements to provide/upgrade pedestrian ramps and concrete sidewalks will be done in conjunction with roadway improvements.

Conejos Street, looking north



FLOODPLAIN MAP

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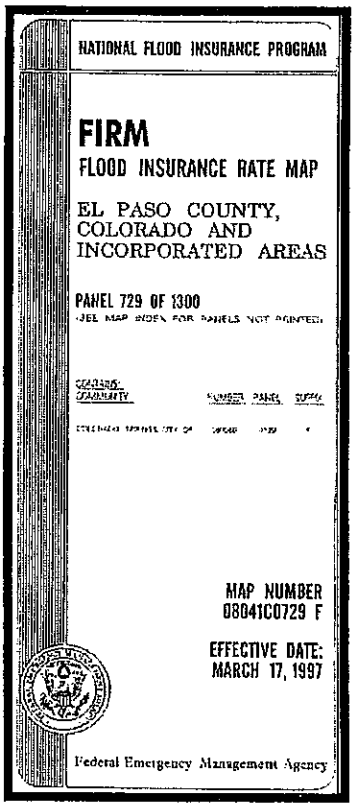

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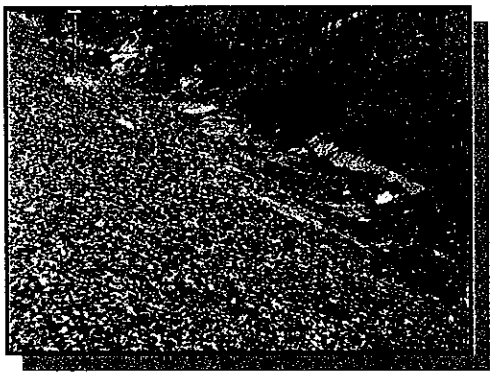
FIG. 4



Debris filled concrete channel north of railroad. The channel will be cleaned as part of the proposed drainage improvements.

The improvements will be funded through a federal Community Development Block Grant. Due to the limited amount of funding available on an annual basis, the ultimate drainage requirements will be evaluated and improvements prioritized based upon community needs. The improvements can be implemented in several phases based upon the resources available to the City. Within this MDDP, proposed improvements have been placed into one of three "need" categories; "High", "Medium", and "Low"; based upon community needs.

6. Right-of-Way and Easements. The majority of proposed improvements will occur within existing right-of-way and easements granted to the City of Colorado Springs through the platting process. Within the Mill Street Neighborhood, coordination with the existing railroad line bisecting the neighborhood will have to occur to upgrade and install some of the proposed drainage and roadway improvements. Right-of-way information has been obtained from CSU's Facility Information Management System (FIMS) data and by research of plats on file with the El Paso County Clerk and Recorders Office. No formal right-of-way survey has been done as part of this study.

II. DRAINAGE BASIN AND SUB-BASINS

A. Major Basin Description

The Mill Street Preservation Area, and upstream tributary area are currently located within a Miscellaneous Drainage Basin per the Drainage Basin Fee Map published by the City of Colorado Springs Planning Department. Review of previous drainage studies on record with the City of Colorado Springs Stormwater Department indicate that a number of subdivision drainage reports have been completed in the area, but no comprehensive drainage plan has been produced.

The tributary area contributing stormwater flows through the Mill Street Neighborhood have been defined by utilizing the Shooks Run Drainage Basin Planning Study, and topography obtained from the Colorado Springs Utilities Facility Information Management System (FIMS). The FIMS data provides 2' interval contours, and existing improvements of the area that can be seen from aerial photography. The FIMS data was supplemented by a field survey of existing drainage facilities in the area.

The Shooks Run Drainage Fee Basin exists as far west as Nevada Avenue. Existing topography, roadways and storm sewer systems create a northern tributary basin boundary along Cimarron Street from Interstate 25 to Cascade Avenue. The basin boundary then extends north to Vermijo Avenue between Cascade Avenue and Tejon Street. The general eastern limits of the tributary area extend to the eastern side of Tejon Street from Vermijo Avenue to East Las Vegas Street. The southern limits of the study lie along East Las Vegas Street. The Martin Drake Power Plant property defines the western limits of the study reach.

Pedestrian ramps at Tejon Street and Mill Street. Sediment is transported to the ramps from stormwater overtopping the end of the existing concrete channel at the railroad and Tejon Street.

Presently, the majority of stormwater in the area is conveyed via existing roadways to one of two major storm sewer systems in the area. A trunk storm sewer system exists under Tejon Street conveying flow southerly to an outfall in Fountain Creek. The upstream end of the storm sewer system begins at East Costilla Street and outfalls to Fountain Creek. In general, the existing system is in fair to poor condition. Interviews with City of Colorado Springs maintenance personnel have provided information that portions of the CMP storm sewer inverts have deteriorated from approximately the outfall point at Fountain Creek to Fountain Boulevard. Several inlets have been recently constructed by the City and connect into the existing trunk system in Tejon Street. Due to the age of this particular system, there are very few record documents of the exact configuration of the sewer. Several City personnel have been interviewed to obtain as much information as possible. The system has been analyzed based upon the information obtained from City personnel and field survey.

The second existing main storm sewer infrastructure was constructed in 1994 along Sierra Madre Street. The system begins at the intersection of Rio Grande Street and Sierra Madre Street, and transports flow southerly to the intersection of East Las Vegas Street and Sierra Madre Street. The storm sewer then follows a utility corridor/City trail system to an outfall point at Fountain Creek. The system provides adequate drainage for the area located to the north of the existing railroad tracks. Prior to the installation of the new storm sewer, flow from this area was conveyed in Sierra Madre Street to inlets at the intersection of Sierra Madre and Fountain Boulevard, causing common localized flooding issues. The updated system provides several large at-grade inlets to pick up flow prior to reaching the historic sump at the Fountain Boulevard intersection.

In addition to the two main components of the existing storm sewer infrastructure, several smaller facilities have been placed to provide relief for specific areas. Cascade Avenue is a divided roadway with a landscaped median from Rio Grande Street to the existing railroad spur. The median creates low points at the downstream ends of the landscaped medians. Curb opening inlets as well as grated inlets create a bubbler system and helps to eliminate nuisance flows at the existing low points. Many of the basins in this area have been constructed with brick and utilize Vitrified Clay Pipe. Per discussions with City Maintenance staff, the inlets at one time connected with a small diameter pipe along the eastern side of the roadway. The pipe is estimated to be a 12" VCP and provided an outfall point draining several inlets located in the landscaped medians. The storm sewer system was installed some time ago and is undersized for any significant storm event. The system has been used as a conduit for other utilities, such as gas and electric lines. The large trees typical of this area that line the roadway have also had their root system enter the storm sewer. The existing storm sewer can no longer convey flow, and maintenance of this storm sewer is extremely labor intensive, and cost prohibitive. The existing inlets at the median now act as a "bubbler" system, in which stormwater enters an inlet on the north side an intersection, is conveyed under the intersection in 8" VCP, and exits the inlet on the southern side of the intersection. Runoff is then transported in the roadway to the next downstream bubbler system in Cascade Avenue. At the intersection of Cascade Avenue and the railroad line, flow enters existing curb opening inlets, and outfalls to the existing concrete swale located to the north of the railroad line.

Bubbler system comprised of brick inlets at the intersection of Cascade Avenue and Fountain Boulevard.

At the Martin Drake Power Plant, an existing railroad spur creates a ridge along the western side of the Colorado Springs Utilities Department electric plant. Although the spur creates a drainage basin boundary, only a small portion of runoff from the Martin Drake Power Plant parcel will enter the Mill Street Preservation area. The majority of the site drains to one of two solar ponds located on the southern portion of the property. The ponds have been sized to accommodate the 100-year storm event per the Final Drainage Report for Martin Drake Power Plant Filing No. 1, prepared by Lutz, Daily and Brian Consulting Engineers, dated November 1984 with outfall facilities to Fountain Creek.

Roadway improvements are under construction within the Interstate 25 corridor. As part of the roadway improvements by the Colorado Department of Transportation, drainage infrastructure in the area is also being upgraded to avoid potential flooding problems that may impact the Interstate. An analysis of the Fountain Creek Floodplain/Floodway is being completed for this project, with a formal submittal to the Federal Emergency Management Agency (FEMA) planned to revise the floodplain along Interstate 25.

In addition to the floodplain re-delineation, work is being done right now by the Colorado Water Conservation Board (CWCB) to re-evaluate the hydrology within the area. A preliminary draft of the revised hydrology is anticipated for release in summer/fall 2003. The revised hydrology will be detailed enough for submittal and acceptance by FEMA. Indications from the CWCB and the regional Floodplain Administrator are that in general, the majority of the study area in the Fountain Creek area will have calculated peak flood hydrology reduced from current values. Potentially, some of the reductions could be as much a 50% of the current listed flows. It should be noted that some areas will also have increases in peak flow rates. The CWCB is still in the process of producing hydrology models for the area and information to the changes in flows are not available at this time. Future drainage studies done in the area should consider the final release of the updated hydrology.

B. Existing Mill Street Preservation Area Drainage Facilities

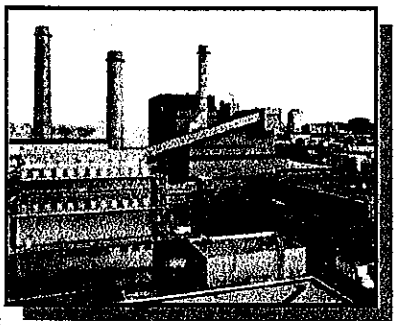
Several drainage systems have been installed in the Mill Street Preservation Area beyond the trunk infrastructure described in the earlier section. One such existing drainage system is the existing concrete channel aligned east-west immediately to the north of the existing railroad line. The swale begins south of Sahwatch Street and transports flow easterly past Cascade Avenue. The channel provides an outfall point for inlets at the dead end of Sahwatch Street as well as the inlets at the dead end of Cascade Avenue. A 42" CMP exists at the end of the swale, but is plugged due to the significant amount of debris and sediment that has accumulated at the end of the concrete swale. Currently, an earthen berm exists at the end of the swale, creating an area for sedimentation and a minor volume of stormwater retention. Stormwater collects, overtops the berm, and flows down to Tejon Street. Riprap consisting of rock and concrete rubble helps to provide some erosion protection of the area, but a significant amount of sediment is transported to Tejon Street and accumulates in the road and storm sewers. When runoff overtops the berm, stormwater flows to an at-grade 20' inlet sloping at 8% at the railroad crossing. Other downstream inlets along Tejon Street eventually intercept any flow-by stormwater that does not enter the 20' inlet.

Sediment accumulation at Tejon Street and railroad intersection at 20' inlet

As part of the drainage investigation for this study, the City Maintenance Department has been contacted to remove the existing sediment and debris from the existing channel to allow runoff to

follow the intended route to the Tejon Street storm sewer. This work is being conducted by City Maintenance and will be the first step in the Mill Street Drainage improvements.

During the recent construction of the Martin Drake Power Plant railroad spur extension, several adjacent properties were purchased along Baltic Street (south of Mill Street) by CSU altering the drainage patterns in the area. Runoff from the area sheet flows over vacant reseeded land into a gravel channel. The channel is located along the northeast side of the railroad spur. Runoff from the channel enters a 36" diameter HDPE storm sewer system that connects to the trunk storm system in Sierra Madre Street. The stormwater facilities have been sized for 100-year event assuming that portions of the property purchased by CSU will be subdivided and redeveloped with single family homes constructed by the Habitat for Humanity foundation, and that land use on the Martin Drake Power Plant would remain essentially unchanged.



Martin Drake Power Plant

The Martin Drake Power Plant property was platted as Martin Drake Filing No. 1. Parcels that are platted or improved require payment of fees and installation of any necessary improvements to adjacent roadways and infrastructure. As part of the platting process, CSU has agreed to provide improvements along one-half of Conejos Street fronting the property from approximately Las Animas Street to Mill Street. CSU will provide City standard sidewalks, curb and gutter, and associated asphalt patching required to adequately install the curb and gutter. The Mill Street Preservation Plan was being drafted at the time of the railroad spur construction and identified improvements that would be required to Conejos Street. In the spirit of cooperation, CSU has postponed the construction of their portion of roadway improvements to allow additional time for proper planning of Conejos Street. CSU has also relocated some overhead electric lines onto their property in anticipation of the roadway improvements.

Other existing improvements in the Mill Street Preservation Area include a concrete basin at the end Sahwatch Street that outfalls to a CMP, and into a concrete chase. The chase transports flows to East Las Vegas Street, and is directed easterly to the storm sewer in Tejon Street.

Two curb opening sump inlets also exist at the intersection of East Las Vegas Street and Sierra Madre Street. These inlets are drained by a storm sewer system that transports flows to the south through private property and outfalls to the Fountain Creek Floodplain. The inlets and storm sewer are independent of the recently constructed trunk system in Sierra Madre Street.

III. DESIGN CRITERIA

A. Regulations

This report adheres to the Drainage Criteria Manual for the City of Colorado Springs and El Paso County, revised November 1991 including subsequent addendums. In addition to City criteria, the Urban Drainage Criteria Manual published by the Urban Drainage and Flood Control District was also used.

Several subdivision drainage reports have been completed for specific developments in the area, and have been listed as references in this report. No comprehensive plan has been completed that encompasses the entire Mill Street Preservation Area as well as the upstream tributary area. A Drainage Basin Planning Study for the Shooks Run Fee Basin located to the east has been utilized to refine basin boundaries impacting the Mill Street Neighborhood.

B. Hydrologic Criteria

Hydrologic analyses of the project have been performed using the Rational Method in accordance with the Criteria Manual for basins less than 100 acres:

$$Q=C*I*A$$

Where:

Q = Maximum runoff rate in cubic feet per second
C = Runoff coefficient
I = Average rainfall intensity in inches per hour
A = Area of drainage sub-basin in acres

An update to the rainfall intensity frequency curves for the City of Colorado Springs was issued on January 7, 2003 from the Stormwater Engineering Review team. The updated information has been utilized in this study. Runoff rates have been routed to design points through out the Mill Street Preservation Area to allow for preliminary design of proposed drainage facilities, as well as evaluate the existing stormwater system.

The design storm events are:

- Initial Storm = 5-Year Storm
- Major Storm = 100-Year Storm

Runoff coefficients are based upon field observations of the area. Type "B" hydrologic soil characteristics have been assumed throughout the area. Weighted runoff coefficients have been calculated based upon one of four land uses:

Land Use	C(5)	C(100)
Commercial (Business Areas)	0.90	0.90
Residential (1/8 Acre or less)	0.60	0.70
Industrial (Heavy Areas)	0.80	0.90
Industrial (Light Areas)	0.70	0.80

The weighted runoff calculations have been included within the appendix of this report.

Additional considerations have been given to consider the new requirements triggered by the recent adoption of the Phase II Water Quality Requirements. The City of Colorado Springs has published Volume 2 of the Drainage Criteria Manual that cover the new criteria.

D. Hydraulic Criteria

Detailed hydraulic analyses of the existing and proposed roadways were completed as part of this study to determine the capacities of the roadways, and place proposed drainage inlets. Per City of Colorado Springs Criteria, criteria used for the 5-year and 100-year storm events are as follows:

Roadway Capacity Criteria:

Street Type	Initial Storm Criteria	Major Storm Criteria
Residential Street (6" ramp curb)	Flow spread to crown; Maximum 20 cfs per side	12" max. depth at flow line; No adjacent flooding
Residential Street (8" vertical curb)	6" allowable depth at flow line; Maximum 34 cfs per side	12" max. depth at flow line; No adjacent flooding
Collector Street (8" vertical curb)	6" allowable depth at flow line; Maximum 34 cfs per side; No overtopping crown	12" max. depth at flow line; No adjacent flooding

Each roadway within the Mill Street Neighborhood was evaluated to determine additional constraints that may not allow the full allowable depth of flow to be utilized. In general, the roadway capacities for the major storm are limited to flow to the top of curb and gutter. Proposed improvements within the area will allow the current City Criteria to be maintained. Roadways outside of the Mill Street Preservation area have also been analyzed to determine drainage patterns through the study reach, however the analysis is only to determine existing drainage conditions and no improvements are proposed.

In addition to the roadway capacities, the existing inlets and storm sewers have also been evaluated. A thorough analysis of the existing storm sewer system along Sierra Madre has been previously completed as part of the storm sewer design.

IV. DRAINAGE PLAN

A. General Concept/ Existing Facilities

The Mill Street Preservation Area, as well as the upstream contributing basins, are essentially fully developed. It has been assumed for the purposes of calculating the peak runoff rates that the entire study reach is fully developed. A summary of the design points, and sub-basin information is provided within the Appendix of this report, as well as on the Drainage Maps.

The study reach has been divided into three main drainage areas, designated by "A", "B", and "C" drainage areas. The offsite sub-basins are generally larger in size and used to determine flows directed through the Mill Street Neighborhood. Sub-basins within the Mill Street Preservation Area have been reduced in size to evaluate specific areas and determine where proposed drainage improvements should be placed.

Sub-basin A comprises 67 acres of the northeastern portion of the study area that is north of the existing railroad line and ultimately drains to Tejon Street. Runoff from this area is primarily conveyed along curb and gutter to inlets and the storm sewer located under Tejon Street. An existing concrete drainage channel to the north of the existing railroad line picks up runoff that is not directed via curb and gutter to Tejon Street. Flow is directed easterly in the channel to a plugged 42" CMP pipe at the end of the channel. The invert of existing 42" CMP is currently plugged with sediment and large debris creating an area for unintended retention. This system will be unplugged as part of the initial work done for the Mill Street Preservation Area.

Other proposed improvements in this area include installing a storm sewer and upgrading inlets along Cascade Avenue to replace the existing bubbler system. An existing inlet at the dead end of Sahwatch Street and directly north of the railroad line will also be upgraded. Details on each of these improvements are provided within the Evaluation Matrix provided later in this report.

Sub-basin B is 32 acres in size comprising the southern portion of the study area south of the railroad line and drains to the existing system in Tejon Street. Runoff from this area is almost entirely drained via roadway curb and gutter to Tejon Street, where inlets and the roadway convey runoff to Fountain Creek. Sub-basin B is almost entirely within the limits of the Mill Street Preservation Area.

Fountain Creek Trailhead

Improvements in this area include installing curb and gutter along Sahwatch Street; installing curb and gutter and paving Cascade Avenue; upgrading inlets and installing cross pans along Mill Street; paving and installing curb and gutter along the existing alley south of the railroad tracks; installing inlets and a new storm sewer along East Las Vegas Street; and improving/rehabilitating the existing storm sewer system under Tejon Street.

Sub-basin C covers 73 acres of the western portion of the study area. This area is drained by an existing storm sewer system constructed within the Sierra Madre right-of-way. Runoff to the north of the existing railroad tracks is collected in a series of flow by inlets along Sierra Madre Street or by one combination sump inlet at Sierra Madre Street and Fountain Boulevard. The

storm sewer transports flows southerly to Fountain Creek. A second set of inlets at the intersection of Sierra Madre Street and East Las Vegas Street collects runoff in one of two sump inlets, and outfalls to Fountain Creek.

A portion of the Martin Drake Power Plant along Conejos Street does contribute flow to the roadway. Runoff from Conejos Street flows south to the intersection of Mill Street and Conejos Street, enters a gravel channel, and flows to an existing 24" HDPE flared end section, which connects to the Sierra Madre Street storm system.

An existing railroad spur boxes in the majority of the Martin Drake Power Plant, located to the west of the Mill Street Neighborhood. Per the *Drainage Report and Plan for Martin Drake Filing No.* 1, by Lutz, Daily and Brian Consulting Engineers, dated November 1984, runoff from this area is directed to the existing solar ponds on the property. The minor storm event at the site will be collected in the solar ponds, while the 100-year storm event will be discharged to the west through existing dual 60 culverts that cross the existing railroad spur.

The peak stormwater runoff rates have been used to analyze the adequacy of the existing stormwater infrastructure. Where the existing infrastructure cannot keep stormwater flows within City criteria, improvements have been proposed. A list of improvements have been identified based on the need to remedy localized flooding is provided later in this section. The list breaks down the improvements into one of three "need" categories – high, medium, and low.

In general, each of the proposed storm sewer systems will accommodate the 5-year storm event, and provide an acceptable way to convey the 100-year storm. A combination of facilities will be required to achieve a cost effective system while maintaining City Criteria. Roadway capacities have been calculated, and utilized to the maximum extent where possible. Improvements to the roadways will not only provide a drainage conveyance system, but also upgrade existing roadways to provide better access within the neighborhood. At points where the roadway capacity is exceeded, additional drainage facilities are proposed.

B. Agency Jurisdictions

As part of the first step in the completion of the proposed improvements, coordination must occur with multiple governmental and private agencies to ensure the drainage systems can be constructed as planned. Several agencies have already been contacted as part of the preparation of this drainage study. The following is a list of agencies that may need to be contacted during the final design phase of the proposed improvements:

Agency	*Involvement*
City of Colorado Springs Engineering Deptarment 30 S. Nevada Ave., #403 Colorado Springs, CO 80903 Phone: (719) 385-5058 Contact: *Mr. Robin Kidder, PE*	➢ Review agency of Drainage Study ➢ Assisting in public process ➢ Providing input on proposed improvements and phasing based upon drainage concerns.

Agency	*Involvement*
City of Colorado Springs Neighborhood Redevelopment 704 East Boulder Street Colorado Springs, CO 80903 Phone: (719) 578-6748 Contact: *Mr. Don Sides*	➢ Created Mill Street Preservation Plan ➢ Created Mill Street Strategy Area ➢ Point of contact for the Mill Street Neighborhood Association ➢ Obtained federal funding through a Community Development Block Grant ➢ Overseeing implementation of drainage improvements and other construction ➢ Agency dispersing future funding
Mill Street Neighborhood Association	➢ Providing input on drainage concerns
City of Colorado Springs Maintenance Division 404 West Fontanero Street Colorado Springs, CO 80907 Phone: (719) 578-6239 Contact: *Mr. Kim Karr* Phone: (719) 578-6388 Contact: *Mr.Gary Knopp*	➢ Kim Karr – Drainage Maintenance Supervisor for open channels ➢ Gary Knopp – Drainage Maintenance Supervisor for storm sewers ➢ Providing initial work outlined in this MDDP
Colorado Springs Utilities Martin Drake Power Plant 215 Nichols Boulevard Colorado Springs, CO 80947 Phone: (719) 668-4097 Contact: *Ms. Darlene Garcia*	➢ Owns and operates Martin Drake Power Plant ➢ Providing a portion of improvements along Conejos Street ➢ Agency producing FIMS data
Pikes Peak Regional Building Department Regional Floodplain Office 101 West Costilla Street Colorado Springs, CO 80903 Phone: (719) 327-2953 Contact: *Mr. Kevin Stilson, PE*	➢ Evaluating impacts to Fountain Creek ➢ Will review any construction within floodplain/floodways, including any improvements to outfall points ➢ Providing assistance in review and ensuring compliance with FEMA regulations
City of Colorado Springs Stormwater 101 W. Costilla St., #113 Colorado Springs, CO 80903 Phone: (719) 385-5057 Contact: *Mr. Brian Kelley*	➢ Department providing drainage information for area ➢ Maintain record copies of reports ➢ Providing information on previous platting and drainage agreements
City of Colorado Springs Parks & Recreation 1401 Recreation Way Colorado Springs, CO 80905 Phone: (719) 385-5940 Contact: *Mr. Paul Butcher*	➢ Maintains trail system along Fountain Creek at existing outfall storm sewer outfall points
Union Pacific Railroad Finance Department 1800 Farnam St., WP001 Omaha, NE 68102 Phone: (402) 271-5000 Contact: *Mr. Bill Ince* Direct: (402) 997-3498	➢ Operates the existing railroad line bisecting the Mill Street Neighborhood ➢ Coordination required to implement a portion of proposed improvements

C. Proposed Drainage Improvements

As described earlier, the proposed drainage improvements have been categorized into one of three "need" areas – "High", "Medium" or "Low". High priority improvements will help to eliminate flooding problems that are impacting multiple adjacent property owners and causing a significant amount of damage. The improvements are also viewed as an urgent community need for upgrades to roadways to provide not only drainage improvements, but also to allow for proper vehicular access, which includes emergency vehicles. Medium priorities are drainage and roadway improvements that are impacting a minimal number of adjacent property owners or are in areas that have some kind of acceptable overflow path. Low priority drainage improvements are those outside of the Mill Street Preservation Plan, or those that are simple upgrades to existing facilities to meet City Criteria and do not cause flooding problems.

To help define the scope of work required to complete each portion of the construction, a list of quantities has been provided within the Appendix of this report.

The proposed drainage improvements within the Mill Street Neighborhood will rely on conveying peak 5-year and 100-year stormwater rates to previously established outfall points along Fountain Creek. Detention within this area is not considered a feasible alternative due to the limited amount of available land to construct the facilities as well as creating additional undesired maintenance requirements for City staff.

A summary of improvements with an assigned priority is as follows:

Figure 6

Community and MDDP Evaluation Matrix –Medium Priorities

Priority	Item No.	Proposed Improvement	Location	Description	Drainage/Community Impacts	Notes
Medium	5	Cascade Avenue Storm Sewer Improvements (South of Mill Street)	Cascade Avenue, at the dead end south of Mill Street	➢ Install inlets and storm sewer. ➢ Storm sewer will direct runoff to East Las Vegas Street, and to the existing system in Tejon Street. ➢ Storm sewer to be routed to the east of Cascade Avenue through City owned lot and southerly through alley. ➢ Utility crossings of the storm sewer area expected, and should be planned for.	➢ Reduces localized flooding issues along unpaved Cascade Avenue. ➢ Eliminates flooding problem to commercial/industrial lots to the south	➢ Drainage and roadway impacts will be maximized if done in conjunction with *Cascade Avenue Roadway Improvements*. ➢ Proposed system to run through City owned lot; alternative of obtaining a drainage easement from commercial property owner to the south is an alternative storm sewer route.
Medium	6	Cascade Avenue Roadway Improvements	Cascade Avenue, from the railroad line to the dead end south of Mill Street	➢ Regrade portions of Cascade Avenue. ➢ Pave Cascade Avenue. ➢ Install curb and gutter on both sides of roadway. ➢ Construct sidewalk and pedestrian ramps.	➢ Improves vehicular and pedestrian access to residential lots upgrading roadway to City standards. ➢ Eliminates localized ponding issues. ➢ Increases street capacity for stormwater. ➢ Avoids sediment transport onto Mill Street and into private property.	➢ Drainage impacts will be maximized if done in conjunction with *Cascade Avenue Storm Sewer Improvements*. ➢ On street parking must be maintained for residents.
Medium	7	Sahwatch Street Roadway Improvements	Sahwatch Street, from the railroad line to the dead end south of Mill Street	➢ Install curb and gutter on both sides of roadway. ➢ Construct sidewalk and pedestrian ramps. ➢ Upgrade existing non-standard inlet to City standard D10R curb opening inlet.	➢ Increase street capacity for stormwater. ➢ Improved vehicular and pedestrian access to residential lots. ➢ Avoids some minor issues with sediment transport	On street parking must be maintained for residents.
Medium	8	Sahwatch Street Storm Sewer Improvements	Sahwatch Street, at the dead end north of the existing railroad line	➢ Remove and replace existing curb opening inlet. ➢ Install larger outfall pipe to the existing concrete channel located north of the railroad line.	➢ Eliminate/reduce localized flooding issue. ➢ Upgrade inlet to City standards. ➢ Eliminates roadway overtopping of runoff, reducing erosion potential into the concrete channel. The downstream end of the channel currently is plugged with debris and sediment.	
Medium	9	Cascade Avenue Storm Sewer Improvements (North of Railroad)	Cascade Avenue, Fountain Boulevard	➢ Install downstream portion of storm sewer system to drain Cascade Avenue. ➢ Upstream portion of Cascade Avenue to be extended in the future by others. ➢ Install curb opening inlets.	➢ Eliminates localized flooding of intersection. ➢ Replaces plugged storm sewer. ➢ Eliminates existing bubbler system. ➢ Reduces surface flows to Tejon Street.	Future extension of system to be done by others. Pipe sizing will provide sufficient capacity to accept upstream flows.

Note: The *Item Number* correlates to *Appendix B, Proposed Improvements – Approximate Quantities* and is NOT intended for use as a prioritization of the proposed improvements.

Figure 5

Community and MDDP Evaluation Matrix –High Priorities

Priority	Item No.	Proposed Improvement	Location	Description	Drainage/Community Impacts	Notes
High	-	Concrete channel debris removal	Northwest of the intersection of Tejon Street and the existing railroad line (south of Fountain Boulevard)	➢ Remove sediment and large debris from the end of existing concrete channel. ➢ Flush existing storm sewer to remove sediment.	➢ Restores original intended drainage patterns. ➢ Eliminate severe existing erosion problem impacting downstream inlets.	City of Colorado Springs Maintenance Division is available to perform work immediately.
High	1	Conejos Street Improvements	Conejos Street from Mill Street to Fountain Boulevard/Martin Drake entrance	➢ Widen existing 20' wide asphalt roadway to 28' flow line to flow line. ➢ Install curb and gutter along both sides of Conejos Street to replace existing shallow roadside swale. ➢ Provide sidewalks and pedestrian ramps along both sides of road. ➢ Relocation of utility poles. ➢ Landscape restoration along residential lots.	➢ Increases roadway stormwater capacity of roadway. ➢ Eliminates minor erosion problems along side of roadway. ➢ Provides improved vehicular and pedestrian access for residents.	➢ Colorado Springs Utilities (CSU) has provided an additional 16.3' of right of way for Conejos Street (total right of way width = 50') ➢ CSU will fund improvements to ½ of the roadway per an earlier platting agreement. Details of payment to be worked out between City Neighborhood Services office and CSU.
High	2	Baltic Street Improvements	Baltic Street from Mill to Fountain Street to the north; Fountain Street from Conejos Street to Sierra Madre Street	➢ Pave Baltic Street. ➢ Install curb and gutter along both sides along all roadways. ➢ Regrade the eastern portion of Fountain Street to eliminate an existing sump; redirect stormwater flows down improved Baltic Street. ➢ Install sidewalk along Fountain Street.	➢ Eliminates reoccurring flooding area at low point in Fountain Street impacting several residents. ➢ Improved access (create one way road). ➢ Eliminates severe erosion problem from unpaved Baltic Street.	Coordination with the City of Colorado Springs and the Union Pacific Railroad will be required to construct improvements to Fountain Street. Some existing improvements are currently on railroad property.
High	3	Mill Street Storm Inlet Replacement	West of the intersection of Mill Street and Tejon Street	➢ Remove existing 4' inlet and replace with a 20' City Standard D10R curb opening inlet. ➢ Remove and replace existing storm sewer pipe. Existing storm sewer pipe is a small diameter. Replace with 24" RCP. ➢ Utility crossings are anticipated	➢ Restore inlet to avoid excessive stormwater flow from flowing to existing alley and Tejon Street. ➢ Eliminates localize flooding issues	The current inlet is plugged. As an initial phase of work, the City of Colorado Springs Maintenance Division will unplug the inlet immediately.
High	4	Railroad Alley Improvements	South of the existing railroad tracks, from Sierra Madre past Cascade Avenue	➢ Provide asphalt roadway, grade alley to create a flow line to the north side. ➢ Provide curb and gutter along one side of alley to define drainage path.	➢ Eliminates localized flooding issues by directing runoff to Sahwatch Street, Cascade Avenue, and alley east of Cascade Avenue. ➢ Improves access point from alley. ➢ Will reduce erosion concerns.	Coordination with the City of Colorado Springs and the Union Pacific Railroad will be required to construct improvements to Fountain Street. Some existing improvements are currently on railroad property.

Note: The *Item Number* correlates to *Appendix B, Proposed Improvements – Approximate Quantities* and is NOT intended for use as a prioritization of the proposed improvements.

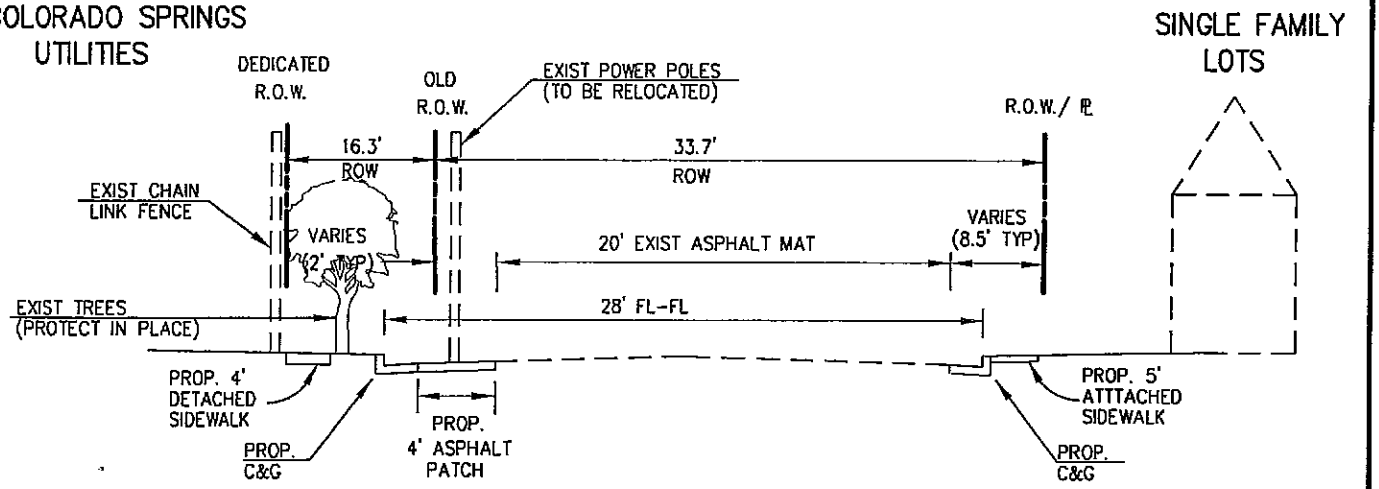
Figure 7

Community and MDDP Evaluation Matrix –Low Priorities

Priority	Item No.	Proposed Improvement	Location	Description	Drainage/Community Impacts	Notes
Low	10	East Las Vegas Street Storm Sewer	East Las Vegas Street, east of Sierra Madre Street to Tejon Street	➢ Install a series of City standard D10R curb opening inlets. ➢ Install storm sewer. ➢ Existing utility line crossings are anticipated. Appropriate planning to avoid conflicts should occur.	➢ Reduces flows in East Las Vegas Street to acceptable City criteria for roadway capacity. ➢ Eliminates localized flooding issues.	Las Vegas Street storm improvements may trigger need to upgrade or rehabilitate Tejon Street storm sewer.
Low	11	Tejon Street Storm Sewer Rehabilitation	Tejon Street from Fountain Boulevard to Fountain Creek.	➢ Install slip lining or Cast in Place Pipe (CIPP) to restore existing CMP storm sewer. Per City staff, the existing storm sewer's invert has deteriorated.	➢ Provides storm sewer improvement for not only the Mill Street Area, but also surrounding areas. ➢ Will avoid future storm sewer failures. ➢ Will lower Mannings Coefficient and increase pipe capacity with minimal loss of cross sectional area. ➢ Can restore structural integrity of existing CMP and significantly extend design life of pipe.	➢ Video documentation of pipe should be conducted prior to completion of final design to provide a more accurate bid to restore pipe. ➢ Las Vegas Street storm sewer improvements may trigger need to rehabilitate Tejon Street storm sewer.

Note: The *Item Number* correlates to *Appendix B, Proposed Improvements – Approximate Quantities* and is NOT intended for use as a prioritization of the proposed improvements.

(MARTIN DRAKE FILING 1)
COLORADO SPRINGS
UTILITIES



CONEJOS STREET
LOOKING NORTH

N.T.S.

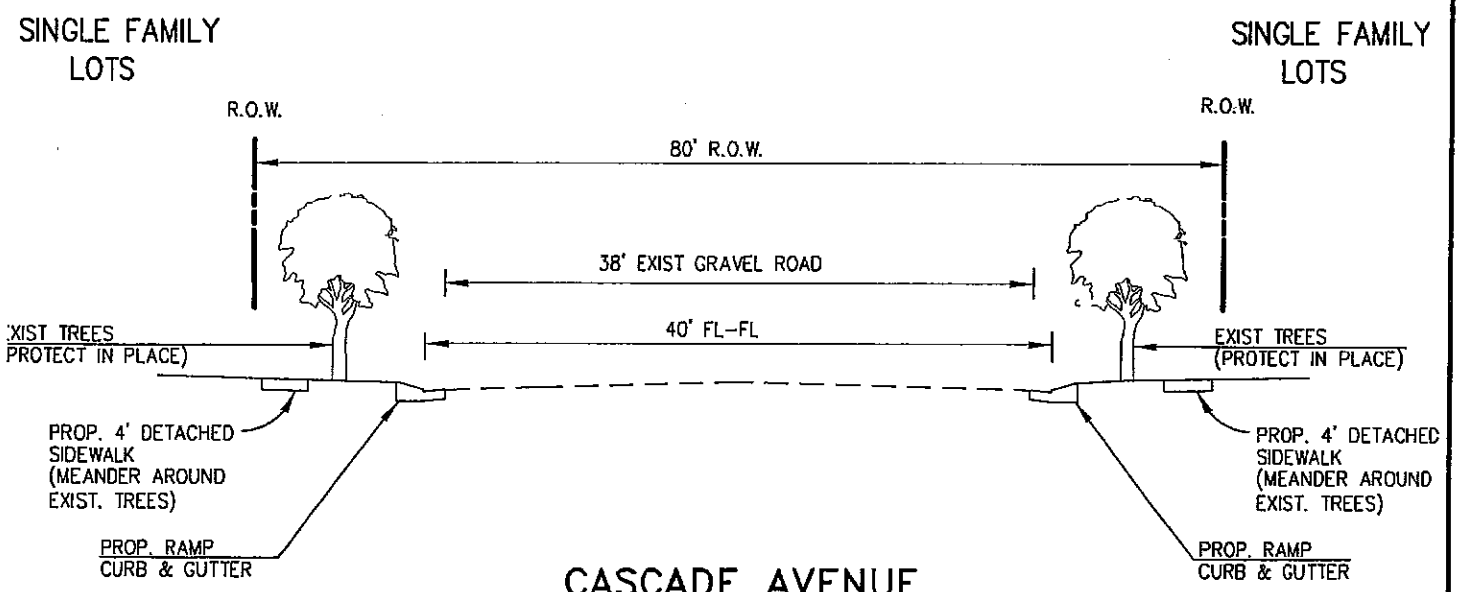
Matrix Design Group, Inc.
Integrated Design Solutions
2925 Professional Place, Suite 202
Colorado Springs, CO 80904
Phone 719-575-0100
Fax 719-575-0208

MILL STREET NEIGHBORHOOD

DRAINAGE BASIN PLANNING STUDY

TYPICAL SECTION
CONEJOS STREET

DESIGNED BY:	RGG	SCALE		DATE ISSUED: APRIL 2003	FIG 8
DRAWN BY:	MEM	HORIZ:	N/A		
CHECKED BY:	RGG	VERT.	N/A		



CASCADE AVENUE

LOOKING NORTH

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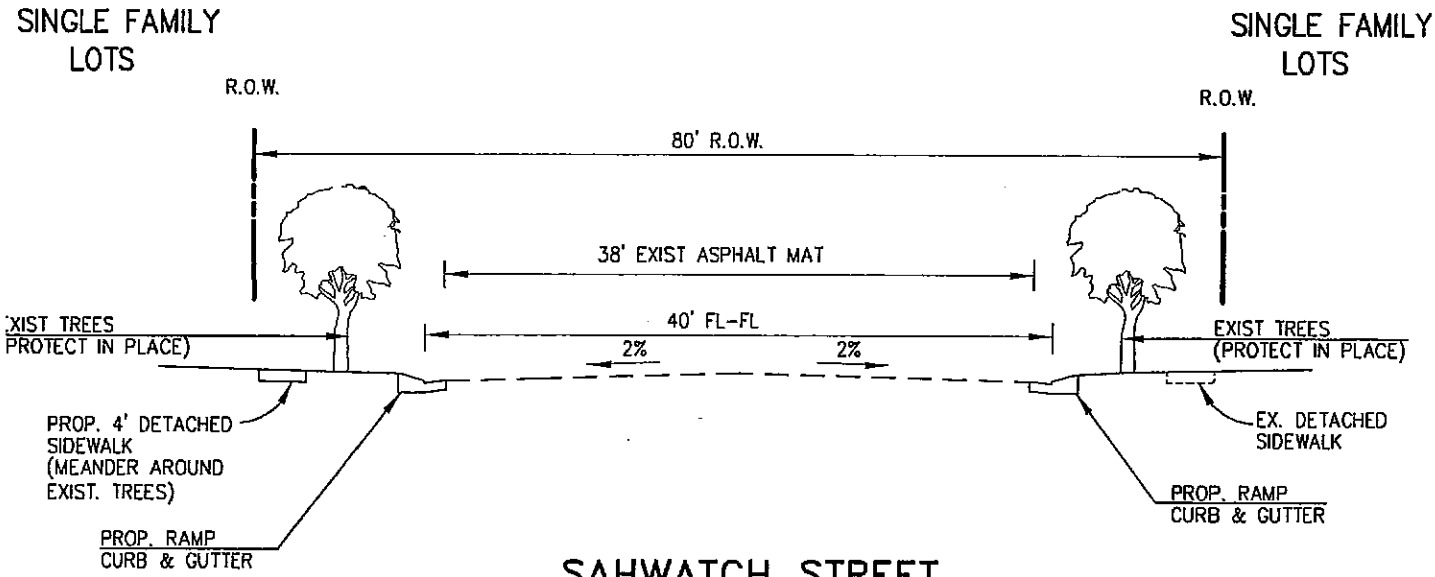
MILL STREET NEIGHBORHOOD

DRAINAGE BASIN PLANNING STUDY

TYPICAL SECTION CASCADE AVENUE

DESIGNED BY:	RGG	SCALE		DATE ISSUED: APRIL 2003	FIG 9
DRAWN BY:	MEM	HORIZ:	N/A		
CHECKED BY:	RGG	VERT.	N/A		



SAHWATCH STREET

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MILL STREET NEIGHBORHOOD

DRAINAGE BASIN PLANNING STUDY

TYPICAL SECTION SAHWATCH STREET

DESIGNED BY:	RGG	SCALE			FIG10
DRAWN BY:	MEM	HORIZ:	N/A	DATE ISSUED: APRIL 2003	
CHECKED BY:	RGG	VERT.	N/A		

The previously listed improvements are based upon drainage concerns and community needs. This list is intended to provide a guide for improvements to be constructed as funding becomes available. The exact phasing of each proposed improvement will depend on the monies available for the project, and the needs of the area as determined by the Mill Street residents and the City of Colorado Springs Neighborhood Services Department. It should be noted that the phasing of improvements may also have a designated lower priority improvement constructed prior to a higher priority improvement based upon funds available, and community needs that may change over the course of several years.

D. Cost Estimate

Funding for proposed drainage improvements is limited at this point in time. Future construction costs will be financed mainly through an annual renewal of the Community Development Block Grant. The limited annual funding creates the need to phase improvements over the next several years. Due to the fact that construction costs can significantly fluctuate over the course of several years, a cost estimate of the proposed improvement has not been prepared as part of this Master Development Drainage Plan. Instead, estimated construction quantities with line items for engineering, contingencies, and construction administration have been provided in this report. As improvements are considered, up to date construction costs information can be used to estimate the total costs for each phase of work, and match available funds to the scope of work.

E. Stormwater Quality/Best Management Practices

The City of Colorado Springs Engineering Division has recently published *Volume 2 of the Drainage Criteria Manual*, dated November 1, 2002, which details requirements for redevelopment and construction activities. The Mill Street Neighborhood is within a largely developed urban drainage basin. The proposed construction, while significantly improving existing drainage concerns, is not considered as a major redevelopment. The proposed improvements within the Mill Street Preservation Area will not trigger the need to provide extensive stormwater quality facilities. The cost of retro fitting the area with stormwater quality facilities will be cost prohibitive with the limited funds available to provide drainage improvements.

Although no new water quality facilities are proposed as part of this MDDP, stormwater does still receive some treatment prior to discharging to Fountain Creek. The main water quality measure is diverting roof drains overland across landscaped areas in the residential and portions of the commercial areas.

As each proposed improvement is implemented, Construction Best Management Practices (BMP's) should be utilized and planned for during the design phase of work to provide erosion and sediment control, and drainageway protection measures. These BMP's as listed in *Volume 2* include, but are not limited to:

- Silt Fences
- Check Dams
- Vehicle Tracking Controls
- Erosion Blankets
- Inlet Protection
- Reseeding/Mulching
- Maintenance BMP's
- Straw Bales

A detailed description of each of these measures and when in the construction process to install them is given within *Volume 2* of the City Drainage Criteria. Regular inspection of each control measure should be provided and any necessary repairs or replacements shall occur in a timely manner.

In addition to the erosion control measures listed above, the construction of storm sewers and any underground utility shall have care taken to avoid unwanted sediment accumulation. Excavated soils should be placed in a location where sediment will erode back into the trench.

V. CONCLUSIONS

A. Compliance with Standards

The proposed drainage improvements within this Master Development Drainage Plan complies with the criteria set forth in the City of Colorado Springs & El Paso County Drainage Criteria Manual, dated November 1991. No previous Master Drainage Plan, or Drainage Basin Planning Studies have been done for the area of the Mill Street Preservation Area.

B. Drainage Concept

1. Runoff will continue to follow historic drainage patterns through the area. All proposed improvements will provide additional capacity to convey stormwater to existing outfall points along Fountain Creek and remain within City of Colorado Springs Criteria.

2. Detention facilities within the Mill Street Preservation Area are not proposed as part of this MDDP.

3. The MDDP considers existing drainage facilities, as well as all found record copies of subdivision drainage reports available at the City Stormwater Division.

VI. LIST OF REFERENCES

1. *City of Colorado Springs and El Paso County, Colorado, Drainage Criteria Manual,* latest edition.

2. *City of Colorado Springs Engineering Drainage Map Book,* prepared by the City of Colorado Springs Engineering Department, dated August 2002.

3. *Combination Public Access Map for Mill Street, Panels G-34, G-35, G-36, F-34, F-35, and F-36,* prepared by Colorado Springs Utilities Facilities Information Management System, dated October 2002.

4. *Drainage Basin Planning Study for Shooks Run, City of Colorado Springs,* prepared by Wilson and Company, dated September 1993.

5. *Drainage Report for Bonicelli Subdivision,* prepared by Guenther Polok Professional Engineer, dated April 13, 1983.

6. *Drainage Plan and Report for Molly Subdivision Filing No. 2,* prepared by Four Square Engineering and Surveying, Inc., dated June 1, 1979.

7. *Drainage Report for Molly's Subdivision,* prepared by Schaarschmidt Engineering Company, dated September 29, 1977.

8. *Drainage Report and Plan for Martin Drake Filing No. 1, City of Colorado Springs, Colorado,* prepared by Lutz, Daily and Brian Consulting Engineers, dated November 1984.

9. *Drainage Report for Venture Partners Subdivision Filing No. 1,* prepared by Richards Land Surveying Company, dated March 26, 1984.

10. *Martin Drake Power Plant Rail Spur Extension, Colorado Springs, Colorado, Final Drainage Report,* prepared by Merrick and Company, revised November 6, 2001.

11. *Mill Street Preservation Area Plan,* prepared by the City of Colorado Springs Restoration Department, 2003.

12. *Nevada Avenue Bridge Over Fountain Creek, Colorado Springs, Colorado. Final Hydraulics Report,* prepared by JF Sato and Associates, Inc., dated November 2000.

13. *Nevada/Tejon Interchange Assessment Report, Fountain Creek and Cheyenne Creek Floodplain Boundaries Under Existing Conditions,* prepared by JF Sato and Associates, Inc., August 1998.

14. *Nevada/Tejon/I-25 Interchange Final Hydraulics Report,* prepared by JF Sato and Associates, Inc., dated January 2001.

15. *Preliminary and Final Drainage Report for Brookharts-Svedala Subdivision,* prepared by Jeffries Engineering, dated March 25, 1996.

16. *Preliminary and Final Drainage Report and Plan for Weather Engineering Addition,* prepared by Leigh Whitehead and Associates, dated October 1996.

APPENDIX A

DRAINAGE MAPS

APPENDIX B

PROPOSED IMPROVEMENTS – APPROXIMATE QUANTITIES

Priority: High (Item 1)

Conejos Street Improvements- West (Adjacent to Martin Drake)

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	650
Curb (Ramp and Vertical)	LF	950
Concrete Pedestrian Ramp	EA	2
Concrete Sidewalk (4 inch)	SF	4750
Concrete Cross Pan (8" Thick)	SY	50
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	215
Removal of Curb and Gutter	LF	30
Removal of Sidewalk	SY	250
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	8
Adjust Water Service Valves	LS	1
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	4
Reset Existing Fence	LF	950
Reseed	AC	0.3
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL Conejos Street -West		

Priority: High (Item 1)

Conejos Street Improvements - East

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	267
Curb (Ramp and Vertical)	LF	720
Concrete Pedestrian Ramp	EA	4
Concrete Sidewalk (4 inch)	SF	3600
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	170
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	6
Adjust Water Service Valves	LS	10
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	610
Landscape Restoration	LF	610
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL Conejos Street - East		

Priority: High (Item 2)

Baltic Street Improvements

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	2128
Curb (Ramp and Vertical)	LF	2260
Concrete Pedestrian Ramp	EA	8
Concrete Sidewalk (4 inch)	SF	6600
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	620
Granular Fill (Complete in Place)	CY	400
Removal of Bituminous Pavement	SY	995
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	1
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	5
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0.4
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL Baltic Street		

Priority: High (Item 3)

Mill Street Storm Inlet Replacement

Description	Unit	Quantity:
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	170
Curb (Ramp and Vertical)	LF	30
Concrete Pedestrian Ramp	EA	0
Concrete Sidewalk (4 inch)	SF	0
Concrete Cross Pan (6" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	170
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	0.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	190
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	1
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	1
Remove Existing Storm	LF	190
Connect to Existing Storm sewer	EA	1
Waterline Crossing	EA	1
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL 24" RCP (Mill Street)		

Priority: High (Item 4)

Railroad Alley Improvements

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	2240
Curb (Ramp and Vertical)	LF	1550
Concrete Pedestrian Ramp	EA	0
Concrete Sidewalk (4 inch)	SF	0
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	0
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	

SUBTOTAL Alley south of Railroad

Priority: Medium (Item 5)

Cascade Avenue Storm Sewer Improvements (South of Mill St.)

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	620
Curb (Ramp and Vertical)	LF	560
Concrete Pedestrian Ramp	EA	0
Concrete Sidewalk (4 inch)	SF	0
Concrete Cross Pan (8" Thick)	SY	60
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	620
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	525
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	270
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	1
Inlet L=5'	EA	2
Inlet L=10'	EA	1
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	3
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0.2
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	

SUBTOTAL Cascade Avenue South of Railroad (18" Storm)

Priority: Medium (Item 6)

Cascade Avenue Roadway Improvements (south of railroad)

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	1402
Curb (Ramp and Vertical)	LF	920
Concrete Pedestrian Ramp	EA	8
Concrete Sidewalk (4 inch)	SF	3350
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	460
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	40
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL Casade Street		

Priority: Medium (Item 7)

Sahwatch Street Roadway Improvements (south of railroad)

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	255
Curb (Ramp and Vertical)	LF	700
Concrete Pedestrian Ramp	EA	8
Concrete Sidewalk (4 inch)	SF	2500
Concrete Cross Pan (8" Thick)	SY	60
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	255
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	

SUBTOTAL Sahwatch Street (South of Railroad)

Priority: Medium (Item 8)

Sahwatch Street Sewer Improvements (North of Railroad)

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	0
Curb (Ramp and Vertical)	LF	0
Concrete Pedestrian Ramp	EA	0
Concrete Sidewalk (4 inch)	SF	0
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	0
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	0.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	50
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	1
Headwall @ Channel	EA	1
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	1
Remove Existing Storm	LF	50
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	

SUBTOTAL Sahwatch Inlet (North of Railroad)

Priority: Medium (Item 9)

Cascade Avenue Storm Sewer Improvements (North of Railroad)

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	350
Curb (Ramp and Vertical)	LF	150
Concrete Pedestrian Ramp	EA	12
Concrete Sidewalk (4 inch)	SF	0
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	350
Removal of Curb and Gutter	LF	75
Removal of Sidewalk	SY	0
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	35
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	590
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
Storm Plug	LF	1
Inlet L=5'	EA	3
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	3
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	

SUBTOTAL Cascade Avenue Storm (North of Railroad)

Priority: Low (Item 10)

E. Las Vegas Street Storm Sewer

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	1030
Curb (Ramp and Vertical)	LF	1090
Concrete Pedestrian Ramp	EA	8
Concrete Sidewalk (4 inch)	SF	10200
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	1030
Removal of Curb and Gutter	LF	1090
Removal of Sidewalk	SY	5000
Erosion Control	LS	1.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	160
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	290
48" RCP CLASS II	LF	750
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	0
42" Plug	LF	0
Inlet L=5'	EA	0
Inlet L=10'	EA	4
Inlet L=15'	EA	4
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	2
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL W. Las Vegas Street		

Priority: Low (Item 11)

Tejon Street Storm Sewer Rehabilitation

Description	Unit	Quantity
ROADWAY IMPROVEMENTS		
Full Depth Bituminous Pavement (6" Thick)	SY	150
Curb (Ramp and Vertical)	LF	0
Concrete Pedestrian Ramp	EA	0
Concrete Sidewalk (4 inch)	SF	0
Concrete Cross Pan (8" Thick)	SY	0
Pavement Markings	SF	0
Granular Fill (Complete in Place)	CY	0
Removal of Bituminous Pavement	SY	180
Removal of Curb and Gutter	LF	0
Removal of Sidewalk	SY	0
Erosion Control	LS	0.00
Subtotal Roadway Improvements		
STORM DRAIN IMPROVEMENTS		
18" RCP CLASS II	LF	0
24" RCP CLASS II	LF	0
30" RCP CLASS II	LF	0
42" RCP CLASS II	LF	0
48" RCP CLASS II	LF	0
54" RCP CLASS II	LF	0
60" RCP CLASS II	LF	0
Storm Drain Manhole	EA	1
Cast In Place Pipe	LF	1900
Inlet L=5'	EA	0
Inlet L=10'	EA	0
Inlet L=15'	EA	0
Inlet L=20'	EA	0
Headwall @ Channel	EA	0
42" Headwall	EA	0
Connect to Existing Inlet	EA	0
Removal of Large Dia. Rubble	LS	0
Remove Inlet	EA	0
Remove Existing Storm	LF	0
Connect to Existing Storm sewer	EA	0
Waterline Crossing	EA	0
Trench Backfill	CY	0
Subtotal Storm Drain Improvements		
UTILITY ADJUSTMENTS		
Relocate Utility Poles	EA	0
Adjust Water Service Valves	LS	0
Subtotal Utility Adjustments		
LANDSCAPE IMPROVEMENTS		
Relocate Trees	EA	0
Reset Existing Fence	LF	0
Reseed	AC	0
Remove and Replace 4' Fences	LF	0
Landscape Restoration	LF	0
Subtotal Landscape Improvements		
ENGINEERING/PLANNING		
Final Design	15%	
Geotechical	1%	
Design Survey	3%	
Subtotal Engineering/Planning Improvements		
CONSTRUCTION		
Traffic Control	5%	
Construction Assistance	3%	
Construction Surveying	3%	
Subtotal Construction		
Contingency	20%	
SUBTOTAL Tejon Street		

APPENDIX C

HYDROLOGIC CALCULATIONS

Mill Street Preservation Area
Rational Method

Sub-Basin Designation	Design Point	Sub-Basins	Total Area (ac.)	Drainage Basin Percent Impervious				Weighted Coefficients		CA		Overland Time			Travel Time					T(c) Check L/180+10	Final T(c)	Intensity		Peak Runoff	
				Business Area (ac.)	Residential Area (ac.)	Industrial Area (ac.)	Total Imp. (%)	C(5)	C(100)	CA(5)	CA(100)	Overland Length (ft)	Overland Slope (%)	T(initial) (min.)	Travel Length (ft)	Weighted Slope (%)	Velocity (fps)	T(travel) (min.)	Final T(c)			I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
A1			13.81	13.81	0.00	0.00	95%	0.90	0.90	12.43	12.43	25	1.50%	7.0	1475	0.8%	2.4	10.2	17.2	18.3	17.2	3.25	5.78	40.4	71.9
A2			7.64	7.64	0.00	0.00	95%	0.90	0.90	6.88	6.88	25	1.50%	7.0	1380	0.9%	2.4	9.6	16.5	17.8	16.5	3.31	5.89	22.8	40.5
A3			10.53	0.00	10.53	0.00	65%	0.60	0.70	6.32	7.37	50	2.00%	8.9	1550	0.9%	2.4	10.8	19.7	18.9	18.9	3.10	5.52	19.6	40.7
A4			7.05	3.03	4.02	0.00	78%	0.60	0.79	4.23	5.54	40	2.00%	8.0	770	1.0%	2.4	5.3	13.3	14.5	13.3	3.65	6.49	15.4	36.0
A5			2.15	0.00	2.15	0.00	65%	0.60	0.70	1.29	1.51	50	2.00%	8.9	390	1.3%	2.5	2.6	11.5	12.4	11.5	3.88	6.90	5.0	10.4
A6			2.63	0.00	2.63	0.00	65%	0.60	0.70	1.58	1.84	50	2.00%	8.9	425	1.2%	2.4	3.0	11.9	12.6	11.9	3.83	6.82	6.0	12.5
A8			1.07	0.00	1.07	0.00	65%	0.60	0.70	0.64	0.75	50	2.00%	8.9	270	1.9%	2.9	1.6	10.5	11.8	10.5	4.03	7.17	2.6	5.4
A10			1.52	0.00	1.52	0.00	65%	0.60	0.70	0.91	1.06	50	2.00%	8.9	275	1.5%	2.5	1.8	10.8	11.8	10.8	3.99	7.09	3.6	7.5
A11			6.87	0.00	6.87	0.00	65%	0.60	0.70	4.12	4.81	75	2.20%	10.6	1190	1.0%	4.0	5.0	15.6	17.0	15.6	3.40	6.06	14.0	29.1
A12			17.76	15.46	3.00	0.00	94%	0.88	0.90	15.71	16.01	75	2.00%	11.0	1550	3.3%	3.7	7.0	17.9	19.0	17.9	3.18	5.66	50.0	90.7
	11	A3, A5, A8	13.75							8.25	9.63				425	1.2%	2.5	2.8			21.7	2.89	5.14	23.8	49.5
	12	A4, A6	9.68							5.81	7.38				500	1.0%	3.0	2.8			16.1	3.35	5.96	19.4	44.0
	13	-	0.00							0.00	0.00				300	1.0%	3.0	1.7			17.8	3.19	5.69	0.0	0.0
	14	A10, A11 11	15.26							9.16	10.68				850	1.0%	10.0	1.4			23.1	2.79	4.97	25.6	53.1
	15	A1, A2, A12	39.21							35.02	35.32				1600	3.4%	3.7	7.2			24.4	2.72	4.84	95.1	170.8
	16	14, 15	54.47							44.18	46.00										24.4	2.72	4.84	120.0	222.4
OS1			2.13	2.1	0.0	0.0	95%	0.90	0.90	1.92	1.92	25	2.00%	6.3	650	3.1%	3.6	3.0	9.3	13.8	9.3	4.21	7.49	8.1	14.4
-																									

Business areas =	95.0%	(Commercial Areas)	C(5) = 0.90	C(100) = 0.90
Residential areas =	65.0%	(1/8 Acre or Less)	C(5) = 0.60	C(100) = 0.70
Industrial areas =	90.0%	(Heavy Areas)	C(5) = 0.80	C(100) = 0.90
	80.0%	(Light Areas)	C(5) = 0.70	C(100) = 0.80

Mill Street Preservation Area
Rational Method

Sub-Basin Designation	Design Point	Sub-Basins	Total Area (ac.)	Drainage Basin Percent Impervious				Weighted Coefficients		CA		Overland Time			Travel Time						Intensity		Peak Runoff	
				Business Area (ac.)	Residential Area (ac.)	Industrial Area (ac.)	Total Imp. (%)	C(5)	C(100)	CA(5)	CA(100)	Overland Length (ft)	Overland Slope (%)	T(initial) (min.)	Travel Length (ft)	Weighted Slope (%)	Velocity (fps)	T(travel) (min.)	Final T(c)	T(c) Check L/180+10	Final T(c)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
B1			1.00	0.00	1.00	0.00	65%	0.60	0.70	0.60	0.70	30	4.00%	5.5	450	2.7%	3.1	2.4	7.9	12.7	7.9	4.46	7.93	2.7	5.6
B2			1.15	0.00	1.15	0.00	65%	0.60	0.70	0.69	0.81	25	4.00%	5.0	425	2.8%	3.2	2.2	7.2	12.5	7.2	4.59	8.17	3.2	6.6
B3			1.26	0.00	1.26	0.00	65%	0.60	0.70	0.76	0.88	20	4.00%	4.5	415	4.6%	4.5	1.5	6.0	12.4	6.0	4.85	8.64	3.7	7.6
B4			2.06	0.00	2.06	0.00	65%	0.60	0.70	1.24	1.44	60	4.50%	7.5	375	0.8%	2.4	2.6	10.1	12.4	10.1	4.09	7.27	5.1	10.5
B5			3.05	0.00	3.05	0.00	65%	0.60	0.70	1.83	2.14	75	2.50%	10.2	690	2.3%	3.0	3.8	14.0	14.3	14.0	3.57	6.36	6.5	13.6
B6			1.01	0.00	1.01	0.00	65%	0.60	0.70	0.61	0.71	50	2.50%	8.3	200	1.5%	2.5	1.3	9.6	11.4	9.6	4.16	7.40	2.5	5.2
B7			3.41	0.00	1.00	2.41	83%	0.74	0.84	2.53	2.87	50	2.50%	8.3	450	4.7%	4.5	1.7	10.0	12.8	10.0	4.11	7.31	10.4	21.0
B8			1.04	0.00	1.04	0.00	65%	0.60	0.70	0.62	0.73	25	3.30%	5.4	310	4.2%	4.2	1.2	6.6	11.9	6.6	4.73	8.42	3.0	6.1
B9			1.00	0.00	1.00	0.00	65%	0.60	0.70	0.60	0.70	25	2.70%	5.7	240	2.9%	3.2	1.3	7.0	11.5	7.0	4.65	8.27	2.8	5.8
B10			3.81	0.00	1.44	2.37	81%	0.72	0.82	2.76	3.14	50	2.00%	8.9	575	3.1%	3.7	2.6	11.5	13.5	11.5	3.88	6.90	10.7	21.7
B12			3.19	0.00	0.00	3.19	90%	0.80	0.90	2.55	2.87	50	1.50%	9.8	600	1.5%	2.5	4.0	13.8	13.6	13.6	3.62	6.44	9.2	18.5
B13			3.47	0.00	0.75	2.72	85%	0.76	0.86	2.63	2.97	50	3.00%	7.8	440	1.8%	3.6	2.0	9.9	12.7	9.9	4.12	7.34	10.8	21.8
B14			1.67	0.00	0.48	1.19	83%	0.74	0.84	1.24	1.41	50	3.00%	7.8	425	1.9%	2.9	2.4	10.3	12.6	10.3	4.06	7.23	5.0	10.2
B15			5.42	4.55	0.67	0.20	91%	0.86	0.88	4.66	4.74	75	5.00%	8.1	890	1.6%	3.7	4.0	12.1	15.4	12.1	3.80	6.77	17.7	32.1
	21	B1, B4	3.06							1.84	2.14										10.1	4.09	7.27	7.5	15.6
	22	21, B6	4.07							2.44	2.85				220	1.3%	2.5	1.5			11.6	3.87	6.90	9.5	19.6
	23(storm)	22, B10	7.88							5.20	5.99				250	2.0%	5.0	0.8			12.4	3.76	6.70	19.6	40.1
	23(surf)	B10	3.81							1.78	2.05										11.5	3.88	6.90	6.9	14.2
	24(surf)	23, B7	7.22							4.31	4.92				300	0.5%	3.0	1.7			13.2	3.66	6.52	15.8	32.1
	24(storm)	23, B7	11.29							8.48	9.73										13.2	3.66	6.52	31.1	63.5
	25(surf)	24, B13	10.69							3.66	4.15				275	0.5%	3.0	1.5			14.7	3.49	6.21	12.8	25.8
	25(storm)	24, B13	14.76							11.26	13.48										14.7	3.49	6.21	39.3	83.8
	26	B8, B9	2.04							1.22	1.43				225		5.0	0.8			7.7	4.50	8.00	5.5	11.4
	27(surf)	25, B12, B14	15.55							4.67	5.27				450	0.5%	3.0	2.5			17.2	3.24	5.78	15.1	30.5
	27(storm)	25, 26, B12, B14	16.80							17.16	20.18										17.2	3.24	5.78	55.7	116.5
	28	B2, B3, B5	5.46							3.28	3.82										14.0	3.57	6.36	11.7	24.3
	29	All of B	32.54							23.31	26.10										17.2	3.24	5.78	75.6	150.8
	29ab	A & B	87.01							67.48	72.11				900	2.7%	5.0	3.0			41.63	2.00	3.55	134.6	256.1

Business areas =	95.0%	(Commercial Areas)	C(5) = 0.90	C(100) = 0.90
Residential areas =	65.0%	(1/8 Acre or Less)	C(5) = 0.60	C(100) = 0.70
Industrial areas =	90.0%	(Heavy Areas)	C(5) = 0.80	C(100) = 0.90
	80.0%	(Light Areas)	C(5) = 0.70	C(100) = 0.80

Mill Street Preservation Area
Rational Method

Sub-Basin Designation	Design Point	Sub-Basins	Total Area (ac.)	Drainage Basin Percent Impervious				Weighted Coefficients		CA		Overland Time			Travel Time					T(c) Check L/180+10	Final T(c)	Intensity		Peak Runoff	
				Business Area (ac.)	Residential Area (ac.)	Industrial Area (ac.)	Total Imp. (%)	C(5)	C(100)	CA(5)	CA(100)	Overland Length (ft)	Overland Slope (%)	T(initial) (min.)	Travel Length (ft)	Weighted Slope (%)	Velocity (fps)	T(travel) (min.)	Final T(c)			I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
C1			53.27	6.23	7.66	35.08	80%	0.72	0.80	38.27	42.54	50	2.00%	8.9	4100	1.0%	2.5	27.3	36.3	33.1	33.1	2.29	4.08	87.6	173.4
C2			1.64	0.00	0.25	1.39	86%	0.77	0.87	1.26	1.43	25	1.60%	6.8	400	2.0%	2.9	2.3	9.1	12.4	9.1	4.25	7.56	5.4	10.8
C3			6.03	0.00	1.72	4.31	69%	0.74	0.84	4.48	5.08	100	2.00%	12.6	1675	1.9%	2.9	9.6	22.3	19.9	19.9	3.02	5.38	13.6	27.4
C4			1.08	0.00	0.00	1.08	70%	0.80	0.90	0.86	0.97	50	2.00%	8.9	560	2.5%	3.1	3.0	12.0	13.4	12.0	3.82	6.80	3.3	6.6
C4a			1.15	0.00	1.15	0.00	65%	0.60	0.70	0.69	0.81	50	2.00%	8.9	560	2.5%	3.1	3.0	12.0	13.4	12.0	3.82	6.80	2.6	5.5
C5			4.80	0.00	4.30	0.00	58%	0.54	0.63	2.58	3.01	50	2.00%	8.9	650	3.1%	3.6	3.0	12.0	13.9	12.0	3.82	6.80	9.9	20.5
C6			4.71	0.00	3.31	1.90	82%	0.74	0.85	3.51	4.03	50	2.00%	8.9	825	4.4%	4.4	3.1	12.1	14.9	12.1	3.81	6.78	13.3	27.3
	31	C2, C5, C4a	7.59							4.53	5.24				450	0.7%	2.5	3.0			15.0	3.47	6.17	15.7	32.3
	32	31, C6	12.30							6.45	8.76				580	3.4%	5.0	1.9			16.9	3.28	5.83	21.1	51.1
	33	C3, C4	7.11							5.34	6.06										19.9	3.02	5.38	16.2	32.6

Business areas =	95.0%	(Commercial Areas)	C(5) = 0.90	C(100) = 0.90
Residential areas =	65.0%	(1/8 Acre or Less)	C(5) = 0.60	C(100) = 0.70
Industrial areas =	90.0%	(Heavy Areas)	C(5) = 0.80	C(100) = 0.90
	80.0%	(Light Areas)	C(5) = 0.70	C(100) = 0.80

APPENDIX D

HYDRAULIC CALCULATIONS

Mill Street Preservation Area
Street Capacities

Street	Drainage Basins	Pavement Width (ft)	Description	Storm Event	Criteria	Max. Depth (ft)	Flow Area (sq. ft.)	Wetted Perimeter (ft)	Minimum Slope (%)	Q(cap) (cfs)	Max. Q(runoff) (cfs)	Meets Criteria?
Sahwatch St. (North of RR) (Existing)	DP 11	50	Typical Crown	5-year	Flow to Crown of Road	0.50	6.3	25.5	1.0%	36.3	23.8	yes
				100-year	Flow to Top of Curb	0.67	20.8	51.3	1.0%	84.8	49.5	yes
Tejon Street (Existing)	DP 16	56	Typical Crown	5-year	Flow to Crown of Road	0.57	8.0	28.6	1.0%	50.4		
				100-year	Flow to Top of Curb	0.67	21.4	57.3	1.0%	82.5		
Cascade Ave. (North of RR) (Existing)	DP 12	30	Typical Crown Divided	5-year	Flow to Crown of Road	0.30	3.8	15.3	1.0%	44.6	19.4	yes
				100-year	Flow to Top of Curb	0.67	9.2	31.3	1.0%	60.7	44.0	yes
Alley South of Railroad (Proposed)	B1, B2, B3	15	2% slope to north	5-year	.3' Depth	0.30	2.3	15.3	0.9%	4.4	3.7	yes
				100-year	Top of Curb	0.80	9.8	16.3	0.9%	48.8	7.6	yes
Mill Street (Existing)	B4	28	Typical Crown	5-year	Flow to Crown of Road	0.28	2.0	14.3	0.8%	6.7	5.1	yes
				100-year	Flow to Top of Curb	0.67	14.7	29.3	0.8%	60.2	10.5	yes
Mill Street (Existing)	DP 28	28	Typical Crown	5-year	Flow to Crown of Road	0.28	2.0	14.3	2.7%	12.9	11.7	yes
				100-year	Flow to Top of Curb	0.67	14.7	29.3	2.7%	112.4	24.3	yes
Sahwatch Street (Proposed)	DP 22	40	Typical Crown	5-year	Flow to Crown of Road	0.40	4.0	20.4	1.3%	22.4	9.5	yes
				100-year	Flow to Top of Ramp Curb	0.50	12.0	41.0	1.3%	43.9	19.6	yes
Cascade Avenue (Proposed)	B9	40	Typical Crown	5-year	Flow to Crown of Road	0.40	4.0	20.4	1.3%	22.4	2.8	yes
				100-year	Flow to Top of Ramp Curb	0.50	12.0	41.0	1.3%	43.9	5.8	yes
West Las Vegas Street (Existing)	DP 23	40	Typical Crown	5-year	Flow to Crown of Road	0.40	4.0	20.4	0.4%	13.1	6.9	yes
				100-year	Flow to Top of Curb	0.67	18.7	41.3	0.4%	53.3	14.2	yes
West Las Vegas Street (Existing)	DP 24	40	Typical Crown	5-year	Flow to Crown of Road	0.40	4.0	20.4	0.4%	13.1	15.8	no
				100-year	Flow to Top of Curb	0.67	18.7	41.3	0.4%	53.3	32.1	yes
West Las Vegas Street (Existing)	DP 25	40	Typical Crown	5-year	Flow to Crown of Road	0.40	4.0	20.4	0.4%	13.1	12.8	yes
				100-year	Flow to Top of Curb	0.67	18.7	41.3	0.4%	53.3	25.8	yes
West Las Vegas Street (Existing)	DP 27	40	Typical Crown	5-year	Flow to Crown of Road	0.40	4.0	20.4	0.6%	15.1	15.1	no
				100-year	Flow to Top of Curb	0.67	18.7	41.3	0.6%	61.7	30.5	yes
Conejos Street (Proposed)	C4	28	Typical Crown	5-year	Flow to Crown of Road	0.28	2.0	14.3	1.9%	10.6	3.3	yes
				100-year	Flow to Top of Curb	0.67	14.7	29.3	1.9%	94.7	6.6	yes
Baltic Street (Proposed)	C5	18	Typical Crown	5-year	Flow to Crown of Road	0.36	1.6	9.4	4.0%	14.9	9.9	yes
				100-year	Flow to Top of Curb	0.67	8.8	19.3	4.0%	76.8	20.5	yes
Mill Street (Existing)	DP 31	30	Typical Crown	5-year	Flow to Crown of Road	0.30	2.3	15.3	0.7%	7.6	15.7	no
				100-year	Flow to Top of Curb	0.67	15.5	31.3	0.7%	58.8	32.3	yes
Sierra Madre Street (Existing)	DP 32	50	Typical Crown	5-year	Flow to Crown of Road	0.50	6.3	25.5	1.6%	46.1	21.1	yes
				100-year	Flow to Top of Curb	0.67	20.8	51.3	1.6%	107.7	51.1	yes

Notes:

1. 5-year storm event not to overtop crown of roadways where possible.
   City Criteria (per 10/11/94 resolution): 6" max. depth at gutter flowline; collector and residential streets are limited to a maximum of 34 cfs per side to avoid excessive velocities; stormwater allowed to cross crown of road
2. 100-year storm event not to overtop top of curb and gutter (City of Colorado Springs Type I vertical 8" curb and gutter)
   City Criteria (per 10/11/94 resolution): 12" max. depth at the gutter flowline; 4" max. depth at crown of road (which ever is less)

Mill Street Preservation Area
Inlets

Flow By Inlets

Design Point	Description	Storm Event	Q (cfs)	Spread (ft)	Cross Slope (%)	Street Slope (%)	I (in/hr)	Fr	L(1)	L(2)	L(3)	Inlet Size (ft)	Q(in) (cfs)	CA (in)	Q(fb) (cfs)	CA (fb)
23	Las Vegas	5-year	19.6	20.0	2.0%	0.4%	3.88	0.90	13.9	8.3	29.7	*10*	12.7	3.26	6.9	1.78
	(Proposed)	100-year	40.1	20.0	2.0%	0.4%	6.90	0.90	13.9	8.3	29.7	*10*	26.0	3.76	14.2	2.05
24	Las Vegas	5-year	15.8	20.0	2.0%	0.4%	3.66	0.90	13.9	8.3	29.7	*15*	12.0	3.28	3.8	1.03
	(Proposed)	100-year	32.1	20.0	2.0%	0.4%	6.52	0.90	13.9	8.3	29.7	*15*	24.4	3.74	7.7	1.18
25	Las Vegas	5-year	12.8	20.0	2.0%	0.4%	3.49	0.90	13.9	8.3	29.7	*15*	9.7	2.78	3.1	0.86
	(Proposed)	100-year	25.8	20.0	2.0%	0.4%	6.21	0.90	13.9	8.3	29.7	*15*	19.6	3.16	6.2	0.99
31	Sierra Madre	5-year	15.7	25.0	2.0%	1.6%	3.82	1.83	35.2	21.1	75.4	*10*	4.5	1.17	11.2	2.94
	(Existing)	100-year	32.3	27.0	2.0%	1.6%	6.80	1.85	38.5	23.1	82.5	*10*	8.4	1.23	23.9	3.52

Mill Street Preservation Area
Inlets

Sump Inlets

Design Point	Description	Storm Event	Q (cfs)	Inlet Size (ft)	Clogging Factor	Calculated Depth (ft)	D(max) (ft)	Meets Criteria?
11	Sahwatch	5-year	23.8	*12.0*	1.25	0.88	0.50	no
	(Existing)	100-year	49.5	*12.0*	1.25	1.43	0.67	no
11	Sahwatch	5-year	23.8	*20.0*	1.25	0.63	0.67	yes
	(Proposed)	100-year	49.5	*20.0*	1.25	1.00	1.00	yes
A5	Fountain	5-year	5.0	*10.0*	1.25	0.35	0.50	yes
	(Proposed)	100-year	10.4	*10.0*	1.25	0.57	0.67	yes
A6	Cascade	5-year	6.0	*10.0*	1.25	0.40	0.50	yes
	(Proposed)	100-year	12.5	*10.0*	1.25	0.65	0.67	yes
A10	Cascade	5-year	3.6	*8.0*	1.25	0.33	0.50	yes
	(Existing)	100-year	7.5	*8.0*	1.25	0.54	0.67	yes
22	Sahwatch	5-year	9.5	*15.0*	1.25	0.41	0.50	yes
	(Proposed)	100-year	19.6	*15.0*	1.25	0.67	0.67	yes
27	Las Vegas	5-year	15.1	*8.0*	1.25	0.85	0.50	no
	(Existing)	100-year	30.5	*8.0*	1.25	1.36	0.67	no
27	Las Vegas	5-year	15.1	*23.0*	1.25	0.42	0.50	yes
	(Ex. 8' & Pp. 15')	100-year	30.5	*23.0*	1.25	0.66	0.67	yes
28	Mill Street	5-year	11.7	*20.0*	1.25	0.39	0.50	yes
	(Proposed)	100-year	11.7	*20.0*	1.25	0.39	0.67	yes
32	Las Vegas	5-year	16.7	*21.0*	1.25	0.48	0.67	yes
	(Existing 8', 10')	100-year	42.7	*21.0*	1.25	0.90	1.00	yes

APPENDIX E

DESIGN CHARTS AND TABLES

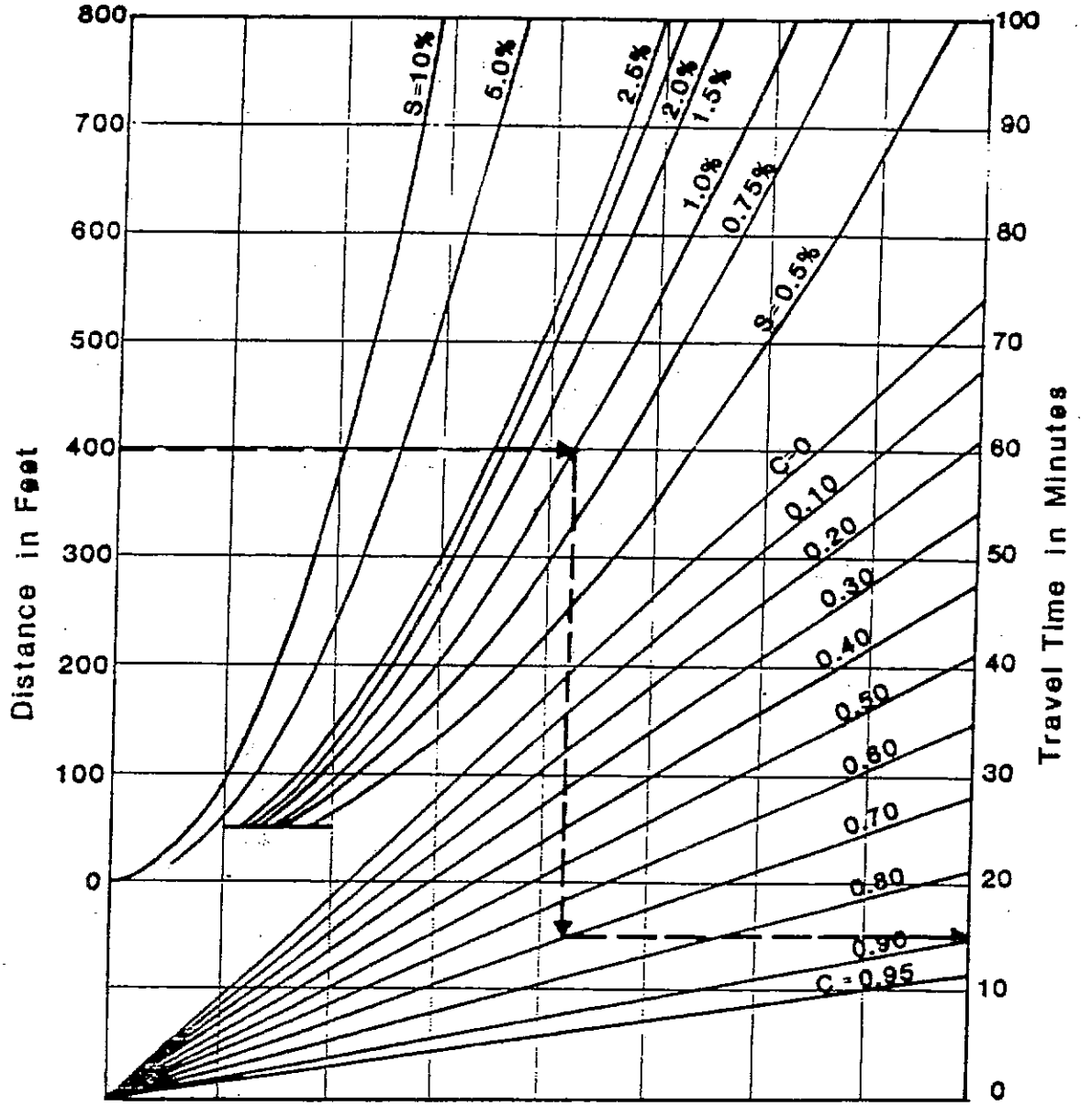
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



REFERENCE : Wright – McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1, Denver Regional Council of Governments, Denver, Co. 1977

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Overland Flow Curves

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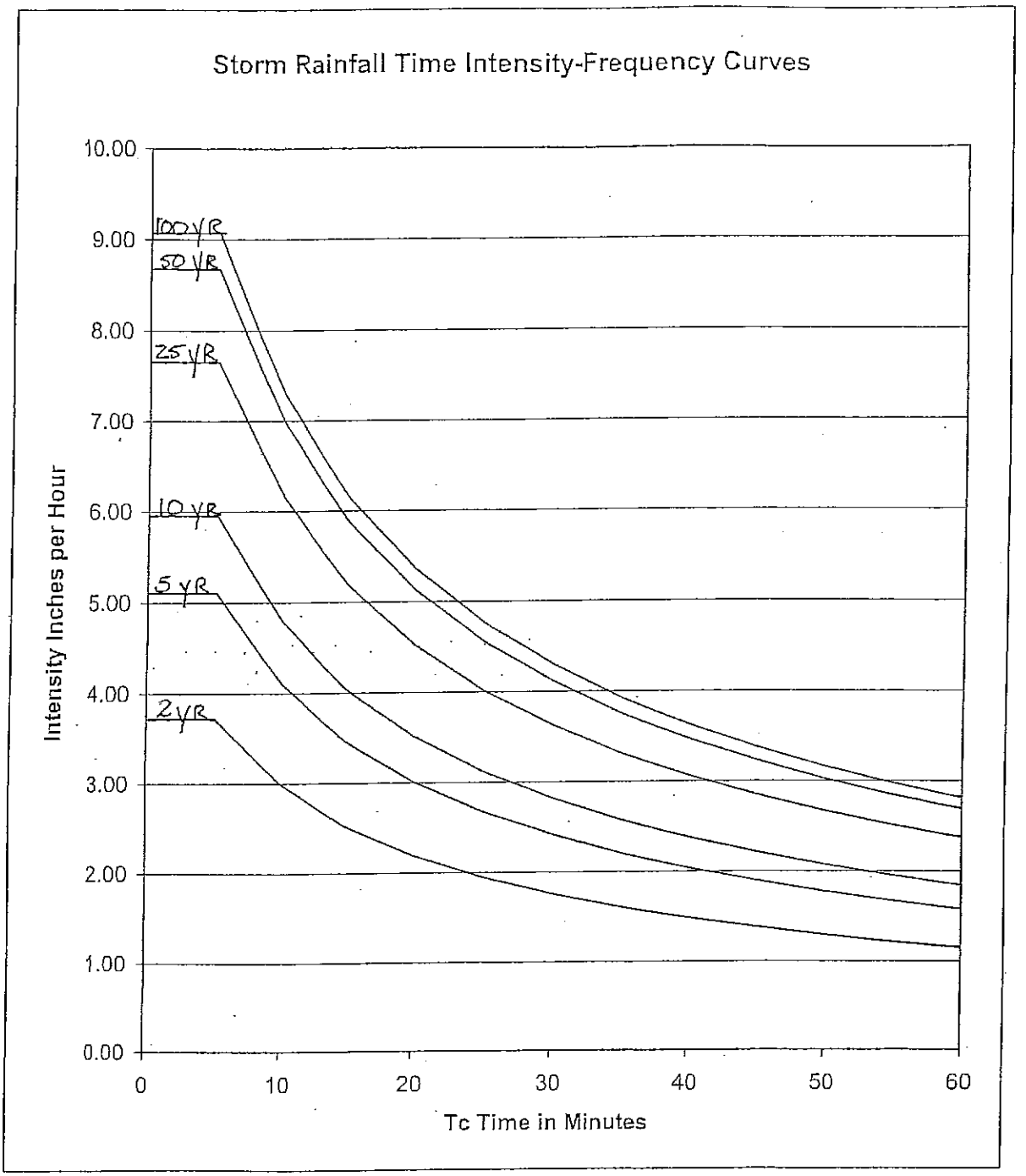
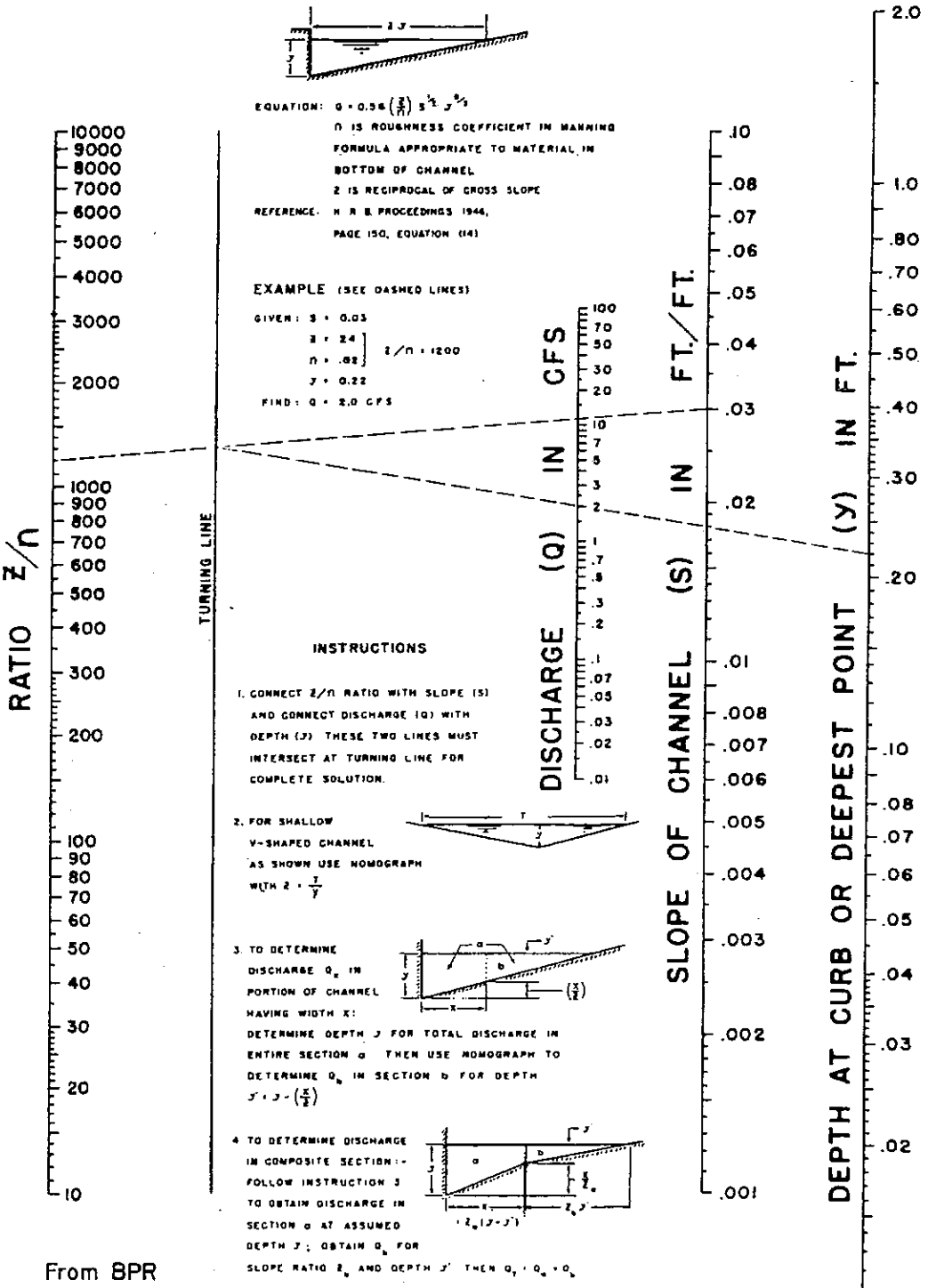
Figure: 5–2



Rainfall Depth - Duration - Frequency Table derived from Rainfall Atlas III for Colorado
Resource: Guo, James C.Y., (2001) "Urban Storm Water Modeling", Chapter 5: Runoff Prediction for Small Catchment, published by Auraria Campus Book Company, University of Colorado at Denver, Denver, Colorado.

Duration Td Minutes	2 Yr Formula Inch/hr	5 yr Formula Inch/hr	10 yr Formula Inch/hr	25 yr Formula Inch/hr	50 yr Formula Inch/hr	100 yr Formula Inch/hr
0	3.72	5.10	5.96	7.66	8.68	9.07
5	3.72	5.10	5.96	7.66	8.68	9.07
10	2.99	4.10	4.79	6.15	6.97	7.29
15	2.52	3.46	4.04	5.19	5.89	6.15
20	2.20	3.01	3.52	4.52	5.12	5.36
25	1.95	2.68	3.13	4.02	4.56	4.77
30	1.77	2.42	2.83	3.63	4.12	4.31
35	1.61	2.21	2.58	3.32	3.77	3.94
40	1.49	2.04	2.39	3.07	3.48	3.63
45	1.39	1.90	2.22	2.85	3.23	3.38
50	1.30	1.78	2.08	2.67	3.03	3.16
55	1.22	1.67	1.95	2.51	2.85	2.98
60	1.15	1.58	1.85	2.37	2.69	2.81



From BPR

NONOGRAPH FOR FLOW IN TRIANGULAR GUTTERS
(From U.S. Dept. of Commerce, Bureau of Public Roads, 1965)

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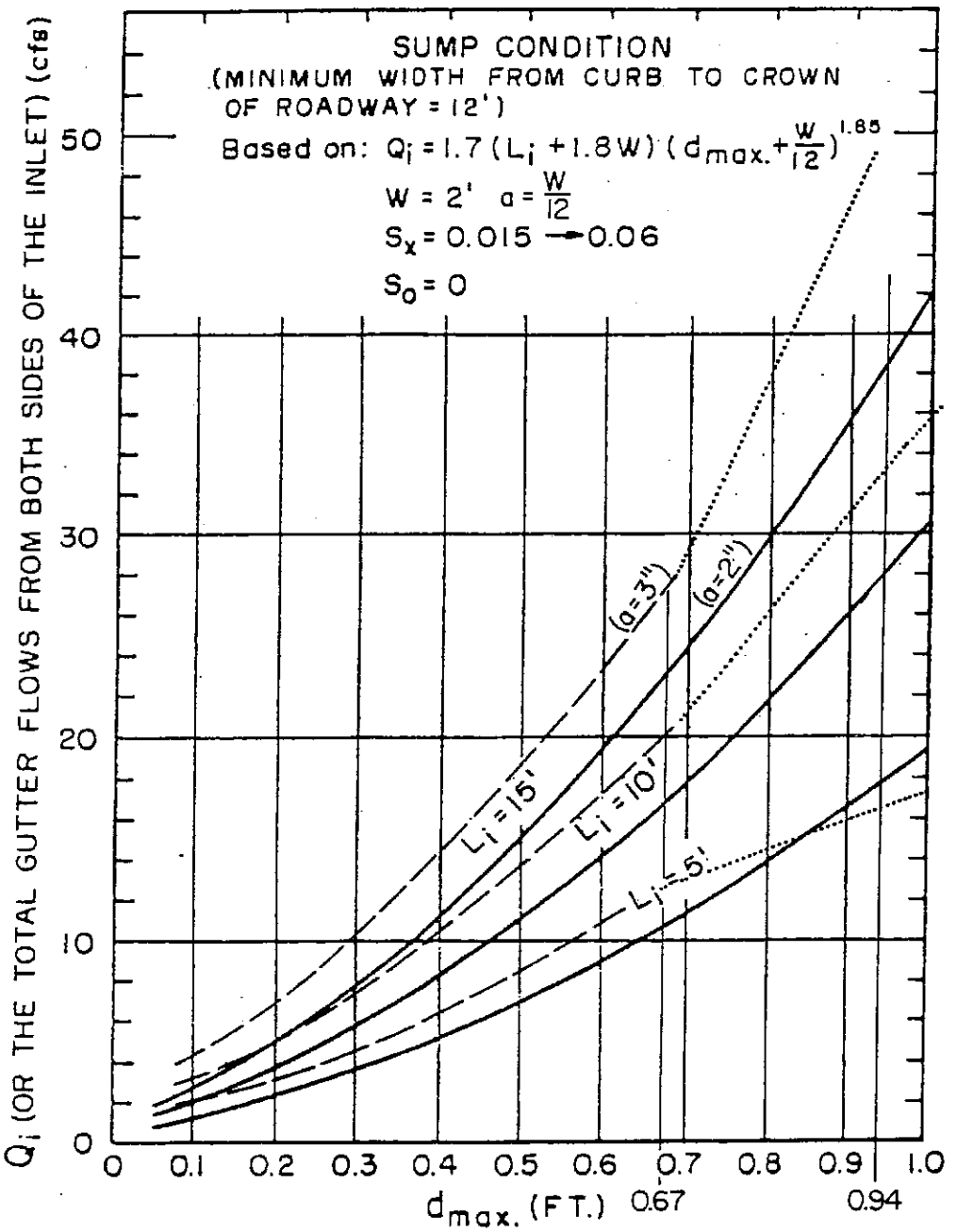
NOMOGRAPH FOR FLOW IN TRIANGULAR GUTTERS.

Date
OCT. 1987

Figure
7 - 2



REFERENCE : Izzard, Carl. f., Report presented at the Annual Meeting of the National Transportation Board, January 1977; Simplified Method For Design of Curb-opening Inlets

——— (As Modified by El Paso County, per Type R Inlet)

Note: Depth of ponding measured at curb above depressed area ; a = 3", For $d \leq .67$

$Q_i = (1.7 L_i + 6.12)(d_{max} + .25)^{1.85}$; $Q_i = 3.60 L_i (d - .08)^{.5}$ For $d \geq .94$; Note : No Clogging Factor

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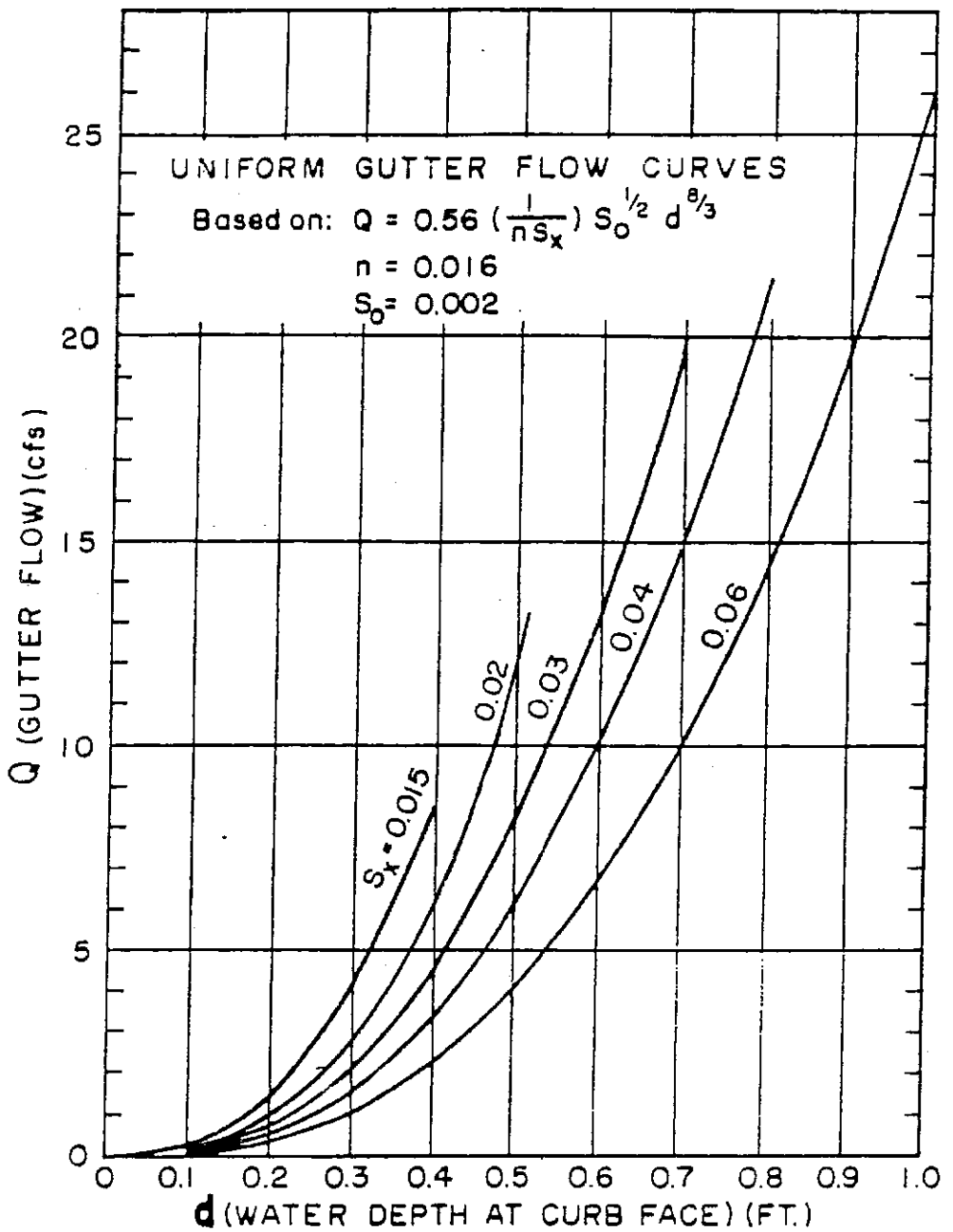
Sump Capacity for Curb-opening Inlets

Date: OCT. 1987

Figure: 7-11



REFERENCE : Izzard, Carl. f., Report presented at the Annual Meeting of the National Transportation Board, January 1977; Simplified Method For Design of Curb-opening Inlets

Uniform Gutter Flow Curves