Kenneth G. Rowberg
Planning Director

Carl F. Schueler
Assistant Director

El Paso County Planning Department

September 20, 2001

City of Colorado Springs
Planning Commission
c/o Planning, Development and Finance
P. O. Box 1575
Colorado Springs, Colorado 80901

In compliance with CRS 30-28-109, transmitted herewith is a copy of an amendment to the El Paso County Master Plan, consisting of the *West Fork Jimmy Camp Creek Drainage Basin Planning Study* and related documents.

In order for our office to verify your receipt, please sign both copies of the Receipt and return one of them to our office. You may retain the other as a cover letter for the attachments.

Should you have any questions or if I can be of further assistance, please contact our office at (719) 520-6300.

Sincerely,

Carl F. Schueler, Assistant Director

RECEIVED
OCT 10 2001
COLORADO SPRINGS
CITY PLANNING

Enclosures

27 East Vermijo Avenue
Colorado Springs, Colorado 80903-2088
Web Site: www.co.el-paso.co.us

(719) 520-6300
FAX: (719) 520-6322

P. O. Box 2007
Colorado Springs, Colorado 80901
E-mail: plnweb@co.el-paso.co.us

Kenneth G. Rowberg
Planning Director

Carl F. Schueler
Assistant Director

El Paso County Planning Department

I hereby certify that the enclosed **Amendment to the El Paso County**, consisting of the *West Fork Jimmy Camp Creek Drainage Basin Planning Study,* as well as the descriptive materials, is a duly adopted amendment to the County Master Plan of El Paso County, Colorado.

Elaine V. Nelson

Secretary to the El Paso County
Planning Commission

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Colorado Springs, Colorado 80903-2088
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P. O. Box 2007
Colorado Springs, Colorado 80901
E-mail: plnweb@co.el-paso.co.us

Approved
El Paso County
Planning Commission
This 19 day of June 2001

Joseph C. Gallagher, Chairman
Elaine Gibson, Secretary

AMENDMENT TO THE COUNTY PLAN (Approved)

Commissioner Peterson-Falcone moved that the following Resolution be adopted.

RECEIVED
SEP 19 2001
EL PASO COUNTY
CLERK TO THE
BOARD

BEFORE THE PLANNING COMMISSION

OF THE COUNTY OF EL PASO

STATE OF COLORADO

RESOLUTION NO. MP-01-001

WHEREAS, the El Paso County Department of Transportation and Kiowa Engineering request approval of and amendment to the Master Plan by adoption of the West Fork – Jimmy Camp Creek Drainage Basin Planning Study for the Basin located east of Widefield and draining southeasterly to the main stem of Jimmy Camp Creek within the designated areas of the unincorporated area of El Paso County; and

WHEREAS, a public hearing was held by this Commission on June 19, 2001; and

WHEREAS, based on the evidence, testimony, exhibits, study of the master plan for the unincorporated area of the county, comments of the El Paso County Planning Department, comments of public officials and agencies, and comments from all interested parties, this Commission finds as follows:

1. That proper posting, publication and public notice was provided as required by law for the hearing of the Planning Commission.

2. That the hearing before the Planning Commission was extensive and complete, that all pertinent facts, matters and issues were submitted and that all interested parties were heard at that meeting

3. That all data, surveys, analyses, studies, plans, and designs as are required by the State of Colorado and El Paso County have been submitted, reviewed and found to meet all sound planning and engineering requirements of the El Paso County Subdivision Regulations.

4. That the proposal shall amend the Master Plan for El Paso County.

5. That for the above-stated and other reasons, the proposal is in the best interests of the health, safety, morals, convenience, order, prosperity and welfare of the citizens of El Paso County.

WHEREAS, Section 30-28-108 C.R.S. provides that a county planning commission may adopt, amend, extend, or add to the County Master Plan.

NOW, THEREFORE, BE IT RESOLVED that the Amendment to the Master Plan for El Paso County be approved for the following described unincorporated area of El Paso County:

See attached Figure 1

BE IT FURTHER RESOLVED that the following condition and notation shall be placed upon this approval:

CONDITION:

1. Section 30-28-109, C.R.S. requires the Planning Commission to certify a copy of the Master Plan, or any adopted part or amendment thereof or addition thereto, to the Board of County Commissioners and to the Planning Commission of all municipalities within the County. The Planning Commission's action to amend the Master Plan shall not be considered final until the applicant submits a minimum of ten (10) complete sets of the final documents and maps to the Planning Department and such documents and maps are certified by the Chairman of the Planning Commission and distributed as required by law.

NOTATION

1. Although this Drainage Basin Master Plan is adopted as a County Master Plan element pursuant to State Statute, the intent is not to use its land use assumptions for subsequent zoning and subdivision decisions.

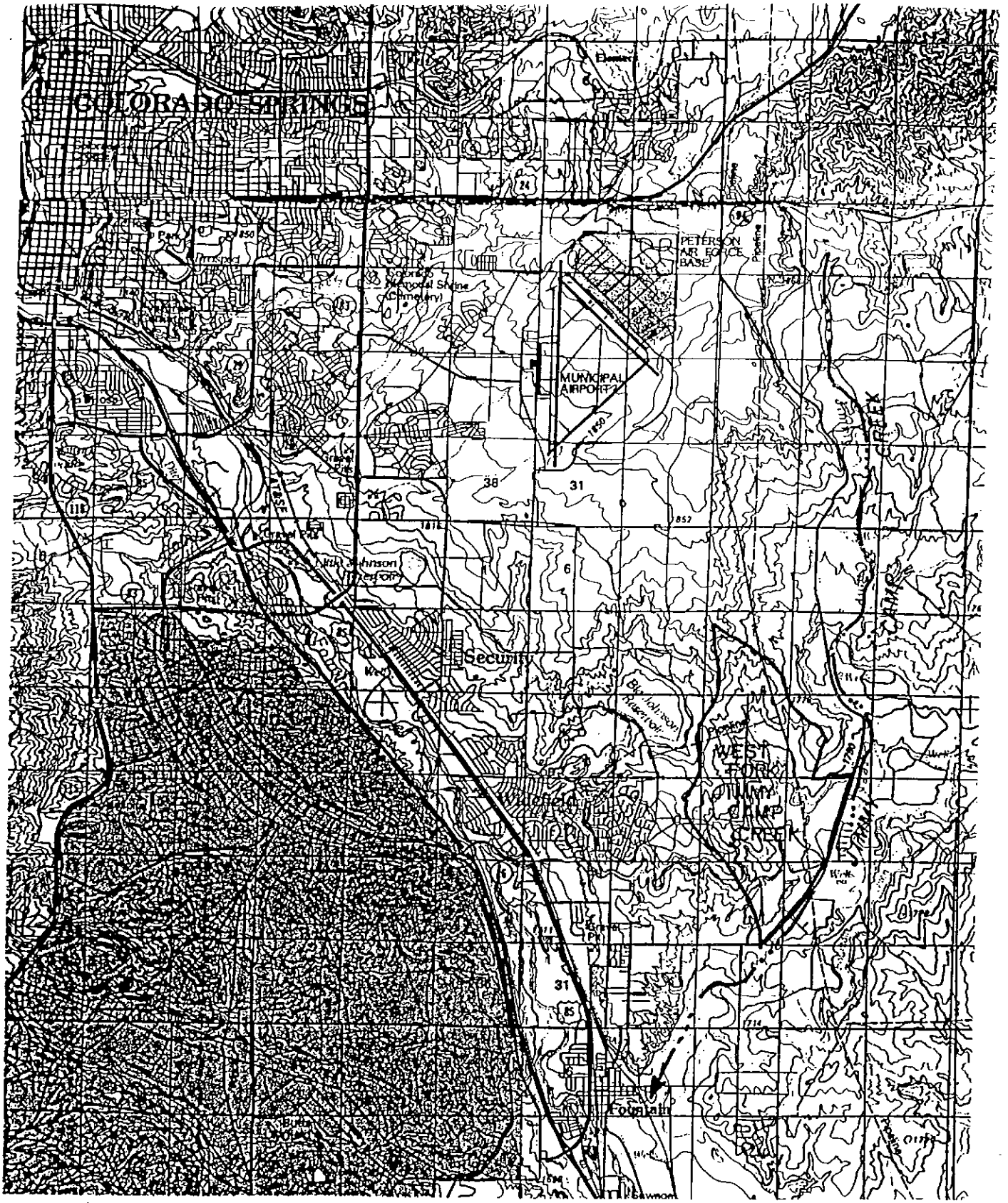
Commissioner Heiser seconded the adoption of the foregoing Resolution.

The roll having been called, the vote was as follows:

Commissioner Peterson-Falcone	aye
Commissioner Mason	aye
Commissioner Pullara	aye
Commissioner Sery	aye
Commissioner Heiser	aye
Commissioner Miller	aye
Commissioner Bell	aye
Commissioner Salute	aye
Commissioner Bernstein	aye

The Resolution was adopted by a unanimous vote of 9 to 0 by the Planning Commission of the County of El Paso, State of Colorado.

DATED: June 19, 2001



n.t.s.

FIGURE 1

VICINITY MAP

GMS, INC.
CONSULTING ENGINEERS
611 NORTH WEBER, SUITE 300
COLORADO SPRINGS, COLORADO 80903-1074

TELEPHONE (719) 475-2935
TELECOPY (719) 475-2938

EDWARD D. MEYER, P.E.
ROGER L. SAMS, P.E.

GREGORY R. WORDEN, P.E.
KEN L. WHITE, P.L.S.
DAVID R. FRISCH, P.L.S.

September 28, 1999

Mr David Smedsrud, Planning Director
City of Fountain
106 S. Main Street
Fountain, CO 80817-2214

via Telefax (5 Pages)
Hard Copy to Follow

RE: West Fork Jimmy Camp Creek Drainage Basin Planning Study
Comments on Draft Study dated June 1999

Dear Dave:

In accordance with your request, we have reviewed the draft report of the West Fork Jimmy Camp Creek Drainage Basin Planning Study prepared by the Kiowa Engineering Cooperation dated June 1999. This study was prepared on behalf of New Generation Homes, the owner/developer of a project known as "The Glen at Widefield" located between the Peaceful Valley Estates and Sunrise Ridge developments and Marksheffel Road. "The Glen at Widefield" is bounded on the north by the Crescent Heights property which is within the corporate limits of the City of Fountain. It is bounded on the south by the project known as Cross Creek at Mesa Ridge, a portion of which is within the corporate limits of the City of Fountain. The remaining portion of the Cross Creek project has been proposed for annexation to the City of Fountain prior to development.

By copy of this letter to Mr. Richard Wray, P.E., Kiowa Engineering Corporation, we are providing these comments to the Design Professional of Record for consideration in finalizing of this document.

The drainage patterns in this area are generally north to south with off-site runoff generated north of Fontaine Boulevard flowing southerly through the Crescent Heights property which is in the City of Fountain, then into, "The Glen at Widefield," project which is in El Paso County. Runoff flows from this unincorporated area into the Cross Creek at Mesa Ridge property which is proposed to be within the City of Fountain. In the event development within "The Glen at Widefield" precedes development within the City of Fountain, Crescent Heights or Cross Creek, concepts will be established with which future storm water management infrastructure within the City of Fountain must be compatible. This particular situation is a classic example of the impact of multi-governmental jurisdictions, i.e. City of Colorado Springs, El Paso County and City of Fountain which require adequate master planning, coordination and implementation.

Another issue which requires a cursory look is the fact that a prior drainage basin master plan for the Jimmy Camp Basin was prepared in 1987 under the direction of El Paso County. Although that DBPS was not officially adopted, it has served up to this point in time as a guideline under which planning and development could occur. That DBPS was used in the development of a master development drainage plan (MDDP) for the Crescent Heights project which was submitted to the City of Fountain in 1988. Different storm water management

approaches in the current West Fork DBPS and the prior basin DBPS require attention, particularly in the Crescent Heights Project.

The following are our general comments on this study, suggestions for enhancement of the study and questions which may have arisen during our cursory review.

A. Compatibility of West Fork DBPS with Prior Land Development Activities

As is indicated in the discussion above, the Crescent Heights MDDP did not address on-site detention as is proposed in the West Fork DBPS. The preliminary Crescent Heights MDDP utilized the prior Jimmy Camp Creek DBPS for flows onto that project and flows from that project. The level of detail and routing of flows in the MDDP documents submitted to date are not sufficient to confirm those values.

It is noted that the present West Fork DBPS has runoff values similar to the prior Jimmy Camp Creek DBPS at Fontaine Boulevard. However, the flows exiting the Crescent Heights project appear to be significantly higher, even with detention within the Crescent Heights project. Should downstream development occur and implementation of storm water management infrastructure be based on the proposed West Fork DBPS, it does not appear that would result in an undue burden on the Crescent Heights project even though and MDDP has been submitted to the City of Fountain.

The general policy of the City of Fountain remains in place, that is storm water will be delivered downstream in a fashion that it creates no greater burden on the downstream land than existed prior to development. In this particular case, if facilities downstream are in place to accept runoff in the quantities represented by the West Fork DBPS, it appears reasonable that development within the Crescent Heights could accommodate that requirement without an undue burden.

B. General Technical Comments

1. The purpose and scope of the project indicates that the Design Professional solicited the desires/input and procured current information relative to development plans in the basin. It is requested that the Design Professional confirm with the City of Fountain that they considered the MDDP prepared by URS Consultants, Inc. in support of the master plan for the Crescent Heights project.

2. The hydrologic criteria utilized to develop runoff conditions in the West Fork DBPS appears to be reasonably compatible with the Crescent Heights MDDP (ignoring editorial errors in the Crescent Heights MDDP). In particular, Soil Conservation Service (SCS) curve numbers and design rainfall criteria do not appear to be significantly different between the two efforts. In addition the criteria used appears to be reasonably compatible with the Cross Creek MDDP submitted to the City of Fountain.

3. Even though the hydrologic criteria appears to be reasonably compatible, it appears as if runoff computations, using two different methodologies (TR-20 and HEC-1) have resulted in markedly different runoff values. We are not in a position to offer an opinion as to whether one method provides more precise information over another; however, it is suggested that the responsible Design Professional briefly address this matter.

4. The reports note that the drainage subbasin boundaries shown on Figure 3 need to be verified using more definitive topographic mapping. We trust that the responsible Design Professional is aware that there is detailed two foot interval mapping on the entirety of the Crescent Heights project which was used in the MDDP for that project. That may provide more definitive topographic mapping to develop criteria than the enlarged USGS represented in Figure 3 and other documents in this project.

5. We suggest that the responsible Design Professional review the discussion of the "Drainageway A drainageways" located on the page of text following Table 5. Segment 2110 is identified in the first paragraph of that section. Should this be Segment 2160?

6. The discussion following Table 5 addresses the Fountain Mutual Irrigation Ditch as it traverses this subbasin. We suggest that the proposed Fountain Mutual Metropolitan District be discussed as to its stated purpose and the possible impact on storm water management in this subbasin be analyzed. In particular, Fountain Mutual Metropolitan District may be useful as a conveyance mechanism to collect and convey storm water to an outfall point where it can be more readily managed in regional detention facilities. Please refer to subsequent comments relative to regional versus small on-site detention facilities.

7. It is suggested that some additional text be provided addressing the impact of implementation of the proposed storm water management concepts shown in this West Fork DBPS on the existing regulatory flood plains represented by the FIRM mapping. What is the relative area (size/acres) which would be removed from a regulatory flood plain upon implementation of the proposals in this West Fork DBPS?

8. Section V of the study provides an evaluation of alternatives and defines evaluation parameters. Detention is a valid concept to be implemented in storm water management in this basin. The study indicates consideration of two concepts, "on-site detention" utilizing basins typically less than 2-3 acre feet in volume and what is referred to here as regional detention having storage volumes in excess of 5 acre feet. The study specifically recommends that regional detention be considered over on-site detention.

   On behalf of the City of Fountain we would request that the Design Professional, prior to finalization of this document further address this issue. On Figure 6 there are 12 detentions basins represented. Of those 12, seven are less than 5-acre feet in volume. We recognize that 5 acre-feet is not necessarily an established, "hard and fast" criteria. However, we would question the value of those detention basins having a 100-year storage volume of 2-acre feet or less, particular detention basin 2111 having a volume of only 0.6-acre feet. The relative cost effectiveness, environmental benefit and other factors should more thoroughly be considered prior to adoption of this drainage basin planning study.

We also would question the benefit of these detention ponds where the attenuated flow i.e. peak inflow rate versus outflow rate, is less than say 25% different. This is particularly the case for detention basin 3081, 4021 and 3091. Again the relative cost benefit of these facilities would appear to be marginal. The cost of construction and perpetual operation and maintenance must be weighed with the benefits of a marginally reduced downstream flow condition. Such a benefit may be easily realized by simply providing for a greater attenuation of peak flows through the detention basins, further limiting the scope of downstream direct flow facilities.

9. Section VI, Selected Plan, indicated the master land development plans for Cross Creek at Mesa Ridge, "The Glen at Widefield" and Crescent Heights were reviewed and taken into account in the selection of the channel section and detention basin locations. It is requested that the Design Professional provide the City of Fountain with a copy of the Crescent Heights master plan annotated to specifically locate the 3 detention facilities proposed in that development. In addition, it is requested that the discussions and review by the landowners be documented to the City of Fountain.

10. It is requested that the Design Professional annotate Figure 6 with a designation of the detention basin lying north of Fontaine Boulevard. Is this detention basin 3021?

11. It would be useful if a table could be provided in the report which demonstrates the undeveloped, undetained peak flow rates at locations where on stream detention is proposed to be practiced and at other design points. This would give a reasonable database to compare conformance of this drainage basin planning study with the general drainage policy of the City of Fountain, i.e. runoff downstream shall not place a greater burden on property than that which exists prior to development.

12. We would request that the Design Professional review the text contained in Section VI addressing detention. It indicates that the detention basin characteristics are presented on Table 7. However the Table 7 provided in the draft review is a summary of major roadway crossings.

13. On behalf of the City of Fountain we would request that the West Fork DBPS make specific recommendations as to ownership of detention basin sites, drainage channel rights-of-way and other storm water management infrastructure. In addition it is requested that the DBPS identify mechanisms by which operation and maintenance responsibility can be placed for these facilities.

14. The West Fork DBPS indicates, "Land acquisition may be required for the regional detention basins." If there are "on-site" detention basins to be implemented, it is suggested that those be specifically identified as opposed to "regional detention basins." As far as it impacts the City of Fountain, it appears as if the detention basins proposed in the present and anticipated corporate limits should be considered "on-site". They do not appear to be on-stream detention basins managing storm water from "off-site". Therefore it appears as if the dedication/reservation of detention basin sites would be the responsibility of the landowner.

These are the majority of our comments on this draft West Fork DBPS at this time. Should you have any questions or desire additional information, please contact us at your convenience.

Sincerely,

Roger J. Sams, P.E.

RJS/mv

cc: Mr. Richard N. Wray, P.E., Kiowa Engineering Corporation, via telefax to 630-0406, hardcopy to follow
Mr. David Lethbridge, City Engineering Consultant, via telefax to 392-7375

CITY OF COLORADO SPRINGS

PUBLIC WORKS
City Engineering

CITY OF COLORADO SPRINGS/EL PASO COUNTY
DRAINAGE BOARD AGENDA
December 21, 2000

The City of Colorado Springs/El Paso County Drainage Board will hold its regularly scheduled meeting at 2:00 PM on December 21, 2000 in the City Council Chambers, City Administration Building, 30 South Nevada Avenue.

Item 1

Approval of the minutes of the October 25, 2000 Board Meeting. The minutes are enclosed.

Item 2

Presentation on the West Fork Jimmy Camp Creek Drainage Basin Planning Study by Kiowa Engineering Corporation, on behalf of the applicant, New Generation Homes, Inc., **for Board action.** See attached Executive Summary.

Item 3

Recommendation to increase the 2000 Cottonwood Creek Drainage Fees by $36.00/acre to $7073.00/acre to allow for reimbursement of the revised Drainage Basin Planning Study **for Board action.** See attached City background and recommendation.

Items 4 and 5: Consent Items Unless Called up for Discussion

Item 4

Request for CASH reimbursement for costs expended to develop the revised Cottonwood Creek Drainage Basin Planning Study. Reimbursement will be split equally and made payable to Development Management Inc., 4064 Sinton Rd., Suite 200 Colorado Springs, CO 80907 and to LP47, 2315 Briargate Parkway, Suite 100, Colorado Springs, CO 80920. See attached City staff recommendation.

Item 5

Request for CASH reimbursement for construction of public reimbursable drainage facilities within the Douglas Creek drainage basin in conjunction with Windward Corner Subdivisions Filing No. 1 and No. 2. Reimbursement will be made to Crestone Development, 2 N. Cascade Ave., Suite 650, Colorado Springs, CO 80903. See attached City staff recommendation.

Item 6

Proposed 2001 Drainage, Bridge and Detention Pond Land/Facilities Fees for the City, **for Board action.** Attached is staff background information, the recommended fee increases and the proposed 2001 fee list by drainage basin.

Stormwater Management, 101 West Costilla, Suite 113 • TEL 719-385-5979 FAX 719-578-6161
Mailing Address: Post Office Box 1575, Mail Code 1110 • Colorado Springs, Colorado 80901-1575
www.colorado-springs.com/cityeng/envirn2.htm

Item 7

Open for discussion.

A. Regional Stormwater Services Intergovernmental Agreement (see attached Agreement).

FOR THE CITY ENGINEER

Bruce A. Thorson
Stormwater Manager

c: (with Attachments)

Drainage Board Members (7)
Robert Mack, Senior Corporate Attorney
Bruce A. Thorson, City Engineering
Tom Bonifas, Development Review and Zoning
Andre Brackin, Stormwater Supervisor, El Paso County DOT
Brian Kelley, City Engineering
Don Steger, HBA

c: (w/o Attachments)

David S. Zelenok, Public Works Group Support Manager
Gary R. Haynes, City Engineer
City Clerk (for posting)
Nancy Bramwell, Assistant to the Mayor
Patricia Kelley, City Attorney
Dave Lethbridge, City Engineering
Tim Mitros, City Engineering
Ken Sampley, City Engineering
John McCarty, County Engineer, El Paso County DOT
Bob Plese, Regional Floodplain Administrator
Public Communications Department (2)
Ira Joseph, Comprehensive Planning and Land Use
Paul Butcher, Parks and Recreation Group Support Manager
Roland Obering, Obering Wurth & Assoc.
David Schneider, JR Engineering
Mike Mallon, Mallon Development Co.
Rich Wray, Kiowa Engineering Corporation, 2814 International Circle, Colorado Springs, CO 80910-3127
David Jenkins, Norwood Development Corp., 4065 Sinton Rd., Suite 200, Colorado Springs, CO 80907
Scott Smith, LaPlata Investments, 2315 Briargate Parkway, Suite 100, Colorado Springs CO 80920
John Gatto, Crestone Development, 2 N. Cascade Ave., Suite 650, Colorado Springs, CO 80903

DRAINAGE BOARD AGENDA

December 21, 2000: Item No. 2

EXECUTIVE SUMMARY
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
REVISED DECEMBER 7, 2000

Authorization

The Drainage Basin Planning Study (DBPS) for the West Fork Jimmy Camp Creek Drainage Basin was authorized by New Generation Homes, Inc., under the terms of agreement between New Generation Homes and Kiowa Engineering Corporation. The requirement to prepare the DBPS is associated with the Glen at Widefield development plan submittal, which is a proposed land development that lies within the West Fork Jimmy Camp Creek basin. This basin lies within El Paso County, and within portions of the incorporated areas of the City of Fountain and the City of Colorado Springs.

Purpose and Scope

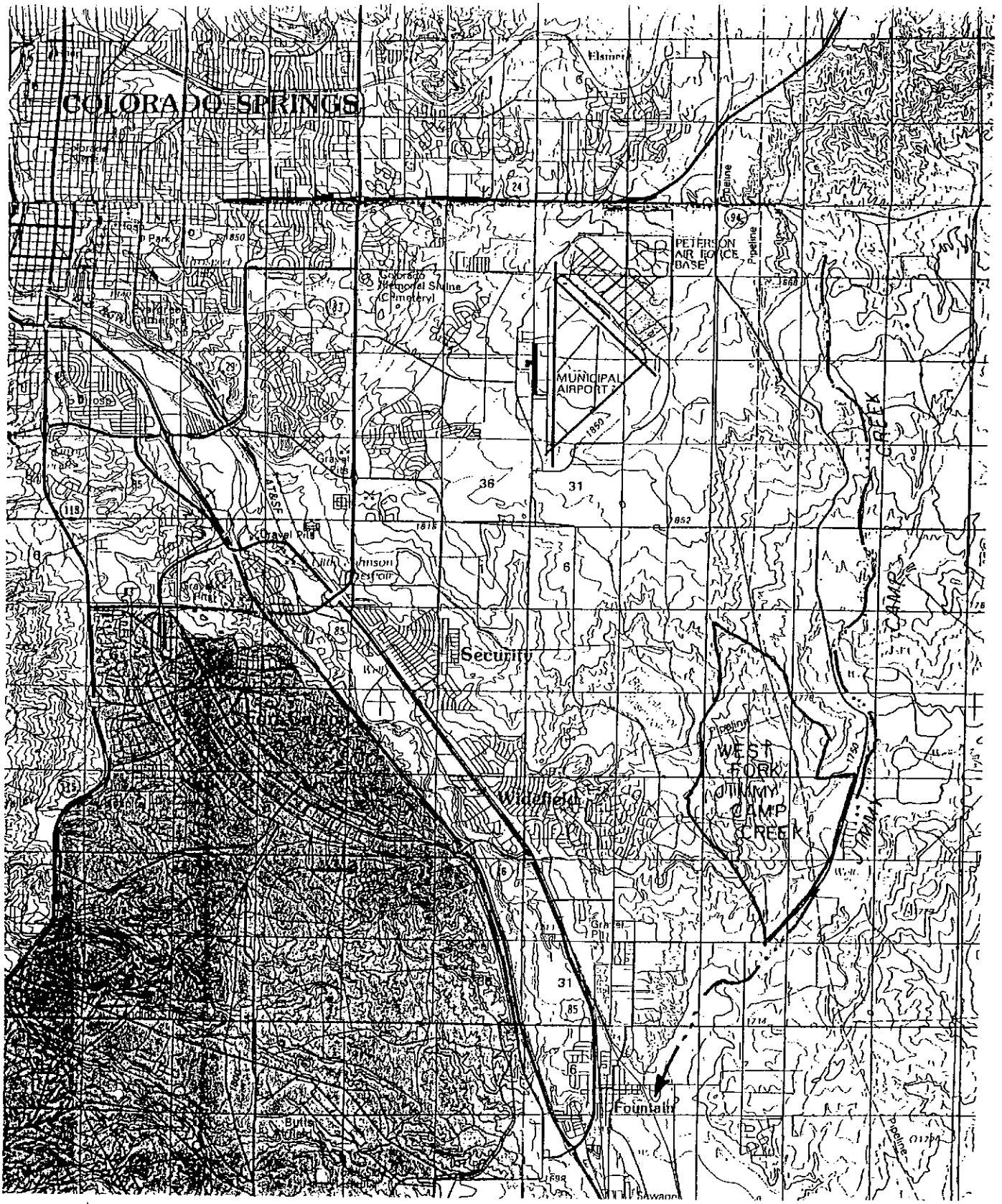
The purpose of the study is to identify feasible stormwater management plans to satisfy the existing and future needs within the West Fork Jimmy Camp Creek Drainage Basin. The West Fork Jimmy Camp Creek basin is to be referred to throughout this study and is inclusive of the mainstem and "Drainageway A" watersheds.

Mapping and Surveying

Mapping used in the planning effort for the West Fork Jimmy Camp Creek basin consisted of USGS 7-1/2 minute quadrangles and two-foot contour mapping for selected areas of the basin. Two-foot contour interval, 1-inch to 200-foot scale planimetric topographic maps were used within the developments known as Cross Creek at Mesa Ridge and the Glen at Widefield in order to confirm basin divides and to layout major drainageway facilities and detention basins within these areas. The City FIMS mapping was utilized in the area north of Fontaine Boulevard.

Basin Description

The West Fork Jimmy Camp Creek basin covers a total of 4 square miles in unincorporated El Paso County, the City of Fountain and the Colorado Springs, Colorado. Of this total, approximately 0.7 square miles is encompassed by the Drainageway "A" basin, and 2.9 square miles for the mainstem West Fork Jimmy Camp Creek basin. The remainder of the basin is direct flow area (DFA), to Jimmy Camp Creek. The basin trends in generally a south to southeasterly direction, entering Jimmy Camp Creek at approximately one-half mile upstream of



n.t.s.

FIGURE 1

VICINITY MAP

Link Road. At this time, approximately 10 percent of the basin is developed. Strong development pressure now exists within the balance of the basin.

The maximum basin elevation is approximately 6,010 feet above mean sea level, and falls to approximately 5,620 feet at the confluence with Jimmy Camp Creek. The headwaters of the basin originate in grassland covered areas of the southeastern portion of the Colorado Springs Municipal Airport property. The surface characteristics of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates. There are three open water storage areas that exist along the West Fork Jimmy Camp Creek and Drainageway "A" channel. These open water areas are remnants of the earlier irrigation facilities associated with the former ranch land operations. The Fountain Mutual Irrigation Canal traverses the basin from southwest to northeast.

Hydrology

A hydrologic analysis was conducted in order to determine peak discharges and runoff volumes for various storm types, and basin development conditions. This data was used in the evaluation of floodplains and in the evaluation of drainageway alternatives. Hydrology has been prepared for the West Fork Jimmy Camp Creek watershed in previous reports. The hydrologic analysis contained within the DBPS has been prepared in conformance with the City/County Storm Drainage Criteria Manual. The runoff model used to determine the peak flows and volumes within the study area is the U. S. Army Flood Hydrograph Package (HEC-1). The use of this hydrological model is in compliance with the City of Colorado Springs/El Paso County Drainage Criteria Manual.

Results

The results of the hydrologic analysis have been presented in several formats within the DBPS. A basin hydrologic map presents the major basin boundary, sub-basin boundaries and numbers, routing elements, and design points. A summary of flow rates for key design points is presented on Figure 3 within the DBPS. The peak discharges at the confluence with Jimmy Camp Creek for the existing and developed conditions (i.e., 3,550 cfs and 4,900 cfs respectively), compare well with the discharges presented in the Jimmy Camp Creek Drainage Basing Planning Study prepared by Wilson and Company and the El Paso County Flood Insurance Study (FIS). Differences in sub-basin delineation and flow routing parameters between the DBPS and past hydrology evaluations are responsible for the variations in peak discharges at comparable design points within the West Fork Jimmy Camp Creek basin.

Hydraulic Analysis

A hydraulic analysis was conducted to ascertain the conveyance capacity of existing hydraulic structures along the major drainageways of the West Fork Jimmy Camp Creek Basin. Field verifications of roadway crossings and existing channel improvements were conducted and the physical condition of the structure(s) noted. In some areas of the basin, a hydraulic analysis was conducted using the U. S. Army Corps of Engineers (COE), HEC-2 water-surface profile program. Cross-section data for the areas analyzed were obtained by using the two-foot contour interval planimetric topographic mapping.

Hydraulic Structure Inventory

As part of the field investigation, the existing drainage facilities were verified and inventoried. The size, type, and condition was recorded for all the bridges, culverts, channels, inlets, pipes, and miscellaneous drainage features in the basin. Hydraulic capacities were estimated for the culverts and bridges over the major drainageways. The physical condition of the major drainageways was reviewed in the field and using existing topographic mapping.

Alternative Analysis

Alternative drainageway improvement concepts have been examined that address the existing and future stormwater management needs of the basin. Quantitative and qualitative comparisons are presented in the DBPS, and a recommendation made as to which concepts are most feasible to advance to preliminary design and eventually implementation. The general planning goals to be achieved during the alternative evaluation phase were:

1. Identify stormwater facilities that will reduce existing floodplains and flooding problems within urbanized areas;
2. Provide stormwater management within developing areas of the basin in order to reduce the detrimental effects of runoff and sedimentation from disturbed areas;
3. Provide stormwater facilities that preserve and/or enhance the existing drainageway and areas adjacent to the drainageway that provide an environmental resource in the area;
4. Identify facilities which will minimize future operations and maintenance costs; and
5. Provide stormwater management facilities that will at least maintain and/or enhance the water quality characteristics of the basin.

Evaluation Parameters

The following list of parameters were considered when evaluating alternatives for addressing the long-term stormwater management needs for the basin:

- Flood Control
- Erosion Control
- Operation and Maintenance
- Open Space/Aesthetics
- Land Use
- Water Quality

- Recreation
- Right-of-way
- Transportation - Roadway and Trails
- Habitat
- Construction Cost
- Administration and Implementation

Environmental Resource Review

An environmental resource review was conducted for the major drainageways of the West Fork Jimmy Camp Creek basin. The resource review was conducted using aerial photographs of the basin and field visits to view areas of significant environmental resource. The most significant factors that have created the existing vegetative setting along the major drainageway (i.e., the West Fork and Drainageway A), has been the irrigation facilities and the land uses within the basin. Irrigation facilities that lie within basin include the Fountain Mutual Irrigation Ditch and two open water storage areas that lie below the irrigation canal. Seepage from the ditch as well as from the lakes is the source of the water supply that has created and supported wetland areas along some of segments of Drainageway A. Wetland and riparian zones were identified along segments several segments within the basin. It is likely that disturbance and/or encroachment into these areas resulting from land development activities will require notification of the U. S. Army Corps of Engineers and probably the issuance of a 404 permit.

Selected Improvements

The recommended channel sections for each reach of drainageway has been presented on on preliminary plans contained within the DBPS. In general, the banks of the West Fork of Jimmy Camp Creek within segments below future Mesa Ridge Parkway are to be lined with riprap to 100-year flow depth. For the drainageways north of Mesa Ridge Parkway the low flow areas should have selectively lined riprap bank protection such as at outside bends, at bridge or culvert outlets, and at the confluence with side tributaries. In conjunction with the selective improvement measures, the 100-year floodplain should be preserved and regulated. Check structures have been sited along the drainageways in order to maintain the channel invert at a stable gradient. A degraded slope of no more than one-half of the existing slope was assumed when estimating the number of check structures needed along a given segment. The checks have been conceptually designed to allow for a maximum drop of three feet once the degraded slope has been reached.

Detention

The recommended plan calls for the construction of regional detention basins within the West Fork Jimmy Camp Creek Basin. The locations of the regional detention basins are shown on the design plans. The purpose of the detention basins is to limit peak discharges at the basin's outfall to Jimmy Camp Creek to the existing hydrologic condition. The regional basins have also

been sited within each of the major land developments to more locally control runoff to existing levels. Wherever practical, the regional detention basins should be designed so as to take advantage of the adjacent roadway embankments. It is not anticipated that any of the regional detention basins will be subject to State Engineer's regulations. Stormwater quality measures should be designed into the regional stormwater detention basins. These measures would include the provision of a water quality and sediment pool area in addition to the volume required for stormwater detention.

Right-of-Way

For the most part the main channels within the basin which pass through undeveloped areas and the right-of-way can be dedicated as part of the land development process. For those segments of the drainageway where floodplain preservation is the recommended plan, a combination of open space dedication (such as park-land and greenbelts), in combination with a more narrow dedicated right-of-way along the low flow area of the drainageway should be obtained through the land development process. Land acquisition will be required for the regional detention basins. The dedication of easements and right-of-way for the drainageways and detention basins would be accomplished at the time of development planning and platting of the parcels that lie adjacent to or upstream of the stormwater facility.

Cost Estimates and Drainage Basin Fees

Cost estimates have been prepared and are contained within the DBPS. The cost of the major drainageway facilities has been determined for each jurisdiction. The facility cost estimate will be used in the determination of the drainage and bridge fees for this basin. Bridge crossing costs have been determined as well for the basin.

Presented on Table 17 through 19 is the cost and plattable acreage (i.e., that area available for platting into subdivisions), data associated with the determination of drainage and bridge fees for the basin. The plattable acreage has been determined using a combination of assessors maps, aerial photographs and topographic mapping that covering the watershed. As presented on Table 17, the reductions in the area available for platting have been listed. The reductions are mostly attributable to areas that are already platted, known roadway or planned road right-of-ways for minor and major arterials, and the area underlying the proposed detention basins.

Drainage basin fees have been determined for those areas that are within the City of Colorado Springs and El Paso County. The City of Fountain does not have a drainage basin fee system and therefore no fees have been calculated for the areas within the City of Fountain. The area of the basin within the City of Colorado Springs lies within the Colorado Centre development. Agreements with the City related to the collection and/or assessment of drainage

and bridge fees were previously developed for the Colorado Centre area. These agreements are subject to further review by the City. The drainage and bridge fees calculated for the County areas have been determined in accordance with Resolution No. 99-383. The percent impervious values listed on Exhibit 3 of this resolution where applied when calculating the weighted percent impervious value for the sub-basins within the County.

WEST FORK JIMMY CAMP CREEK
DRAINAGE BASIN PLANNING STUDY

Approved
El Paso County
Planning Commission
this 19th day of June A.D. 2001

Joseph C. Sahlstrom
Chairman
Elaine Nelson, Secretary

Kiowa Engineering Corporation

WEST FORK JIMMY CAMP CREEK
DRAINAGE BASIN PLANNING STUDY

Prepared for:

New Generation Homes, Inc.
3 Widefield Boulevard
Colorado Springs, CO 80911

Prepared by:

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KIOWA Project No. 98.93
wfjc*.doc

June 1999
July 2000
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I. INTRODUCTION

Authorization

The Drainage Basin Planning Study (DBPS) for the West Fork Jimmy Camp Creek Drainage Basin was authorized by New Generation Homes, Inc., under the terms of agreement between New Generation Homes and Kiowa Engineering Corporation. The requirement to prepare the DBPS is associated with the Glen at Widefield development plan submittal, which is a proposed land development that lies within the West Fork Jimmy Camp Creek basin. This basin lies within El Paso County, and within portions of the incorporated areas of the City of Fountain and the City of Colorado Springs.

Purpose and Scope

The purpose of the study is to identify feasible stormwater management plans to satisfy the existing and future needs within the West Fork Jimmy Camp Creek Drainage Basin. The West Fork Jimmy Camp Creek basin is to be referred to throughout this study and is inclusive of the mainstem and "Drainageway A" watersheds. The specific scope of work for this study included the following tasks:

1. Meet with the Client and County to: insure compliance with the City/County Storm Drainage Criteria Manual, obtain existing data and general information from participating entities, solicit desires of participating entities and other interested agencies or groups in order to develop alternate plans, procure current information relative to development plans in the basin, procure information relative to right-of-way limitations, proposed stormwater projects, potential hazards due to flooding, and avoid duplication of effort whenever possible by utilizing existing information available from other agencies and past studies.

2. Contact the City(s), County, individuals, and other agencies who have knowledge and/or interest in the study area.

3. Utilize City/County policies and criteria and applicable information wherever possible.

4. Perform hydraulic and hydrologic analyses within the study area.

5. Identify environmental setting of basin.

6. Identify existing and potential drainage and/or flooding problems.

7. Develop improvement alternatives to reduce existing and potential flooding problems, and to mitigate the impact of stormwater runoff upon environmentally significant areas along the drainageway(s).

8. Recommend and prepare a conceptual design for a selected alternative plan.

10. Prepare written report for submittal to the County, City of Fountain and the City of Colorado Springs discussing items examined in the study.

Summary of Data Obtained

Listed below are the technical reports collected for the review as part of preparing this study:

1. Soil Survey for El Paso County, Colorado, dated June 1981.

2. "City of Colorado Springs/El Paso County Drainage Criteria Manual", prepared by City of Colorado Springs, El Paso County, dated May 1987, revised 1996.

3. "Flood Insurance Studies for Colorado Springs, and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), revised march, 1997.

4. Jimmy Camp Creek Drainage Basin Planning Study prepared by Wilson & Company, dated January, 1987, (unapproved).

5. Flood Plain Information Report, Jimmy Camp Creek, El Paso County, Colorado, prepared by the U. S. Army Corps of Engineers, dated December, 1976.

6. Peaceful Valley Estates Filing No. 2, Preliminary and Final Drainage Plan, prepared by Rockwell Minchow, Inc., dated March, 1995.

7. Cross Creek at Mesa Ridge, Master Development Drainage Plan, prepared by Rockwell Minchow, Inc., dated January 1999.

8. Peaceful Valley Road and Powers Boulevard Final Drainage Report, prepared by Wilson & Company, December, 1994.

9. The Glen at Widfield Master Development Drainage Plan, prepared by Kiowa Engineering Corporation, dated December 1999.

Mapping and Surveying

Mapping used in the planning effort for the West Fork Jimmy Camp Creek basin consisted of USGS 7-1/2 minute quadrangles and two-foot contour mapping for selected areas of the basin. Two-foot contour interval, 1-inch to 200-foot scale planimetric topographic maps were used within the developments known as Cross Creek at Mesa Ridge and the Glen at Widefield in order to confirm basin divides and to layout major drainageway facilities and detention basins within these areas. The City FIMS mapping was utilized in the area north of Fontaine Boulevard.

Drainageway site inspections were conducted throughout the study area, and photographs were taken documenting the key drainage features.

II. STUDY AREA DESCRIPTION

The West Fork Jimmy Camp Creek drainage basin is a right-bank tributary to Jimmy Camp Creek lying in the west-central portions of El Paso County. The West Fork Jimmy Camp Creek drainage basin covers approximately 4 square miles. Approximately 1.7 square miles are inside the City of Colorado Springs corporate limits. Approximately 1.5 square miles of the basin lies within the City of Fountain corporate limits. The balance of the basin lies within unincorporated El Paso County. The basin is divided into two major sub-basins, the West Fork Jimmy Camp Creek mainstem, and the Drainageway "A" basin. There is one direct flow area to Jimmy Camp Creek also contained within the study area. Figure 1 shows the location of the West Fork Jimmy Camp Creek basin.

Basin Description

The West Fork Jimmy Camp Creek basin covers a total of 4 square miles in unincorporated El Paso County, the City of Fountain and the Colorado Springs, Colorado. Of this total, approximately 0.7 square miles is encompassed by the Drainageway "A" basin, and 2.9 square miles for the mainstem West Fork Jimmy Camp Creek basin. The remainder of the basin is direct flow area (DFA), to Jimmy Camp Creek. The basin trends in generally a south to southeasterly direction, entering Jimmy Camp Creek at approximately one-half mile upstream of Link Road. At this time, approximately 10 percent of the basin is developed. Strong development pressure now exists within the balance of the basin.

The maximum basin elevation is approximately 6,010 feet above mean sea level, and falls to approximately 5,620 feet at the confluence with Jimmy Camp Creek. The headwaters of the basin originate in grassland covered areas of the southeastern portion of the Colorado Springs Municipal Airport property. The surface characteristics of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates. There are three open water storage areas that exist along the West Fork Jimmy Camp Creek and Drainageway "A" channel. These open water areas are remnants of the earlier irrigation facilities associated with the former ranch land operations. The Fountain Mutual Irrigation Canal traverses the basin from southwest to northeast.

Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry.

Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low-pressure cells that draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30°F in the winter to 75° in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils

Surficial soils within the West Fork Jimmy Camp Creek basin vary between hydrologic types B through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant B-soil groupings are in the Stoneham sandy loam, Nelson Tassel fine sandy loam, Ustic Torrifluvents loam, Wiley silt loam, and Fort Collins loam soil associations. The predominant C-soil groupings are in the Razor-Midway complex, Nunn clay loam, and Manzanola loam soil associations. These soils consist of deep, well-drained soils that formed in alluvium and residium, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists.

Property Ownership and Impervious Land Densities

Property ownership along the major drainageways within the West Fork Jimmy Camp Creek basin is mostly private. The only existing developed areas of the basin are the Sunrise Ridge Phase I medium density single-family development and the Peaceful Valley Estates low-density residential development. Both of these developments drain to Drainageway "A", and lie west and east of future Powers Boulevard. Where development has not occurred, the drainageways remain under private ownership and no delineated drainage right-of-ways or easements.

The undeveloped land in the basin is primarily controlled by four major landowners. In the lower portion of the basin, the Cross Creek at Mesa Ridge Development is proposed. This area extends from Marksheffel Road to future Mesa Ridge Parkway (formerly known as Peaceful Valley Road). The Cross Creek at Mesa Ridge property lies within El Paso County. Between Mesa Ridge Parkway and Fontaine Boulevard the Glen at Widefield and the "Singer" properties exist. The "Singer" property, also known as the Crescent Heights Development, lies within the City of Fountain. The Glen at Widefield property lies within unincorporated El Paso County. North of Fontaine Boulevard is the Colorado Centre Development and a small portion of the City of Colorado Springs Municipal Airport. The majority of the area north of Fontaine Boulevard lies within the City of Colorado Springs corporate limits.

Land-use information related to the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure 2 is the proposed land use map that was used in the development of soil curve numbers (i.e., CN-values). Figure 2 is not intended to reflect the future zoning or land use policies of the City(s) or the County. Land-use information for the areas described above were obtained from published drainage reports and master development plans.

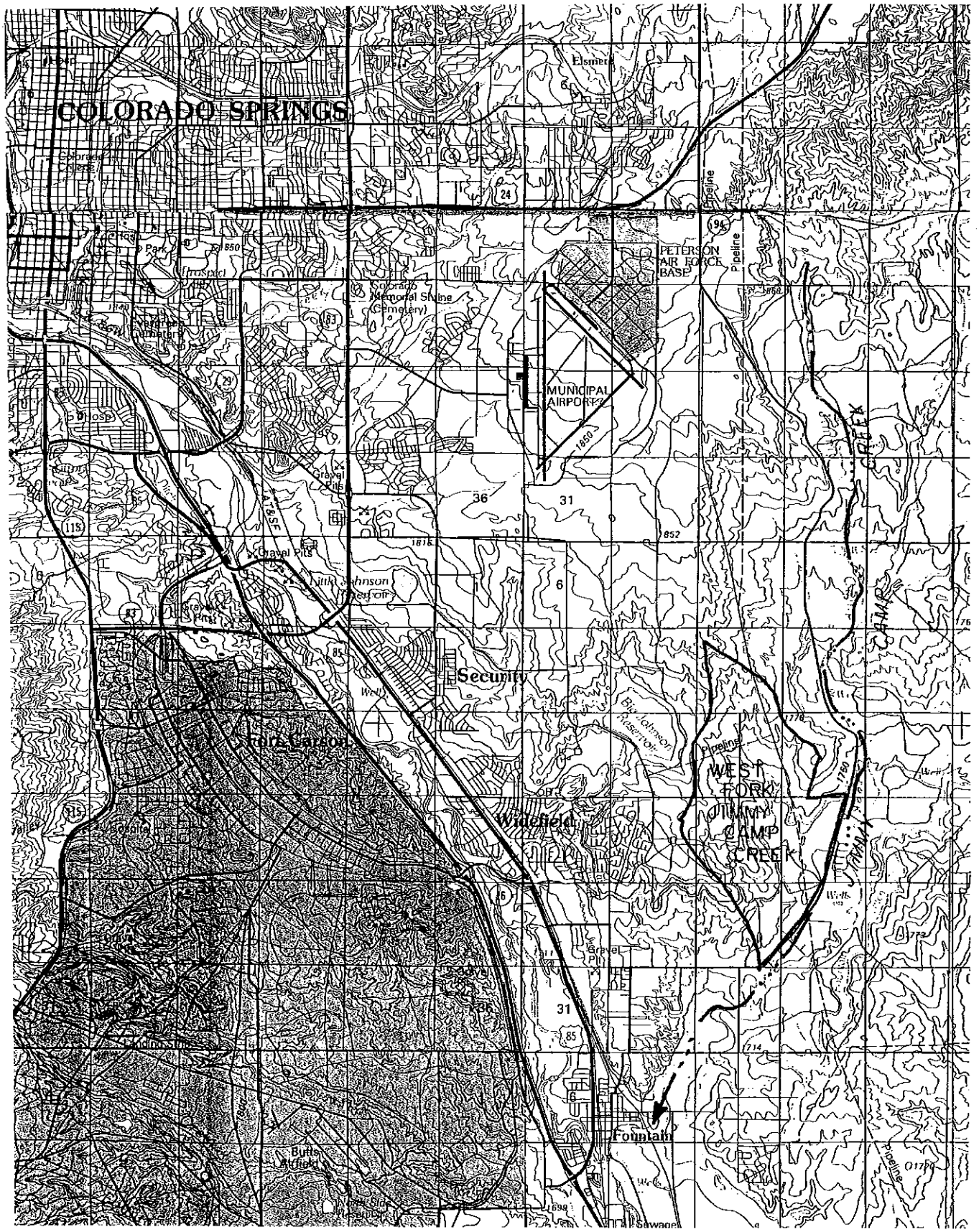

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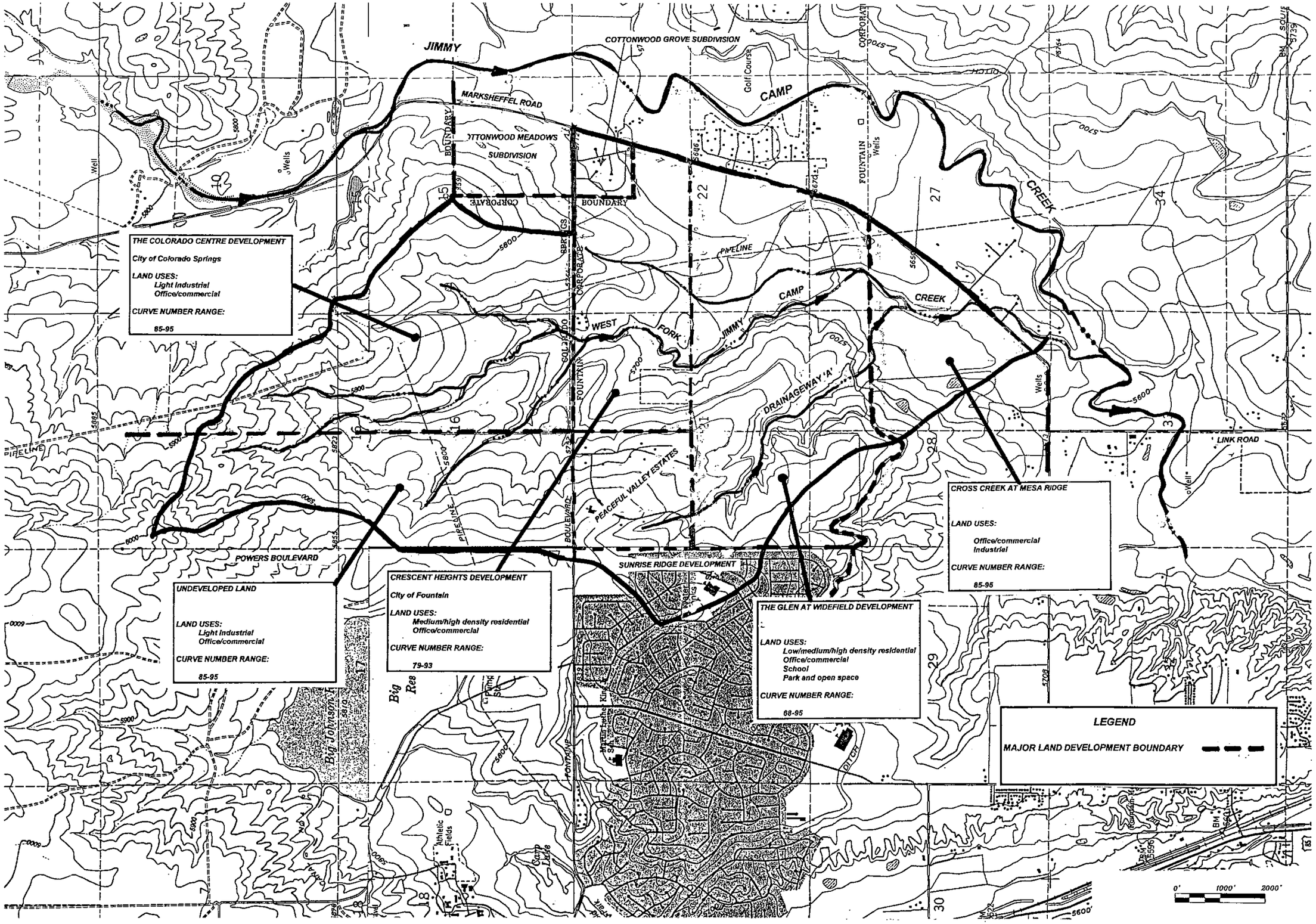
FIGURE 1

VICINITY MAP



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West Fork Jimmy Camp Creek Drainage Basin Planning Study

MAJOR DEVELOPMENT & LAND USE MAP

EL PASO COUNTY, COLORADO

Project No.:	9893
Date:	6/99
Design:	RNW
Drawn:	CAD
Check:	RNW
Revisions:	

FIGURE 2

III. HYDROLOGIC ANALYSIS

A hydrologic analysis was conducted in order to determine peak discharges and runoff volumes for various storm types, and basin development conditions. This data was used in the evaluation of floodplains and in the evaluation of drainageway alternatives. Hydrology has been prepared for the West Fork Jimmy Camp Creek watershed in some of the reports previously referenced. The hydrologic analysis contained within this report has been prepared in conformance with the City/County Storm Drainage Criteria Manual.

Runoff Model

The runoff model used to determine the peak flows and volumes within the study area is the U. S. Army Flood Hydrograph Package (HEC-1), Version 4.1 dated June 1998. The use of this hydrological model is in compliance with the City of Colorado Springs/El Paso County Drainage Criteria Manual.

Basin Characteristics

The study area subject to the hydrologic evaluation is the West Fork Jimmy Camp Creek basin. The basin was broken into sub-basins. Sub-basin numbered in the 2000's lie within the Drainageway A sub-tributary basin. Sub-basins numbered in the 3000's lie within West Fork Jimmy Camp Creek sub-tributary basin. Sub-basins numbered in the 4000's are direct flow areas to Jimmy Camp Creek that abut the West Fork Jimmy Camp Creek basin on the east. Basins numbered in the 5000's lie within the Cross Creek at Mesa Ridge property and are tributary to the mainstem of West Fork Jimmy Camp Creek. .

Basin characteristics such as size, curve numbers (CN-values), basin slope, soils, flow path, time of concentration (Tc), time lag, channel type, slope, flow velocity and size were estimated. These parameters were determined from available topographic, land use and soils maps, and field investigation.

Curve Numbers

Land use for existing and future basin conditions were determined using a combination of zoning maps, City/County Comprehensive Plan(s), development plans, aerial photographs, and other related land use documents. Land use density and corresponding curve numbers were determined in accordance with the City/County Drainage Criteria Manual. Presented on Table 1 is a listing of the Curve Numbers (CN-values) for possible land uses which may occur within the

basin in the future. The Soil Conservation Service (SCS), curve number is an input parameter for the HEC-1 Hydrologic model. Curve numbers for both the existing and future conditions were estimated. The curve numbers applied were compared to the curve numbers used in past studies and report. The curve numbers used to develop the peak discharges summarized in this report compare well with those applied in the referenced reports.

Design Rainfall

In accordance with the City/County Drainage Criteria Manual the 24-hour Type II-A storm with an antecedent moisture condition (AMC) of II was applied in the hydrologic modeling. The 24-hour duration storm events for the 5-year and 100-year recurrence intervals were evaluated. The rainfall depths used in this study were 4.4 inches and 2.5 inches for the 100-year and 5-year frequencies, respectively.

Hydrologic Modeling

The hydrologic model is a series of sub-basins, ranging in size from 60 to 200 acres, linked by drainageways or "routing elements." Presented on Figure 3 (in map pocket) is the Hydrologic Basin Map. Hydrographs are accumulated at design points along the major drainageways. No channel improvements have been assumed for the future condition hydrologic model. The input and output for the HEC-1 computer models are contained within the appendices of this report.

Results

The results of the baseline hydrologic analysis have been presented in several formats. A basin hydrologic map (Figure 3) presents the major basin boundary, sub-basin boundaries and numbers, routing elements, and design points. A summary of flow rates for key design points is presented on Figure 3. Presented on Table 2 is a summary of the sub-basin discharges for existing and future basin conditions. Presented on Table 3 is a summary of the design point discharges for existing and future basin conditions.

The peak discharge data presented in this section of the report and on Figure 3 represent the baseline hydrologic condition, and does not reflect improvements within the basin such as detention or drainageway facilities. Presented in Section VI of this report is peak discharge data for the recommended plan that incorporates the selected improvements for the basin.

The peak discharges at design point 5010 for the existing and developed conditions compare reasonably well with the discharges presented in the Jimmy Camp Creek Drainage Basing Planning Study prepared by Wilson and Company. Differences in sub-basin delineation and flow routing parameters between this study and past hydrology evaluations are responsible for

the variations in peak discharges at comparable design points within the West Fork Jimmy Camp Creek basin.

The hydrology contained in this report is not intended for use in the sizing of storm drainage facilities within individual residential or commercial subdivisions. Hydrology for areas smaller than those sub-basins shown in this report should be determined using the procedures outlined in the City/County Drainage Criteria Manual. The sub-basin boundaries shown on Figure 3 need to be verified using more definitive topographic mapping whenever possible so more exact limits of smaller sub-basin can be more accurately estimated.

Table 1: Land Use Data (1)

Land Use Classification	Percent Impervious	Land Use Density	SCS Curve Number (2)
Residential high density	65-80	10-24 DU/AC	88-94
Residential medium density	45-65	6-10 DU/AC	85-92
Residential medium-low density	40-45	4-6 DU/AC	72-86
Residential low density	20-40	3 DU/AC	68-84
Residential very low	5-20	1-2 DU/AC	66-82
Office/Commercial	80-90	N/A	85-95
Schools	50-70	N/A	75-80
Dedicated Open Space/Park	5-10	N/A	61-80

NOTES:

(1) The above data was used in the preparation of the hydrologic analysis for the West Fork Jimmy Camp Creek Drainage Basin Planning Study. These data are not intended to reflect future land use development criteria within the City of Fountain, City of Colorado Springs or El Paso County.

(2) The curve number applied depends upon hydrologic soil type. Curve number range on this table represents SCS Hydrologic Soils Groups B through D.

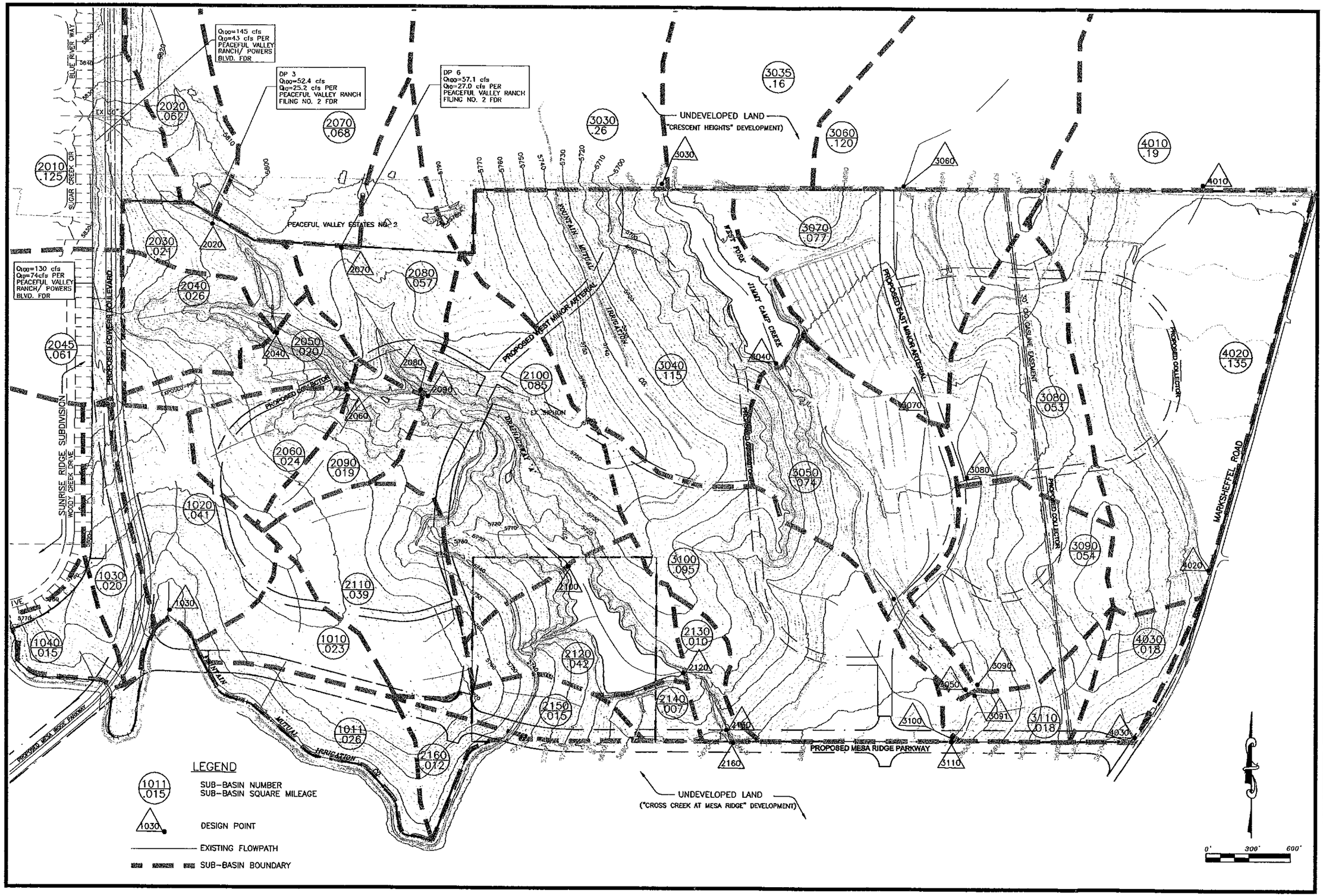
TABLE 2: SUMMARY OF SUB- BASIN DISCHARGES

WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SUB-BASIN	EX/FUT DRAINAGE	EX/FUT DRAINAGE	EXISITING CONDITION (cfs)		FUTURE CONDITION (cfs)	
NUMBER	AREA (sm)	AREA (ac)	5 YR	100 YR	5 YR	100YR
2010	0.125	80.0	40	142	40	142
2020	0.062	39.7	9	47	19	68
2030	0.021	13.4	5	22	6	24
2040	0.026	16.6	5	26	7	29
2045	0.061	39.0	48	124	48	124
2050	0.020	12.8	4	17	4	19
2060	0.024	15.4	5	24	8	30
2070	0.068	43.5	8	44	17	65
2080	0.057	36.5	12	58	15	64
2090	0.019	12.2	3	14	5	19
2100	0.095	60.8	13	64	24	89
2110	0.034	21.8	6	29	8	33
2120	0.047	30.1	9	45	9	45
2130	0.010	6.4	2	11	2	11
2140	0.007	4.5	2	4	2	9
2150	0.015	9.6	6	20	6	21
2160	0.012	7.7	8	18	17	35
3000	0.420	268.8	140	474	190	568
3005	0.240	153.6	107	347	144	407
3010	0.220	140.8	81	288	138	383
3012	0.210	134.4	54	199	94	272
3015	0.110	70.4	55	181	75	212
3020	0.190	121.6	69	231	204	428
3025	0.260	166.4	82	324	347	712
3030	0.260	166.4	65	262	116	361
3035	0.160	102.4	63	234	106	306
3040	0.115	73.6	23	110	31	129
3050	0.049/074	31.4/47.4	18	61	56	136
3060	0.119	76.2	48	163	63	189
3070	0.077	49.3	23	78	27	87
3080	0.050	32.0	16	58	23	68
3090	0.082/.05	52.5/32.0	27	93	21	67
3100	0.095	60.8	35	123	61	166
3110	0.018	11.5	5	17	14	31
4010	0.190	121.6	38	153	108	279
4020	0.135	86.4	26	90	39	114
4030	0.018	11.5	7	25	20	44
5010	0.156	99.8	35	133	101	246
5020	0.200	128.0	52	200	1514	362

TABLE 3: SUMMARY OF DESIGN POINT DISCHARGES
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DESIGN POINT NUMBER	EX/FUT DRAINAGE AREA (sm)	EX/FUT DRAINAGE AREA (acres)	EXISITING CONDITION 5 YR cfs	EXISITING CONDITION 100 YR cfs	FUTURE CONDITION 5 YR cfs	FUTURE CONDITION 100YR cfs
2020	0.190	121.6	47	189	57	210
2040	0.300	192.0	97	335	109	362
2060	0.340	217.6	105	372	120	406
2080	0.130	83.2	17	88	28	113
2090	0.480	307.2	123	473	152	535
2100	0.610	390.4	140	558	181	651
2120	0.660	422.4	148	600	189	692
2130	0.670	428.8	145	594	186	687
2160	0.700	448.0	151	624	196	723
3000	0.660	422.4	147	233	317	935
3020	1.650	1056.0	528	1857	1059	2737
3030	2.070	1324.8	601	2216	1209	3267
3040	2.180	1395.2	618	2316	1239	3364
3050	2.26/2.23	1446/1427	627	2351	1275	3444
3070	0.200	128.0	67	235	86	270
3080	.25/.05	160/32	82	290	23	72
3090	.33/.11	211/70	106	373	44	138
3091	2.560	1638.4	732	2722	1380	3843
3100	2.660	1702.4	757	2828	1428	3990
3110	2.670	1708.8	761	2845	1442	4022
4020	0.320	204.8	63	238	145	383
5010	3.730	2387.2	943	3550	1722	4904



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West Fork Jimmy Camp Creek Drainage Basin Planning Study

HYDROLOGIC SUB-BASIN MAP

EL PASO COUNTY, COLORADO

Project No.:	9893
Date:	7/00
Design:	RNW
Drawn:	CAD
Check:	RNW
Revisions:	

FIG.3A

IV. HYDRAULIC ANALYSIS AND FLOODPLAIN DESCRIPTION

A hydraulic analysis was conducted to ascertain the conveyance capacity of existing hydraulic structures along the major drainageways of the West Fork Jimmy Camp Creek Basin. Field verifications of roadway crossings and existing channel improvements were conducted and the general physical condition of the structure(s) noted. In some areas of the basin, a hydraulic analysis was conducted using the U. S. Army Corps of Engineers (COE) HEC-2 water surface profile program.. Cross section data for the areas analyzed were obtained by using the two-foot contour interval planimetric topographic mapping compiled in 1997 for the Glen at Widefield property. The future condition 100-year peak discharge data shown on Table 3 was used in the estimation of the 100-year flood profiles through the Glen at Widefield property.

The capacity of the existing roadway crossing culverts structures were estimated using the HYDRAIN culvert modeling program. The 5- and 100-year existing condition flow rates were used in determining whether or an existing culvert was judged to have adequate capacity.

The West Fork Jimmy Camp Creek floodplain has been included within the City of Colorado Springs and El Paso County Flood Insurance Study (FIS), from its confluence with Jimmy Camp Creek to Fontaine Boulevard. No other tributaries to the West Fork have been studied in the FIS. The floodplain data and associated base flood elevations presented in the FIS is used in the regulation of the floodplain as it relates to the County's participation in the National Flood Insurance Program. The floodplains developed in this report are not intended to replace the FIS data and are only being used to determine the area along the drainageways which would be prone to flooding in the 100-year event.

Hydraulic Structure Inventory

As part of the field investigation, the existing drainage facilities were verified and inventoried. The size, type, and condition was recorded for all the bridges, culverts, channels, inlets, pipes, and miscellaneous drainage features in the basin. Hydraulic capacities were estimated for the culverts and bridges over the major drainageways. An inventory of the roadway crossings along the major drainageways is presented on Table 4. The hydraulic capacity of crossings was calculated for a headwater to depth ratio of 1.2. Culvert capacity was assumed to be reached when the 100-year, future condition undetained discharge overtopped the culvert. The location of the structures listed on Table 4 is shown on Figure 4.

The physical condition of the major drainageways was reviewed in the field and using existing topographic mapping. Presented on Table 5 is a summary of the major drainageway characteristics. A description of each drainageway segment follows. The locations of the segments are presented on Figure 4.

West Fork Jimmy Camp Creek Drainageways

Segment 5010: This segment is the outfall drainageway to Jimmy Camp Creek. The channel cross-section is poorly defined and passes through a low density residential area. The drainageway is fully contained with the Jimmy Camp Creek floodplain. This segment of channel is currently stable and generally well vegetated. No base flow exists. The existing channel slope is estimated at 0.3 percent.

Segment 3110: This segment passes though the proposed Cross Creek at Mesa Ridge development. The channel cross-section is poorly defined and has no apparent base flow. The drainageway has a wide but shallow floodplain. This segment of channel is currently stable and generally well vegetated. The existing channel slope is estimated at 0.6 percent.

Segment 3030: This segment passes though the proposed Glen at Widefield development. The channel well defined and has a base flow. The drainageway has a generally narrow floodpla except at the outfall point to segment 3110. Within this segment is an embankment which stores water behind it, but has limited flood storage capacity above the mean water surface. It is believed that this impoundment is fed by groundwater and irrigation seepage. There is no record of this impoundment at the State Engineer's office. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 0.7 percent.

Segment 3020: This segment passes though the proposed Crescent Heights development. The channel well defined and has a base flow. The drainageway has a generally narrow floodplain with depths ranging from two to four feet. As in segment 3030, this segment is an embankment which stores water behind it, but has limited flood storage capacity above the mean water surface. It is believed that this impoundment is fed by groundwater and irrigation seepage. There is no record of this impoundment at the State Engineer's office. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 0.8 percent.

Segment 3000: This segment is contained within the Colorado Centre development. The channel well defined and has no base flow. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 1.0 percent.

Segment 3010: This segment is contained within the Colorado Centre development. The channel well defined and has no base flow. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 1.0 percent.

Segment 3021: This segment is contained within the Colorado Centre development. The channel well defined and has no base flow. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 0.8 percent.

Drainageway "A" Drainageways

Segment 2160: This segment outfalls to West Fork Jimmy Camp Creek. This segment lies within the proposed Cross Creek development. The channel cross-section is poorly defined. This segment of channel is currently stable and generally well vegetated. No base flow exists. The existing channel slope is estimated at 2.6 percent.

Segment 2090: This segment passes though the proposed Glen at Widefield development. The channel well defined and has a base flow. The drainageway has a generally narrow floodplain with depths ranging from two to four feet. Within this segment is an embankment which stores water behind it, but has limited flood storage capacity above the mean water surface. It is believed that this impoundment is fed by groundwater and irrigation seepage. The impoundment lies within a parcel of land owned by the Fountain Mutual Irrigation Company. There is no record of this impoundment at the State Engineer's office. This segment of channel is currently stable and well vegetated. The existing channel slope is estimated at 1.8 percent.

Fountain Mutual Irrigation Ditch

The Fountain Mutual Irrigation ditch traverses the study area in generally a southwest to northeast direction. The ditch crosses through portions of the proposed Cross Creek at Mesa Ridge, the Glen at Widefield and the Crescent Heights developments. There is one siphon along the ditch within the study area which takes the flow in the ditch under Drainageway A, just downstream of design point 2090. As part of the drainage planning for the West Fork Jimmy Camp Creek basin, it was assumed that the irrigation ditch would convey only the adjudicated

water right through the basin. Existing and proposed runoff was assumed to be passed over or under the ditch in the hydrologic modeling of the basin. There was no diversion of runoff by the ditch assumed in compilation of the hydrologic model for this basin.

Floodplains

Floodplains for the 100-year existing condition discharge have been delineated for the West Fork Jimmy Camp Creek within the Colorado Springs and El Paso County Flood Insurance Study (FIS). Shown on Figure 5 is the FIS floodplain and base flood elevation data. There are no other drainageways within this basin which have been studied by FEMA. As part of the Master development drainage planning process the floodplains along the major drainageways should be determined. Channel improvements along the West Fork Jimmy Camp Creek which would alter the floodplain information as developed by FEMA would require the preparation of the a Letter of Map Revision in accordance with FEMA technical criteria and specifications.

There are not any significant areas of existing flood hazard within the basin mainly because of the undeveloped nature of the basin and because the drainageways are unencroached at this time. Some damage could occur to roadway crossings wherever culverts lack sufficient capacity to convey the runoff reaching them without overtopping the roadway. The affect of development within the basin will be to generally increase runoff rate, frequency and velocity along the major drainageways.

TABLE 4: SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS

WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	CULVERT #	SIZE	TYPE	PROPOSED FLOW Q5 (cfs)	PROPOSED FLOW Q100 (cfs)	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
FONTAINE BLVD	3000-1	12'x28'	CBC	770	1,970	ADEQUATE	ADEQUATE	STRUCTURE HAS ADEQUATE CAPACITY TO PASS THE PROPOSED 100-YEAR FLOW
FONTAINE BLVD	3010-1	36"x54"'	CMP ARCH	N/A	N/A	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-1	30"	CMP	530	1,100	INADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
FONTAINE BLVD	3020-2	36"x54"'	CMP ARCH	NA	NA	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-3	30"	CMP	N/A	N/A	ADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
MARKSHEFFEL ROAD	5010-1	36"	CMP	1,700	4,830	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
MARKSHEFFEL ROAD	5020-1	36"	CMP	150	360	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
POWERS BOULEVARD	2010-1	30"	CMP	40	142	ADEQUATE	ADEQUATE	CULVERT TO BE REPLACED WITH CONSTRUCTION OF POWERS BOULEVARD
MARKSHEFFEL ROAD	4010-1	N/A	DETENTION BASIN	N/A	N/A	ADEQUATE	ADEQUATE	DETENTION BASIN SERVES THE COTTONWOOD GROVE SUBDIVISION
MARKSHEFFEL ROAD	4020-1	36" (est)	CMP	145	383	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED

TABLE 5: SUMMARY OF HYDRAULIC STRUCTURES - DRAINAGEWAYS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	SEGMENT #	SLOPE (Percent)	TYPE	100-YEAR FLOW RANGE Qex (cfs)	Qfut (cfs)	COMMENTS
WEST FORK JIMMY CAMP CREEK						
JIMMY CAMP CREEK TO MARKSHEFFEL ROAD	5010	0.3	UNIMPROVED	3,590	4,830	DRAINAGEWAY OUTFALLS TO JIMMY CAMP CREEK
MARKSHEFFEL ROAD TO MESA RIDGE PARKWAY	3110	0.6	UNIMPROVED	2,860-3,590	3,390-4,830	WIDE AND SHALLOW FLOODPLAIN
MESA RIDGE PARKWAY TO N PL OF THE GLEN	3030	0.7	UNIMPROVED	2,275-2,860	3,190-3,390	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES
NORTH PL OF THE GLEN TO FONTAINE BOULEVARD	3020	0.8	UNIMPROVED	1,930-2,275	2,710-3,190	
FONTAINE BLVD TO STUDY LIMITS	3000	1.0	UNIMPROVED	880	1,050	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3010	1.0	UNIMPROVED	480	640	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3021	0.8	UNIMPROVED	620	1,100	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
DRAINAGEWAY A						
CONFLUENCE WITH WEST FORK JIMMY TO LAKE	2160	2.6	UNIMPROVED	620	720	
LAKE TO DESIGN POINT DP2040	2090	1.8	UNIMPROVED	335-620	360-720	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES

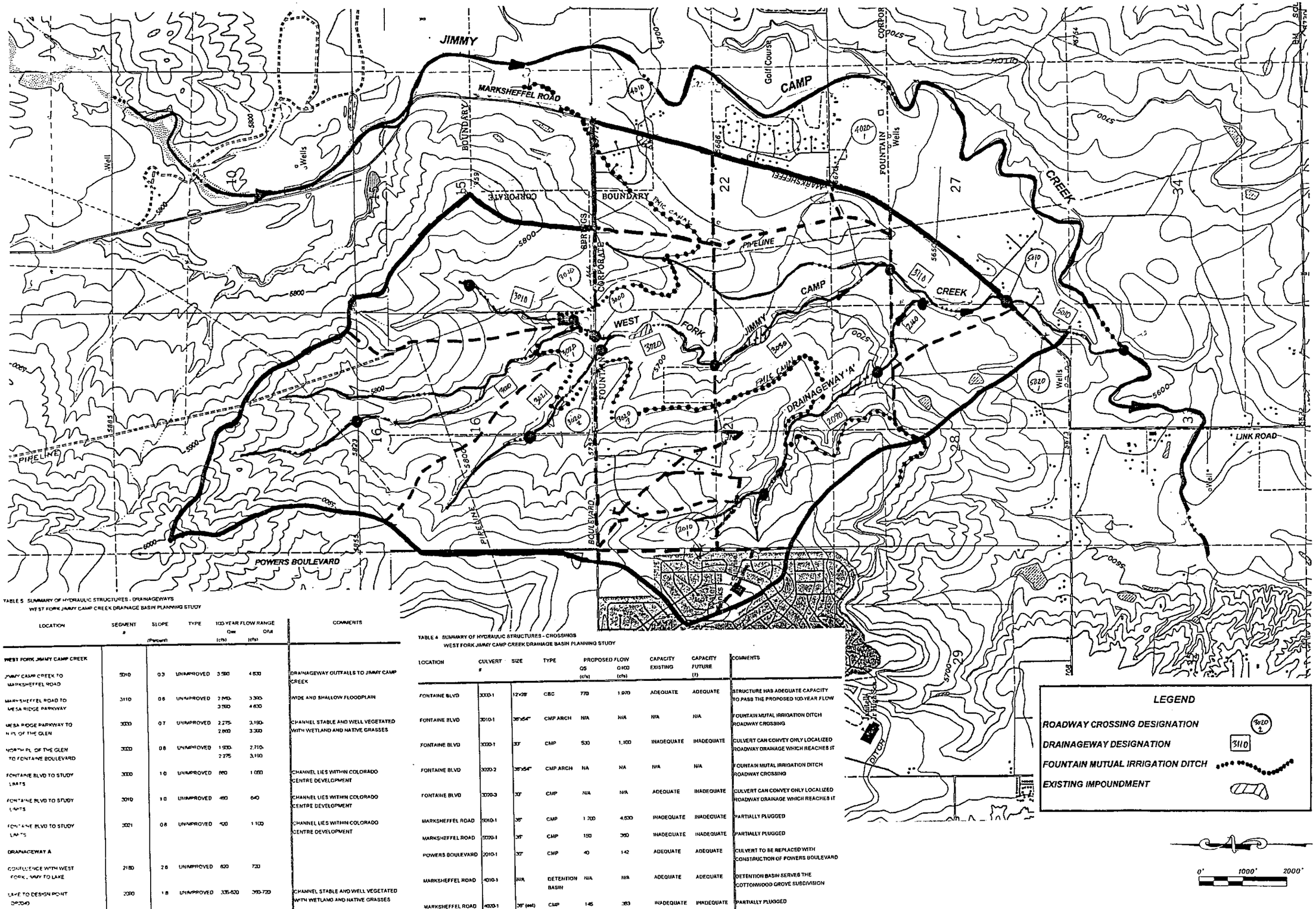

TABLE 5 SUMMARY OF HYDRAULIC STRUCTURES - DRAINAGEWAYS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	SEGMENT #	SLOPE (Percent)	TYPE	100-YEAR FLOW RANGE Qmin (cfs)	Qmax (cfs)	COMMENTS
WEST FORK JIMMY CAMP CREEK						
JIMMY CAMP CREEK TO MARKSHEFFEL ROAD	5010	0.3	UNIMPROVED	3,580	4,630	DRAINAGEWAY OUTFALLS TO JIMMY CAMP CREEK
MARKSHEFFEL ROAD TO MESA RIDGE PARKWAY	3110	0.6	UNIMPROVED	2,960-3,550	3,300-4,630	WIDE AND SHALLOW FLOODPLAIN
MESA RIDGE PARKWAY TO N'PL OF THE GLEN	3030	0.7	UNIMPROVED	2,275-2,860	3,180-3,300	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES
NORTH PL OF THE GLEN TO FONTAINE BOULEVARD	3020	0.8	UNIMPROVED	1,930-2,275	2,710-3,180	
FONTAINE BLVD TO STUDY LIMITS	3000	1.0	UNIMPROVED	860	1,050	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3010	1.0	UNIMPROVED	480	640	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
FONTAINE BLVD TO STUDY LIMITS	3021	0.8	UNIMPROVED	420	1,100	CHANNEL LIES WITHIN COLORADO CENTRE DEVELOPMENT
DRAINAGEWAY A						
CONFLUENCE WITH WEST FORK, WWY TO LAKE	2180	2.6	UNIMPROVED	620	720	
LAKE TO DESIGN POINT DP2040	2030	1.8	UNIMPROVED	335-620	360-720	CHANNEL STABLE AND WELL VEGETATED WITH WETLAND AND NATIVE GRASSES

TABLE 4 SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	CULVERT #	SIZE	TYPE	PROPOSED FLOW Q5 (cfs)	Q100 (cfs)	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
FONTAINE BLVD	3000-1	12'x28'	CBC	770	1,970	ADEQUATE	ADEQUATE	STRUCTURE HAS ADEQUATE CAPACITY TO PASS THE PROPOSED 100-YEAR FLOW
FONTAINE BLVD	3010-1	38"x54"	CMP ARCH	N/A	N/A	N/A	N/A	FOUNTAIN MUTUAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-1	30"	CMP	530	1,100	INADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
FONTAINE BLVD	3020-2	38"x54"	CMP ARCH	N/A	N/A	N/A	N/A	FOUNTAIN MUTAL IRRIGATION DITCH ROADWAY CROSSING
FONTAINE BLVD	3020-3	30"	CMP	N/A	N/A	ADEQUATE	INADEQUATE	CULVERT CAN CONVEY ONLY LOCALIZED ROADWAY DRAINAGE WHICH REACHES IT
MARKSHEFFEL ROAD	5010-1	36"	CMP	1,700	4,630	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
MARKSHEFFEL ROAD	5020-1	36"	CMP	150	360	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED
POWERS BOULEVARD	2010-1	30"	CMP	40	142	ADEQUATE	ADEQUATE	CULVERT TO BE REPLACED WITH CONSTRUCTION OF POWERS BOULEVARD
MARKSHEFFEL ROAD	4010-1	N/A	DETENTION BASIN	N/A	N/A	ADEQUATE	ADEQUATE	DETENTION BASIN SERVES THE COTTONWOOD GROVE SUBDIVISION
MARKSHEFFEL ROAD	4020-1	36" (est)	CMP	145	353	INADEQUATE	INADEQUATE	PARTIALLY PLUGGED

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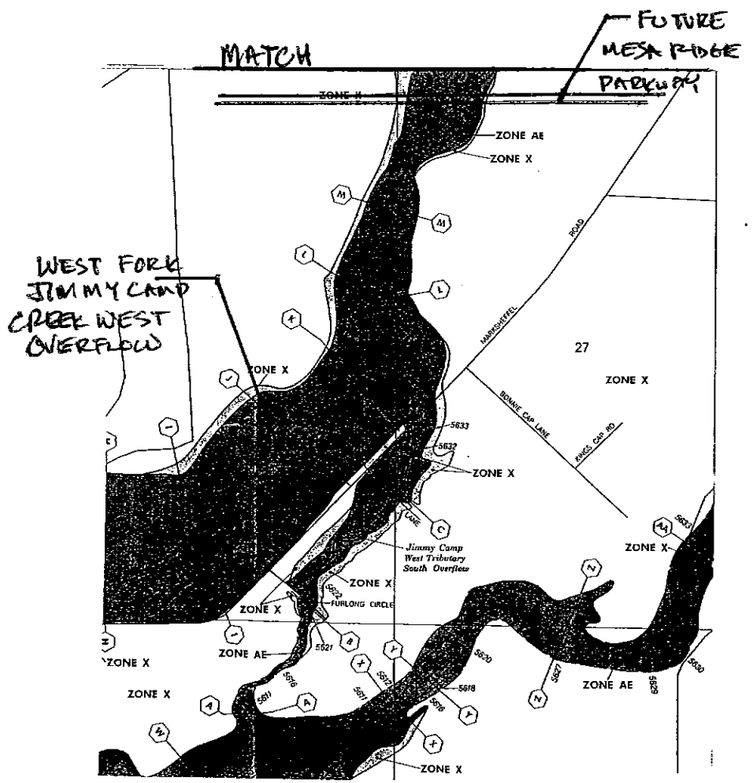
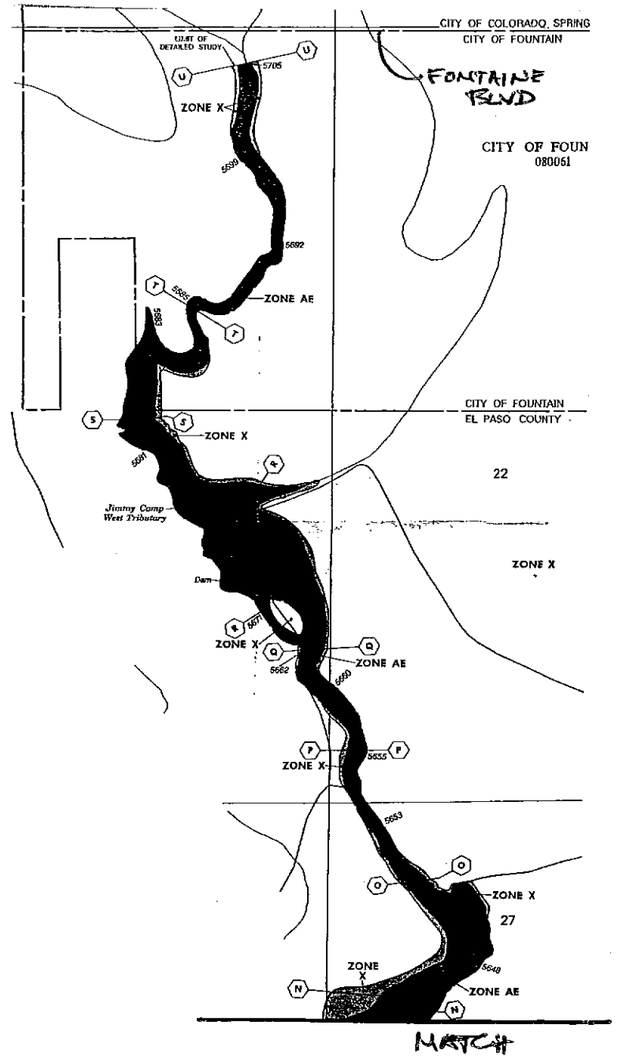
Colorado Springs, Colorado
80910-3127
(719) 630-7342

West Fork Jimmy Camp Creek
Drainage Basin Planning Study
INVENTORY OF EXISTING DRAINAGE STRUCTURES
EL PASO COUNTY, COLORADO

Project No.:	9893
Date:	6/99
Design:	RNW
Drawn:	CAD
Check:	RNW
Revisions:	

FIGURE 4





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SCALE 1"=1000'

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West Fork Jimmy Camp Creek
Drainage Basin Planning Study
FLOOD INSURANCE STUDY FLOODPLAINS
EL PASO COUNTY, COLORADO

Project No.:	9893
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Drawn:	CAD
Check:	RNW
Revisions:	

FIG.5

V. EVALUATION OF ALTERNATIVES

Introduction

Alternative drainageway improvement concepts have been examined that address the existing and future stormwater management needs of the basin. Quantitative and qualitative comparisons are presented, and a recommendation made as to which concepts are most feasible to advance to preliminary design and eventually implementation.

The general planning goals to be achieved during the alternative evaluation phase were:

1. Identify stormwater facilities that will reduce existing floodplains and flooding problems within urbanized areas;

2. Provide stormwater management within developing areas of the basin in order to reduce the detrimental effects of runoff and sedimentation from disturbed areas;

3. Provide stormwater facilities that preserve and/or enhance the existing drainageway and areas adjacent to the drainageway that provide an environmental resource in the area;

4. Identify facilities which will minimize future operations and maintenance costs; and

5. Provide stormwater management facilities that will at least maintain and/or enhance the water quality characteristics of the basin.

The City/County Drainage Criteria Manual was used as a guide in the conceptual sizing of facilities. Planning goals were developed through the agency/individual coordination process.

Evaluation Parameters

The following list of parameters were considered when evaluating alternatives for addressing the long-term stormwater management needs for the basin:

- Flood Control
- Erosion Control
- Operation and Maintenance
- Recreation
- Right-of-way
- Transportation - Roadway and Trails
- Open Space/Aesthetics
- Land Use
- Water Quality
- Habitat
- Construction Cost
- Administration and Implementation

By reviewing the relative impact of future storm water runoff upon the major drainageways, each of the above evaluation parameters can be ranked. A minimal impact was assumed wherever the increase of runoff due to urbanization would cause little physical change

along the drainageways with respect to a specific parameter. Neutral impact upon a given parameter was considered wherever the negative effects of increased runoff due to urbanization can planned and mitigated for. High impact was considered wherever the existing channel section would be rendered unsuitable to provide for a given parameter in the future flow condition. Using data gathered with respect to flood hazard, habitat, erosion control, open space, transportation (more specifically trails), and right-of-way, conceptual alternatives were compared.

Environmental Resource Review

An environmental resource review was conducted for the major drainageways of the West Fork Jimmy Camp Creek basin. The resource review was conducted using aerial photographs of the basin and field visits to view areas of significant environmental resource. The most significant factors that have created the existing vegetative setting along the major drainageway (i.e., the West Fork and Drainageway A), has been the irrigation facilities and the land uses within the basin. Irrigation facilities that lie within basin include the Fountain Mutual Irrigation Ditch and two open water storage areas that lie below the irrigation canal. Seepage from the ditch as well as from the lakes is the source of the water supply that has created and supported wetland areas along some of segments of Drainageway A. Previous agricultural land use within the basin has changed the native vegetative cover due to over grazing and cultivation. Large areas of non-native vegetation ahs developed over the years along the drainageway and significant area of weed infestation has occurred. It was also noted while viewing historic photographs of the basin that the some of the wetland vegetation that has developed along Drainageway A has occurred after the development of the land that lies west of Powers Boulevard. It is suspected that lawn watering within these areas has contributed to the groundwater resources that support the growth of the wetland vegetation.

Two open water lakes exist within the basin. One occurs along segment 2160 of Drainageway A, north of future Mesa Ridge Parkway, and the other along segment 3040 of the West Fork Jimmy Camp Creek. Historically these lakes were used as a water supply to support the agricultural use of the land. At the perimeter and for three to four hundred feet upstream of the lakes, significant medium to high quality wetland and riparian zones exist. It is the intent of the landowner of the property adjacent to an upstream of these lakes to leave the lakes and the drainageways that outfall to them as open space.

Wetland and riparian zones were identified along segments 2090, 2050 and 2040 of Drainageway A. Wetland and riparian zones were identified along segments 3110, 3090, 3040, and 3030 of the West Fork Jimmy Camp Creek drainageway. The only other wetland resource identified occurs just north of Fontaine Boulevard, and below the Fountain Mutual Irrigation

Ditch. It is likely that disturbance and/or encroachment into these areas resulting from land development activities will require notification of the U. S. Army Corps of Engineers and probably the issuance of a 404 permit. Because of the quality and extent of the wetland and riparian areas the 404 permitting of drainageway improvements to handle the anticipated increase in runoff due to urbanization will have to consider avoidance and minimization of impact in the development of channel and detention basin alternatives.

Preliminary Matrix of Conceptual Alternatives

The alternative planning process included the evaluation of general drainageway planning concepts. The alternatives that are generally available when planning stormwater management facilities include:

1. Floodplain preservation (do nothing alternative),
2. Channelization, using various materials and of varying capacity,
3. Detention, on-site or regional,
4. Selective stabilization, and
5. Combinations of the above.

These concepts were qualitatively evaluated for each of the major drainageways and to some to degree within each of the major land development parcels presented on Figure 2. The qualitative assessments were made using the information gathered in the field and from past or ongoing drainage assessments for areas within the West Fork Jimmy Camp Creek basin. A table that summarizes the qualitative evaluation of impacts is contained within Appendix B of this report.

Drainageway System Alternatives

A review of each drainageway alternative with respect to the evaluation parameters listed earlier was conducted. Based upon the technical work and field visits the alternative drainage concepts were developed. Alternatives for floodplain and channel sections and detention facilities have been evaluated.

Detention

As presented in the Hydrology Section of this report, it has been estimated that peak discharges and volumes will increase significantly along the major drainageways of the West Fork Jimmy Camp Creek as a result of urbanization within the basin. Another impact that urbanization will have upon the basin hydrology is that "everyday" rainfall events will increase in their peak rates of runoff, frequency, and duration. This will create greater instability in the existing channel

sections as well as increase flood hazards if the runoff is allowed to flow through the basin in the developed condition. Detention schemes were analyzed in the alternative planning process in order to address this situation. Because of the high level of urbanization that has been assumed for this basin, increases in peak flows for the frequencies analyzed can double or triple. The increase in runoff becomes a significant burden for those properties lying low in the basin, such as the Glen at Widefield and the Cross Creek at Mesa Ridge developments. At this time the City of Fountain requires detention to limit flows to downstream drainageways to historic levels.

Two distinct types of detention can be considered within this basin. One form of stormwater detention is onsite detention. Onsite detention is accomplished within a single subdivision or within each developed parcel. Onsite detention basins are generally small with 100-year storage volumes typically less than two to three acre-feet. These detention basins typically discharge to storm sewer system or collector channels that in turn discharge to the major drainageways. One of the negative aspects of this concept is that the detention basins present a long-term maintenance responsibility to private property owners and for the local agencies that may provide for stormwater facility maintenance. In Colorado Springs and El Paso County, onsite detention basins have generally been categorized as a private drainage facilities and the long-term maintenance is left up to the property owner(s). There is currently one onsite detention facility in the basin within the Cottonwood Grove Subdivision.

The other form of detention is regional stormwater detention. Regional detention basins usually serve a greater drainage area and many times more than one property. Regional detention basins have storage volumes in excess of 5-acre feet. Regional detention basins can be constructed along of off of the main drainageways. Whether on stream or off stream regional detention basins are to be considered depend upon the total flow volume, site availability and peak flow rates. For the West Fork Jimmy Camp Creek basin, on stream detention facilities are feasible within the upper portions of the West Fork Jimmy Camp Creek (i.e., above Fontaine Boulevard), and along Drainageway A. In the lower reaches of the West Fork Jimmy Camp Creek drainageway, the use of on stream detention is not as feasible since site availability is limited.

Based upon the qualitative review of impacts, it is recommended that regional detention be considered over onsite detention. The primary reasons for this recommendation is founded on the environmental impact, maintenance and ownership aspects associated with stormwater detention. Regional detention facilities are less maintenance intensive compared to onsite facilities simply because of there would be fewer regional detention basins required. Regional detention basins have greater accessibility with respect to maintenance and can be designed to be physically more open and broad in their design. Regional detention basins can also offer a resource to the area in regard to open space dedication and wetland mitigation areas if necessary. For the West Fork Jimmy Camp Creek basin, regional detention may be a more feasible solution to implement owing

to the fact that there are a limited number of major developments within the basin which will develop at their own pace. Once a regional detention facility was established, a greater area of development can then proceed without being encumbered by the construction of small onsite facilities.

Floodplain Preservation

This concept involves the preservation of the natural floodplains in combination with the provision of open space buffer adjacent to the urbanized area. This concept works well wherever the floodplain and channel area is well defined and stable with respect to vegetative invert and bank linings. Within the West Fork Jimmy Camp Creek basin, channel segments 3030, 2090, 3000, 3010 and 3021 each have characteristics that make the implementation of a floodplain preservation concept feasible. These channels and floodplains are well defined and naturally stabilized with native vegetation. For channels 5010, 3110, 3020 and 2160 floodplain preservation is less feasible due to the poor channel definition that presently characterizes these segments. This situation is most evident in segments 5010, 3110 and 2160 where the 100-year floodplain is very wide and uncontained by the existing banks of the drainageway.

The implementation of a floodplain preservation plan can not be considered without the assumption that the channel invert will remain stable. To achieve this grade control structures need to be constructed an interval that depends upon the existing stream gradient and the invert soils. Selective area of bank lining may also be required to implement a floodplain preservation concept. Lining of the low flow area of the floodplain on one or both sides may be necessary at outside bends and at the inlet and outlet of culverts and bridges.

Channelization

This concept would involve the construction of lined channels generally trapezoidal in shape. Riprap lined channels are the most common lining material. Within the West Fork Jimmy Camp Creek basin, channel segments 5010, 3110, 3020 and 2160 have the greatest feasibility for channelization due to the reasons pointed out above. Grade control structures to maintain the channel invert at constant and stable gradient would be required.

Conclusions

Based upon the qualitative alternative evaluation process, the following findings were established:

1. Detention is a desirable and feasible alternative to addressing the future stormwater management needs of the basin. The primary advantages of the implementation of a regional detention concept are in the areas of floodplain hazard and damage reduction,

reduction in channel and roadway crossing costs, habitat preservation, and in open space. Disadvantages with the concept are in the areas of implementation and detention basin right-of-way or land acquisition issues.

2. Feasible channel alternatives for the major drainageway range from the floodplain preservation, or "do nothing" alternate to riprap bank linings. Along the West Fork Jimmy Camp Creek drainageways, floodplain preservation is feasible in segments 3030, 2090, 3000, 3010 and 3021. The implementation of the floodplain preservation concept will maintain the existing floodplains and natural vegetation which is presently keeping the channel bank and invert stable. Proposing to channelize these segments may result in permitting or environmental concerns by the 404 review agencies. Grade control structures to stabilize the drainageways will be required to address the potential for stream invert degradation that can occur because of increased runoff volumes due to urbanization.

3. Channelization is feasible within segments 5010, 3110, 3020 and 2160. Grade control structures to stabilize the invert of the channel will be required. The channelization of segments 5010 and 3110 would result in significant reductions in the extent of the 100-year floodplain.

VI. SELECTED PLAN

The results of the drainage basin planning analysis are summarized in this section. The alternative drainage concepts have been quantitatively and qualitatively evaluated. Field visits have been conducted in order to refine the channel treatments suggested for use along drainageways of the West Fork Jimmy Camp Creek basin. The conceptual plan for the recommended alternatives is shown on Figure 6 contained at the map pocket at the rear of this report.

Criteria

The City of Colorado Springs, El Paso County Drainage Criteria Manual was used in the development of the typical sections and plans for the major drainageways within the Basin. The City/County manual was supplemented by various criteria manuals with more specific application. These were:

1. Urban Storm Drainage Criteria Manual, Volumes I, II, and III, prepared by the Urban Drainage and Flood Control District.

The design plans and report for the Powers Boulevard extension through the basin were reviewed in order to prepare the conceptual design plans. The master land development plans for the Cross Creek at Mesa Ridge, The Glen at Widefield, and the Crescent Heights developments were reviewed and taken into account in the selection of the channel sections and detention basin locations. Hydrologic data prepared for the Colorado Centre contained in the Jimmy Camp Creek Drainage Basin Planning Study prepared by Wilson & Company was reviewed and incorporated into this plan.

The general design criteria followed for the sizing of the facilities shown on Figure 6 were:

1. Average channelized velocity for riprap channels: 7 feet per second
2. Maximum 100-year channel depth: 5-feet
3. Degraded channel slope: One-half of existing slope
4. Maximum culvert headwater to depth ratio: 1.2
5. Bridge velocity: 10 feet per second
6. Maximum height of detention basin embankment: 10-feet

Hydrology

Presented on Table 6 is the selected detention basin plan hydrologic data to be used for the sizing of major drainageway improvements within the Basin. **Peak flow rates for the 5- and 100-year frequency incorporating and the regional detention alternative for the West Fork Jimmy Camp Creek Basin are summarized for key points along the major drainageways.** Contained within the appendices of this report are the HEC-1 input and output data for the baseline and detention basin hydrologic conditions.

Land development activities may alter the location of design points along the drainageways and therefore slight alteration in a sub-basin's characteristics such as length, slope and area may occur. The methods outlined in the City/County Drainage Criteria Manual should be applied during master development and final development drainage plan phases.

Channels

The recommended channel sections for each reach of drainageway has been presented on Sheets 1 through 7 at the rear of this report. In general, the banks of the West Fork of Jimmy Camp Creek within segments 5010, 2160, 3110 and 3020 are to be lined with riprap to 100-year flow depth. Within segments 3030, 2090, 3000, 3010, and 3021 the drainageway low flow areas should have selectively lined riprap bank protection such as at outside bends, at bridge or culvert outlets, and at the confluence with side tributaries. In conjunction with the selective improvement measures, the 100-year floodplain should be preserved and regulated.

Check Structures

Check structures have been sited along the drainageways in order to maintain the channel invert at a stable gradient. A degraded slope of no more than one-half of the existing slope was assumed when estimating the number of check structures needed along a given segment. The checks have been conceptually designed to allow for a maximum drop of three feet once the degraded slope has been reached. Check structures are needed along the floodplain preservation and channelized segments. In the segments to be selectively lined, check structures will protect the native vegetation from the detrimental effects of stream invert headcutting. A typical check structure detail has been presented on Sheet 7.

Detention

The recommended plan calls for the construction of regional detention basins within the West Fork Jimmy Camp Creek Basin. The locations of the regional detention basins are shown on sheets 1 through 6. The purpose of the detention basins is to limit peak discharges at the

basin's outfall to Jimmy Camp Creek to the existing hydrologic condition. The regional basins have also been sited within each of the major land developments in order to more locally control runoff to existing levels. Regional detention basins at design points 3030, 3020 and 2090 are onstream basins and the remainder will be off-stream basins. It is not anticipated that any of the regional detention basins will be subject to State Engineer's regulations. Each of the regional basins will have to be designed taking into the geotechnical considerations at each site. Specific design criteria for detention basins can be found in the City/County Storm Drainage Criteria Manual. It may be possible to consolidate two or more of the smaller detention basins. This can be determined during the master development and final development planning phases. During the initial development stages of a sub-basin that is tributary to a regional detention facility, temporary detention basins may need to be constructed until such time that the regional facility shown in this plan has been constructed. A summary of the detention basin characteristics is presented on Table 7 and on sheets 1 through 6.

Stormwater quality measures should be designed into the regional stormwater detention basins. These measures would include the provision of a water quality and sediment pool area in addition to the volume required for stormwater detention. Forebays at the inlet to all of the regional detention facilities is recommended. The water quality capture volume for each of the detention basins should be calculated as part of the final design of these facilities. Criteria and methodology for the sizing and the design of the water quality measures for stormwater detention facilities features can be found within Volume III of the Urban Storm Drainage Criteria Manual.

Roadway Crossings

Summarized on Sheets 1 through 7 are the size, type and location of roadway crossings along the major drainageways. The location of future arterials and collector streets was obtained from the various development plans for the major land developments within the basin. A summary of the roadway crossings is provided on Table 8.

Trails

Trails for access to the detention basins and drainageways need to be incorporated into the design of the improvements. For this basin, multi-purpose trails that can be used for open space, channel maintenance and utility access is recommended. The siting of a trail along a drainageway should be carried out taking into account hydraulic considerations, utilities in the area, access to dedicated parks and roadway crossings. Maintenance access to the drainageway and to existing utilities within the drainageway corridor can offer a multiple use aspect to a trail project. The design of the trails along the drainageways will be mostly dependent upon the type of development adjacent to the particular drainageway.

Maintenance and Revegetation

Maintenance of drainageway facilities is essential in preventing long term degradation of the drainageway and overbank areas. Along the drainageway, clearing of debris and dead vegetation should be considered within the low flow area of the creek and its tributaries. On the overbanks, limited maintenance of the existing vegetative cover is recommended. Yearly clearing of trash and debris at roadway crossings is also recommended to ensure the design capacity of the crossing, and to enhance the crossings for trail users if a trail exists. Caution should be taken when clearing culverts of sediment so as not to leave the dredged soil within the channel or overbank area. This disturbs the native vegetation and creates a potential water quality concern if the dredged material is subsequently washed into the drainageway by natural erosion. In those reaches designated to be selectively lined and the floodplain preserved, maintenance activities should be carried out while minimizing the disturbances to native vegetation.

Right-of-Way

For the most part the main channels within the basin which pass through undeveloped areas and the right-of-way can be dedicated as part of the land development process. For those segments of the drainageway where floodplain preservation is the recommended plan, a combination of open space dedication (such as park-land and greenbelts), in combination with a more narrow dedicated right-of-way along the low flow area of the drainageway should be obtained through the land development process. Land acquisition will be required for the regional detention basins. The dedication of easements and right-of-way for the drainageways and detention basins would be accomplished at the time of development planning and platting of the parcels that lie adjacent to or upstream of the stormwater facility.

Erosion and Sedimentation Control

Soils in the West Fork Jimmy Camp Creek basin vary widely and because of this, areas within the basin are subject to varying degrees of hazard resulting from sediment being transported to the drainageway(s). During the collection of field and drainage inventory data, some areas were noted which were being impacted by either erosion (of one form or another), or sediment deposition. The soil make up of the basin is generally highly erodible, and this is particularly the case in the upper portions of the drainageway where the channel has a sand bottom and the watersheds have poor to fair vegetative cover. The disturbance of the native vegetation and failure to properly revegetate areas impacted by site development, utility, roadway and landscape construction has in some cases negatively affected downstream portions of the basin.

The City of Colorado Springs, City of Fountain and El Paso County have enacted erosion control ordinances and criteria to address these problems. In general, it is the responsibility of the entity conducting any land disturbance activity to properly control surface runoff, erosion and sedimentation during and after the activity. Technical criteria identifying measures which help mitigate the impacts of erosion and sedimentation is available and being used throughout the Front Range area.

TABLE 6
SUMMARY OF DESIGN POINT DISCHARGES WITH REGIONAL DETENTION
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DESIGN POINT NUMBER	DRAINAGEWAY	LOCATION	EXISTING 100-YEAR FLOW	DETAINED CONDITION	
				5 YR	100YR
			(cfs)	(cfs)	(cfs)
2020	DRAINAGEWAY A	AT NORTH PL OF THE GLEN	189	57	210
2090	DRAINAGEWAY A	INFLOW TO DET BASIN 2091	219	152	535
2091	DRAINAGEWAY A	OUTFLOW FROM DET BASIN 2091	219	147	473
2160	DRAINAGEWAY A	AT MESA RIDGE PARKWAY	624	188	640
3020	WEST FORK	AT FONTAINE BOULEVARD	1857	1059	2737
3021	WEST FORK	OUTFLOW FROM DET BASIN 3021	1857	348	1810
3030	WEST FORK	AT NORTH PL OF THE GLEN	2216	401	2007
3031	WEST FORK	OUTFLOW FORM DET BASIN 3031	2216	399	1970
3060	WEST FORK	INFLOW TO DET BASIN 3061	163	63	190
3061	WEST FORK	OUTFLOW FROM DET BASIN 3061	163	50	165
3110	WEST FORK	AT MESA RIDGE PARKWAY	2828	585	2500
4010	DIRECT FLOW AREA	INFLOW TO DET BASIN 4011	153	108	279
4011	DIRECT FLOW AREA	OUTFLOW FROM DET BASIN 4011	153	64	157
4020	DIRECT FLOW AREA	INFLOW TO DET BASIN 4021	238	100	265
4021	DIRECT FLOW AREA	OUTFLOW FROM DET BASIN 4021	238	77	210
5010	WEST FORK	AT MARKSHEFFEL ROAD	3550	866	3318

TABLE 7
SUMMARY OF DETENTION BASIN DATA
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DETENTION BASIN NO.	STORAGE (AF)	JURISDICTION	OUTLET PIPE SIZE	Q100 IN (cfs)	Q100 OUT (cfs)
3021	80.0	CITY OF CS	2-8'Hx15'W CBC	2740	1810
4011	8.4	CITY OF FOUNTAIN	54" RCP	279	157
3061	2.0	CITY OF FOUNTAIN	60" RCP	190	165
3031	12.0	CITY OF FOUNTAIN	2-8'Hx15'W CBC	2010	1970
4021	8.4	EL PASO COUNTY	4'H x 8'W CBC	265	210
3091	4.0	EL PASO COUNTY	48" CMP	138	107
3101	6.1	EL PASO COUNTY	54" CMP	166	116
2091	4.1	EL PASO COUNTY	N/A	535	473
5011	9.0	EL PASO COUNTY	60" CMP	250	130
5021	10.5	EL PASO COUNTY	4'H x 8'W	360	190

TABLE 8
SUMMARY OF MAJOR ROADWAY CROSSINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

ROADWAY CROSSING #	TRIBUTARY DRAINAGEWAY	ROADWAY	FLOW RATE 100-year (cfs)	SIZE	TYPE
2160	DRAINAGEWAY A	MESA RIDGE PARKWAY	620	2-5'x8'	CBC
2160	DRAINAGEWAY A	PROPOSED SNEFFELS ROAD	620	2-5'x8'	CBC
2091	DRAINAGEWAY A	FUTURE ARTERIAL	470	1-5'x12'	CBC
2050	DRAINAGEWAY A	WAYFARER LANE	430	1-4'x12'	CBC
2110	TRIBUTARY TO DRAINAGEWAY A	FUTURE ARTERIAL	30	1-36"	CMP
5011	WEST FORK JIMMY CAMP CREEK	MARKSHEFFEL ROAD	3320	75'	BRIDGE
5010	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	3320	5-6'H x 15'W	CBC
3110	WEST FORK JIMMY CAMP CREEK	MESA RIDGE PARKWAY	2630	50'	BRIDGE
3092	WEST FORK JIMMY CAMP CREEK	FUTURE EAST ARTERIAL	2510	50'	BRIDGE
3081	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	105	54"	RCP
3080	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	72	48"	RCP
3070	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	190	4'H x 8'W	CBC
3000-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	570	5'H x 18'W'	CBC
3000-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	380	5'H x 12'W'	CBC
3005-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	205	4'H x 9'W'	CBC
3005-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	410	5'H x 12'W'	CBC
3000	WEST FORK JIMMY CAMP CREEK	FUTURE ARTERIAL	935	2-6'H x 12' W	CBC
3010	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	380	5'H x 12'W	CBC
3020	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	420	5'H x 12'W	CBC
3025	TRIBUTARY DRAINAGEWAY	FUTURE ARTERIAL	910	2-6'H x 12'W	CBC
3030	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	1850	2-8'x15'	CBC
3040	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	360	5'H x 10'W	CBC
3040	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	360	5'H x 10'W	CBC
3060	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	195	4'H x 8'W	CBC
4030	DFA 4030	MARKSHEFFEL ROAD	50	42"	CMP
4010	DFA 4010	FUTURE COLLECTOR	280	4'H x 10'W	CBC

VII. PLAN IMPLEMENTATION

General

Many of the channel sections shown on the plans will have to be modified to fit specific site conditions. This will be particularly true in the segments where selective channel treatments are proposed. Check locations are approximate and may be moved to minimize disturbances to existing vegetation, roads, trails, and utilities. Future easements and/or right-of-way for the stormwater facilities must be dedicated as part of the land development and platting process. Channel sizes, sections and alignments for minor drainage systems will have to be verified at the time the surrounding land is proposed for development. The final location of the proposed arterial and collector roadways shown in this plan are also subject to revision as development of the basin proceeds.

The detention basin locations shown on the preliminary design drawings are approximate, and will have to be verified during final design. The acquisition of property for the detention basins should be coordinated as the master development planning for the major parcels moves forward. The scheduling of the detention basin construction will depend upon the rate of development as well as the location. The regional detention basins will serve large areas, and therefore the need for the detention storage will not be critical until at least twenty-five percent of the tributary watershed is developed.

Improvements along the West Fork of Jimmy Camp Creek and Drainageway A should be refined when master development drainage plans are prepared for the major land parcels identified in this report. The channels are intended to be public drainageway system that will be owned and maintained by the respective governing agency of Flood Conservancy District that it lies within. The outfall channel identified as segment 5012 will need to be constructed whenever the improvements to the Marksheffel Road and/or the development of the Crossings at Mesa Ridge parcel. There is currently no outfall to Jimmy Camp Creek that can handle the existing 100-year discharge. The right-of-way for channel 5012 will need to be acquired by the County. This is a critical segment of the drainageway system that will need to be installed in the very early

development stages of the basin. The design of improvements for Marksheffel Road should take into consideration the bridge structure recommended in this study during the design.

Cost Estimates

Presented on Tables 9 and 10 are the costs for the proposed bridge and roadway crossing improvements for the West Fork Jimmy Camp Creek basin. The division of the crossings between bridges and culverts was established based upon the requirements contained within the City/County Storm Drainage Criteria Manual. Presented on Table 11 is the summary of detention basin costs. The estimated construction cost has been based upon a unit cost of $15,000 per acre-foot (with the exception of detention basin 3021). The cost of the outlet structure and outlet piping for each basin is included in the costs shown on Table 11. Presented on Table 12 is the summary of the major drainageway and grade control structure costs for the basin. No costs have been estimated for local or initial systems. Costs associated with utility relocations have not been estimated or included in the costs estimates. Presented on Tables 13 through 15 are breakdowns of the major drainageway improvement costs by jurisdiction. These estimates include an allowance for engineering and contingency of 10 percent and 5 percent respectively. Presented on Table 16 is a summary of the costs for bridge improvements within the County.

The costs for revegetation have been included within the drainageway improvement costs. No cost for habitat mitigation has been provided in the cost estimate. The cost of protection and/or replacement of habitat impacted by the construction of the facilities can be minimized by paying attention to siting, construction sequencing and access.

Jurisdictions and Plattable Acreage

As mentioned previously, the West Fork Jimmy Camp Creek basin lies within portions of the City of Fountain, the City of Colorado Springs, and unincorporated El Paso County. Currently, the City of Fountain does not have a drainage or bridge fee collection system for new development. The portion of the basin in the City of Colorado Springs lies within the Colorado Centre property and the Banning-Lewis Ranch Flood Conservancy District (District). It is the intent of the City of Colorado Springs that the District will be responsible for all drainage, detention and bridge improvement construction and maintenance. Prior to any development within the City, specific

agreements will have to be finalized between the City and the District. A fee calculation for the areas within the City has been included within this report for information purposes only.

Using aerial photographs, El Paso County Tax Assessor maps and the USGS quadrangle map, the amount of unplatted acreage was estimated. Presented on Table 17 are estimates of the area within the West Fork Jimmy Camp Creek basin that are unplatted and subject to fee calculation for the City of Colorado Springs and El Paso County. The percent impervious area value shown on Table 17 was obtained by calculating the weighted percent impervious value for the County sub-basins. A weighted percent imperviousness of 62.9 was estimated. The percent impervious values for major land use types as listed on Exhibit 3 of Board of County Commissioners Resolution No. 99-383 was used in the weighted percent impervious calculation. The weighted percent impervious value was then used to calculate the "impervious plattable acreage" noted on Table 17.

Drainage and Bridge Fee Calculations

Presented on Table 18 is the estimated bridge calculation for El Paso County. There are no bridges for the portion of the basin within the City of Colorado Springs. Presented on Table 19 are the estimated drainage fees for the City of Colorado Springs and El Paso County.

TABLE 9
SUMMARY OF BRIDGE COSTS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

ROADWAY CROSSING #	TRIBUTARY DRAINAGEWAY	ROADWAY	SIZE	TYPE	LENGTH/ SQ. FOOT. (ft)/(sf)	UNIT COST	TOTAL COST
5011	WEST FORK JIMMY CAMP CREEK	MARKSHEFFEL ROAD	75'	BRIDGE	7500	$ 140	$ 1,050,000
5010	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	5-6'x15'	CBC	80	$ 3,100	$ 248,000
3110	WEST FORK JIMMY CAMP CREEK	MESA RIDGE PARKWAY	50'	BRIDGE	4000	$ 140	$ 560,000
3092	WEST FORK JIMMY CAMP CREEK	FUTURE EAST ARTERIAL	50'	BRIDGE	3200	$ 140	$ 448,000
3030	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	2-8'x15'	CBC	100	$ 1,400	$ 140,000

TOTAL COSTS OF BRIDGES	$	2,446,000
ENGINEERING	$	244,600
CONTINGENCY	$	122,300
TOTAL COSTS OF BRIDGES	$	2,812,900

TABLE 10
SUMMARY OF MAJOR ROADWAY CROSSING COSTS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

ROADWAY CROSSING #	TRIBUTARY DRAINAGEWAY	ROADWAY	SIZE	TYPE	LENGTH (ft)	UNIT COST	TOTAL COST
2160	DRAINAGEWAY A	MESA RIDGE PARKWAY	2-5'x8'	CBC	100	$ 550	$ 55,000
2160	DRAINAGEWAY A	PROPOSED SNEFFELS ROAD	2-5'x8'	CBC	100	$ 550	$ 55,000
2091	DRAINAGEWAY A	FUTURE ARTERIAL	1-5'x12'	CBC	80	$ 570	$ 45,600
2050	DRAINAGEWAY A	WAYFARER LANE	1-4'x12'	CBC	60	$ 530	$ 31,800
2110	TRIBUTARY TO DRAINAGEWAY A	FUTURE ARTERIAL	1-36"	CMP	200	$ 75	$ 15,000
3081	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	54"	RCP	60	$ 120	$ 7,200
3080	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	48"	RCP	60	$ 110	$ 6,600
3070	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	4'H x 8'W	CBC	80	$ 405	$ 32,400
3000-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	5'H x 18'W'	CBC	100	$ 770	$ 77,000
3000-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	5'H x 12'W'	CBC	100	$ 570	$ 57,000
3005-1	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	4'H x 9'W'	CBC	100	$ 430	$ 43,000
3005-2	WEST FORK JIMMY CAMP CREEK	FUTURE COLLECTOR	5'H x 12'W'	CBC	100	$ 570	$ 57,000
3000	WEST FORK JIMMY CAMP CREEK	FUTURE ARTERIAL	2-6'H x 12' W	CBC	120	$ 1,100	$ 132,000
3010	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	5'H x 12'W	CBC	100	$ 570	$ 57,000
3020	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	5'H x 12'W	CBC	120	$ 570	$ 68,400
3025	TRIBUTARY DRAINAGEWAY	FUTURE ARTERIAL	2-6'H x 12'W	CBC	150	$ 1,100	$ 165,000
3040	TRIBUTARY DRAINAGEWAY	FUTURE EAST ARTERIAL	5'H x 10'W	CBC	120	$ 500	$ 60,000
3040	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	5'H x 10'W	CBC	120	$ 500	$ 60,000
3060	TRIBUTARY DRAINAGEWAY	FUTURE COLLECTOR	4'H x 8'W	CBC	100	$ 405	$ 40,500
4030	DFA 4030	MARKSHEFFEL ROAD	42"	CMP	80	$ 100	$ 8,000
4010	DFA 4010	FUTURE COLLECTOR	4'H x 10'W	CBC	120	$ 440	$ 52,800

TOTAL COST OF ROADWAY CROSSINGS $ 1,126,300

TABLE 11
SUMMARY OF DETENTION BASIN DATA AND COSTS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DETENTION BASIN NO.	DRAINAGEWAY	STORAGE (AF)	JURISDICTION	OUTLET PIPE SIZE	COST
3021	WEST FORK JIMMY CAMP CREEK	80.0	CITY OF CS	2-8'Hx15'W CBC	$ 710,000
4011	DFA 4010	8.4	CITY OF FOUNTAIN	54" RCP	$ 148,000
3061	TRIBUTARY DRAINAGEWAY	2.0	CITY OF FOUNTAIN	60" RCP	$ 55,600
3031	WEST FORK JIMMY CAMP CREEK	12.0	CITY OF FOUNTAIN	2-8'Hx15'W CBC	$ 363,000
4021	DFA 4020	8.4	EL PASO COUNTY	4'H x 8'W CBC	$ 208,900
3091	TRIBUTARY DRAINAGEWAY	4.0	EL PASO COUNTY	48" CMP	$ 84,300
3101	TRIBUTARY DRAINAGEWAY	6.1	EL PASO COUNTY	54" CMP	$ 119,500
2091	DRAINAGEWAY A	4.1	EL PASO COUNTY	N/A	$ 71,500
5011	TRIBUTARY DRAINAGEWAY	9.0	EL PASO COUNTY	60" CMP	$ 165,800
5021	TRIBUTARY DRAINAGEWAY	10.5	EL PASO COUNTY	4'H x 8'W	$ 181,500

TABLE 12
SUMMARY OF MAJOR DRAINAGEWAY COSTS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

DRAINAGEWAY #	DRAINAGEWAY	TYPE	LENGTH (ft)	UNIT COST	TOTAL COST
5012	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	1400	$ 209.50	$ 293,300
5011	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	1270	$ 275.60	$ 350,012
5010	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	2050	$ 239.80	$ 491,590
3110	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	870	$ 227.20	$ 197,664
3040	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	2350	$ 241.40	$ 567,290
3030-1	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	1060	$ 335.25	$ 355,365
3030-2	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	900	$ 458.30	$ 412,470
3000	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	3230	$ 218.50	$ 705,755
3005	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	3000	$ 218.00	$ 654,000
3012	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	2000	$ 194.80	$ 389,600
3015	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	1550	$ 226.90	$ 351,695
3021	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	1750	$ 219.65	$ 384,388
3025	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	1380	$ 249.70	$ 344,586
3060	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	2000	$ 152.40	$ 304,800
3070	WEST FORK JIMMY CAMP CREEK	RIRPAP AND GC	800	$ 201.25	$ 161,000
4020	DFA 4020	GRASSLINED AND GC	2500	$ 70.35	$ 175,875
4010	DFA 4010	GRASSLINED AND GC	900	$ 42.50	$ 38,250
2160	DRAINAGEWAY A	RIRPAP AND GC	1030	$ 377.90	$ 389,237
	WFJCC AND DRWY A IN THE 'GLEN'	SEL. RIPRAP	5700	$ 115.00	$ 655,500
	WFJCC AND DRWY A IN THE 'GLEN'	GRADE CONTROLS	1830	$ 300.00	$ 549,000
	WFJCC AND DRWY A IN THE 'GLEN'	SPILLWAY MOD	2	$ 30,000.00	$ 60,000
TOTAL DRAINAGEWAY COSTS					$ 7,831,377

TABLE 13
SUMMARY OF COSTS FOR THE CITY OF FOUNTAIN
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SEGMENT #	DRAINAGEWAY/ROADWAY	TYPE	LENGTH (ft)	UNIT COST	TOTAL COST
3040	WFJCC	RIRPAP AND GC	2350	$ 241.40	$ 567,290
3030-1	WFJCC	RIRPAP AND GC	1060	$ 335.25	$ 355,365
3030-2	WFJCC	RIRPAP AND GC	900	$ 458.30	$ 412,470
4010	DFA 4010	GRASSLINED AND GC	900	$ 42.50	$ 38,250
3040	FUTURE EAST ARTERIAL	5'H x 10'W	120	$ 500.00	$ 60,000
3040	FUTURE COLLECTOR	5'H x 10'W	120	$ 500.00	$ 60,000
3060	FUTURE COLLECTOR	4'H x 8'W	100	$ 405.00	$ 40,500
4010	FUTURE COLLECTOR	4'H x 10'W	120	$ 440.00	$ 52,800
4011		DETENTION BASIN	8.4 AF		$ 148,000
3061			2.0		$ 84,300
3031			12.0		$ 119,500

TOTAL COSTS WITHIN FOUNTAIN	$	1,938,475
ENGINEERING	$	193,848
CONTINGENCY	$	96,924
TOTAL	$	2,229,246

TABLE 14
SUMMARY OF COSTS FOR THE CITY OF COLORADO SPRINGS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SEGMENT #	DRAINAGEWAY/ROADWAY	TYPE	LENGTH (ft)	UNIT COST		TOTAL COST
3000	WFJCC	RIRPAP AND GC	3230	$218.50	$	705,755
3005	WFJCC	RIRPAP AND GC	3000	$218.00	$	654,000
3012	WFJCC	RIRPAP AND GC	2000	$194.80	$	389,600
3015	WFJCC	RIRPAP AND GC	1550	$226.90	$	351,695
3025	WFJCC	RIRPAP AND GC	1380	$249.70	$	344,586
3000-1	FUTURE COLLECTOR	5'H x 18'W' CBC	100'	$770	$	77,000
3000-2	FUTURE COLLECTOR	5'H x 12'W' CBC	100	$570	$	57,000
3005-1	FUTURE COLLECTOR	4'H x 9'W' CBC	100	$430	$	43,000
3005-2	FUTURE COLLECTOR	5'H x 12'W CBC	100	$570	$	57,000
3000	FUTURE ARTERIAL	2-6'H x 12' W CBC	120	$1,100	$	132,000
3010	FUTURE COLLECTOR	5'H x 12'W CBC	100	$570	$	57,000
3020	FUTURE COLLECTOR	5'H x 12'W CBC	60	$570	$	68,400
3025	FUTURE ARTERIAL	2-6'H x 12'W CBC	150	$1,100	$	165,000
3021		DETENTION BASIN	80 AF		$	710,000
3025, 3015, 3012		IRRIGATION STRUCT.	3.0	$5,000	$	15,000

TOTAL COSTS WITHIN COLORADO SPRINGS	$ 3,827,036.00
ENGINEERING	$ 382,703.60
CONTINGENCY	$ 191,351.80
TOTAL	$ 4,401,091.40

TABLE 15
SUMMARY OF COSTS WITHIN EL PASO COUNTY
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SEGMENT #	DRAINAGEWAY/ROADWAY	TYPE	LENGTH (ft)	UNIT COST	TOTAL COST
5012	WFJCC	RIRPAP AND GC	1400	$ 209.50	$ 293,300
5011	WFJCC	RIRPAP AND GC	1270	$ 275.60	$ 350,012
5010	WFJCC	RIRPAP AND GC	2050	$ 239.80	$ 491,590
3021	WFJCC	RIRPAP AND GC	1750	$ 219.65	$ 384,388
3110	WFJCC	RIRPAP AND GC	870	$ 227.20	$ 197,664
3070	WFJCC	RIRPAP AND GC	800	$ 201.25	$ 161,000
4020	DFA 4020	GRASSLINED AND GC	2500	$ 70.35	$ 175,875
2160	DRWY A	RIRPAP AND GC	1030	$ 377.90	$ 389,237
	WFJCC/DRWY A IN GLEN	SEL. RIPRAP	5700	$ 115.00	$ 655,500
	WFJCC/DRWY A IN GLEN	GRADE CONTROLS	1830	$ 300.00	$ 549,000
2160	MESA RIDGE PARKWAY	2-5'x8' CBC	100	$ 550.00	$ 55,000
2160	FUTURE SNEFFELS ROAD	2-5'x8' CBC	100	$ 550.00	$ 55,000
2091	FUTURE ARTERIAL	1-5'x12' CBC	80	$ 570.00	$ 45,600
2050	WAYFARER LANE	1-4'x12' CBC	60	$ 530.00	$ 31,800
2110	FUTURE ARTERIAL	1-36" CMP	200	$ 75.00	$ 15,000
3020	FUTURE COLLECTOR	1-5'x12' CBC	60	$ 570.00	$ 34,200
3081	FUTURE COLLECTOR	54" RCP	60	$ 120.00	$ 7,200
3080	FUTURE COLLECTOR	48" RCP	60	$ 110.00	$ 6,600
3070	FUTURE EAST ARTERIAL	4'H x 8'WCBC	80	$ 405.00	$ 32,400
4030	MARKSHEFFEL ROAD	42" CMP	80	$ 100.00	$ 8,000
4020	PEACEFUL VALLEY ROAD	42" RCP	1200	$ 100.00	$ 120,000
4021		DETENTION BASIN	8.4 AF		$ 2,089,000
3091			4 AF		$ 84,300
3101			6.1 AF		$ 119,500
2091			4.1 AF		$ 71,500
5011			9 AF		$ 165,800
5021			10.5 AF		$ 181,500

TOTAL COSTS WITHIN EL PASO COUNTY	$	6,769,966
ENGINEERING	$	676,997
CONTINGENCY	$	338,498
TOTAL	$	7,785,460

TABLE 16
SUMMARY OF BRIDGE COSTS WITHIN EL PASO COUNTY
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

SEGMENT #	DRAINAGEWAY/ROADWAY	TYPE	LENGTH/ AREA (ft/sf)	UNIT COST	TOTAL COST
5011	WFJCC/MARKSHEFFFEL ROAD	75' BRIDGE	7500	$ 140.00	$ 1,050,000
5010	WFJCC/FUTURE COLLECTOR	5-6'H x 15'W CBC	80	$ 3,100.00	$ 248,000
3110	WFJCC/MESA RIDGE PARKWAY	50' BRIDGE	5000	$ 140.00	$ 700,000
3092	WFJCC/FUTURE EAST ARTERIAL	2-8'H x 15'W CBC	3200	$ 140.00	$ 448,000
TOTAL BRIDGE COSTS WITHIN EL PASO COUNTY					$ 2,446,000
ENGINEERING					$ 244,600
CONTINGENCY					$ 122,300
TOTAL					$ 2,812,900

TABLE 17
SUMMARY OF PLATTABLE ACREAGE
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

JURISDICTION		ACREAGE (AC)
EL PASO COUNTY	TOTAL ACREAGE	1658.0
REDUCTIONS	THE GLEN FILINGS 1 AND 2	70.7
	PEACEFUL VALLEY ESTATES #1	135.0
	PEACEFUL VALLEY ESTATES #2	23.0
	SUNRISE RIDGE	72.2
	FOUNTAIN MUTUAL IRRIGATION PARCEL	40.0
	MAJOR ROADWAYS	
	MESA RIDGE PARKWAY	1.8
	POWERS BOULEVARD	3.2
	FONTAINE BOULEVARD	0.6
	DETENTION BASINS	7.0
	TOTAL REDUCTIONS	353.5
	NET PLATTABLE ACREAGE	1304.5
	IMPERVIOUS PLATTABLE ACREAGE (1)	820.5
COLORADO SPRINGS	TOTAL ACREAGE	1392.0
REDUCTIONS	DETENTION BASIN 3021	10.3
	NET PLATTABLE ACREAGE	1381.7

(1) Based upon weighted percent imperviousness of 62.9 for County basins only.

TABLE 18
BRIDGE FEE CALCULATION
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

JURISDICTION			TOTAL COST (AC)
EL PASO COUNTY	WFJCC FUTURE COLLECTOR	$	248,000.00
	MESA RIDGE PARKWAY	$	700,000.00
	WFJCC EAST ARTERIAL	$	448,000.00
	TOTAL	$	1,396,000.00
	ENGINEERING, 10%	$	139,600.00
	CONTINGENCY, 5%	$	69,800.00
	TOTAL	$	1,605,400.00
	IMPERVIOUS PLATTABLE ACREAGE		820.5
	BRIDGE FEE ($/AC)	$	1,956.61

TABLE 19
FEE CALCULATIONS
WEST FORK JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

JURISDICTION			TOTAL COST (AC)
EL PASO COUNTY	ROADWAY CROSSING AND DRAINAGEWAYS AND DETENTION BASINS	$	6,769,966.00
	TOTAL	$	6,769,966.00
	ENGINEERING, 10%	$	676,996.60
	CONTINGENCY, 5%	$	338,498.30
	SUBTOTAL	$	7,785,460.90
	DETENTION BASIN LAND COST 7.0 ACRES @$36,000 PER ACRE	$	252,000.00
	TOTAL	$	8,037,460.90
	IMPERVIOUS PLATTABLE ACREAGE		820.5
	DRAINAGE FEE ($/AC)	$	9,795.81
COLORADO SPRINGS	ROADWAY CROSSING AND DRAINAGEWAYS AND DETENTION BASINS	$	3,827,036.00
	TOTAL	$	3,827,036.00
	ENGINEERING, 10%	$	382,703.60
	CONTINGENCY, 5%	$	191,351.80
	TOTAL	$	4,401,091.40
	PLATTABLE ACREAGE		1381.7
	DRAINAGE FEE ($/AC)	$	3,185.27
COLORADO SPRINGS	DETENTION BASIN LAND ACQUISITION AND DETENTION BASINS		
	10.3 ACRES @$35,280 PER ACRE	$	363,384.00
	TOTAL	$	363,384.00
	PLATTABLE ACREAGE		1381.7
	DETENTION BASIN LAND FEE ($/AC)	$	263.00

HEC-1 HYDROGRAPH PACKAGE
HYDROLOGIC CALCULATIONS

APPENDIX A

```
1*****************************************
************************************
 *                                   *                                                   *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY
CORPS OF ENGINEERS     *
 *            SEPTEMBER 1990             *                                                   *    HYDROLOGIC
ENGINEERING CENTER     *
 *              VERSION 4.0              *                                                   *          609
SECOND STREET          *
 *                                       *                                                   *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE  10/19/1999  TIME  12:39:04 *                                                   *
(916) 756-1104             *
 *                                       *                                                   *
*
 ***************************************
************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT


```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

            1           ID   WEST JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
            2           ID   KIOWA ENGINEERING  -  PROJECT NO. 98.93
            3           ID   2, 5, 10 & 100 YEAR STORMS FILENAME: WFJCEX.DAT  EXISTING BASIN CONDITIONS
            4           ID   24HR STORM DURATION
                        *DIAGRAM
            5           IT       5       0       0     250
            6           IO       5
            7           JR    PREC     .47     .56     .70       1

            8           KK   E1010
            9           BA     .05
           10           IN      15
           11           PB     4.4
           12           PC     0.0   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
           13           PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
           14           PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
           15           PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
           16           PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
           17           PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
```

```
 18          PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
 19          PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
 20          PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
 21          PC   .9963   .9975   .9988  1.0000
 22          LS      0    73.2
 23          UD    .392

 24          KK   E1020
 25          KM        RUNOFF FROM BAS 1020
 26          KO       0
 27          BA    .041
 28          LS       0    71.1
 29          UD    .467

 30          KK   E1030
 31          KM        RUNOFF FROM BAS 1030
 32          KO       0
 33          BA    .020
 34          LS       0    72.5
 35          UD    .383

 36          KK  DP1030
 37          KM        COMBINE FLOW FROM E1020 & ROUTED FLOW FROM E1030
 38          HC       2

 39          KK   E1040
 40          KM        RUNOFF FROM BAS 1040
 41          KO       0
 42          BA  .02171
 43          LS       0      75
 44          UD     .41
1                                        HEC-1 INPUT
PAGE  2

          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 45          KK   E2010
 46          KM        RUNOFF FROM BAS 2010
 47          KO       0
 48          BA    .125
 49          LS       0      75
 50          UD    .350

 51          KK   R2020
 52          KM        ROUTE FLOW FROM E2010 TO DP2020
 53          KO       0
 54          RK     800     .03     .05            TRAP      20      10

 55          KK   E2020
 56          KM        RUNOFF FROM BASIN 2020
 57          KO       0
 58          BA    .062
 59          LS       0      68
 60          UD    .376

 61          KK  DP2020
 62          KM        COMBINE FLOW FROM E2010 & ROUTED FLOW FROM E2020
 63          HC       2

 64          KK   R2030
 65          KM        ROUTE FLOW FROM DP2020 TO DP2040
 66          RK     800   .0275     .05            TRAP      20       8

 67          KK   E2030
 68          KM        RUNOFF FROM BAS 2030
 69          KO       0
 70          BA    .021
 71          LS       0      69
 72          UD    .233
```

```
                73          KK   E2045
                74          KM        RUNOFF FROM BAS 2045
                75          KO        0
                76          BA     .061
                77          LS        0       85
                78          UD     .258

                79          KK   R2040
                80          KM        ROUTE FLOW FROM E2045 TO DP2040
                81          RK     1200    .0314      .04             TRAP       20        8

                82          KK   E2040
                83          KM        RUNOFF FROM BAS 2040
                84          KO        0
                85          BA     .026
                86          LS        0       69
                87          UD     .268
1                                                    HEC-1 INPUT
PAGE  3

           LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

                88          KK  DP2040
                89          KM        COMBINE FLOW FROM DP2020, E2030, E2045, E2040
                90          HC        4

                91          KK   R2050
                92          KM        ROUTE FLOW FROM DP2040 TO DP2060
                93          RK      600      .03      .03             TRAP       20        3

                94          KK   E2050
                95          KM        RUNOFF FROM BAS 2050
                96          KO        0
                97          BA     .020
                98          LS        0       69
                99          UD      .33

               100          KK   E2060
               101          KM        RUNOFF FROM BAS 2060
               102          KO        0
               103          BA     .024
               104          LS        0       69
               105          UD     .253

               106          KK  DP2060
               107          KM        COMBINE FLOW FROM DP2040, E2050, E2060
               108          HC        3

               109          KK   R2090
               110          KM        ROUTE FLOW FROM DP2060 TO DP2090
               111          RK      500     .023      .03             TRAP       30        3

               112          KK   E2070
               113          KM        RUNOFF FROM BAS 2070
               114          KO        0
               115          BA     .068
               116          LS        0       68
               117          UD     .463

               118          KK   R2080
               119          KM        ROUTE FLOW FROM E2070 TO DP2080
               120          RK     1220     .035      .04             TRAP       10        5

               121          KK   E2080
               122          KM        RUNOFF FROM BAS 2080
               123          KO        0
               124          BA     .057
               125          LS        0       69
               126          UD     .247
```

```
          127          KK  DP2080
          128          KM        COMBINE FLOW FROM E2070, E2080
          129          HC       2
1                                              HEC-1 INPUT
PAGE  4

          LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10


          130          KK   E2090
          131          KM        RUNOFF FROM BAS 2090
          132          KO       0
          133          BA    .019
          134          LS       0      69
          135          UD    .414

          136          KK  DP2090
          137          KM        COMBINE FLOW FROM DP2060, DP2080, E2090
          138          HC       3

          139          KK   R2100
          140          KM        ROUTE FLOW FROM DP2090 TO DP2100
          141          RK    1800   .0169     .03            TRAP      60       4

          142          KK   E2110
          143          KM        RUNOFF FROM BAS 2110
          144          KO       0
          145          BA    .034
          146          LS       0      69
          147          UD    .329

          148          KK   R2101
          149          KM        ROUTE FLOW FROM E2110 TO DP2100
          150          RK     900    .025     .04            TRAP      40       5

          151          KK   E2100
          152          KM        RUNOFF FROM BAS 2100
          153          KO       0
          154          BA    .095
          155          LS       0      69
          156          UD    .482

          157          KK  DP2100
          158          KM        COMBINE FLOW FROM DP2090, E2110, E2100
          159          HC       3

          160          KK   E2120
          161          KM        RUNOFF FROM BAS 2120
          162          KO       0
          163          BA    .047
          164          LS       0      69
          165          UD    .288

          166          KK  DP2120
          167          KM        COMBINE FLOW FROM DP2100, E2120
          168          HC       2

          169          KK   R2120
          170          KM        ROUTE FLOW FROM DP2120 THROUGH LAKE
          171          RK    1000    .025     .04            TRAP      40       5
1                                              HEC-1 INPUT
PAGE  5

          LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10


          172          KK   R2130
          173          KM        ROUTE FLOW FROM DP2120 TO DP2130
          174          RK     550     .05     .04            TRAP       8       3

          175          KK   E2130
```

```
176          KM        RUNOFF FROM BAS 2130
177          KO       0
178          BA     .010
179          LS       0       69
180          UD     .218

181          KK   DP2130
182          KM        COMBINE FLOW FROM DP2120, E2130
183          HC       2

184          KK    E2140
185          KM        RUNOFF FROM BAS 2140
186          KO       0
187          BA     .007
188          LS       0       69
189          UD      .16

190          KK    E2150
191          KM        RUNOFF FROM BAS 2150
192          KO       0
193          BA     .015
194          LS       0       75
195          UD     .259

196          KK    E2160
197          KM        RUNOFF FROM BAS 2160
198          KO       0
199          BA     .012
200          LS       0     72.6
201          UD     .162

202          KK   DP2160
203          HC       4

204          KK    R5010
205          KM        ROUTE FLOW FROM DP2160 TO DP5010
206          RK     2900     .015      .04             TRAP       20        4

207          KK    E3000
208          KM        RUNOFF FROM BAS 3000
209          KO       0
210          BA      .42
211          LS       0       77
212          UD     .414
```



```
LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

213          KK    E3005
214          KM        RUNOFF FROM BASIN 3005
215          KO       0
216          BA      .24
217          LS       0       77
218          UD      .27

219          KK   DP3000
220          KM        COMBINE FLOW FROM E3000 AND E3005
221          HC       2

222          KK    R3015
223          KM        ROUTE FLOW FROM DP3000 TO DP3020
224          RK     3200     .031      .04             TRAP       15        3

225          KK    E3015
226          KM        RUNOFF FROM BASIN 3015
227          KO       0
228          BA      .11
229          LS       0       77
230          UD      .21
```

```
231          KK   E3010
232          KM        RUNOFF FROM BAS 3010
233          KO         0
234          BA       .22
235          LS         0     75.1
236          UD       .28

237          KK   R3012
238          KM        ROUTE FLOW FROM E3010 TO DP 3020
239          RK    2600      .03      .04            TRAP       15        3

240          KK   E3012
241          KM        RUNOFF FROM BASIN E3012
242          KO         0
243          BA       .21
244          LS         0     75.1
245          UD       .47

246          KK   E3020
247          KM        RUNOFF FROM BAS 3020
248          KO         0
249          BA      .188
250          LS         0       77
251          UD       .36

252          KK   R3025
253          KM        ROUTE FLOW FROM BASIN E3020 TO DP 3020
254          RK    2600     .035      .04            TRAP       15        3
1                                        HEC-1 INPUT
PAGE  7

          LINE       ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

255          KK   E3025
256          KM        RUNOFF FROM BASIN E3025
257          KO         0
258          BA       .26
259          LS         0     72.2
260          UD       .23

261          KK  DP3020
262          KM        COMBINE FLOW FROM E3015, E3012, E3025, R3015, R3012 AND R3025
263          HC         6

264          KK   R3030
265          KM        ROUTE FLOW FROM DP3020 TO DP3030
266          RK    3000      .05      .04            TRAP       20       10

267          KK   E3030
268          KM        RUNOFF FROM BAS 3030
269          KO         0
270          BA       .26
271          LS         0     72.2
272          UD       .34

273          KK   E3035
274          KM        RUNOFF FROM BASIN E3035
275          KO         0
276          BA       .16
277          LS         0     72.2
278          UD       .16

279          KK  DP3030
280          KM        COMBINE FLOW FROM R3030, E3030 AND E3035
281          HC         3

282          KK   R3040
283          KM        ROUTE FLOW FROM DP 3030 TO DP 3040
284          RK    1450      .03      .03            TRAP       30        5
```

```
                285          KK   E3040
                286          KM        RUNOFF FROM BAS 3040
                287          KO        0
                288          BA     .115
                289          LS        0     69.3
                290          UD     .294

                291          KK   DP3040
                292          KM        COMBINE FLOW FROM R3040, E3040
                293          HC        2

                294          KK   R3050
                295          KM        ROUTE FLOW FROM DP3040 TO DP3050
                296          RK     2850     .009      .03            TRAP       10        7
1                                                        HEC-1 INPUT
PAGE  8

              LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                297          KK   E3050
                298          KM        RUNOFF FROM BAS 3050
                299          KO        0
                300          BA     .049
                301          LS        0     77.5
                302          UD     .371

                303          KK   DP3050
                304          KM        COMBINE FLOW FROM DP3040, E3050
                305          HC        2

                306          KK   E3060
                307          KM        RUNOFF FROM BAS 3060
                308          KO        0
                309          BA     .119
                310          LS        0     75.4
                311          UD     .257

                312          KK   R3070
                313          KM        ROUTE FLOW FROM E3060 TO DP3070
                314          RK     2000     .009      .04            TRAP       30       10

                315          KK   E3070
                316          KM        RUNOFF FROM BAS 3070
                317          KO        0
                318          BA     .077
                319          LS        0     77.1
                320          UD     .486

                321          KK   DP3070
                322          KM        COMBINE FLOW FROM R3070, E3070
                323          HC        2

                324          KK   R3080
                325          KM        ROUTE FLOW FROM DP3070 TO DP3080
                326          RK      350      .01      .04            TRAP       30       10

                327          KK   E3080
                328          KM        RUNOFF FROM BAS 3080
                329          KO        0
                330          BA     .050
                331          LS        0     75.4
                332          UD     .355

                333          KK   DP3080
                334          KM        COMBINE FLOW FROM R3080, E3080
                335          HC        2

                336          KK   R3090
                337          KM        ROUTE FLOW FROM DP3080 TO DP3090
```

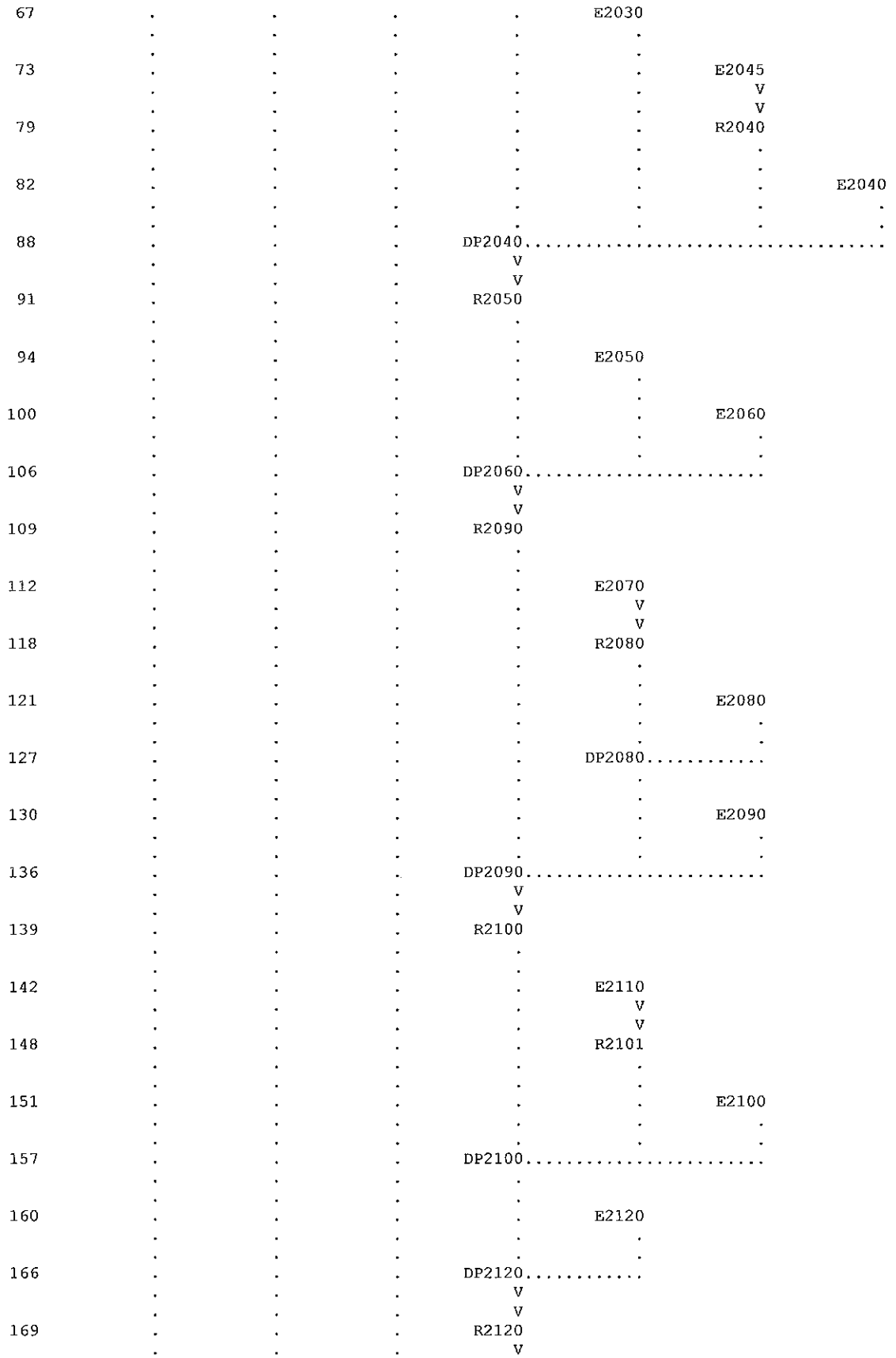
```
          338          RK    1750     .01     .03            TRAP      30      10
1                                                HEC-1 INPUT
PAGE  9

          LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          339          KK   E3090
          340          KM        RUNOFF FROM BAS 3090
          341          KO       0
          342          BA     .082
          343          LS       0   76.85
          344          UD     .411

          345          KK  DP3090
          346          KM        COMBINE FLOW FROM DP3090, E3090
          347          HC       2

          348          KK  DP3091
          349          KM        COMBINE FLOW FROM DP3050, DP3090
          350          HC       2

          351          KK   R3100
          352          KM        ROUTE FLOW FROM DP3091 TO DP3100
          353          RK     350     .01     .03            TRAP      10       10

          354          KK   E3100
          355          KM        RUNOFF FROM BAS 3100
          356          KO       0
          357          BA     .095
          358          LS       0   75.75
          359          UD     .303

          360          KK  DP3100
          361          KM        COMBINE FLOW FROM DP3090, E3100
          362          KO       0
          363          HC       2

          364          KK   E3110
          365          KM        RUNOFF FROM BAS 3110
          366          KO       0
          367          BA     .018
          368          LS       0   75.15
          369          UD     .472

          370          KK  DP3110
          371          KM        COMBINE FLOW FROM E3110 AND DP3100
          372          HC       2

          373          KK   R5010
          374          KM        ROUTE FLOW FROM DP3110 TO DP5010
          375          RK    2900    .015     .04            TRAP      20       4

          376          KK   E5011
          377          KM        RUNOFF FROM BAS E5010
          378          KO       0
          379          BA     .156
          380          LS       0      74
          381          UD      .50
1                                                HEC-1 INPUT
PAGE 10

          LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          382          KK  DP5010
          383          KM        COMBINE FLOW FROM E5010, R5011, R5010
          384          HC       3

          385          KK   E5020
          386          KM        RUNOFF FROM BASIN 5020
```

```
387           KO       0
388           BA      .2
389           LS       0      74
390           UD      .4

391           KK   E4010
392           KM        RUNOFF FROM BAS 4010
393           KO       0
394           BA     .19
395           LS       0   72.75
396           UD    .497

397           KK   R4020
398           KM        ROUTE FLOW FROM E4010 TO DP4020
399           RK    2400    .005     .05            TRAP      10      30

400           KK   E4020
401           KM        RUNOFF FROM BAS 4020
402           KO       0
403           BA    .135
404           LS       0   76.65
405           UD    .822

406           KK  DP4020
407           KM        COMBINE FLOW FROM R4020, E4020
408           HC       2

409           KK   E4030
410           KM        RUNOFF FROM BAS 4030
411           KO       0
412           BA    .018
413           LS       0   75.65
414           UD    .251
415           ZZ
```

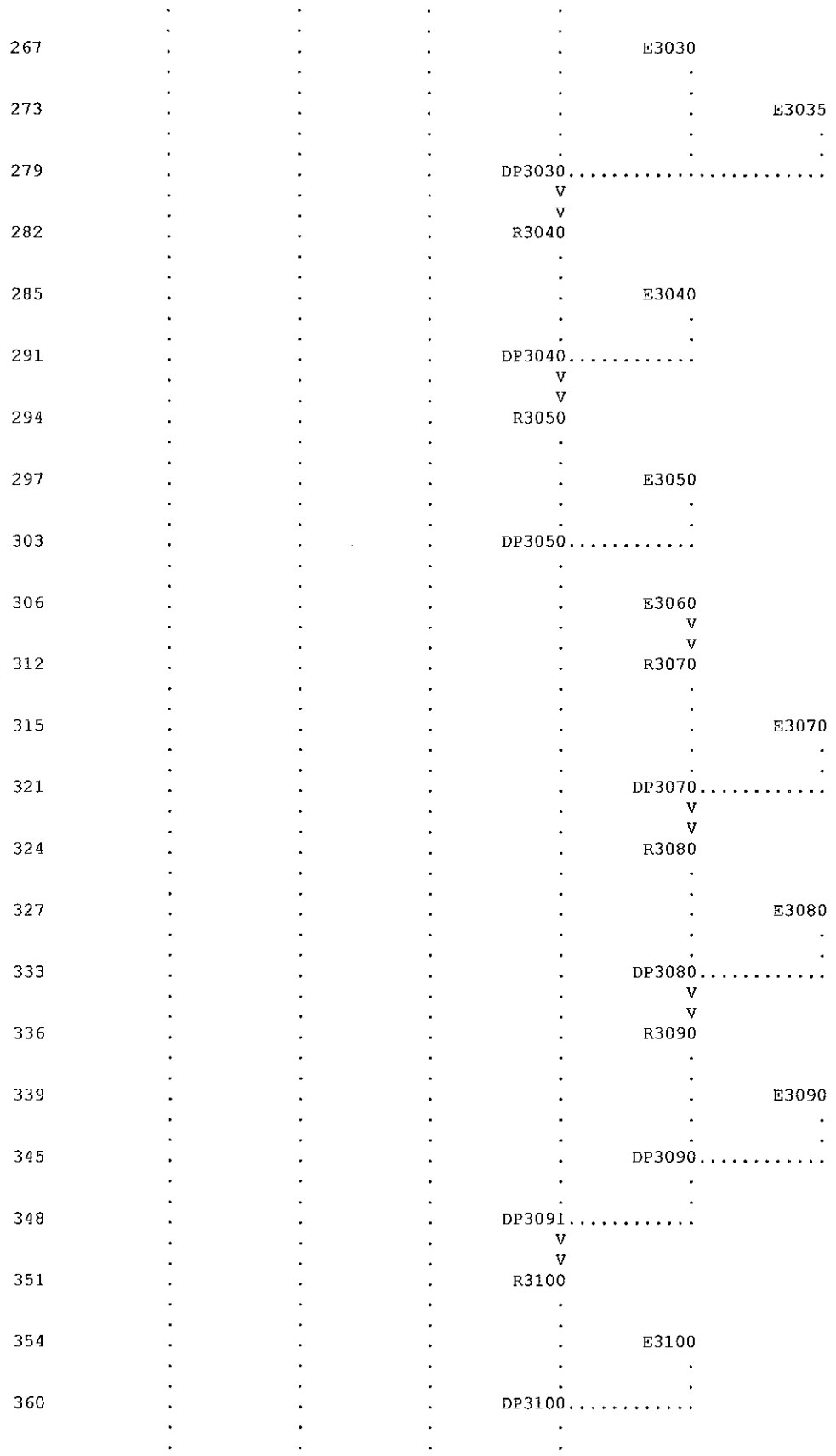
1

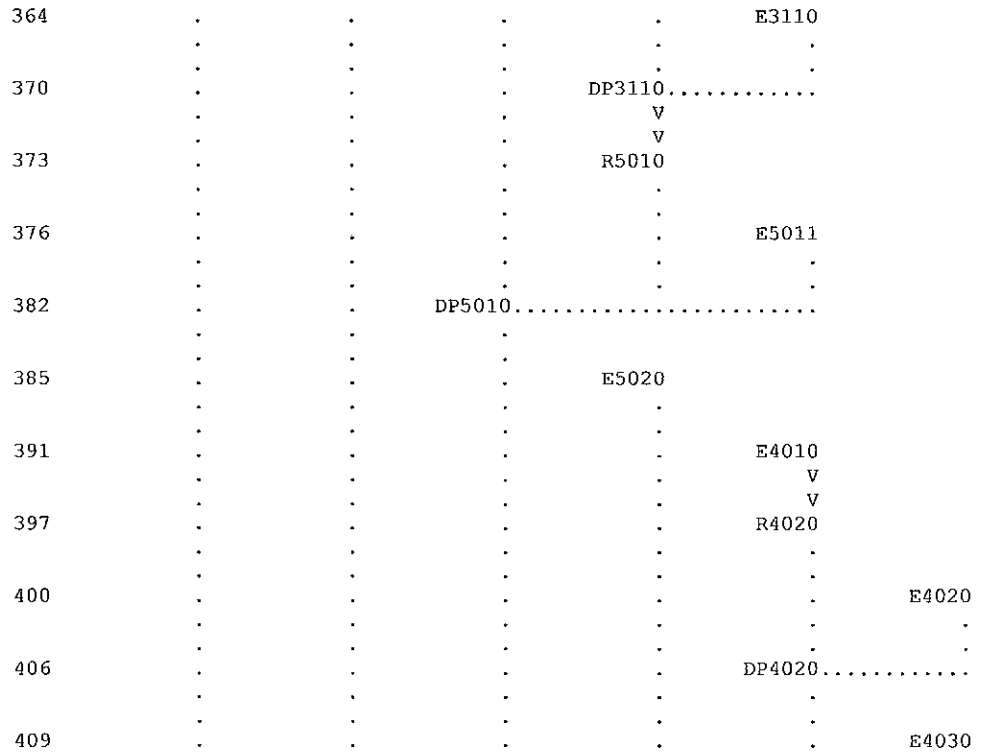
SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     8       E1010
                .
                .
    24          .       E1020
                .           .
                .           .
    30          .           .       E1030
                .           .           .
                .           .           .
    36          .      DP1030............
                .           .
                .           .
    39          .           .       E1040
                .           .           .
                .           .           .
    45          .           .           .       E2010
                .           .           .           V
                .           .           .           V
    51          .           .           .       R2020
                .           .           .           .
                .           .           .           .
    55          .           .           .           .       E2020
                .           .           .           .           .
                .           .           .           .           .
    61          .           .           .      DP2020............
                .           .           .           V
                .           .           .           V
    64          .           .           .       R2030
                .           .           .           .
                .           .           .           .
```


67
E2030
73
E2045
79
R2040
82
E2040
88
DP2040
91
R2050
94
E2050
100
E2060
106
DP2060
109
R2090
112
E2070
118
R2080
121
E2080
127
DP2080
130
E2090
136
DP2090
139
R2100
142
E2110
148
R2101
151
E2100
157
DP2100
160
E2120
166
DP2120
169
R2120

```
                                              V
  172          .          .          .    R2130
               .          .          .        .
               .          .          .        .
  175          .          .          .        .        E2130
               .          .          .        .            .
               .          .          .        .            .
  181          .          .          .   DP2130............
               .          .          .        .
               .          .          .        .
  184          .          .          .        .        E2140
               .          .          .        .            .
               .          .          .        .            .
  190          .          .          .        .            .         E2150
               .          .          .        .            .             .
               .          .          .        .            .             .
  196          .          .          .        .            .             .         E2160
               .          .          .        .            .             .             .
               .          .          .        .            .             .             .
  202          .          .          .   DP2160....................................
               .          .          .        V
               .          .          .        V
  204          .          .          .    R5010
               .          .          .        .
               .          .          .        .
  207          .          .          .        .        E3000
               .          .          .        .            .
               .          .          .        .            .
  213          .          .          .        .            .         E3005
               .          .          .        .            .             .
               .          .          .        .            .             .
  219          .          .          .        .       DP3000............
               .          .          .        .            V
               .          .          .        .            V
  222          .          .          .        .        R3015
               .          .          .        .            .
               .          .          .        .            .
  225          .          .          .        .            .         E3015
               .          .          .        .            .             .
               .          .          .        .            .             .
  231          .          .          .        .            .             .         E3010
               .          .          .        .            .             .             V
               .          .          .        .            .             .             V
  237          .          .          .        .            .             .         R3012
               .          .          .        .            .             .             .
               .          .          .        .            .             .             .
  240          .          .          .        .            .             .             .         E3012
               .          .          .        .            .             .             .             .
               .          .          .        .            .             .             .             .
  246          .          .          .        .            .             .             .             .
E3020
               .          .          .        .            .             .             .             .
V
               .          .          .        .            .             .             .             .
V
  252          .          .          .        .            .             .             .             .
R3025
 *** HEC1 ERROR 5 *** TOO MANY HYDROGRAPHS. COMBINE MORE OFTEN.
               .          .          .        .            .             .             .             .
               .          .          .        .            .             .             .             .
  255          .          .          .        .            .             .             .             .
E3025
               .          .          .        .            .             .             .             .
.
               .          .          .        .            .             .             .             .
.
  261          .          .          .
DP3020...........................................................
               .          .          .        V
               .          .          .        V
  264          .          .          .    R3030
```


267
E3030
273
E3035
279
DP3030
282
R3040
285
E3040
291
DP3040
294
R3050
297
E3050
303
DP3050
306
E3060
312
R3070
315
E3070
321
DP3070
324
R3080
327
E3080
333
DP3080
336
R3090
339
E3090
345
DP3090
348
DP3091
351
R3100
354
E3100
360
DP3100



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .47	RATIO 2 .56	RATIO 3 .70	RATIO 4 1.00
HYDROGRAPH AT								
+	E1010	.05	1	FLOW	7.	12.	22.	49.
				TIME	6.33	6.33	6.25	6.25
HYDROGRAPH AT								
+	E1020	.04	1	FLOW	4.	7.	14.	32.
				TIME	6.42	6.42	6.33	6.33
HYDROGRAPH AT								
+	E1030	.02	1	FLOW	3.	5.	9.	19.
				TIME	6.33	6.33	6.25	6.25
2 COMBINED AT								
+	DP1030	.06	1	FLOW	6.	12.	22.	50.
				TIME	6.42	6.33	6.33	6.33
HYDROGRAPH AT								
+	E1040	.02	1	FLOW	4.	6.	11.	22.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2010	.13	1	FLOW	24.	40.	68.	142.
				TIME	6.25	6.25	6.25	6.25
ROUTED TO								
+	R2020	.13	1	FLOW	23.	38.	67.	142.
				TIME	6.33	6.33	6.25	6.25

HYDROGRAPH AT								
+	E2020	.06	1	FLOW	4.	9.	18.	47.
				TIME	6.33	6.33	6.25	6.25
2 COMBINED AT								
+	DP2020	.19	1	FLOW	28.	47.	86.	189.
				TIME	6.33	6.33	6.25	6.25
ROUTED TO								
+	R2030	.19	1	FLOW	27.	47.	84.	185.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2030	.02	1	FLOW	2.	5.	9.	22.
				TIME	6.17	6.17	6.17	6.08
HYDROGRAPH AT								
+	E2045	.06	1	FLOW	35.	48.	70.	124.
				TIME	6.17	6.17	6.08	6.08
ROUTED TO								
+	R2040	.06	1	FLOW	34.	48.	70.	121.
				TIME	6.17	6.17	6.17	6.17
HYDROGRAPH AT								
+	E2040	.03	1	FLOW	3.	5.	11.	26.
				TIME	6.25	6.17	6.17	6.17
4 COMBINED AT								
+	DP2040	.30	1	FLOW	61.	97.	164.	335.
				TIME	6.25	6.25	6.25	6.17
ROUTED TO								
+	R2050	.30	1	FLOW	60.	96.	163.	333.
				TIME	6.25	6.25	6.25	6.25
HYDROGRAPH AT								
+	E2050	.02	1	FLOW	2.	4.	7.	17.
				TIME	6.25	6.25	6.25	6.25
HYDROGRAPH AT								
+	E2060	.02	1	FLOW	3.	5.	10.	24.
				TIME	6.17	6.17	6.17	6.17
3 COMBINED AT								
+	DP2060	.34	1	FLOW	64.	105.	180.	372.
				TIME	6.25	6.25	6.25	6.17
ROUTED TO								
+	R2090	.34	1	FLOW	63.	104.	179.	371.
				TIME	6.25	6.25	6.25	6.25
HYDROGRAPH AT								
+	E2070	.07	1	FLOW	4.	8.	18.	44.
				TIME	6.42	6.42	6.42	6.33
ROUTED TO								
+	R2080	.07	1	FLOW	4.	8.	17.	44.
				TIME	6.50	6.50	6.42	6.42
HYDROGRAPH AT								
+	E2080	.06	1	FLOW	6.	12.	25.	58.
				TIME	6.17	6.17	6.17	6.17
2 COMBINED AT								
+	DP2080	.13	1	FLOW	8.	17.	35.	88.
				TIME	6.25	6.25	6.25	6.17
HYDROGRAPH AT								
+	E2090	.02	1	FLOW	1.	3.	6.	14.

				TIME	6.42	6.33	6.33	6.33
3 COMBINED AT								
+	DP2090	.48	1	FLOW	72.	123.	219.	473.
				TIME	6.25	6.25	6.25	6.25
ROUTED TO								
+	R2100	.48	1	FLOW	72.	122.	213.	471.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2110	.03	1	FLOW	3.	6.	12.	29.
				TIME	6.25	6.25	6.25	6.25
ROUTED TO								
+	R2101	.03	1	FLOW	3.	6.	12.	29.
				TIME	6.42	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2100	.09	1	FLOW	6.	13.	26.	64.
				TIME	6.50	6.42	6.42	6.33
3 COMBINED AT								
+	DP2100	.61	1	FLOW	81.	140.	250.	558.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2120	.05	1	FLOW	5.	9.	18.	45.
				TIME	6.25	6.25	6.17	6.17
2 COMBINED AT								
+	DP2120	.66	1	FLOW	85.	148.	265.	600.
				TIME	6.33	6.33	6.33	6.25
ROUTED TO								
+	R2120	.66	1	FLOW	84.	145.	265.	591.
				TIME	6.42	6.33	6.33	6.25
ROUTED TO								
+	R2130	.66	1	FLOW	83.	143.	264.	586.
				TIME	6.42	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2130	.01	1	FLOW	1.	2.	5.	11.
				TIME	6.17	6.17	6.17	6.08
2 COMBINED AT								
+	DP2130	.67	1	FLOW	84.	145.	267.	594.
				TIME	6.42	6.33	6.33	6.25
HYDROGRAPH AT								
+	E2140	.01	1	FLOW	1.	2.	4.	9.
				TIME	6.08	6.08	6.08	6.08
HYDROGRAPH AT								
+	E2150	.01	1	FLOW	4.	6.	10.	20.
				TIME	6.17	6.17	6.17	6.17
HYDROGRAPH AT								
+	E2160	.01	1	FLOW	3.	5.	9.	18.
				TIME	6.08	6.08	6.08	6.08
4 COMBINED AT								
+	DP2160	.70	1	FLOW	87.	151.	277.	624.
				TIME	6.42	6.33	6.33	6.25
ROUTED TO								
+	R5010	.70	1	FLOW	86.	150.	274.	617.
				TIME	6.50	6.42	6.42	6.33
HYDROGRAPH AT								

+	E3000	.42	1	FLOW	88.	140.	233.	474.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E3005	.24	1	FLOW	68.	107.	176.	347.
				TIME	6.17	6.17	6.17	6.17
2 COMBINED AT								
+	DP3000	.66	1	FLOW	147.	233.	388.	779.
				TIME	6.25	6.25	6.25	6.17
ROUTED TO								
+	R3015	.66	1	FLOW	145.	228.	383.	777.
				TIME	6.33	6.33	6.25	6.25
HYDROGRAPH AT								
+	E3015	.11	1	FLOW	35.	55.	91.	181.
				TIME	6.08	6.08	6.08	6.08
HYDROGRAPH AT								
+	E3010	.22	1	FLOW	49.	81.	140.	288.
				TIME	6.17	6.17	6.17	6.17
ROUTED TO								
+	R3012	.22	1	FLOW	48.	80.	136.	279.
				TIME	6.25	6.25	6.25	6.17
HYDROGRAPH AT								
+	E3012	.21	1	FLOW	33.	54.	94.	199.
				TIME	6.42	6.42	6.33	6.33
HYDROGRAPH AT								
+	E3020	.19	1	FLOW	44.	69.	115.	231.
				TIME	6.25	6.25	6.25	6.25
ROUTED TO								
+	R3025	.19	1	FLOW	43.	68.	113.	228.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E3025	.26	1	FLOW	47.	82.	147.	324.
				TIME	6.17	6.17	6.17	6.08
6 COMBINED AT								
+	DP3020	1.65	1	FLOW	321.	528.	901.	1857.
				TIME	6.25	6.25	6.25	6.17
ROUTED TO								
+	R3030	1.65	1	FLOW	319.	516.	885.	1846.
				TIME	6.33	6.33	6.25	6.25
HYDROGRAPH AT								
+	E3030	.26	1	FLOW	36.	65.	119.	262.
				TIME	6.25	6.25	6.25	6.25
HYDROGRAPH AT								
+	E3035	.16	1	FLOW	36.	63.	111.	234.
				TIME	6.08	6.08	6.08	6.08
3 COMBINED AT								
+	DP3030	2.07	1	FLOW	367.	601.	1058.	2216.
				TIME	6.33	6.25	6.25	6.25
ROUTED TO								
+	R3040	2.07	1	FLOW	362.	598.	1044.	2213.
				TIME	6.33	6.33	6.25	6.25
HYDROGRAPH AT								
+	E3040	.12	1	FLOW	12.	23.	45.	110.
				TIME	6.25	6.25	6.17	6.17

2 COMBINED AT								
+	DP3040	2.18	1	FLOW	373.	618.	1089.	2316.
				TIME	6.33	6.33	6.25	6.25
ROUTED TO								
+	R3050	2.18	1	FLOW	369.	609.	1075.	2290.
				TIME	6.42	6.33	6.33	6.25
HYDROGRAPH AT								
+	E3050	.05	1	FLOW	12.	18.	31.	61.
				TIME	6.25	6.25	6.25	6.25
2 COMBINED AT								
+	DP3050	2.23	1	FLOW	379.	627.	1104.	2351.
				TIME	6.42	6.33	6.33	6.25
HYDROGRAPH AT								
+	E3060	.12	1	FLOW	29.	48.	81.	163.
				TIME	6.17	6.17	6.17	6.17
ROUTED TO								
+	R3070	.12	1	FLOW	28.	45.	79.	161.
				TIME	6.33	6.25	6.25	6.25
HYDROGRAPH AT								
+	E3070	.08	1	FLOW	15.	23.	38.	78.
				TIME	6.42	6.42	6.33	6.33
2 COMBINED AT								
+	DP3070	.20	1	FLOW	42.	67.	114.	235.
				TIME	6.33	6.33	6.25	6.25
ROUTED TO								
+	R3080	.20	1	FLOW	41.	67.	112.	233.
				TIME	6.33	6.33	6.25	6.25
HYDROGRAPH AT								
+	E3080	.05	1	FLOW	10.	16.	28.	58.
				TIME	6.25	6.25	6.25	6.25
2 COMBINED AT								
+	DP3080	.25	1	FLOW	50.	82.	139.	290.
				TIME	6.33	6.33	6.25	6.25
ROUTED TO								
+	R3090	.25	1	FLOW	50.	81.	139.	283.
				TIME	6.42	6.42	6.33	6.33
HYDROGRAPH AT								
+	E3090	.08	1	FLOW	17.	27.	45.	93.
				TIME	6.33	6.33	6.33	6.25
2 COMBINED AT								
+	DP3090	.33	1	FLOW	66.	106.	184.	373.
				TIME	6.42	6.42	6.33	6.33
2 COMBINED AT								
+	DP3091	2.56	1	FLOW	445.	732.	1288.	2722.
				TIME	6.42	6.33	6.33	6.25
ROUTED TO								
+	R3100	2.56	1	FLOW	443.	727.	1285.	2714.
				TIME	6.42	6.33	6.33	6.25
HYDROGRAPH AT								
+	E3100	.09	1	FLOW	21.	35.	60.	123.
				TIME	6.25	6.17	6.17	6.17
2 COMBINED AT								
+	DP3100	2.66	1	FLOW	458.	757.	1334.	2828.
				TIME	6.42	6.33	6.33	6.25

HYDROGRAPH AT								
+	E3110	.02	1	FLOW	3.	5.	8.	17.
				TIME	6.42	6.42	6.33	6.33
2 COMBINED AT								
+	DP3110	2.67	1	FLOW	461.	761.	1342.	2845.
				TIME	6.42	6.33	6.33	6.25
ROUTED TO								
+	R5010	2.67	1	FLOW	454.	758.	1311.	2800.
				TIME	6.50	6.42	6.33	6.33
HYDROGRAPH AT								
+	E5011	.16	1	FLOW	20.	35.	62.	133.
				TIME	6.42	6.42	6.42	6.33
3 COMBINED AT								
+	DP5010	3.53	1	FLOW	561.	943.	1640.	3550.
				TIME	6.50	6.42	6.33	6.33
HYDROGRAPH AT								
+	E5020	.20	1	FLOW	31.	52.	92.	200.
				TIME	6.33	6.33	6.33	6.25
HYDROGRAPH AT								
+	E4010	.19	1	FLOW	21.	38.	69.	153.
				TIME	6.42	6.42	6.42	6.33
ROUTED TO								
+	R4020	.19	1	FLOW	21.	37.	68.	151.
				TIME	6.83	6.75	6.67	6.58
HYDROGRAPH AT								
+	E4020	.14	1	FLOW	16.	26.	44.	90.
				TIME	6.83	6.75	6.75	6.67
2 COMBINED AT								
+	DP4020	.32	1	FLOW	38.	63.	112.	238.
				TIME	6.83	6.75	6.67	6.58
HYDROGRAPH AT								
+	E4030	.02	1	FLOW	5.	7.	12.	25.
				TIME	6.17	6.17	6.17	6.17

*** NORMAL END OF HEC-1 ***

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1*****************************************
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 *                                   *                                                   *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                   *    U.S. ARMY
CORPS OF ENGINEERS     *
 *            SEPTEMBER 1990             *                                                   *    HYDROLOGIC
ENGINEERING CENTER    *
 *             VERSION 4.0               *                                                   *          609
SECOND STREET          *
 *                                       *                                                   *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE  10/19/1999  TIME  12:41:18 *                                                   *           (916)
756-1104            *
 *                                       *                                                   *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT
PAGE 1

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          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

            1           ID   WEST JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
            2           ID   KIOWA ENGINEERING  -  PROJECT NO. 98.93
            3           ID   2, 5, 10 & 100 YEAR STORMS FILENAME: WFJCFUT.DAT DEV BASIN CONDITION
            4           ID   24HR STORM DURATION  NO DETENTION
                        *DIAGRAM
            5           IT       5       0       0     250
            6           IO       5
            7           JR    PREC     .47     .56     .70       1

            8           KK   E1010
            9           BA     .05
           10           IN      15
           11           PB     4.4
           12           PC     0.0   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
           13           PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
           14           PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
           15           PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
           16           PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
           17           PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
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                18          PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
                19          PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
                20          PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
                21          PC   .9963   .9975   .9988  1.0000
                22          LS      0    73.2
                23          UD    .392

                24          KK   E1020
                25          KM        RUNOFF FROM BAS 1020
                26          KO       0
                27          BA    .041
                28          LS       0    88.8
                29          UD    .467

                30          KK   E1030
                31          KM        RUNOFF FROM BAS 1030
                32          KO       0
                33          BA    .020
                34          LS       0      80
                35          UD    .383

                36          KK  DP1030
                37          KM        COMBINE FLOW FROM E1020 & ROUTED FLOW FROM E1030
                38          HC       2

                39          KK   E1040
                40          KM        RUNOFF FROM BAS 1040
                41          KO       0
                42          BA  .02171
                43          LS       0      75
                44          UD     .41
1                                                HEC-1 INPUT
PAGE  2

           LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                45          KK   E2010
                46          KM        RUNOFF FROM BAS 2010
                47          KO       0
                48          BA    .125
                49          LS       0      75
                50          UD    .350

                51          KK   R2020
                52          KM        ROUTE FLOW FROM E2010 TO DP2020
                53          KO       0
                54          RK     800     .03     .05            TRAP      20       10

                55          KK   E2020
                56          KM        RUNOFF FROM BASIN 2020
                57          KO       0
                58          BA    .062
                59          LS       0      75
                60          UD    .376

                61          KK  DP2020
                62          KM        COMBINE FLOW FROM E2010 & ROUTED FLOW FROM E2020
                63          HC       2

                64          KK   R2030
                65          KM        ROUTE FLOW FROM DP2020 TO DP2040
                66          RK     800   .0275     .05            TRAP      20        8

                67          KK   E2030
                68          KM        RUNOFF FROM BAS 2030
                69          KO       0
                70          BA    .021
                71          LS       0      71
                72          UD    .233
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                73          KK   E2045
                74          KM        RUNOFF FROM BAS 2045
                75          KO        0
                76          BA     .061
                77          LS        0       85
                78          UD     .258

                79          KK   R2040
                80          KM        ROUTE FLOW FROM E2045 TO DP2040
                81          RK     1200    .0314      .04             TRAP       20        8

                82          KK   E2040
                83          KM        RUNOFF FROM BAS 2040
                84          KO        0
                85          BA     .026
                86          LS        0       71
                87          UD     .268
1                                                  HEC-1 INPUT
PAGE  3

            LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                88          KK  DP2040
                89          KM        COMBINE FLOW FROM DP2020, E2030, E2045, E2040
                90          HC        4

                91          KK   R2050
                92          KM        ROUTE FLOW FROM DP2040 TO DP2060
                93          RK      600      .03      .03             TRAP       20        3

                94          KK   E2050
                95          KM        RUNOFF FROM BAS 2050
                96          KO        0
                97          BA     .020
                98          LS        0       71
                99          UD      .33

               100          KK   E2060
               101          KM        RUNOFF FROM BAS 2060
               102          KO        0
               103          BA     .024
               104          LS        0     73.1
               105          UD     .253

               106          KK  DP2060
               107          KM        COMBINE FLOW FROM DP2040, E2050, E2060
               108          HC        3

               109          KK   R2090
               110          KM        ROUTE FLOW FROM DP2060 TO DP2090
               111          RK      500     .023      .03             TRAP       30        3

               112          KK   E2070
               113          KM        RUNOFF FROM BAS 2070
               114          KO        0
               115          BA     .068
               116          LS        0       75
               117          UD     .463

               118          KK   R2080
               119          KM        ROUTE FLOW FROM E2070 TO DP2080
               120          RK     1220     .035      .04             TRAP       10        5

               121          KK   E2080
               122          KM        RUNOFF FROM BAS 2080
               123          KO        0
               124          BA     .057
               125          LS        0       71
               126          UD     .247
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          127          KK  DP2080
          128          KM        COMBINE FLOW FROM E2070, E2080
          129          HC       2
1                                                HEC-1 INPUT
PAGE  4

          LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          130          KK   E2090
          131          KM        RUNOFF FROM BAS 2090
          132          KO        0
          133          BA     .019
          134          LS        0       75
          135          UD     .414

          136          KK  DP2090
          137          KM        COMBINE FLOW FROM DP2060, DP2080, E2090
          138          HC       3

          139          KK   R2100
          140          KM        ROUTE FLOW FROM DP2090 TO DP2100
          141          RK    1800    .0169      .03             TRAP       60        4

          142          KK   E2110
          143          KM        RUNOFF FROM BAS 2110
          144          KO        0
          145          BA     .034
          146          LS        0       71
          147          UD     .329

          148          KK   R2101
          149          KM        ROUTE FLOW FROM E2110 TO DP2100
          150          RK     900     .025      .04             TRAP       40        5

          151          KK   E2100
          152          KM        RUNOFF FROM BAS 2100
          153          KO        0
          154          BA     .095
          155          LS        0     75.3
          156          UD     .482

          157          KK  DP2100
          158          KM        COMBINE FLOW FROM DP2090, E2110, E2100
          159          HC       3

          160          KK   E2120
          161          KM        RUNOFF FROM BAS 2120
          162          KO        0
          163          BA     .047
          164          LS        0       69
          165          UD     .288

          166          KK  DP2120
          167          KM        COMBINE FLOW FROM DP2100, E2120
          168          HC       2

          169          KK   R2120
          170          KM        ROUTE FLOW FROM DP2120 THROUGH LAKE
          171          RK    1000     .025      .04             TRAP       40        5
1                                                HEC-1 INPUT
PAGE  5

          LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          172          KK   R2130
          173          KM        ROUTE FLOW FROM DP2120 TO DP2130
          174          RK     550      .05      .04             TRAP        8        3

          175          KK   E2130
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