There are some key issues that ~~are going to~~ have to be solved before this can proceed. — mainly issues with closed basin & the metropolitan district. We will probably need an Intergovernmental Agreement in regards to the district

Master Development Drainage Plan
Wolf Ranch Development

City of Colorado Springs, Colorado

NKM
2/11/05

Prepared For:

Nor'wood Development Group
4065 Sinton Road Suite 200
Colorado Springs, CO 80907

Prepared By:

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904

Project Number 03094
July 2004
November 2004

13457

LIST OF TABLES

LIST OF FIGURES

in regards to the bridge

WOODMEN HEIGHTS NO 1
ANNEXATION AGREEMENT

THIS ANNEXATION AGREEMENT (this "Agreement"), dated this 23rd day of July, 2004, is between the City of Colorado Springs, a home rule city and Colorado municipal corporation (the "City"), and The Robert W. Kinzler Revocable Living Trust and The Evelyn M. Kinzler Revocable Living Trust (collectively referred to as "Owners" or the "Property Owners").

I.
INTRODUCTION

The Owners own all of the real property located in El Paso County, Colorado, identified and described in the legal description attached hereto as **Exhibit A** (the "Property").

The growth of the Colorado Springs metropolitan area makes it likely that the Property will experience development in the future and the Property is identified in the City Annexation Plan as recommended for annexation. Subject to the terms and conditions set forth herein, both the City and the Owners wish to annex the Property into the City to ensure its orderly development. In consideration of the mutual covenants contained in this Agreement, the receipt and sufficiency of which are acknowledged by each of the parties, the City and the Owners agree as follows.

II
ANNEXATION

The Owners have petitioned the City for annexation of the Property as set forth in **Exhibit A**. The annexation will become effective upon final approval by the City Council and the recording of the annexation plat and annexation ordinance with the El Paso County Clerk and Recorder.

All references to the Property or to the Owners' Property are to the Property described in **Exhibit A** except as otherwise indicated.

III.
LAND USE

A Master Plan for the Property, Woodmen Heights Master Plan, has been proposed and submitted to the City for approval. Owners will comply with the approved Master Plan or an amended Master Plan approved in accord with applicable provisions of the Code of the City of Colorado Springs 2001, as amended or recodified ("City Code").

IV.
ZONING

A. Zoning. The City Planning and Community Development Department of the City agrees to recommend that the initial zone for the Owners' Property shall be Agricultural (A) upon annexation. While zoned A, a development plan shall be required for any use requiring a building permit except for agricultural uses. Owners acknowledge and understand that the City Council determines what is an appropriate zone for the Property, and this recommendation does not bind the Planning Commission or City Council to adopt an Agricultural zone for the Property.

B. Rezoning. Rezonings shall conform to the Master Plan, as approved or as amended by the City in the future. Rezoning in accord with the land uses reflected on the Master Plan will occur prior to actual development of the site.

V.
PUBLIC FACILITIES

A. Street / Traffic. The Owners agree to construct, at the Owners' expense (unless provided by the Woodmen Road Metropolitan District as defined below (V 1.b.)) those street and/or traffic

Vollmer Road may be reduced to match the ultimate design of Vollmer Road as determined by El Paso County

4. Black Forest Road. The Owners will be responsible for dedicating one-half (1/2) of the necessary right-of-way for, and constructing Black Forest Road so that Black Forest Road has four (4) lanes and meets City standards for a principal arterial road with a total right-of-way of one hundred twenty feet (120') from its intersection with Woodmen Road north to the northern boundary of the Property. Owners or the District (as defined in Section XII of this Agreement) will be entitled to cost recovery for the costs to construct and improve the west one-half (1/2) of Black Forest Road from owners having frontage on said road in accord with Section 7.7.705.B. of the City Code (Subdivision Regulations).

5. Black Forest Road Cottonwood Creek Crossing. Owners acknowledge that there is a need to construct the Black Forest Road bridge or box culvert, as applicable, across Cottonwood Creek. The Owners, either directly or through the Districts, shall construct the bridge or box culvert over Cottonwood Creek prior to the expiration of the second phase of the development but in any case prior to December 31, 2011. The City commits to acquire the necessary right-of-way and easements necessary for the construction of the bridge through the development process and/or through its powers of eminent domain. The owners will be eligible for reimbursement as applicable, per Section 7.7.1001-1006 (Arterial Roadway Bridges) of the City Code. City participation or reimbursement for the costs of construction of the bridge or box culvert for the Black Forest Road Cottonwood Creek crossing will not be allowed.

6. Construction of Internal Public Street Network to Serve Property. It is recognized that there may be a need for certain Owners to construct portions of the internal public street network, as illustrated on the approved Woodmen Heights Master Plan, that are not adjacent to their property. In order to accommodate this situation, Owners shall dedicate the full right-of-way for any internal public streets, as illustrated on the approved Master Plan. and a temporary construction easement as reasonably required to complete construction of those internal roads, at any time requested by the City or by an Owner that intends to commence development. Additionally, Owners who incur costs associated with the design and construction of internal public streets within the Property shall be eligible for Cost Recovery from Owners having frontage on said street in accord with Section 7.7.705.B. of the City Code (Subdivision Regulations).

B. Marksheffel Road Sand Creek Crossing. The Owners shall construct the Marksheffel Road bridge or box culvert, as applicable, across Sand Creek at their expense. The owners will be eligible for fifty percent (50%) reimbursement for the construction cost of the bridge or box culvert, as applicable, per section 7.7.1001-1006 (Arterial Roadway Bridges) of the City Code.

C. Traffic Control Devices and Street Lights. As required herein, the Owners shall pay for installation of traffic and street signs, striping, and traffic control devices, permanent barriers, and street lights, together with all associated conduit for all streets within or contiguous to the Property as mutually determined necessary by the parties, and in accord with uniformly applied criteria set forth by the City. The City agrees that the traffic signal at the intersection of Woodmen Road and Marksheffel Road may be installed by the Woodmen Road Metro District rather than by Owners, but Owners will remain responsible for that traffic signal if the District does not fund it. Streetlights will be required on collector and larger streets or at intersections for public safety as reasonably determined necessary by the City and Utilities. Traffic signals will be installed only after the intersection warrants such signals, as outlined in the Manual on Uniform Traffic Control Devices in use at the time or another nationally accepted standard. Once the intersection meets the outlined criteria, the City will notify the Owners in writing and the Owners will install the traffic signal within one hundred eighty (180) days after receipt of that notice. The Owners will be responsible for all components of the traffic signal, except the City will supply the controller equipment and cabinet (the reasonable costs therefor to be reimbursed by the Owners). If not provided by the District, the Owners will be responsible for purchasing and installing Intelligent Transportation Systems (ITS) for transit and smart bus stops in the development and along adjacent arterials to the development. This includes Woodmen Road. The level of ITS infrastructure will be determined as the level of transit service develops in the area; however, after the initial installation of the ITS, the Owners shall have no obligation for operating, maintaining, repairing or upgrading such systems. The City shall be solely responsible for further operating, maintenance, repair and upgrading of the ITS.

Kiowa Engineering Corporation

December 1, 2004

Mr. Tim Mitros
Subdivision Engineering
City of Colorado Springs
30 South Nevada, Suite 700
Colorado Springs, Colorado 80903

RE: Wolf Ranch Master Development Drainage Plan, Colorado Springs, Colorado (Kiowa Project No. 03094)

Dear Tim:

Accompanying this letter is a revised copy of the MDDP for the above referenced project. I have also returned your review copy for your files as requested. As a result of this submittal, I would request on behalf of the developer that a drainage board item be scheduled to present and discuss the closing of the basin and the exemption of this site from drainage fee assessment. Please let me know at your earliest convenience when the drainage board item can be scheduled.

If Kiowa can be of any further assistance, please do not hesitate to contact us.

Sincerely,
KIOWA ENGINEERING CORPORATION

Richard N. Wray, P.E.
Principal

Cc: Ralph Braden, Nor'wood Development
RNW/rnw
1201rnw1

1604 South 21st Street, Colorado Springs, CO 80904
(719) 630-7342 (719) 630-0406 FAX

ENGINEER'S STATEMENT:

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

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

____________________________ ________________________

Richard N. Wray Date
Registered Engineer # 19310

DEVELOPER'S STATEMENT:

I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

BY: ____________________________ ________________________
Date

ADDRESS: Nor'wood Development Group
4065 Sinton Road Suite 200
Colorado Springs, CO 80907

CITY OF COLORADO SPRINGS

7.7.906

Filed in accordance with Section ~~15-3-906~~ of the Code of the City of Colorado Springs, ~~1980,~~ as amended.
2001

____________________________ ____________________________

City Engineer **Dated**

PROJECT DESCRIPTION

Wolf Ranch Development is a master planned community located in northeast Colorado Springs. The master development plan includes open space, parks, drainage, residential, office and commercial uses. The development covers approximately 1800 acres. The development is located bordered by Black Forest Road on the east, Old Ranch Road on the north, the Cordera development on the west and Cowpoke Road on the south. The location of the site is presented on Figure 1.

The property subject to development is located in portions of Sections 30 and 31 Township 12 South, Range 65 West of the 6th Principal Meridian and Section 6 Township 13 South Range 65 West of the 6^{th} Principal Meridian. The development subject to master drainage planning has a segment of Cottonwood Creek that passes through the southern portion of the site as well as a major sub-tributary designated as Tributary Four in this report. The property lies completely within the Cottonwood Creek basin.

PREVIOUS REPORTS

The following reports and plans were reviewed in the process of preparing this master development drainage plan:

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. Cottonwood Creek Drainage Basin Planning Study (DBPS) prepared by URS, Inc., dated 1994.
4. Cottonwood Creek Drainage Basin Planning Study prepared by Ayres Associates, Inc. dated June 2000.
5. Westcreek at Wolf Ranch Subdivision Master Development Drainage Plan and Final Drainage Report for Westcreek at Wolf Ranch Filings Nos. 1, 2, 3, 4 and 5, prepared by Rockwell Consulting, dated September 2003.
6. Westcreek at Wolf Ranch Subdivision Master Development Drainage Plan and Final Drainage Report for Westcreek at Wolf Ranch Filings Nos. 6, 7, 8, 9, 10, 11 and 12 and Research Parkway at Wolf Ranch Filings 1, 2, and 3, prepared by Rockwell Consulting, dated December 2003.
7. HEC-1 Flood Hydrograph Package User's Manual, prepared by US Army Corps of Engineers Hydrologic Engineering Center, dated June 1998.
8. Prudent Line for Rural Areas in El Paso County Criteria prepared by Ayres Associates dated June 2000.

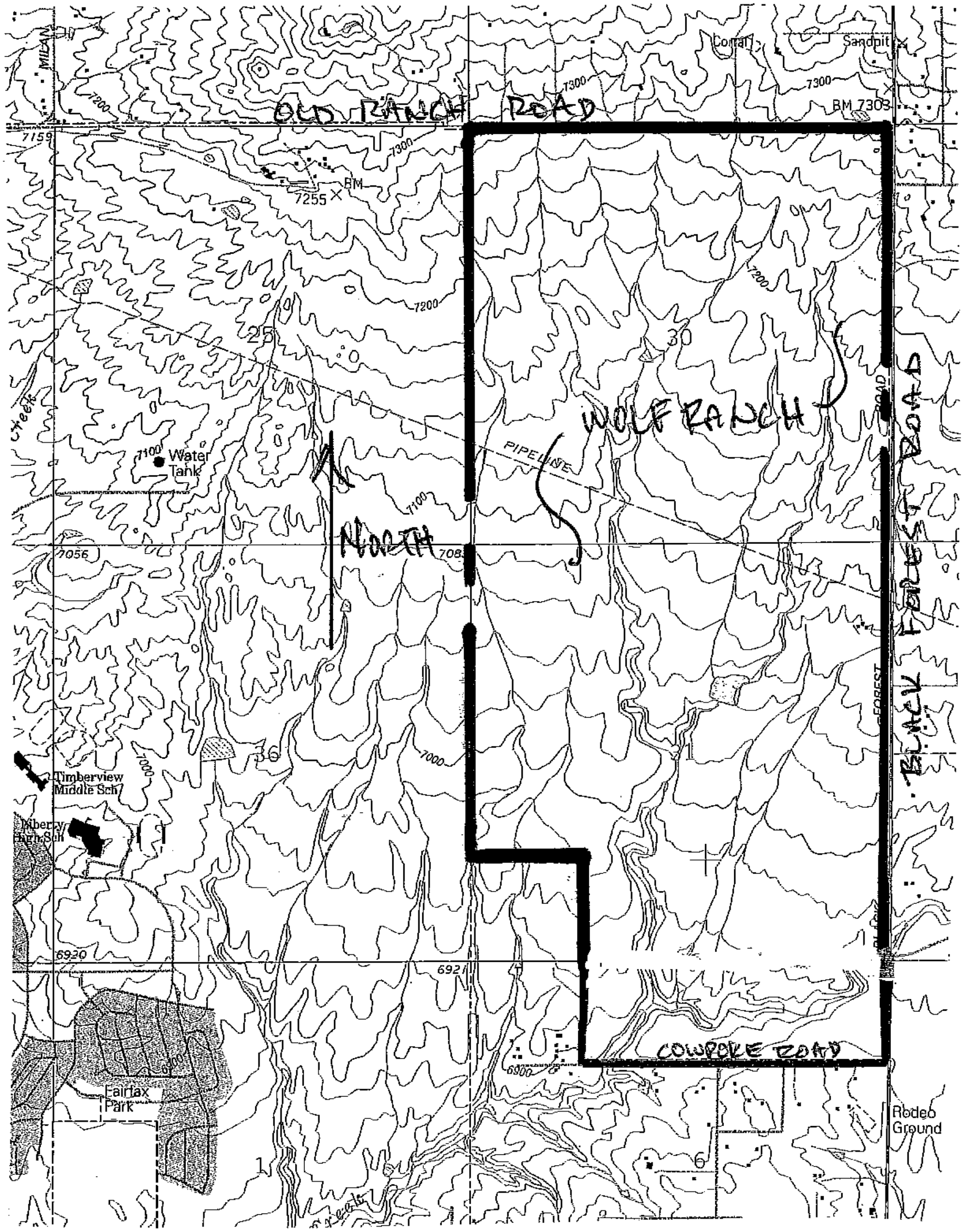


FIGURE 1
VICINITY MAP

References 3 and 4 were prepared for the overall Cottonwood Creek Drainage basin and were used to establish the selected drainageway improvements for the basin. The City adopted the studies and used them in the establishment of the drainage and bridge fees for the basin. The primary difference between these two studies was that in Reference 4 the prudent line concept was incorporated into the DBPS as the preferred alternative channel design for the upper portions of Cottonwood Creek and for Tributary Four as well. The drainage fee was modified in Reference 4 to account for the land costs associated with the creation of a prudent line setback. No channel improvements other than grade control structures were recommended for Cottonwood Creek and Tributary Four for the reaches within the Wolf Ranch development. The peak discharges summarized in Reference 4 were applied in the design of bank improvements and grade controls for the portion of Cottonwood Creek that passes through the southern portion of the development.

References 5 and 6 were used to establish the proposed major drainage structures within the Filings covered by these master development drainage plans and final drainage reports. Storm sewer outfall sewers and detention basins shown recommended in these studies were considered when the hydrologic models were developed for this MDDP.

The purpose of this MDDP is to develop the hydrologic model of the onsite and offsite watersheds related to the Master Planned area. It is also the focus of this MDDP to evaluate the storm sewer infrastructure to be constructed as part of the Westcreek and greater Wolf Ranch developments, and to establish the size, type, and location of the major drainageway facilities for Wolf Ranch. It should however be expected that modifications in the size and location of the major drainageway facilities as shown herein might occur depending upon the actual development of the land within the Wolf Ranch property. In particular the location of the regional detention basins may be shifted as alternatives are analyzed as part of the land development process.

HYDROLOGY

The offsite and onsite hydrology for the site was estimated using the methods outlined in the City/County Storm Drainage Criteria Manual. Topography for the site was compiled at a two-foot contour interval and a horizontal scale of one inch to 400-feet. This topography was used to verify the onsite sub-basin boundaries. Offsite sub-basin boundaries were determined using the above referenced reports, the City of Colorado Springs FIMS mapping base, and the USGS quadrangle maps for the area. Field inspections were also carried out in order to confirm or refine subdivision limits.

Existing and developed condition peak discharges for the sub-basins and design points along the major drainageway associated with Tributary Four and Cottonwood Creek shown on the Hydrologic Sub-basin Map were determined for the 5-year and 100-year recurrence intervals. The 24-hour storm duration was modeled using a Type IIA rainfall distribution. The total 24-hour rainfall depth was 2.5 and 4.4 inches for the 5- and 100-year frequencies, respectively. No area reduction factor was applied to the rainfall distribution and total depths.

Soils within the Wolf Ranch are mostly classified into hydrologic soils group B as shown in Reference 1. A small amount of hydrologic soil group A exists along the west-bank of Tributary Four in the southern portion of the development. For the purposes of modeling the developed conditions, all soils within the development were assumed to be hydrologic soil group B. Presented on Figure 2 are the hydrologic soil types that can be found within the Wolf Ranch development.

Land uses within the development were determined using the master development plan for Wolf Ranch. The development land will be of mixed uses. The land uses were used in the establishment of the curve numbers (CN values) that were input to the HEC-1 model. For the existing development condition and CN value of 61 was used for all of existing sub-basins within the development. Presented on Figure 3 is the hydrologic land use map for Wolf Ranch and their associated CN-values.

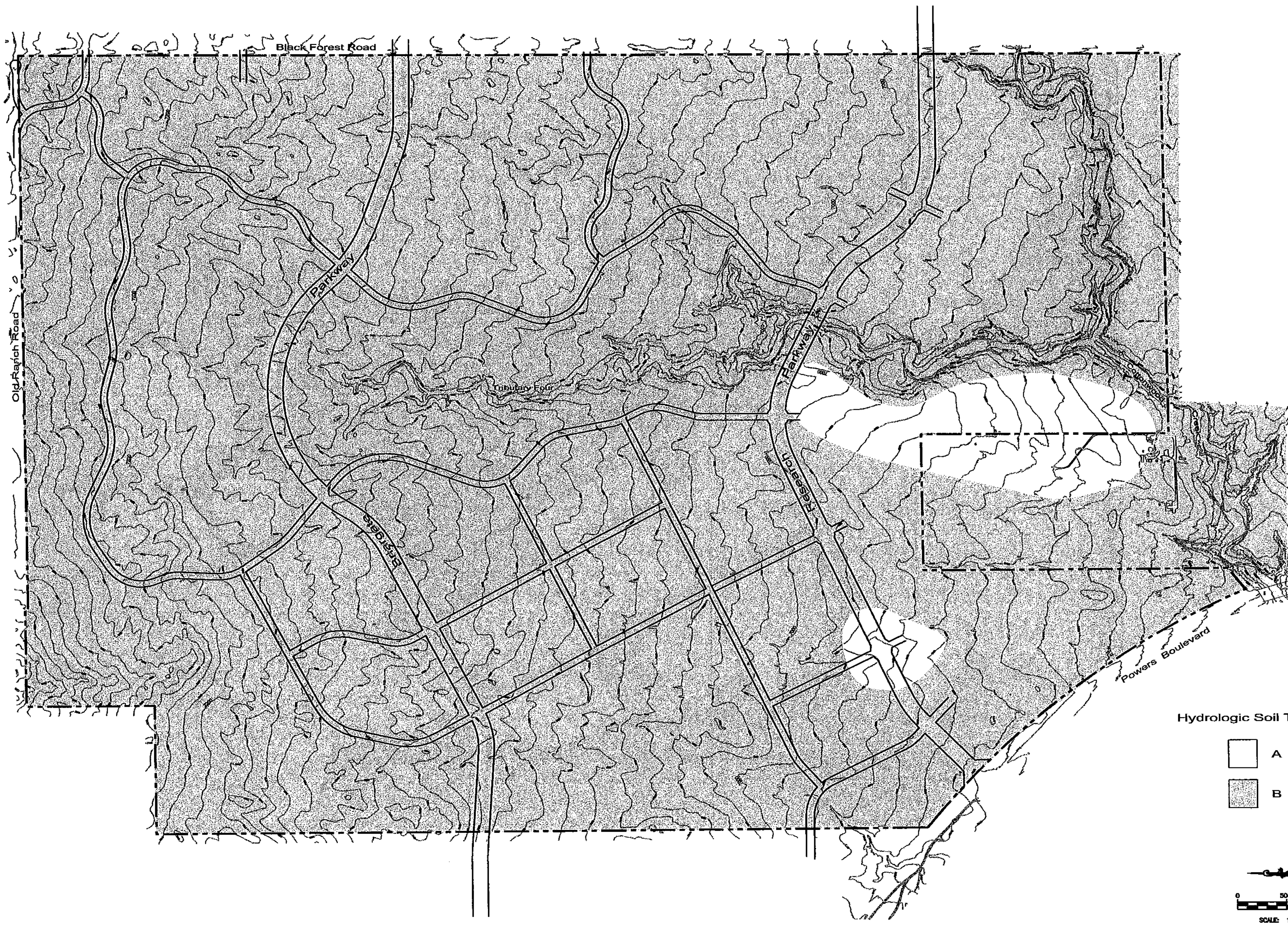
The time of concentration for each of the sub-basins modeled was estimated. The time of concentration was computed from a combination of overland flow, channel and pipe flow for each sub-basin. The time lag for each sub-basin was computed by reducing the time of concentration by 60 percent. The time lag was input to the HEC-1 model.

The Muskingum-Cunge routing technique was used to route the sub-basin hydrographs between design points. The majority of the routing elements were trapezoidal channel sections. Within the Westcreek portion of the development storm sewers were modeled. The longitudinal slope of each routing element was determined using the topographic mapping described above.

Hydrologic flow charts were prepared and are contained within Appendix A of this report. These flow charts were used to compile the HEC-1 model.

EXISTING MAJOR SUB-WATERSHED DESCRIPTIONS

The study area was divided into eight major sub-watersheds. These sub-watersheds are noted in the hydrologic analysis by using the designations A through H. The sub-basins were coded accordingly (i.e., A-1, A-2, B-1, etc). The sub-basins for the existing condition are presented on Figure 4.



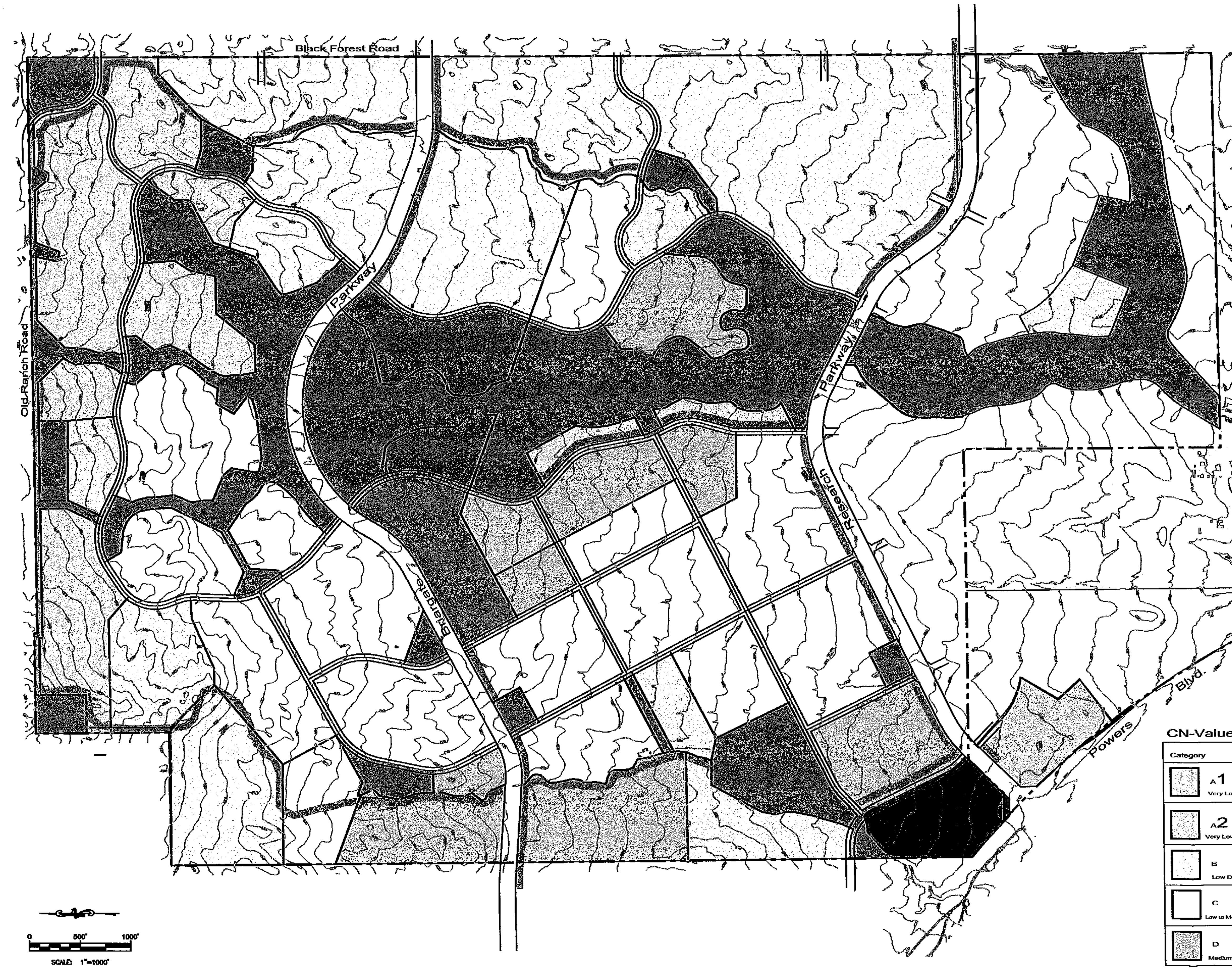
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
HYDROLOGIC SOILS MAP
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 01--04
Design: RNW
Drawn: EAK
Check: RNW
Revisions:

SHEET
Fig. 2

03094 Fig2.dwg/Aug 05, 2004



Category	CN
Neighborhood Commercial	92
Neighborhood Parks Comm. Parks/ Open Space Private Entry Features Open Space Remaining Open Space	61

Category	CN
Elementary School	75
Middle School	80
PF (Public Facility)	70

CN-Value Summary

Category	Max. Du/Ac	CN
A1 Very Low Density Residential	1	70
A2 Very Low Density Residential	2	73
B Low Density Residential	3.5	73
C Low to Medium Density Residential	5	79
D Medium Density Residential	8	85

Category	Max. Du/Ac	CN
E Medium to High Density Residential	12	88
F High Density Residential	25	92
Mixed Use	Up to 25.00	92

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
HYDROLOGIC LANDUSE MAP
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 01-04
Design: RNW
Drawn: EAK
Check: RNW
Revisions:

SHEET
Fig. 3

03094 Fig3.dwg/Aug 06, 2004

As shown on Figure 4 the "A" basins discharge to an existing concrete box culvert under Powers Boulevard. The sub-watershed drains a total of .42 square miles at its outfall point along the west boundary of the development. Slopes along the major drainageway range from 3 to 5 percent. Soils are entirely hydrologic soil group B. There is a portion of sub-basin A-1 that lies offsite from Wolf Ranch. The offsite portion of sub-basin A-1 is presently developed into large rural lots ranging in size from 5 to 40 acres. The watershed is well vegetated with native grasses. A small portion of sub-basin A-1 is forested.

The "B" basins discharge to an existing 54-inch reinforced concrete storm sewer that is within Research Parkway west of Powers Boulevard. The sub-watershed drains a total of .15 square miles at its outfall point at Powers Boulevard. Slopes along the major drainageway range from 2 to 5 percent. Soils are entirely hydrologic soil group B. Sub-watershed B lies entirely within Wolf Ranch. The watershed is well vegetated with native grasses.

The "C" basins discharge to an existing 72-inch reinforced concrete storm sewer that is under Powers Boulevard near the southwest corner of the property. The sub-watershed drains a total of .25 square miles at its outfall point at Powers Boulevard. Slopes along the major drainageway range from 2 to 5 percent. Soils are predominantly hydrologic soil group B however a small portion of type A soil exists within sub-basin C-1. Sub-watershed C lies entirely within Wolf Ranch. Most of sub-basin C-2 lies within the Westcreek subdivision Filings 1 through 3. The watershed is well vegetated with native grasses.

The "D" basins discharge to Cottonwood Creek within an offsite property just upstream of Powers Boulevard. The sub-watershed drains a total of .36 square miles at its outfall point at Cottonwood Creek. Slopes along the major drainageway range from 2 to 5 percent. Soils are predominantly hydrologic soil group B. Sub-watershed D lies mostly within Wolf Ranch however sub-basin D-3 lies within the Goetsch property that lies south of Wolf Ranch. The watershed is well vegetated with native grasses. The major drainageway within sub-basin D-3 is stable and has no improvements such as grade controls or bank lining. The drainageway is poorly defined where it enters Cottonwood Creek.

The "E" basins discharge to the Cottonwood Creek drainageway through an offsite property just upstream of Powers Boulevard. The sub-watershed drains a total of .32 square miles at its outfall point at Cottonwood Creek. Slopes along the major drainageway range from 2 to 5 percent. Soils are entirely hydrologic soil group B.

Approximately 60-percent of sub-watershed E lies within Wolf Ranch however 40 percent lies within the Goetsch property south of Wolf Ranch. The watershed is well vegetated with native grasses. The major drainageway within sub-basin E-2 is stable and has no improvements such as grade controls or bank lining. A stock pond exists along the drainageway within the Goetsch property.

"F" basins discharge to Cottonwood Creek approximately 4,000 feet upstream of the bridge over Powers Boulevard. The sub-watershed drains a total of 2 square miles at its outfall point. Slopes along the major drainageway range from 2 to 4 percent. Soils are mostly classified as hydrologic soil group B however a small area of Type A soil exist along the west overbank of Tributary Four south of Research Parkway. There is a portion of sub-watershed F that is offsite from Wolf Ranch. The offsite portion of the sub-watershed (i.e., sub-basins F-1 though F-7) is presently developed into large rural lots ranging in size from 5 to 40 acres. The watershed is well vegetated with native grasses. A small portion of the upper watershed is forested. The major drainageway in the F sub-watershed is Tributary 4. There are presently no improvements along the drainageway in the form of bank lings or grade controls. The low flow channel and some segments of the 100-year floodplain that have cross-section that is well incised.

The "G" basins discharge to Cottonwood Creek approximately 500 feet upstream of the outfall of sub-watershed F. The sub-watershed drains a total of .32 square miles at its outfall point. Slopes along the major drainageway range from 2 to 3 percent. Soils are entirely hydrologic soil group B. A portion of sub-watershed G lies offsite from Wolf Ranch. The offsite portion of the sub-watershed (i.e., sub-basin G-1) is presently developed into large rural lots ranging in size from 2.5 to 5 acres. The watershed is well vegetated with native grasses.

The "H" basin discharges to Cottonwood Creek just downstream of Black Forest Road. This sub-watershed drains a total of .093 square miles at its outfall point. Slopes along the watershed range from 2 to 6 percent. Soils are entirely hydrologic soil group B. The sub-watershed is well vegetated with native grasses.

It was assumed in this report that the portions of the A- and F-basins that lie north of Old Ranch Road will not develop to any higher land use densities than exist today. If more dense development would occur north of Old Ranch Road, it has been further assumed that detention would be required so that the peak discharges flowing onto the Wolf Ranch development would not be increased over the existing condition rates calculated in this report.

DEVELOPED MAJOR SUB-WATERSHEDS

The study area was divided into nine major sub-watersheds. These sub-watersheds are noted in the hydrologic analysis by using the designations A through J. The sub-basins were coded accordingly (i.e., A-1, A-2, B-1, etc). The sub-basins for the developed condition existing condition are presented on Figure 5. For the most part the developed condition sub-watershed boundaries cover similar areas as compared to existing sub-watersheds. The sub-basin divides were determined using the master development plan so that basin divides and key design points could be evaluated at future major roads. Some minor sub-basin rerouting and diversions have occurred. The curve-numbers were revised for the developed conditions. The developed curve numbers ranged from 72 to 90. The time of concentration values and resulting time lags were evaluating using developed flow paths and storm sewers where applicable.

HYDROLOGY RESULTS

Presented of Figures 4 and 5 are the peak discharges that resulted from the hydrology analysis for sub-basins as well as at key design points within the development. Presented on Table 1 is a comparison of the DBPS discharges summarized in Reference 4 at each common design point. The variances in the peak discharges are largely the result of the differences between the HEC-1 model developed in the Reference 4 and this MDDP. A greater degree of sub-basin delineation has been applied in this MDDP that can cause differences in peak discharges. Differences if the sub-basin area can also produce variances between this MDDP and the DBPS. The input and output for the HEC-1 computer model for the existing and developed hydrologic analyses are contained within Appendix A of this report. There was no analysis conducted in this MDDP for the main stem of Cottonwood Creek. Peak discharges data shown on Table 1 that was obtained derived from the DBPS were applied in this MDDP for the estimation of the 100-year flood plain for Cottonwood Creek and the sizing selective of bank linings.

At design point A the primary difference between the 100-year peak discharge reported in Reference 4 and this MDDP is due to the larger basin area applied in this MDDP for the developed condition. A modestly lower curve number was applied in this MDDP compared to Reference 4. The lower curve number yields a lower unit discharge at design point A for the MDDP hydrology (i.e., 1,490 cubic feet per second/square mile (DBPS) versus 1,270 cubic feet per second/square (MDDP)). This result is consistent with the application of a lower curve number.

At design point F located at the confluence of Tributary Four and Cottonwood Creek the variance in the peak discharges is also the result of a larger area applied in the

TABLE 1:
COMPARISON OF 100-YEAR PEAK DISCHARGES
DEVELOPED CONDITION WITHOUT DETENTION
WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN

DESIGN POINT	DBPS (REFERENCE 4)		MDDP (KIOWA)	
	Q5	Q100	Q5	Q100
(cfs)	(cfs)		(cfs)	
A	n/r	553	~~206~~ 270	~~722~~ 930
F	n/r	1,450	~~360~~ 310	~~1,870~~ 1650
COTTONWOOD CREEK AT POWERS BOULEVARD	n/r	2,730 (1)	ne	ne
COTTONWOOD CREEK UPSTREAM OF TRIBUTARY FOUR	n/r	860 (1)	ne	ne

(1) Source: Cottonwood Creek DBPS, Ayres Associates, June 2000 (reference 4)
n/r = not reported in this MDDP
ne = no estimate made in this MDDP

MDDP and differing curve number. The unit discharges compare well between the DBPS and this MDDP, (i.e., 760 cubic feet per second/square mile (DBPS) versus 810 cubic feet per second/square (MDDP)).

REGIONAL DETENTION HYDROLOGY

Detention storage was determined through an iterative process where an initial volume was calculated based on the changes of SCS curve numbers between the existing and developed condition. The initial volume was refined using the HEC-1 model resulting in the storage volumes summarized in this report. The proposed development condition was modeled with sufficient detention storage so that the flow rates were maintained to historic levels at each outfall point along the development's southern and western boundaries. The implementation of detention storage will have the affect of reducing the size of major drainageway facilities that may lie downstream of a detention basin. Detention will extend the time and duration of peak discharges but significantly reduce the magnitude of the peak flow rates for the 5- and 100-year recurrence intervals.

Presented on Figure 6 are the locations and hydraulic characteristics of six detention basins that are proposed within the Wolf Ranch development. Each detention basin would be built with an outlet structure that would control the 5-year and 100-year discharges from the detention basin to historic levels at the discharge points from the property. Detention basins within sub-watershed A, E/D, DB18, DV19 and G will have additional storage attributed to water quality. Onsite detention is recommended for the development that may occur within sub-watersheds H and J since no site with the physical attributes for a detention basin exists. Detention basins A, DB18, DB19 and DB28 have been sited to take into account a roadway embankment that could be integrated into the design of the detention basin. Presented on Table 2 are peak flow comparisons at the discharge point of each sub-watershed for the existing, developed and detained hydrologic conditions.

At design point A an "allowable" discharge of 553 cubic feet per second was determined in Reference 4. The allowable discharge at Design Point A represents the maximum release rate from a developed A watershed and would be within the hydraulic capacity of the Fairfax Detention Basin. The Fairfax detention basin lies downstream of Powers Boulevard and is a regional detention basin that receives runoff from sub-watershed A. The discharge in the detained condition at design point A is 165 cubic feet per second well below the allowable discharge stated in Reference 4. The existing condition peak discharge estimated herein is 160 cubic feet per second.

TABLE 2:
COMPARISON OF EXISTING, FUTURE AND DETAINED CONDITIONS PEAK DISCHARGES
WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN

DESIGN POINT	LOCATION	EXISTING CONDITION Q5 (cfs)	EXISTING CONDITION Q100 (cfs)	FUTURE CONDITION Q5 (cfs)	FUTURE CONDITION Q100 (cfs)	DETAINED CONDITION Q5 (cfs)	DETAINED CONDITION Q100 (cfs)
A	at West Property Line	11	157	250	854	34	166
A5	at Cross Creek Drive	N/A	N/A	254	862	34	165
A6	at existing stock pond	12	142	199	631	200	632
A3	at Briargate Boulevard	N/A	N/A	155	509	155	509
C	at Cottonwood Creek	8	94	114	328	114	328
D	at Cottonwood Creek	10	107	55	179	N/A	N/A
D2 (1)	at south property line	10	103	57	173	13	156
E	at Cottonwood Creek	11	124	111	334	N/A	N/A
E2 (1)	at south property line	6	66	116	336	13	156
F	Tributary 4 at Cottonwood Creek	49	661	321	1,740	114	600
F28	Tributary 4 at Research Parkway	55	664	323	1,719	112	558
F22	Tributary 4 1,000' south of Briargat	49	570	116	828	47	238
G	at Cottonwood Creek	13	155	120	489	11	140
H-1	at Research Parkway	5	41	17	63	17	63
H-2	at Cottonwood Creek	3	36	25	96	25	96

(1) Detained design points D2 and E2 combine the discharges for existing basins E-1 and design point D2

The input and output for the HEC-1 computer model for the detained hydrologic analysis is contained within Appendix A of this report.

HYDRAULICS

The sizing of the major drainageway conveyances, storm sewer outfall lines and roadway culverts was accomplished using the discharge data produced for the detained hydrologic condition. Presented on Figure 6 are the sizes for each of the major roadway crossings. Roadway culverts were determined using the Federal Highways Administration HY-8 Culvert Analysis program. The input and output for the culvert analyses are contained within Appendix B. Storm sewers shown on Figure 6 were determined using normal flow equations and a minimum slope of 2 percent. The major storm sewers were modeled in the HEC-1 analysis.

With the exception of the Cottonwood Creek and Tributary Four drainageways the open channels shown on Figure 6 were sized using normal depth equations. For grass-lined channels a maximum 100-year velocity of five feet per second was assumed. For channels lined with riprap a maximum 100-year design velocity of nine feet per second was applied. The spacing of grade control along open channels, including Cottonwood Creek and Tributary Four was determined using an assumption that the longitudinal slope would degrade to one-half of the existing longitudinal slope.

Presented on plan and profiles PP1 through PP6 contained within Appendix C are the proposed drainageway improvements for the segments of Tributary Four and Cottonwood Creek within the development. Grade controls would be sloping boulder or soil cement drops with a maximum drop height of six vertical feet. A typical section of a boulder sloping drop is included with the plan and profiles. The drop structure would provide for the control of the 5-year as well as the 100-year discharge through the drop. Selective riprap bank lining is proposed along Cottonwood Creek and Tributary Four. The locations proposed for bank lining are shown on the plan and profiles. A typical bank section and sloping drop has been provided for on the detail sheet PP7 as well.

Presented on the plan and profile drawings is the 100-year floodplain and profile for Cottonwood Creek and Tributary Four. The 100-year water surface was determined using the U. S. Army Corps of Engineers HEC-2 water surface profile program. The hydrology used to determine the floodplain and profile was the developed condition without detention. The 100-year velocity along Cottonwood Creek through the Wolf Ranch development ranges 4 to 10 feet per second. The 100-year velocity for Tributary Four ranges from 6 to 10 feet per second. These velocity ranges were used when determining the average riprap size needed for the selective linings.

Also presented on the plan and profiles is a proposed erosion setback for Cottonwood Creek and Tributary Four. This setback was determined using the "prudent line" methodology for erosion resistant banks conditions as outlined in Reference 8. This setback was determined in order to define the location of the encroachment limits for the Cottonwood Creek and Tributary Four corridors. This setback was determined since the banks will only be selectively lined and therefore some allowance for lateral migration of the stream channel could occur. Using the methodology outlined in Reference 8, the calculated setback ranges from 60 to 140 feet for Tributary Four. The location of the erosion setback denotes the limits of encroachment fill that would be associated with land development activities with the exception of roadway and utility crossings. The potential for vertical degradation will be limited by the drop structures. The use of the prudent line criteria is appropriate for the segments of Tributary Four and Cottonwood Creek within the property and is consistent with the Cottonwood Creek Drainage Basin Planning Study (Reference 4). The calculations associated with determining the location of the erosion setback are included within Appendix B.

FLOODPLAIN STATEMENT

Floodplains for the 100-year existing condition have been delineated for Cottonwood Creek within the Colorado Springs and El Paso County Flood Insurance Study (FIS). Cottonwood Creek is the only drainageway within the Wolf Ranch development that has been studied by FEMA.

Shown on Figure 7 is the project site superimposed on the Flood Insurance Study FIRM panel for this area of El Paso County. Portions of the Wolf Creek property lie within a 100-year floodplain and floodway as depicted in the in the City of Colorado Springs and El Paso County Flood Insurance Study (FIS), prepared by the Federal Emergency Management Agency (FEMA).

PROPOSED FACILITIES

Detention

The primary conclusion of this MDDP is that regional detention will be required to maintain the historic flow conditions at the development's west and south property lines. It is proposed to construct six detention basins within the development. Three of the detention basins lie within the Tributary Four watershed. The remaining three lie within sub-watersheds A, E/D and G. Onsite detention is recommended for sub-watersheds H and J. As discussed above, the detention basins shown on Figure 6 collectively act to reduce the 100-year peak discharge to at or below historic conditions. Detention basin

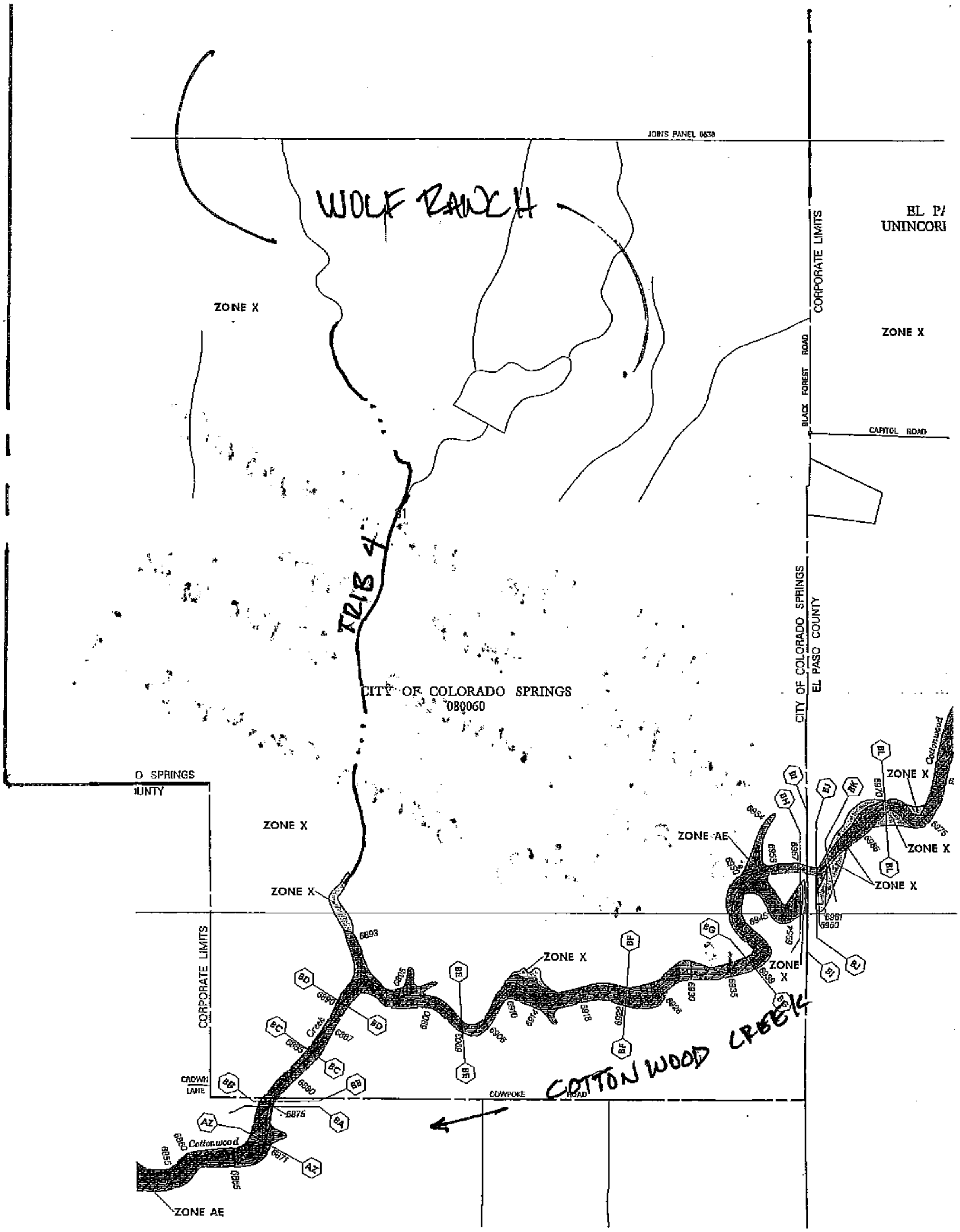


FIGURE 7
FLOODLAIN INFORMATION

E/D will be constructed with the Westcreek II subdivision. It is the intent of this MDDP to incorporate water quality storage and discharge control features for all of the detention basins except detention basin F28 that lies upstream of proposed Research Parkway embankment. Detention basin E/D should be designed with a constructed wetland bottom due to the presence of high groundwater and existing wetland vegetation. The HEC-1 models incorporating these storage facilities are contained within Appendix A of this report. The storage and outflow data for each of the detention basins are presented on Figure 6. Each detention basin will be designed to be in conformance with the City/County storm drainage technical criteria. Each detention basin will be required to have an emergency spillway. Easements or tracts dedicated for access and maintenance will be established at each detention basin site. Maintenance responsibility for each of the detention basins will be with a metropolitan district that will be formed for the area encompassed by the Wolf Ranch development. How would that work?

Drainageways

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 Cross Creek Development. The City/County storm drainage criteria manual was supplemented by other criteria 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 recommended channel sections for each reach of drainageway have been presented on Figure 6 at the rear of this report. Maintenance of the major drainageways including Cottonwood Creek and Tributary Four will be with a metropolitan district that will be formed for the area encompassed by the Wolf Ranch development.

The City of Colorado Springs adopted a streamside overlay zone for many of the natural watercourses that lie within the City in 2001. This zone was established in order to restrict encroachment of fill associated with development into the natural flood zones of a particular drainageway and to promote the preservation of the natural floodplain zones that may exist. Because of the prudent line assumption that has been advanced for Cottonwood Creek, Cottonwood Creek was exempted from the streamside overlay regulations and criteria. Tributary Four does not lie within a designated streamside overlay zone.

Drop and Check Structures

Drop structures have been sited along the Cottonwood Creek, and Tributary Four drainageways in order to maintain the channel invert at a stable gradient or to reduce the slope of the channel gradient so that lower velocities result along the drainageways. When determining the location of drop structures a degraded slope of no more than one-half of the existing slope was assumed. In the case of Cottonwood Creek the design slope ranged from 1.5 percent to 2 percent. In the case of Tributary Four the design slope applied was 1.25 percent. This assumption allows for the design to accommodate future channel degradation without modifying the existing channel section. The drops are designed to allow for a maximum drop of six feet and will have a sloping face of four to one.

Check structures are needed along the invert of some of the natural and smaller improved drainageways shown on Figure 6. The check will allow for a three-foot degradation of the invert prior to undermining a given check. These checks will be constructed of either riprap or concrete. A typical check structure detail has been presented on detail sheet PP7. The interval between checks is shown for each drainageway on Figure 6.

As with the detention basins and major drainageways the responsibility for maintenance will be dedicated to a metropolitan district to be formed for the area encompassed by the Wolf Ranch development. ?

Roadway Crossings

Summarized on Figure 6 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 development plan for Wolf Ranch. A 100-year headwater to depth ratio of 1.1 was assumed in the sizing of the major roadway culverts. The maintenance of roadway culverts under the public right-of-ways will be the responsibility of the City of Colorado Springs.

The existing crossings at Cowpoke Road and Black Forest Road are proposed to remain as they have sufficient capacity to pass the 100-year discharge without overtopping. These crossings are maintained by the El Paso County Department of Transportation. El Paso County recently extended the culvert at Black Forest Road and installed some additional riprap outlet protection. The bridge at Cowpoke Road will be removed ~~probably need replacement if Cowpoke Road~~ ~~is improved in the future.~~ when Tutt Blvd is extended across Cottonwood Creek and Cowpoke is realigned

As part of the annexation agreement for the Wolf Ranch property the Black Forest Road culvert will be required to be rebuilt by the developer of Wolf Ranch when traffic levels on Black Forest Road warrant the widening of the roadway.

DBPS says this is a bridge?

Are you planning to do anything with those culverts? If not, I would state it in this report.

Several culverts exist under Old Ranch Road at this time. These culverts range in size from 18-inches to 48-inches and are all corrugated metal pipe. The culverts have adequate capacity to convey the existing five-year flow under the roadway without overtopping. Some of the culverts have a 100-year capacity. It was assumed in the hydrologic analysis that the areas north of Old Ranch Road will not produce runoff greater than the existing condition rates calculated in this report. The majority of the area north of Old Ranch Road is developed. If a more dense land use takes place in the future detention would be required so as to not increase the rates of runoff to the Wolf Ranch property.

Trails

Trails for access to the detention basins and major drainageways need to be incorporated into the design of the improvements. For the Wolf Ranch a multi-purpose trail is proposed that is aligned along the Tributary Four. This trail will have to be accommodated at each of the roadway crossings by either an at grade or sub-grade crossing. Where practical, this trail can accommodate maintenance access to the channel and the detention basins. If the trail encroaches into a 100-year floodplain, the trail design should take into account hydraulic considerations, utilities in the area and 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.

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. For those reaches of drainageways that are designated for selective lining and the floodplain preservation, maintenance activities should be carried out while minimizing the disturbances to native vegetation.

The proposed detention basins will also require annual maintenance. The outlet structures will need to be cleared and the entry channel and forebays cleared of debris or silt. For those detention basin where water quality storage has been incorporated into the design, the clearing of sediment from the water quality pools will need to be carried out on a yearly basis as well, minimum.

who would own

Right-of-Way

It will be required for the main drainageways within the development that pass through the basin to be within dedicated tracts, easements or right-of-ways. 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 maintenance right-of-way along the low flow area of the drainageway should be obtained through the land development process. Land dedication will be required for the 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/or platting of the parcels that lie adjacent to or upstream of the stormwater facility.

Do you have an estimate of what that amount is?

DRAINAGE BASIN FEES

It is the intent of the developer to request that the developable land within the Wolf Ranch property be exempted from the assessment of drainage fees associated with the Cottonwood Creek basin and in essence "close" the basin. As such the developable acreage subject to fee assessment that has been is estimated at 1,484 acres would be removed from the Cottonwood basin. Additionally, the drainageway improvements identified in the DBPS for the portion of Cottonwood Creek within the property and for Tributary Four would not be subject to reimbursement. The land associated with the erosion control setback will also not be subject to reimbursement through the Cottonwood Creek basin fee system.

A formal presentation to the Drainage Board will be conducted wherein the recalculation of the basins fees will be discussed and revised accordingly based upon the recommendation of the Drainage Board. It is understood that the City will not provide a final approval of the MDDP until the revised fees for the basin have been resolved and reestablished. In addition the Cottonwood DBPS will need to be updated per the outcome of this action

APPENDIX A
HYDROLOGIC CALCULATIONS

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

A-BASINS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES CN 1	CN 2	CN3	CN4	AREAS AREA 1	AREA 2	AREA 3	AREA 4	WEIGHTED CN-VALUE
A-1	38.2	61	0	0	0	38.2	0	0	0	61.0
A-3	96.0	61	85	73	0	7.3	31.1	57.6	0	76.0
A-4	55.1	79	0	0	0	55.1	0	0	0	79.0
A-5	71.3	80	85	61	0	26.7	28.6	16	0	77.7
A-6	23.7	79	85	0	0	20.5	3.2	0	0	79.8
A-7	32.0	70	79	0	0	2.8	29.2	0	0	78.2
A-9	43.1	79	61	70	0	21.4	11.2	10.5	0	72.1
A-10	5.5	61	0	0	0	5.5	0	0	0	61.0
A-11	51.8	61	73	79	0	2.7	0.9	48.2	0	78.0

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

C-BASINS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES				AREAS				WEIGHTED CN-VALUE
		CN 1	CN 2	CN3	CN4	AREA 1	AREA 2	AREA 3	AREA 4	
C-1	29.4	79	0	0	0	29.4	0	0	0	79.0
C-2	70.4	79	88	0	0	58.0	12.4	0	0	80.6
C-3	35.2	79	0	0	0	35.2	0	0	0	79.0

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

B-BASINS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES CN 1	CN 2	CN3	CN4	AREAS AREA 1	AREA 2	AREA 3	AREA 4	WEIGHTED CN-VALUE
B-1	25.6	92	85	73	0	25.6	0	0	0	92.0

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

D-BASINS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES CN 1	CN 2	CN3	CN4	AREAS AREA 1	AREA 2	AREA 3	AREA 4	WEIGHTED CN-VALUE
D-1	39.4	79	70	0	0	35.5	3.9	0	0	78.1
D-2	23.0	79	0	0	0	23.0	0	0	0	79.0
D-3	15.4	61	0	0	0	15.4	0	0	0	61.0

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

E-BASINS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES CN 1	CN 2	CN3	CN4	AREAS AREA 1	AREA 2	AREA 3	AREA 4	WEIGHTED CN-VALUE
E-1	25.8	79	85	0	0	13.9	11.9	0	0	81.8
E-2	33.3	79	0	0	0	33.3	0	0	0	79.0
E-3	63.7	61	0	0	0	63.7	0	0	0	61.0
E-4	27.1	79	0	0	0	27.1	0	0	0	79.0
E-5	25.6	79	0	0	0	25.6	0	0	0	79.0
E-6	30.6	79	0	0	0	30.6	0	0	0	79.0

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES F-BASINS
FUTURE DEVELOPMENT CONDITIONS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES CN 1	CN 2	CN3	CN4	AREAS AREA 1	AREA 2	AREA 3	AREA 4	WEIGHTED CN-VALUE
F-1 to F-7										data taken from prior program compilations
F-8	57.8	61	70	73	0	11.6	17.3	28.9	0	69.7
F-9	27.5	61	70	75	0	8.3	13.7	5.5	0	68.2
F-10	11.5	61	70	75	0	5.2	1.2	5.2	0	68.8
F-11	29.4	61	70	0	0	5.9	23.5	0	0	68.2
F-12	37.8	61	70	0	0	3.7	34.1	0	0	69.1
F-13	9	61	70	0	0	9.0	0	0	0	60.7
F-14	82.6	61	70	73	0	0.0	0	82.6	0	73.0
F-15	13.4	61	70	73	0	2.7	6.7	4	0	69.1
F-16	17.3	61	70	73	0	3.5	3.4	10.38	0	69.9
F-17	24.3	61	70	73	0	23.1	0	1.2	0	61.6
F-18	63	61	73	79	0	17.9	17.9	25.2	0	69.7

F-19	65.3	61	73	79	0	20.9	0	44.4	0	73.2
F-21	50.6	85	88	92	0	12.6	12.6	25.3	0	89.1
F-22	41	61	92	0	0	36.9	4.1	0	0	64.1
F-23	19.8	0	73	0	0	0.0	19.8	0	0	73.0
F-24	57	0	73	79	0	0.0	40	17	0	74.8
F-25	57	0	73	79	0	0.0	51	6	0	73.6
F-26	34	0	79	85	0	0.0	17	17	0	82.0
F-27	129	61	73	85	92	90.0	6	6	27	69.2
F-28	24	61	73	85	92	12.0	0	12	0	73.0
F-29	16	61	73	85	92	8.0	0	8	0	73.0
F-30	14	61	75	85	92	2.8	11.2	0	0	72.2
F-31	60	61	73	85	92	40.0	20	0	0	65.0

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

G-BASINS

SUB-BASIN NUMBER	BASIN AREA (AC)	CN-VALUES CN 1	CN 2	CN3	CN4	AREAS AREA 1	AREA 2	AREA 3	AREA 4	WEIGHTED CN-VALUE
G-1										data taken from prior program compilations
G-2	22.4	73	0	0	0	22.4	0	0	0	73.0
G-3	113.3	73	75	0	0	111.9	1.4	0	0	73.0
G-4	59.9	61	79	92	0	0.2	57.3	2.4	0	79.5
G-5	43.5	61	79	0	0	5.6	37.9	0	0	76.7

Wolf Ranch Master Development Drainage Plan
Time of Concentration
A-basins

Basin	Slope			Length			Run Coef.	Velocity			T_c			T_c	Basin
	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2	(5-year)	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2		
A-1	9.0 %	6.1 %	0 %	1,000 lf	1,650 lf	0 lf	0.20	8.0 ft/sec	8.0 ft/sec	0.0 ft/sec	1536 sec.	206 sec.	0 sec.	**29.0 min.**	A-1
A-3	6.0 %	2.1 %	0 %	300 lf	3,200 lf	0 lf	0.45	8.0 ft/sec	5.0 ft/sec	0.0 ft/sec	696 sec.	640 sec.	0 sec.	**22.3 min.**	A-3
A-4	2.0 %	4.1 %	3 %	300 lf	850 lf	1,650 lf	0.50	2.0 ft/sec	8.0 ft/sec	8.0 ft/sec	926 sec.	106 sec.	206 sec.	**20.6 min.**	A-4
A-5	2.0 %	3.1 %	1 %	300 lf	2,050 lf	1,120 lf	0.60	2.0 ft/sec	8.0 ft/sec	5.0 ft/sec	771 sec.	256 sec.	224 sec.	**20.9 min.**	A-5
A-6	2.0 %	1.6 %	0 %	300 lf	1,550 lf	0 lf	0.50	2.0 ft/sec	5.0 ft/sec	5.0 ft/sec	926 sec.	310 sec.	0 sec.	**20.6 min.**	A-6
A-7	2.0 %	2.0 %	0 %	100 lf	2,000 lf	0 lf	0.50	2.0 ft/sec	4.0 ft/sec	10.0 ft/sec	534 sec.	500 sec.	0 sec.	**17.2 min.**	A-7
A-9	2.0 %	2.0 %	0 %	300 lf	2,300 lf	0 lf	0.45	2.0 ft/sec	4.0 ft/sec	10.0 ft/sec	1003 sec.	575 sec.	0 sec.	**26.3 min.**	A-9
A-10	5.0 %	0.0 %	0 %	550 lf	0 lf	0 lf	0.20	5.0 ft/sec	4.0 ft/sec	10.0 ft/sec	1386 sec.	0 sec.	0 sec.	**23.1 min.**	A-10
A-11	4.7 %	3.4 %	0 %	300 lf	1,252 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	813 sec.	313 sec.	0 sec.	**18.8 min.**	A-11

Equations:

Time of Concentration (Overland) = $1.87(1.1-C_5)L^{0.5}\,S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S+0.3)})$

S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_n^{2/3}\,S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)

Wolf Ranch Master Development Drainage Plan
Time of Concentration
B-basins

Basin	Slope O'land	Slope Chan. 1	Slope Chan. 2	Length O'land	Length Chan. 1	Length Chan. 2	Run Coef (5-year)	Velocity O'land	Velocity Chan. 1	Velocity Chan. 2	T_c O'land	T_c Chan. 1	T_c Chan. 2	T_c	Basin
B-1	2.0 %	2.0 %	0 %	100 lf	1,850 lf	0 lf	0.90	2.0 ft/sec	4.0 ft/sec	0.0 ft/sec	178 sec.	463 sec.	0 sec.	**10.7 min.**	B-1

Equations:

Time of Concentration (Overland) = $1.87(1.1-C_5)L^{0.5}S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S + 0.3)})$

S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_h^{2/3}S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_h = Hydraulic Radius (Reynold's Number)

Wolf Ranch Master Development Drainage Plan
Time of Concentration
C-basins

Basin	Slope			Length			Run Coef.	Velocity			T_c			T_c	Basin
	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2	(5-year)	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2		
C-1	2.0 %	3.0 %	0 %	100 lf	1,950 lf	0 lf	0.60	2.0 ft/sec	4.0 ft/sec	0.0 ft/sec	445 sec.	488 sec.	0 sec.	**15.5 min.**	C-1
C-2	3.0 %	4.0 %	0 %	100 lf	650 lf	3,450 lf	0.55	2.0 ft/sec	4.0 ft/sec	6.0 ft/sec	428 sec.	163 sec.	0 sec.	**9.8 min.**	C-2
C-3	2.5 %	2.0 %	0 %	100 lf	2,650 lf	0 lf	0.55	2.0 ft/sec	4.0 ft/sec	0.0 ft/sec	455 sec.	663 sec.	0 sec.	**18.6 min.**	C-3

Equations:

Time of Concentration (Overland) = $1.87(1.1 - C_5)L^{0.5} S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S + 0.3)})$

S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_n^{2/3} S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)

Wolf Ranch Master Development Drainage Plan
Time of Concentration
D-basins

Basin	Slope			Length			Run Coef	Velocity			T_r			T_c	Basin
	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2	(5-year)	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2		
D-1	2.0 %	2.0 %	0 %	100 lf	2,350 lf	0 lf	0.55	2.0 ft/sec	4.0 ft/sec	0.0 ft/sec	490 sec.	588 sec.	0 sec.	**18.0 min.**	D-1
D-2	2.0 %	3.0 %	0 %	100 lf	1,350 lf	0 lf	0.55	2.0 ft/sec	6.0 ft/sec	0.0 ft/sec	490 sec.	225 sec.	0 sec.	**11.9 min.**	D-2
D-3	4.0 %	2.6 %	0 %	800 lf	1,920 lf	0 lf	0.20	7.0 ft/sec	4.0 ft/sec	0.0 ft/sec	1800 sec.	480 sec.	0 sec.	**38.0 min.**	D-3

Equations:

Time of Concentration (Overland) = $1.87(1.1-C_5)L^{0.5}S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S + 0.3)})$

S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_n^{2/3}S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)

Wolf Ranch Master Development Drainage Plan
Time of Concentration
E-basins

Basin	Slope			Length			Run Coef.	Velocity			T_c			T_c	Basin
	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2	(5-year)	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2		
E-1	2.0 %	2.0 %	0 %	100 lf	1,700 lf	0 lf	0.60	2.0 ft/sec	4.0 ft/sec	0.0 ft/sec	445 sec.	425 sec.	0 sec.	**14.5 min.**	E-1
E-2	3.0 %	3.0 %	0 %	100 lf	2,250 lf	0 lf	0.55	2.0 ft/sec	6.0 ft/sec	0.0 ft/sec	428 sec.	375 sec.	0 sec.	**13.4 min.**	E-2
E-3	3.0 %	2.0 %	0 %	700 lf	3,150 lf	0 lf	0.25	2.0 ft/sec	5.0 ft/sec	0.0 ft/sec	1750 sec.	630 sec.	0 sec.	**39.7 min.**	E-3
E-4	2.0 %	2.0 %	0 %	100 lf	2,150 lf	0 lf	0.55	2.0 ft/sec	6.0 ft/sec	0.0 ft/sec	490 sec.	358 sec.	0 sec.	**14.1 min.**	E-4
E-5	3.0 %	3.0 %	0 %	100 lf	1,700 lf	0 lf	0.55	2.0 ft/sec	6.0 ft/sec	0.0 ft/sec	428 sec.	283 sec.	0 sec.	**11.9 min.**	E-5
E-6	2.0 %	2.0 %	0 %	100 lf	2,200 lf	0 lf	0.50	2.0 ft/sec	4.0 ft/sec	0.0 ft/sec	534 sec.	550 sec.	0 sec.	**18.1 min.**	E-6

Equations:

Time of Concentration (Overland) = $1.87(1.1 - C_5)L^{0.5} S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S + 0.3)})$

S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_n^{2/3} S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)

Wolf Ranch Master Development Drainage Plan
Time of Concentration
F-basins

Basin	Slope			Length			Run Coef.	Velocity			T_c			T_c	Basin
	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2	(5-year)	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2		
F-8	6.7 %	4.4 %	0 %	298 lf	2,323 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	720 sec.	581 sec.	0 sec.	**21.7 min.**	F-8
F-9	6.3 %	4.0 %	0 %	300 lf	927 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	737 sec.	232 sec.	0 sec.	**16.1 min.**	F-9
F-10	6.7 %	5.0 %	0 %	300 lf	600 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	722 sec.	150 sec.	0 sec.	**14.5 min.**	F-10
F-11	5.7 %	4.1 %	0 %	300 lf	918 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	762 sec.	230 sec.	0 sec.	**16.5 min.**	F-11
F-12	4.0 %	3.3 %	0 %	300 lf	1,290 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	857 sec.	323 sec.	0 sec.	**19.7 min.**	F-12
F-13	7.3 %	5.2 %	0 %	300 lf	498 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	702 sec.	125 sec.	0 sec.	**13.8 min.**	F-13
F-14	3.7 %	3.1 %	3 %	300 lf	1,081 lf	1,730 lf	0.40	4.0 ft/sec	4.0 ft/sec	8.0 ft/sec	880 sec.	270 sec.	216 sec.	**22.8 min.**	F-14
F-15	5.8 %	3.7 %	0 %	300 lf	931 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	758 sec.	233 sec.	0 sec.	**16.5 min.**	F-15
F-16	2.6 %	2.6 %	0 %	300 lf	1,085 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	990 sec.	271 sec.	0 sec.	**21.0 min.**	F-16
F-17	3.7 %	3.4 %	3 %	300 lf	945 lf	990 lf	0.40	5.0 ft/sec	4.0 ft/sec	8.0 ft/sec	880 sec.	236 sec.	124 sec.	**20.7 min.**	F-17
F-18	3.3 %	3.5 %	0 %	300 lf	1,465 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	914 sec.	366 sec.	0 sec.	**21.3 min.**	F-18
F-19	4.5 %	5.9 %	4 %	300 lf	634 lf	1,155 lf	0.40	5.0 ft/sec	4.0 ft/sec	8.0 ft/sec	824 sec.	159 sec.	144 sec.	**18.8 min.**	F-19
F-21	3.3 %	2.3 %	0 %	300 lf	2,420 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	914 sec.	605 sec.	0 sec.	**25.3 min.**	F-21
F-22	4.1 %	3.5 %	0 %	300 lf	1,705 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	850 sec.	426 sec.	0 sec.	**21.3 min.**	F-22
F-23	4.0 %	4.8 %	2 %	300 lf	414 lf	890 lf	0.40	5.0 ft/sec	4.0 ft/sec	8.0 ft/sec	857 sec.	104 sec.	111 sec.	**17.9 min.**	F-23
F-24	4.0 %	2.1 %	0 %	300 lf	2,765 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	857 sec.	691 sec.	0 sec.	**25.8 min.**	F-24
F-25	2.0 %	2.8 %	0 %	300 lf	2,270 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	1080 sec.	568 sec.	0 sec.	**27.5 min.**	F-25
F-26	4.7 %	2.7 %	0 %	300 lf	1,250 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	813 sec.	313 sec.	0 sec.	**18.8 min.**	F-26
F-27	2.7 %	3.8 %	2 %	300 lf	1,650 lf	4,150 lf	0.40	5.0 ft/sec	4.0 ft/sec	8.0 ft/sec	977 sec.	413 sec.	519 sec.	**31.8 min.**	F-27
F-28	3.3 %	4.7 %	0 %	300 lf	1,950 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	914 sec.	488 sec.	0 sec.	**23.4 min.**	F-28
F-29	2.7 %	4.3 %	0 %	300 lf	655 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	977 sec.	164 sec.	0.0 ft/sec	**19.0 min.**	F-29
F-30	3.3 %	4.1 %	0 %	300 lf	680 lf	0 lf	0.40	5.0 ft/sec	4.0 ft/sec	0.0 ft/sec	914 sec.	170 sec.	0.0 ft/sec	**18.1 min.**	F-30
F-31	3.3 %	5.0 %	3 %	300 lf	1,600 lf	1,110 lf	0.40	5.0 ft/sec	4.0 ft/sec	8.0 ft/sec	914 sec.	400 sec.	139 sec.	**24.2 min.**	F-31

Equations:

Time of Concentration (Overland) = $1.87(1.1-C_5)L^{0.5} S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S + 0.3)})$

S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_h^{2/3} S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_h = Hydraulic Radius (Reynold's Number)

Wolf Ranch Master Development Drainage Plan
Time of Concentration
G-basins

Basin	Slope			Length			Run Coef.	Velocity			T_t			T_c	Basin
	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2	(5-year)	O'land	Chan. 1	Chan. 2	O'land	Chan. 1	Chan. 2		
G-2	3.5 %	2.9 %	0 %	284 lf	1,796 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	872 sec.	449 sec.	0 sec.	**22.0 min.**	G-2
G-3	3.0 %	2.6 %	0 %	263 lf	3,376 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	883 sec.	844 sec.	0 sec.	**28.8 min.**	G-3
G-4	3.2 %	2.6 %	0 %	249 lf	1,780 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	841 sec.	445 sec.	0 sec.	**21.4 min.**	G-4
G-5	2.7 %	4.1 %	0 %	300 lf	1,900 lf	0 lf	0.40	4.0 ft/sec	4.0 ft/sec	0.0 ft/sec	977 sec.	475 sec.	0 sec.	**24.2 min.**	G-5

Equations:

Time of Concentration (Overland) = $1.87(1.1-C_5)L^{0.5}S^{-0.333}$

C_5 = Runoff coefficient for five-year flow

L = Length of overland flow in feet

S = Slope of flow path in percent

Velocity (Road) = $10(10^{(0.5\log S + 0.3)})$

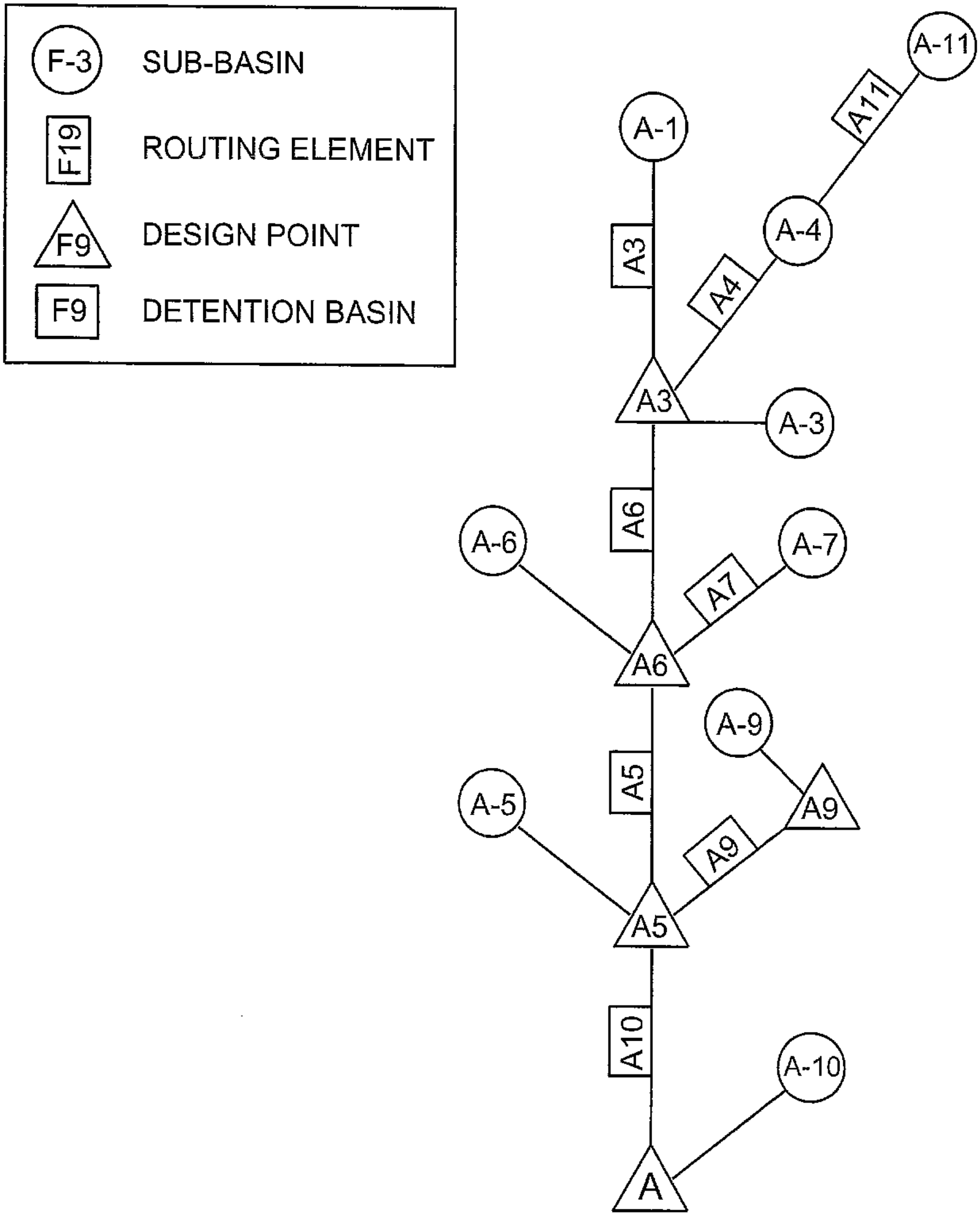
S = Slope of flow path in percent

Velocity (Channel) = $(1.49/n)R_n^{2/3}S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'A' BASINS

Kiowa Engineering Corporation

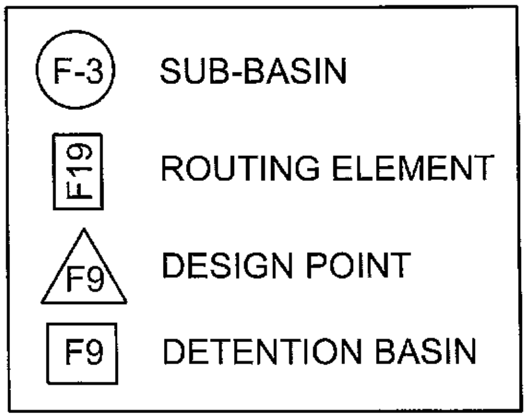
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

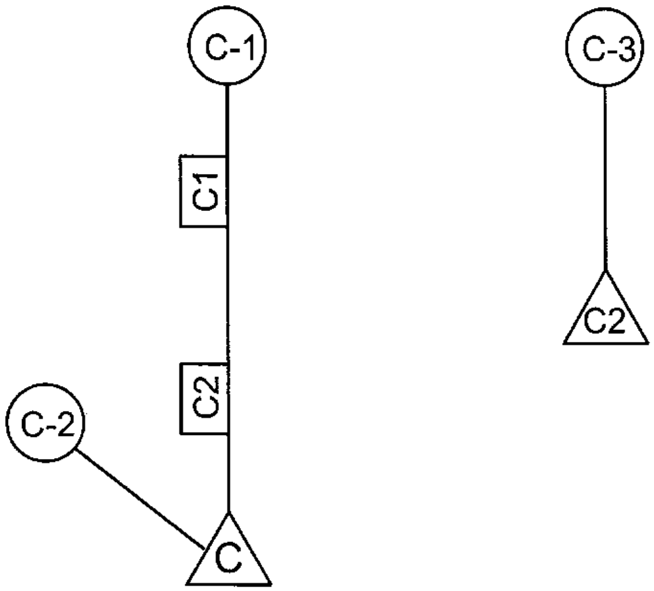
FIGURE A

PROJECT NO.: 03094
DATE: 01/29/04
DESIGN: RNW
REVISIONS:

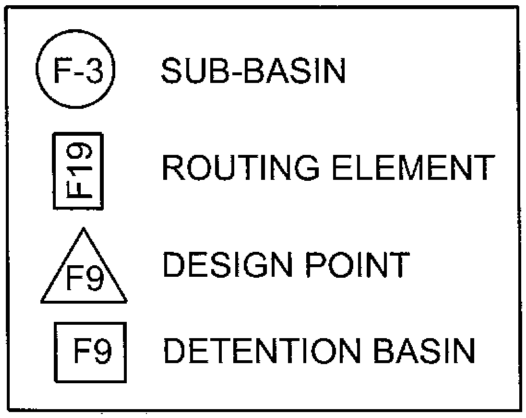
HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'B' BASINS



Kiowa Engineering Corporation 1604 South 21st Street Colorado Springs, Colorado 80904-4208 (719) 630-7342	WOLF RANCH HYDROLOGIC MODEL SCHEMATIC COLORADO SPRINGS, COLORADO FIGURE B	PROJECT NO.: 03094 DATE: 01/29/04 DESIGN: RNW REVISIONS:



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'C' BASINS

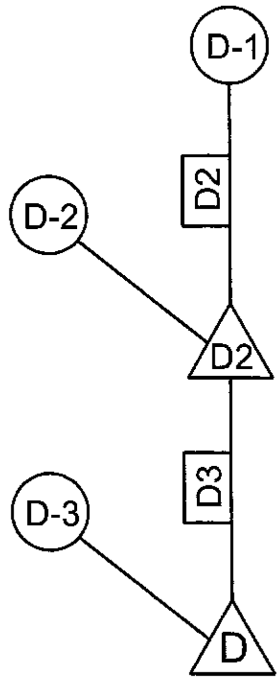


Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

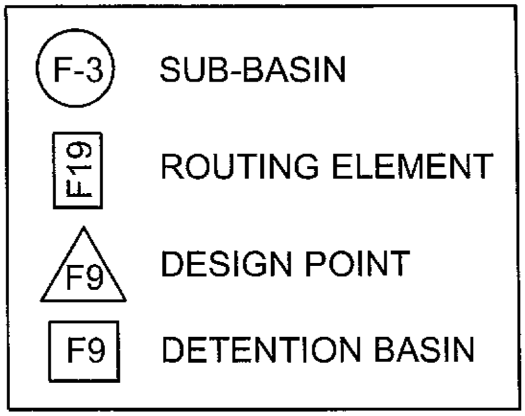
WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

FIGURE C

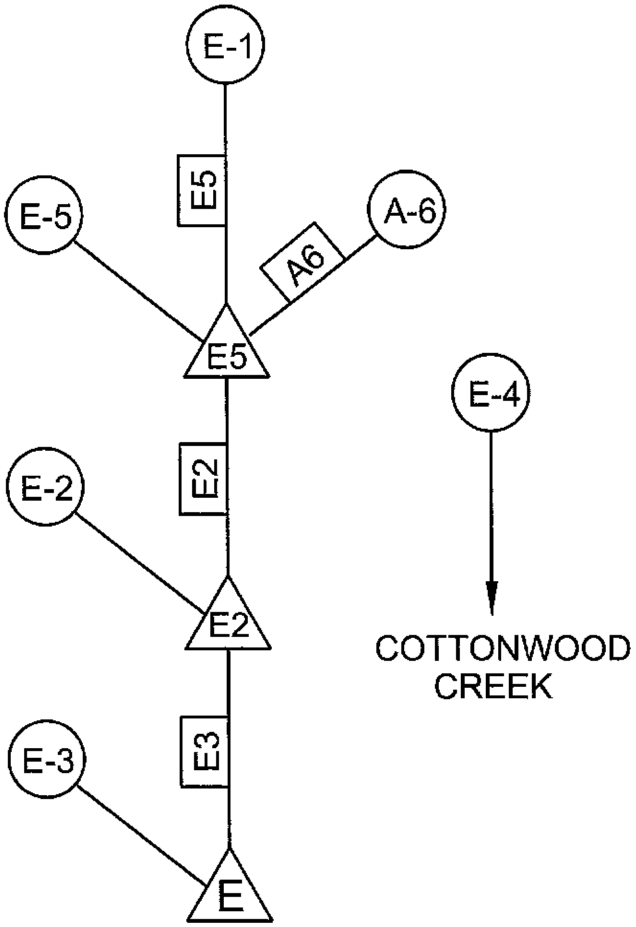
PROJECT NO.: 03094
DATE: 01/29/04
DESIGN: RNW
REVISIONS:



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'D' BASINS



Kiowa Engineering Corporation 1604 South 21st Street Colorado Springs, Colorado 80904-4208 (719) 630-7342	WOLF RANCH HYDROLOGIC MODEL SCHEMATIC COLORADO SPRINGS, COLORADO FIGURE D	PROJECT NO.: 03094 DATE: 01/29/04 DESIGN: RNW REVISIONS:



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'E' BASINS

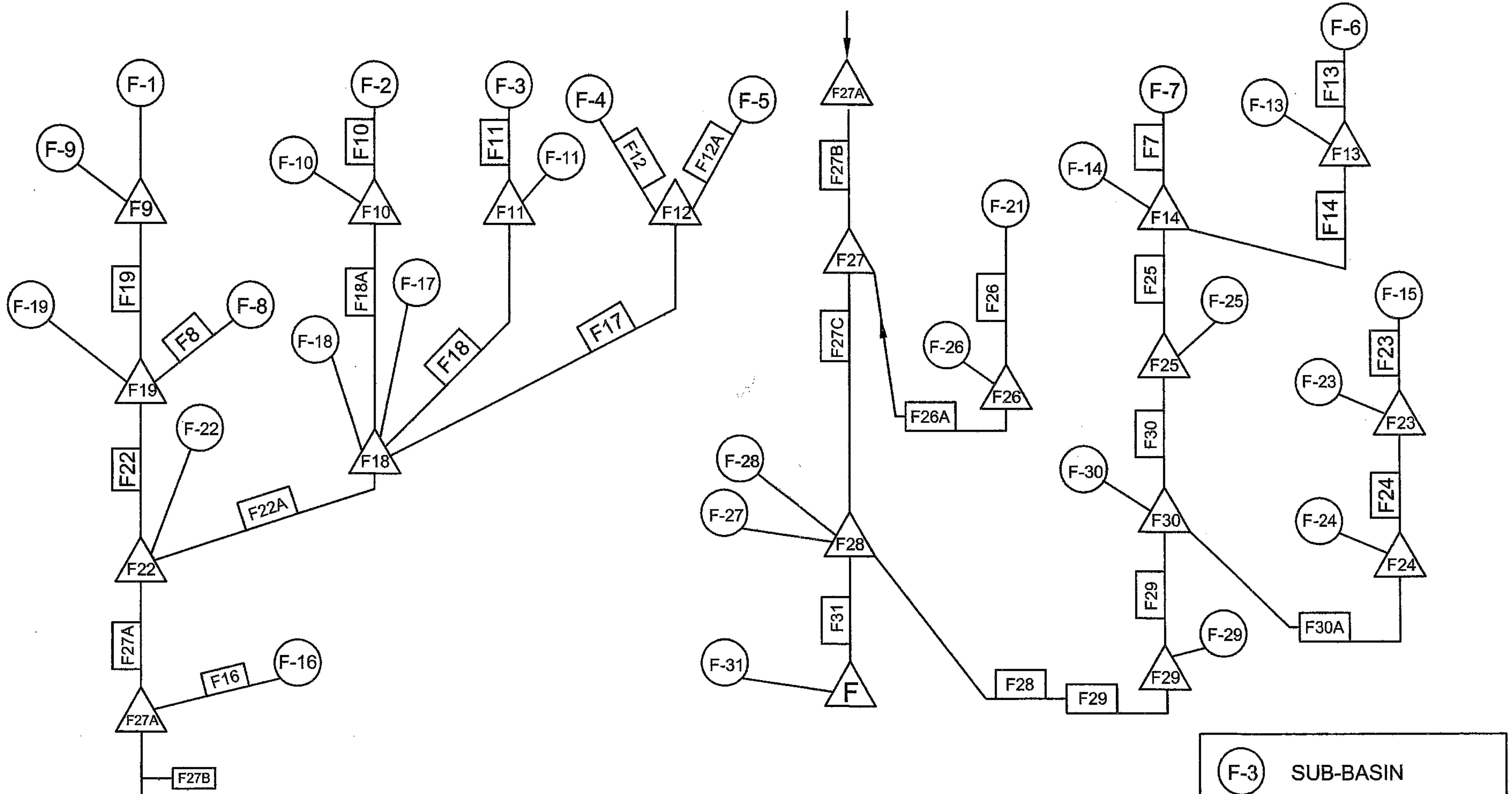
Symbol	Meaning
F-3	SUB-BASIN
F19	ROUTING ELEMENT
F9	DESIGN POINT
F9	DETENTION BASIN

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

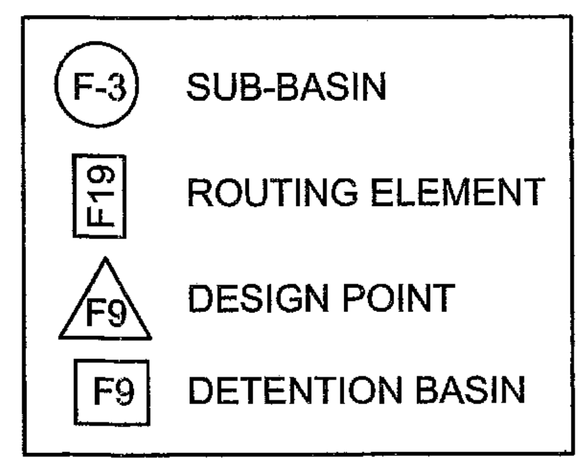
WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

FIGURE E

PROJECT NO.: 03094
DATE: 01/29/04
DESIGN: RNW
REVISIONS:



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'F' BASINS

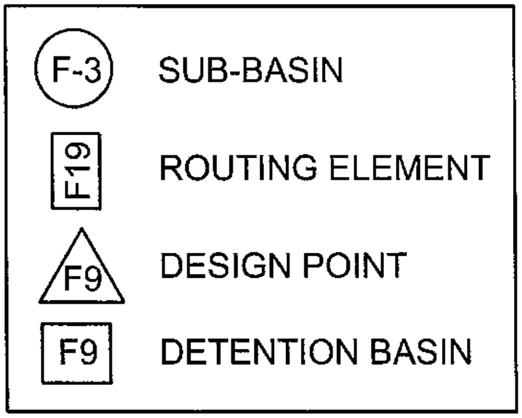


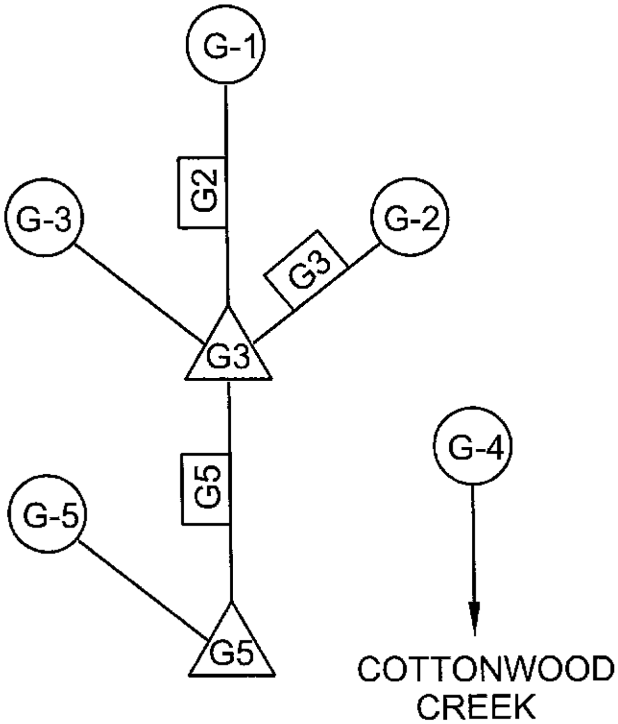
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
FIGURE F
COLORADO SPRINGS, COLORADO

Project No.: 03094	
Scale:	
Date: 03/09/04	
Design: RNW	
Drawn: JLN	
Check: RNW	
Revisions:	

03094 FigF.dwg/Nov 19, 2004





HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'G' BASINS

Kiowa Engineering Corporation 1604 South 21st Street Colorado Springs, Colorado 80904-4208 (719) 630-7342	WOLF RANCH HYDROLOGIC MODEL SCHEMATIC COLORADO SPRINGS, COLORADO FIGURE G	PROJECT NO.: 03094 DATE: 02/17/04 DESIGN: RNW REVISIONS:

HEC-1 INPUT & OUTPUT

EXISTING DEVELOPMENT CONDITIONS

```
1*****************************************
***************************************
 *                                       *
*                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *
*    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *
*         609 SECOND STREET             *
 *                                       *
*      DAVIS, CALIFORNIA 95616          *
 *  RUN DATE   25FEB04  TIME  18:18:07   *
*          (916) 756-1104               *
 *                                       *
*                                       *
 *****************************************
***************************************
```

A- BASINS

EXISTING

```
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
PAGE  1

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

              1           ID         Wolf Ranch  Master Development Drainage Plan
              2           ID           A Basins, existing development condition PN
J3094
```

```
            3          ID             5-year and 100 Year, 24 hr Type IIA  Storm  fn
ABASINE.DAT
                       *DIAGRAM
            4          IT       5       0        0      300
            5          IO       5       0
            6          JR    PREC     .56      1.0

            7          KK   A-1
            8          KM   SCS RUNOFF FOR SUB-BASIN A-1
            9          BA   .1819
           10          IN      15
           11          PB     4.4
           12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080
0.0100  0.0120  0.0143
           13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320
0.0390  0.0460  0.0530
           14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500
0.7650  0.7800  0.7900
           15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400
0.8450  0.8500  0.8550
           16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825
0.8863  0.8900  0.8938
           17          PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180
0.9210  0.9240  0.9270
           18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450
0.9475  0.9500  0.9525
           19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700
0.9725  0.9750  0.9775
           20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875
0.9888  0.9900  0.9913
           21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
           22          LS       0      61
           23          UD    0.36

           24          KK   A-2
           25          KM   RUNOFF FOR SUB-BASIN A-2
           26          BA   .1098
           27          LS       0      61
           28          UD     .29

           29          KK   1A
           30          KM   DESIGN POINT 1A COMBINE RUNOFF FROM A-1 AND A-2
           31          HC       2

           32          KK    DBA1
           33          KM   ROUTE DP 1A THROUGH EXISTING STOCK POND DBA1
           34          RS       1    ELEV    7040                1
           35          SA    0.16    0.34    0.56    0.77
           36          SE    7040    7041    7042    7043
           37          SS    7041      60    0.49     1.5
           38          ST    7041      60    0.49     1.5
           39          SW       0      10      70      90
           40          SE    7043    7041    7041    7043

           41          KK      A3
           42          KM   ROUTE OUTFLOW FROM EXISTING STOCK POND DBA1 THROUGH SUB-
BASIN A-3
```

```
              43            RD     3050     0.03     0.04              TRAP        6         3
1
PAGE  2                                                            HEC-1 INPUT

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


              44            KK      A-3
              45            KM    RUNOFF FOR SUB-BASIN A-3
              46            BA    .1318
              47            LS        0       61
              48            UD     0.28

              49            KK      DPA
              50            KM    DESIGN POINT A COMBINE RUNOFF from A3 AND SUB-BASIN A-3
              51            HC        2
              52            ZZ
1
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE       (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7        A-1
                .
                .
   24           .        A-2
                .           .
                .           .
   29        1A  ............
                V
                V
   32         DBA1
                V
                V
   41          A3
                .
                .
   44           .          A-3
                .           .
                .           .
   49          DPA...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                        *
*                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*    U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                 *
*    HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                  *
*          609 SECOND STREET            *
```

```
 *                                         *
*       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   25FEB04  TIME  18:18:07    *
*          (916) 756-1104               *
 *                                         *
*                                       *
 *****************************************
***************************************
```

```
                                             Wolf Ranch  Master Development Drainage Plan
                                            A Basins, existing development condition PN 03094
                                             5-year and 100 Year, 24 hr Type IIA  Storm  fn
ABASINE.DAT

    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT            5  PRINT CONTROL
                        IPLOT            0  PLOT CONTROL
                        QSCAL           0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN            5  MINUTES IN COMPUTATION INTERVAL
                        IDATE       1    0  STARTING DATE
                        ITIME         0000  STARTING TIME
                           NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE       2    0  ENDING DATE
                       NDTIME         0055  ENDING TIME
                        ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL      .08 HOURS
                         TOTAL TIME BASE    24.92 HOURS

           ENGLISH UNITS
                DRAINAGE AREA          SQUARE MILES
                PRECIPITATION DEPTH    INCHES
                LENGTH, ELEVATION      FEET
                FLOW                   CUBIC FEET PER SECOND
                STORAGE VOLUME         ACRE-FEET
                SURFACE AREA           ACRES
                TEMPERATURE            DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                        NPLAN            1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .56       1.00
1

               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
```

Ex Conditions
B - Basins

```
1*****************************************
***************************************
 *                                        *
*                                                                                                     *
 *   FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *
U.S. ARMY CORPS OF ENGINEERS       *                                                                  *
 *                JUN   1998              *
HYDROLOGIC ENGINEERING CENTER      *                                                                  *
 *              VERSION 4.1               *
609 SECOND STREET           *                                                                         *
 *                                        *
DAVIS, CALIFORNIA 95616         *                                                                     *
 *  RUN DATE   16JAN04  TIME  15:41:35    *
(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
PAGE   1                                              HEC-1 INPUT

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

               1            ID              Wolf Ranch Master Development Drainage Plan
               2            ID                  B basins existing development condition PN 03094
               3            ID              5-year and 100 Year, 24 hr Type IIA  Storm  FN bbas-e.dat
                            *DIAGRAM
               4            IT        5       0        0       300
               5            IO        4       0
               6            JR     PREC     .56      1.0

               7            KK      B-1
               8            KM          RUNOFF FOR SUB-BASIN B1
               9            BA    .1505
              10            IN       15
              11            PB      4.4
              12            PC   0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120
0.0143
              13            PC   0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460
0.0530
```

```
              14            PC   0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800
0.7900
              15            PC   0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500
0.8550
              16            PC   0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900
0.8938
              17            PC   0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240
0.9270
              18            PC   0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500
0.9525
              19            PC   0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750
0.9775
              20            PC   0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900
0.9913
              21            PC   0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
              22            LS        0      61
              23            UD     0.50
              24            ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7          B-1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
***************************************
 *                                      *                                      *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *
U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN  1998               *                                      *
HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *                                      *
609 SECOND STREET          *
 *                                      *                                      *
DAVIS, CALIFORNIA 95616      *
 *  RUN DATE   16JAN04   TIME  15:41:35 *                                      *
(916) 756-1104           *
 *                                      *                                      *
*
 ****************************************
***************************************


                                    Wolf Ranch Master Development Drainage Plan
                                    B basins existing development condition PN 03094
                                    5-year and 100 Year, 24 hr Type IIA  Storm  FN bbas-e.dat

    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          4  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1   0  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2   0  ENDING DATE
                       NDTIME       0055  ENDING TIME
                        ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    .08 HOURS
                      TOTAL TIME BASE  24.92 HOURS
```

```
          ENGLISH UNITS
               DRAINAGE AREA            SQUARE MILES
               PRECIPITATION DEPTH      INCHES
               LENGTH, ELEVATION        FEET
               FLOW                     CUBIC FEET PER SECOND
               STORAGE VOLUME           ACRE-FEET
               SURFACE AREA             ACRES
               TEMPERATURE              DEGREES FAHRENHEIT

     JP             MULTI-PLAN OPTION
                         NPLAN               1  NUMBER OF PLANS

     JR             MULTI-RATIO OPTION
                        RATIOS OF PRECIPITATION
                        .56      1.00


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***


          **************
          *            *
   7 KK   *     B-1    *
          *            *
          **************
                                   RUNOFF FOR SUB-BASIN B1

  10 IN             TIME DATA FOR INPUT TIME SERIES
                         JXMIN              15  TIME INTERVAL IN MINUTES
                        JXDATE       1       0  STARTING DATE
                        JXTIME               0  STARTING TIME

                 SUBBASIN RUNOFF DATA

   9 BA             SUBBASIN CHARACTERISTICS
                         TAREA             .15  SUBBASIN AREA

                    PRECIPITATION DATA

  11 PB                  STORM            4.40  BASIN TOTAL PRECIPITATION

  12 PI               INCREMENTAL PRECIPITATION PATTERN
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .01      .01      .01      .01      .01      .10      .10
 .10      .10
                         .10      .10      .01      .01      .01      .01      .01      .01
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
                         .00      .00      .00      .00      .00      .00      .00      .00
 .00      .00
```

```
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00

   22 LS          SCS LOSS RATE
                       STRTL         1.28  INITIAL ABSTRACTION
                      CRVNBR        61.00  CURVE NUMBER
                       RTIMP          .00  PERCENT IMPERVIOUS AREA

   23 UD          SCS DIMENSIONLESS UNITGRAPH
                        TLAG          .50  LAG

                                                                    ***

                                                             UNIT HYDROGRAPH
                                                          32 END-OF-PERIOD ORDINATES
                  9.        27.       55.       92.       120.      133.      133.      122.      106.
 85.      .
                 63.        49.       38.       30.        23.       18.       14.       11.        9.
 7.
                  5.         4.        3.        2.         2.        1.        1.        1.        1.
 1.
                  0.         0.
 1

                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


                                                            RATIOS APPLIED TO PRECIPITATION
  OPERATION       STATION     AREA    PLAN                RATIO 1   RATIO 2
                                                              .56      1.00

  HYDROGRAPH AT
 +                    B-1       .15      1     FLOW            5.       55.
                                               TIME          6.58      6.42


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

PRECIPITATION OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO RATIO 1 .56	RATIO 2 1.00
HYDROGRAPH AT +	A-1	.18	1	FLOW	7.	85.
				TIME	6.33	6.25
HYDROGRAPH AT +	A-2	.11	1	FLOW	5.	59.
				TIME	6.25	6.17
2 COMBINED AT +	DPA1	.29	1	FLOW	12.	142.
				TIME	6.33	6.25
ROUTED TO +	DBA1	.29	1	FLOW	8.	116.
				TIME	6.75	6.33
			** PEAK STAGES IN FEET **			
			1	STAGE	7041.41	7043.50
				TIME	6.75	6.33
ROUTED TO +	A3	.29	1	FLOW	8.	113.
				TIME	6.92	6.42
HYDROGRAPH AT +	A-3	.13	1	FLOW	6.	72.
				TIME	6.25	6.17
2 COMBINED AT +	DPA	.42	1	FLOW	11.	157.
				TIME	6.75	6.42

1

1

STATION DBA1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR

(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 ....

		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	7040.00	7041.00	7041.00
	STORAGE	0.	0.	0.
	OUTFLOW	0.	0.	0.

TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS
6.75	.00	.56	7041.41	.41	0.	8.	18.58
6.33	.00	1.00	7043.50	2.50	2.	116.	19.00

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

EXISTING CONDITIONS
C - BASINS

```
1***************************************
***************************************
 *                                      *
*                                                                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
U.S. ARMY CORPS OF ENGINEERS     *                                                   *
 *              JUN   1998              *
HYDROLOGIC ENGINEERING CENTER    *                                                   *
 *           VERSION 4.1                *
609 SECOND STREET           *                                                        *
 *                                      *
DAVIS, CALIFORNIA 95616       *                                                      *
 *  RUN DATE   16JAN04   TIME  15:41:52 *
(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
PAGE  1                                                    HEC-1 INPUT

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

           1          ID             Wolf Ranch Master Development Drainage Plan
           2          ID                  C Basins existing development condition PN 03094
           3          ID             5-yaer and 100 Year, 24 hr Type IIA  Storm FN cbas-e.dat
                      *DIAGRAM
           4          IT       5       0       0     300
           5          IO       4       0
           6          JR    PREC     .56     1.0

           7          KK     C-1
           8          KM        RUNOFF FOR SUBBASIN C1
           9          BA   .1508
          10          IN      15
          11          PB     4.4
          12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120
0.0143
          13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460
0.0530
```

```
               14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800
 0.7900
               15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500
 0.8550
               16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900
 0.8938
               17          PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240
 0.9270
               18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500
 0.9525
               19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750
 0.9775
               20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900
 0.9913
               21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
               22          LS       0      61
               23          UD    0.46

               24          KK      C3
               25          RM  ROUTE SUB-BASIN C-1 TO DP C
               26          RD   3700    .032    0.04            TRAP     10      4

               27          KK     C-2
               28          KM       RUNOFF FOR SUB-BASIN C-2
               29          BA  .0991
               30          LS       0      61
               31          UD   0.43

               32          KK     DPC
               33          KM       COMBINE RUNOFF from C3 AND C-1
               34          HC       2
               35          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7       C-1
               V
               V
   24         C3
               .
               .
   27          .          C-2
               .            .
               .            .
   32        DPC............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
 *                                        *                                                         *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
U.S. ARMY CORPS OF ENGINEERS      *                                                                 *
 *              JUN   1998                *
HYDROLOGIC ENGINEERING CENTER     *                                                                 *
 *           VERSION 4.1                  *
609 SECOND STREET          *                                                                        *
 *                                        *
DAVIS, CALIFORNIA 95616       *                                                                     *
 *  RUN DATE   16JAN04  TIME  15:41:52    *
(916) 756-1104             *                                                                        *
 *                                        *
*                                                                                                   *
 *****************************************
****************************************
```

```
                                   Wolf Ranch Master Development Drainage Plan
                                   C Basins existing development condition PN 03094
                                   5-yaer and 100 Year, 24 hr Type IIA  Storm FN cbas-e.dat

  5 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          4  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       0055  ENDING TIME
                    ICENT         19  CENTURY MARK

               COMPUTATION INTERVAL     .08 HOURS
                    TOTAL TIME BASE   24.92 HOURS

       ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT

   JP         MULTI-PLAN OPTION
                   NPLAN           1  NUMBER OF PLANS

   JR         MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                  .56      1.00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***


          **************
          *            *
  7 KK    *     C-1    *
          *            *
          **************

                          RUNOFF FOR SUBIBASN C1

 10 IN        TIME DATA FOR INPUT TIME SERIES
                    JXMIN          15  TIME INTERVAL IN MINUTES
                   JXDATE      1    0  STARTING DATE
                   JXTIME           0  STARTING TIME

            SUBBASIN RUNOFF DATA

  9 BA        SUBBASIN CHARACTERISTICS
                    TAREA         .15  SUBBASIN AREA

              PRECIPITATION DATA

 11 PB              STORM        4.40  BASIN TOTAL PRECIPITATION

 12 PI          INCREMENTAL PRECIPITATION PATTERN
                      .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.10	.10	.00	.01	.01	.01	.01	.01	.10	.10
.00	.00	.10	.10	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
		.00	.00	.00	.00	.00	.00	.00	.00

```
22 LS         SCS LOSS RATE
                 STRTL        1.28  INITIAL ABSTRACTION
                 CRVNBR      61.00  CURVE NUMBER
                 RTIMP         .00  PERCENT IMPERVIOUS AREA

23 UD         SCS DIMENSIONLESS UNITGRAPH
                 TLAG          .46  LAG
```

***

UNIT HYDROGRAPH
30 END-OF-PERIOD ORDINATES

11.	33.	68.	111.	138.	145.	138.	122.	100.	
72.									

```
                  .00        .00        .00        .00        .00        .00        .00        .00

   22 LS          SCS LOSS RATE
                        STRTL        1.28  INITIAL ABSTRACTION
                       CRVNBR       61.00  CURVE NUMBER
                        RTIMP         .00  PERCENT IMPERVIOUS AREA

   23 UD          SCS DIMENSIONLESS UNITGRAPH
                         TLAG         .44  LAG

                                                                              ***

                                                                        UNIT HYDROGRAPH
                                                                   28 END-OF-PERIOD ORDINATES
                  12.        37.        76.       122.       146.       150.       139.       120.        92.
66.
                  50.        38.        29.        22.        16.        12.         9.         7.         5.
4.
                   3.         2.         2.         1.         1.         1.         0.         0.


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
   24 KK      *       D2   *
              *            *
              **************
                                   ROUTE FLOW FROM SUB-BASIN D-1 TP DP D2

               HYDROGRAPH ROUTING DATA

   26 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                            L        5470.  CHANNEL LENGTH
                            S        .0270  SLOPE
                            N         .040  CHANNEL ROUGHNESS COEFFICIENT
                           CA          .00  CONTRIBUTING AREA
                        SHAPE         TRAP  CHANNEL SHAPE
                           WD        10.00  BOTTOM WIDTH OR DIAMETER
                            Z        10.00  SIDE SLOPE

                                                                              ***


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
   27 KK      *     D-2    *
              *            *
              **************
                                  RUNOFF FROM Sub-basin D-2

               SUBBASIN RUNOFF DATA

   29 BA          SUBBASIN CHARACTERISTICS
                        TAREA         .17  SUBBASIN AREA

                  PRECIPITATION DATA

   11 PB                STORM        4.40  BASIN TOTAL PRECIPITATION

   12 PI            INCREMENTAL PRECIPITATION PATTERN
                  .00        .00        .00        .00        .00        .00        .00        .00        .00
.00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.01	.01	.01	.01	.01	.10	.10	.10	.10
.10	.10	.01	.01	.01	.01	.01	.01	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

```
 30 LS          SCS LOSS RATE
                     STRTL          1.28  INITIAL ABSTRACTION
                    CRVNBR         61.00  CURVE NUMBER
                     RTIMP           .00  PERCENT IMPERVIOUS AREA

 31 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG           .37  LAG
```

***

UNIT HYDROGRAPH
24 END-OF-PERIOD ORDINATES

20.	62.	131.	182.	195.	179.	149.	105.	73.	53.

```
                     39.        28.        20.        14.        10.         7.         5.         4.         3.
2.
                      2.         1.         1.         0.


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
   32 KK      *     DPD2   *
              *            *
              **************
                                   COMBINE RUNOFF from D-2 AND D2

   34 HC          HYDROGRAPH COMBINATION
                       ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                                ***


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
   35 KK      *       D3   *
              *            *
              **************
                                   ROUTE FLOW FROM DP D2 TO DP D

             HYDROGRAPH ROUTING DATA

   37 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                              L        3000.  CHANNEL LENGTH
                              S        .0350  SLOPE
                              N         .040  CHANNEL ROUGHNESS COEFFICIENT
                             CA          .00  CONTRIBUTING AREA
                          SHAPE         TRAP  CHANNEL SHAPE
                             WD        10.00  BOTTOM WIDTH OR DIAMETER
                              Z        10.00  SIDE SLOPE

                                                                                ***


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
   38 KK      *      D-3   *
              *            *
              **************
                                   RUNOFF FROM Sub-basin D-3

             SUBBASIN RUNOFF DATA

   40 BA          SUBBASIN CHARACTERISTICS
                       TAREA          .05  SUBBASIN AREA

                  PRECIPITATION DATA

   11 PB               STORM         4.40  BASIN TOTAL PRECIPITATION

   12 PI            INCREMENTAL PRECIPITATION PATTERN
```

```
5.            54.     41.     32.     25.     19.     14.     11.     8.     6.
0.            4.      3.      2.      2.      1.      1.      1.      1.     0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

             **************
             *            *
   24 KK     *       C3   *
             *            *
             **************
                    ROUTE SUB-BASIN C-1 TO DP C

              HYDROGRAPH ROUTING DATA

   26 RD        MUSKINGUM-CUNGE CHANNEL ROUTING
                        L        3700.  CHANNEL LENGTH
                        S        .0320  SLOPE
                        N         .040  CHANNEL ROUGHNESS COEFFICIENT
                       CA          .00  CONTRIBUTING AREA
                    SHAPE         TRAP  CHANNEL SHAPE
                       WD        10.00  BOTTOM WIDTH OR DIAMETER
                        Z         4.00  SIDE SLOPE

                                                    ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

             **************
             *            *
   27 KK     *      C-2   *
             *            *
             **************
                       RUNOFF FOR SUB-BASIN C-2

              SUBBASIN RUNOFF DATA

   29 BA        SUBBASIN CHARACTERISTICS
                    TAREA          .10  SUBBASIN AREA

                PRECIPITATION DATA

   11 PB            STORM         4.40  BASIN TOTAL PRECIPITATION

   12 PI          INCREMENTAL PRECIPITATION PATTERN
.00     .00        .00    .00    .00    .00    .00    .00    .00    .00
.00     .00        .00    .00    .00    .00    .00    .00    .00    .00
.00     .00        .00    .00    .00    .00    .00    .00    .00    .00
.00     .00        .00    .00    .00    .00    .00    .00    .00    .00
.00     .00        .00    .00    .00    .00    .00    .00    .00    .00
.00     .00        .00    .00    .00    .00    .00    .00    .00    .00
.10     .10        .00    .01    .01    .01    .01    .01    .10    .10
.00     .00        .10    .10    .01    .01    .01    .01    .01    .01
```

```
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
   .00     .00          .00     .00     .00     .00     .00     .00     .00     .00
                        .00     .00     .00     .00     .00     .00     .00     .00

    30 LS          SCS LOSS RATE
                        STRTL          1.28  INITIAL ABSTRACTION
                       CRVNBR         61.00  CURVE NUMBER
                        RTIMP           .00  PERCENT IMPERVIOUS AREA

    31 UD          SCS DIMENSIONLESS UNITGRAPH
                        TLAG            .43  LAG

                                                            ***

                                                  UNIT HYDROGRAPH
                                             28 END-OF-PERIOD ORDINATES
                        8.     26.     53.     84.     99.    101.     92.     78.     58.
  42.
                       31.     24.     18.     13.     10.      8.      6.      4.      3.
   2.
                        2.      1.      1.      1.      1.      0.      0.      0.

 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

               **************
               *            *
    32 KK      *       DPC  *
               *            *
               **************
```

COMBINE RUNOFF from C3 AND C-1

34 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

1 ***

COMPUTATIONS PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC

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 .56	RATIO 2 1.00
HYDROGRAPH AT +	C-1	.15	1	FLOW	5.	58.
				TIME	6.50	6.42
ROUTED TO +	C3	.15	1	FLOW	5.	59.
				TIME	6.83	6.50
HYDROGRAPH AT +	C-2	.10	1	FLOW	4.	41.
				TIME	6.50	6.33
2 COMBINED AT +	DPC	.25	1	FLOW	8.	94.
				TIME	6.67	6.50

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

VOLUME (IN)	ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	DT (MIN)	INTERPOLATED TO COMPUTATION INTERVAL PEAK (CFS)	TIME TO PEAK (MIN)
	FOR PLAN = 1 RATIO= .00								
.19	C3	MANE	2.00	5.79	406.00	.18	5.00	5.43	410.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1490E+01 EXCESS= .0000E+00 OUTFLOW= .1481E+01 BASIN STORAGE= .1603E-01 PERCENT ERROR= -.5

VOLUME (IN)	ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)
	FOR PLAN = 1 RATIO= .00								
1.02	C3	MANE	2.50	58.59	390.00	1.02	5.00	58.59	390.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8231E+01 EXCESS= .0000E+00 OUTFLOW= .8223E+01 BASIN STORAGE= .2816E-01 PERCENT ERROR= -.2

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

Existing D Basins 2-100yr

```
1**************************************                                        *
*************************************                                          
 *                                          *                                  *    U.S. ARMY
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *                                  *    HYDROLOGIC
CORPS OF ENGINEERS      *
 *              JUN  1998                   *                                  *          609
ENGINEERING CENTER    *
 *           VERSION 4.1                    *                                  *       DAVIS,
SECOND STREET         *
 *                                          *                                  *
CALIFORNIA 95616      *
 *  RUN DATE   11MAR04  TIME  12:41:53      *                                  *
(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
PAGE 1

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

  1         ID               Wolf Ranch Master Development Drainage Plan
  2         ID                    D Basins existing development conditions  PN 03094
  3         ID               5-year and 100 Year, 24 hr Type IIA  Storm  FN dbas-e.dat
            *DIAGRAM
  4         IT        5       0       0     300
  5         IO        4       0
  6         JR     PREC     .48     .61     .70     .93     1.0

  7         KK    D-1
  8         KM          RUNOFF FOR Sub-basin D-1
  9         BA    .1503
 10         IN       15
 11         PB      4.4
 12         PC   0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
 13         PC   0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
 14         PC   0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
 15         PC   0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
 16         PC   0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
 17         PC   0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
            18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
            19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
            20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
            21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
            22          LS      0      61
            23          UD    0.44

            24          KK      D2
            25          KM        ROUTE FLOW FROM SUB-BASIN D-1 TP DP D2
            26          RD    5470   0.027    0.04             TRAP      10       10

            27          KK    D-2
            28          KM       RUNOFF FROM Sub-basin D-2
            29          BA   .1660
            30          LS      0      61
            31          UD    0.37

            32          KK    DPD2
            33          KM        COMBINE RUNOFF from D-2 AND D2
            34          HC      2

            35          KK     D3
            36          KM        ROUTE FLOW FROM DP D2 TO DP D
            37          RD    3000   0.035    0.04             TRAP      10       10

            38          KK     D-3
            39          KM       RUNOFF FROM Sub-basin D-3
            40          BA   .0450
            41          LS      0      61
            42          UD    0.12
1                                        HEC-1 INPUT
PAGE  2

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


            43          KK    DPD2
            44          KM        COMBINE RUNOFF from D-3 AND D3
            45          HC      2
            46          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7       D-1
              V
              V
   24        D2
              .
              .
   27         .        D-2
              .           .
              .           .
   32       DPD2...........
              V
              V
   35        D3
              .
              .
   38         .          D-3
              .            .
              .            .
   43       DPD2...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
```

```
 *                                          *                                                      *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *                                                      *    U.S. ARMY
CORPS OF ENGINEERS     *
 *            JUN   1998                    *                                                      *    HYDROLOGIC
ENGINEERING CENTER    *
 *           VERSION 4.1                    *                                                      *          609
SECOND STREET          *
 *                                          *                                                      *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   11MAR04  TIME  12:41:53      *                                                      *
(916) 756-1104             *
 *                                          *                                                      *
*
 ****************************************
***************************************
```

```
                                   Wolf Ranch Master Development Drainage Plan
                                   D Basins existing development conditions  PN 03094
                                   5-year and 100 Year, 24 hr Type IIA  Storm  FN dbas-e.dat

   5 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          4  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1   0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2   0  ENDING DATE
                      NDTIME       0055  ENDING TIME
                       ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

     JP           MULTI-PLAN OPTION
                       NPLAN          1  NUMBER OF PLANS

     JR           MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                     .48       .61       .70       .93      1.00


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


             **************
             *            *
   7 KK      *    D-1     *
             *            *
             **************
                                RUNOFF FOR Sub-basin D-1
```

```
10 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN          15  TIME INTERVAL IN MINUTES
                    JXDATE      1    0  STARTING DATE
                    JXTIME           0  STARTING TIME

             SUBBASIN RUNOFF DATA

 9 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .15  SUBBASIN AREA

               PRECIPITATION DATA

11 PB                STORM        4.40  BASIN TOTAL PRECIPITATION

12 PI            INCREMENTAL PRECIPITATION PATTERN
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .01     .01     .01     .01     .01     .10     .10     .10
 .10
                     .10     .10     .01     .01     .01     .01     .01     .01     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
                     .00     .00     .00     .00     .00     .00     .00     .00     .00
 .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.10	.00	.01	.01	.01	.01	.01	.10	.10	.10
.00	.10	.10	.01	.01	.01	.01	.01	.01	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	.00	.00	.00	.00	.00	.00	.00	.00	

```
 41 LS        SCS LOSS RATE
                   STRTL        1.28  INITIAL ABSTRACTION
                  CRVNBR       61.00  CURVE NUMBER
                   RTIMP         .00  PERCENT IMPERVIOUS AREA

 42 UD        SCS DIMENSIONLESS UNITGRAPH
                    TLAG         .12  LAG
```

***

UNIT HYDROGRAPH
9 END-OF-PERIOD ORDINATES

68.	135.	85.	35.	15.	7.	3.	1.	0.

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
   43 KK      *     DPD2   *
              *            *
              **************
                             COMBINE RUNOFF from D-3 AND D3

   45 HC          HYDROGRAPH COMBINATION
                       ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

1                                                                       ***
```

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	RATIO 2	RATIO 3	RATIO 4	RATIO 5
					.48	.61	.70	.93	1.00
HYDROGRAPH AT									
+	D-1	.15	1	FLOW	2.	9.	18.	49.	60.
				TIME	6.58	6.42	6.42	6.33	6.33
ROUTED TO									
+	D2	.15	1	FLOW	2.	9.	20.	49.	59.
				TIME	7.33	7.00	6.67	6.67	6.67
HYDROGRAPH AT									
+	D-2	.17	1	FLOW	2.	11.	22.	61.	75.
				TIME	6.50	6.33	6.33	6.25	6.25
2 COMBINED AT									
+	DPD2	.32	1	FLOW	4.	14.	33.	84.	103.
				TIME	7.33	6.92	6.67	6.50	6.50
ROUTED TO									
+	D3	.32	1	FLOW	3.	15.	31.	88.	103.
				TIME	7.67	7.17	6.92	6.67	6.67
HYDROGRAPH AT									
+	D-3	.05	1	FLOW	1.	6.	12.	30.	36.
				TIME	6.08	6.08	6.08	6.08	6.08
2 COMBINED AT									
+	DPD2	.36	1	FLOW	4.	16.	32.	92.	107.
1				TIME	7.67	7.17	6.92	6.67	6.67

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

Ex Condition
'E' Basins
2 → 100yr

```
1*******************************************
****************************************
 *                                          *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *
CORPS OF ENGINEERS     *
 *              JUN   1998                  *
ENGINEERING CENTER    *
 *           VERSION 4.1                    *
SECOND STREET          *
 *                                          *
CALIFORNIA 95616       *
 *  RUN DATE   11MAR04  TIME  12:43:42      *
(916) 756-1104           *
 *                                          *
*
 *******************************************
****************************************

                                       *       U.S. ARMY
                                       *       HYDROLOGIC
                                       *             609
                                       *          DAVIS,
                                       *
                                       *

      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
PAGE  1                                  HEC-1 INPUT

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

           1           ID                Wolf Ranch master Development Drainage Plan
           2           ID                     E Basins existing development condition PN 03094
           3           ID                5-year and 100 Year, 24 hr Type IIA  Storm  FN ebas-e.dat
                       *DIAGRAM
           4           IT       5       0        0      300
           5           IO       4       0
           6           JR    PREC     .48      .61      .70      .93     1.0

           7           KK     E-1
           8           KM          RUNOFF FOR SUB-BASIN E-1
           9           BA   .1640
          10           IN      15
          11           PB     4.4
          12           PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
          13           PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
          14           PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
          15           PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
          16           PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
          17           PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
            18             PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
            19             PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
            20             PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
            21             PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
            22             LS       0       61
            23             UD    0.44

            24             KK      E2
            25             KM         ROUTE FLOW FROM SUB-BASIN E-1` TO DP E
            26             RD    3050    .035    0.04            TRAP      10       5

            27             KK     E-2
            28             KM         RUNOFF FOR SUB-BASIN E-2
            29             BA   .1520
            30             LS       0       61
            31             UD    0.44

            32             KK     DPE
            33             KM         COMBINE RUNOFF FROM E2 AND E-2
            34             HC       2
            35             ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

     7         E-1
                 V
                 V
    24          E2
                 .
                 .
    27           .          E-2
                 .            .
                 .            .
    32         DPE............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                          *                                                      *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *                                                      *    U.S. ARMY
CORPS OF ENGINEERS      *
 *              JUN   1998                  *                                                      *    HYDROLOGIC
ENGINEERING CENTER     *
 *            VERSION 4.1                   *                                                      *          609
SECOND STREET          *
 *                                          *                                                      *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   11MAR04  TIME  12:43:42      *                                                      *
(916) 756-1104           *
 *                                          *                                                      *
*
 *****************************************
***************************************


                                   Wolf Ranch master Development Drainage Plan
                                    E Basins existing development condition PN 03094
                                   5-year and 100 Year, 24 hr Type IIA  Storm  FN ebas-e.dat

    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          4  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE
```

```
IT          HYDROGRAPH TIME DATA
                  NMIN           5  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1    0  STARTING DATE
                 ITIME        0000  STARTING TIME
                    NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      2    0  ENDING DATE
                NDTIME        0055  ENDING TIME
                ICENT           19  CENTURY MARK

             COMPUTATION INTERVAL     .08 HOURS
                  TOTAL TIME BASE   24.92 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT

JP          MULTI-PLAN OPTION
                 NPLAN           1  NUMBER OF PLANS

JR          MULTI-RATIO OPTION
               RATIOS OF PRECIPITATION
                 .48       .61       .70       .93      1.00


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


          **************
          *            *
   7 KK   *      E-1   *
          *            *
          **************
                             RUNOFF FOR SUB-BASIN E-1

  10 IN         TIME DATA FOR INPUT TIME SERIES
                      JXMIN          15  TIME INTERVAL IN MINUTES
                     JXDATE      1    0  STARTING DATE
                     JXTIME           0  STARTING TIME

              SUBBASIN RUNOFF DATA

   9 BA         SUBBASIN CHARACTERISTICS
                      TAREA         .16  SUBBASIN AREA

                PRECIPITATION DATA

  11 PB               STORM        4.40  BASIN TOTAL PRECIPITATION

  12 PI           INCREMENTAL PRECIPITATION PATTERN
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
.00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
.00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
.00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
.00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
.00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
.00
                      .00       .01       .01       .01       .01       .01       .10       .10       .10
.10
```

```
              .10    .10    .01    .01    .01    .01    .01    .01    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00    .00
 .00
              .00    .00    .00    .00    .00    .00    .00    .00

  22 LS        SCS LOSS RATE
                  STRTL        1.28  INITIAL ABSTRACTION
                 CRVNBR       61.00  CURVE NUMBER
                  RTIMP         .00  PERCENT IMPERVIOUS AREA

  23 UD        SCS DIMENSIONLESS UNITGRAPH
                   TLAG         .44  LAG

                                                 ***

                                             UNIT HYDROGRAPH
                                        28 END-OF-PERIOD ORDINATES
            13.     40.     83.    133.    159.    164.    152.    130.    101.
 72.
            54.     42.     32.     23.     18.     13.     10.      8.      6.
 4.
             3.      2.      2.      2.      1.      1.      1.      0.


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


              **************
              *            *
  24 KK       *        E2  *
```

```
             *              *
             **************
                                   ROUTE FLOW FROM SUB-BASIN E-1` TO DP E

                HYDROGRAPH ROUTING DATA

 26 RD            MUSKINGUM-CUNGE CHANNEL ROUTING
                            L        3050.   CHANNEL LENGTH
                            S        .0350   SLOPE
                            N         .040   CHANNEL ROUGHNESS COEFFICIENT
                           CA          .00   CONTRIBUTING AREA
                        SHAPE         TRAP   CHANNEL SHAPE
                           WD        10.00   BOTTOM WIDTH OR DIAMETER
                            Z         5.00   SIDE SLOPE

                                                                  ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


             **************
             *            *
 27 KK       *      E-2   *
             *            *
             **************
                                   RUNOFF FOR SUB-BASIN E-2

                SUBBASIN RUNOFF DATA

 29 BA            SUBBASIN CHARACTERISTICS
                        TAREA          .15   SUBBASIN AREA

                  PRECIPITATION DATA

 11 PB                  STORM         4.40   BASIN TOTAL PRECIPITATION

 12 PI              INCREMENTAL PRECIPITATION PATTERN
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .01      .01      .01      .01      .01      .10      .10      .10
.10
                         .10      .10      .01      .01      .01      .01      .01      .01      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                         .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
```

```
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00      .00
.00
                  .00      .00      .00      .00      .00      .00      .00      .00

  30 LS         SCS LOSS RATE
                   STRTL        1.28  INITIAL ABSTRACTION
                   CRVNBR      61.00  CURVE NUMBER
                   RTIMP         .00  PERCENT IMPERVIOUS AREA

  31 UD         SCS DIMENSIONLESS UNITGRAPH
                   TLAG          .44  LAG

                                                    ***

                                                UNIT HYDROGRAPH
                                           28 END-OF-PERIOD ORDINATES
              12.      37.      77.     123.     148.     152.     141.     121.     93.
67.
              50.      38.      29.      22.      16.      12.       9.       7.      5.
4.
               3.       2.       2.       1.       1.       1.       1.       0.


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** ***


           **************
           *            *
  32 KK    *      DPE   *
           *            *
           **************
                        COMBINE RUNOFF FROM E2 AND E-2

  34 HC         HYDROGRAPH COMBINATION
                   ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***
1

          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


                                                       RATIOS APPLIED TO PRECIPITATION
```

OPERATION	STATION	AREA	PLAN		RATIO 1 .48	RATIO 2 .61	RATIO 3 .70	RATIO 4 .93	RATIO 5 1.00
HYDROGRAPH AT									
+	E-1	.16	1	FLOW	2.	10.	19.	53.	66.
				TIME	6.58	6.42	6.42	6.33	6.33
ROUTED TO									
+	E2	.16	1	FLOW	2.	10.	19.	53.	66.
				TIME	6.92	6.67	6.58	6.50	6.50
HYDROGRAPH AT									
+	E-2	.15	1	FLOW	2.	9.	18.	49.	61.
				TIME	6.58	6.42	6.42	6.33	6.33
2 COMBINED AT									
+	DPE	.32	1	FLOW	3.	18.	35.	99.	124.
1				TIME	6.92	6.58	6.50	6.42	6.42

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

Ex-Conditions
"F" basins

```
1*****************************************
*****************************************
 *                                       *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *
HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *
609 SECOND STREET         *
 *                                       *
DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   16JAN04  TIME  17:45:26   *
(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
PAGE 1

HEC-1 INPUT

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

           1           ID           Wolf Ranch Master Development Drainage Plan
           2           ID                  F Basins Existing Development Condition  PN 03094
           3           ID           5-year and 100 Year, 24 hr Type IIA  Storm  FN fbas-e.dat
                       *DIAGRAM
           4           IT      5       0        0       300
           5           IO      4       0
           6           JR    PREC    .56      1.0

           7           KK    F-1
           8           KM        RUNOFF SUB-BASIN F-1
           9           BA   .1659
          10           IN      15
          11           PB    4.4
          12           PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120
0.0143
          13           PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460
0.0530
```

```
             14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800
0.7900
             15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500
0.8550
             16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900
0.8938
             17          PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240
0.9270
             18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500
0.9525
             19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750
0.9775
             20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900
0.9913
             21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
             22          LS       0      61
             23          UD    0.20

             24          KK     1-8
             25          KM   ROUTE FLOW FROM F-1 THROUGH F-8
             26          RD    4620    0.04    0.04                TRAP       6       3

             27          KK     F-8
             28          KM   SCS RUNOFF F-8
             29          BA   .1499
             30          LS       0      61
             31          UD     .22

             32          KK      1F
             33          KM   COMBINE RUNOFF FROM F-1 AND F-8
             34          HC       2

             35          KK     F-2
             36          KM   SCS RUNOFF F-2
             37          BA   .0424
             38          LS       0      61
             39          UD     .19

             40          KK     F-3
             41          KM   SCS RUNOFF F-3
             42          BA   .0942
             43          LS       0      61
             44          UD     .22
1
PAGE  2                                        HEC-1 INPUT

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


             45          KK      2F
             46          KM   COMBINE RUNOFF FROM F-2 AND F-3
             47          HC       2

             48          KK   2F-5F
             49          KM   ROUTE FLOW FROM 2F THROUGH F-9
             50          RD    3087   0.036    0.04                TRAP       6       3

             51          KK     F-9
             52          KM   SCS RUNOFF F-9
             53          BA   .1953
             54          LS       0      61
             55          UD     .27

             56          KK      5F
             57          KM   COMBINE RUNOFF FROM 2F AND F-9
             58          HC       2

             59          KK   POND1
             60          KM   ROUTE FLOW THROUGH POND1
             61          RS       1    ELEV    7133            1
```

```
        62            SA    0.41    0.58    0.76    0.86
        63            SE    7133    7134    7135    7136
        64            ST    7133      10    0.50     1.5
        65            SS    7133      10    0.50     1.5
        66            SW       0      50      60      70     125
        67            SE    7136    7135    7133    7133    7136

        68            KK     F-4
        69            KM   SCS RUNOFF F-4
        70            BA   .2681
        71            LS       0      61
        72            UD     .28

        73            KK     F-5
        74            KM   SCS RUNOFF F-5
        75            BA   .1073
        76            LS       0      61
        77            UD     .24

        78            KK      3F
        79            KM   COMBINE RUNOFF FROM F-4 AND F-5
        80            HC       2

        81            KK   3F-6F
        82            KM   ROUTE FLOW FROM 3F THROUGH F-10
        83            RD    3790   0.034    0.04              TRAP      10      10

        84            KK    F-10
        85            KM   SCS RUNOFF F-10
        86            BA   .0883
        87            LS       0      61
        88            UD     .28
1
PAGE  3                                                  HEC-1 INPUT

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


        89            KK      6F
        90            KM   COMBINE RUNOFF FROM 3F AND F-10
        91            HC       2

        92            KK      8F
        93            KM   COMBINE RUNOFF FROM 5F AND 6F
        94            HC       2

        95            KK   8F-9F
        96            KM   ROUTE FLOW FROM 8F TO 9F
        97            RD    1706   0.034    0.04              TRAP       6       2

        98            KK      F9
        99            KM   COMBINE RUNOFF FROM 1F AND 9F
       100            HC       2

       101            KK     F12
       102            KM      ROUTE FLOW FROM DP F9 TO DP F12
       103            RC     .04   0.035    0.04    5200   0.022
       104            RX       0      20      33      37      43      47      60      80
       105            RY    7014    7004    7004    7000    7000    7004    7004    7014

       106            KK     F-6
       107            KM   SCS RUNOFF F-6
       108            BA   .0310
       109            LS       0      61
       110            UD     .19

       111            KK     F-7
       112            KM   SCS RUNOFF F-7
       113            BA   .0782
       114            LS       0      61
```

```
          115          UD     .19

          116          KK      4F
          117          KM    COMBINE RUNOFF FROM F-6 AND F-7
          118          HC       2

          119          KK    4F-7F
          120          KM    ROUTE FLOW FROM 4F THROUGH F-11
          121          RD     3610     0.06     0.04               TRAP      10      10

          122          KK     F-11
          123          KM    SCS RUNOFF F-11
          124          BA    .1136
          125          LS        0       61
          126          UD      .16

          127          KK       7F
          128          KM    COMBINE RUNOFF FROM 4F AND F-11
          129          HC       2
1
PAGE   4                                              HEC-1 INPUT

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


          130          KK   7F-10F
          131          KM    ROUTE FLOW FROM 7F THROUGH F-14
          132          RD     4970    0.023     0.04               TRAP       6       3

          133          KK     F-14
          134          KM    SCS RUNOFF F-14
          135          BA    .1493
          136          LS        0       61
          137          UD      .30

          138          KK     F-13
          139          KM         RUNOFF SUB-BASIN F-13
          140          BA    .1169
          141          LS        0       61
          142          UD      .44

          143          KK      F14
          144          KM         COMBINE RUNOFF FROM 7F, F-13, AND F-14
          145          HC        3

          146          KK    DBF13
          147          KM         ROUTE FLOW FROM DP F14 THROUGH POND DBF13
          148          RS        1     ELEV     7026                1
          149          SA     1.97     2.35     2.83     3.21     3.66     4.0     4.33
          150          SE     7026     7027     7028     7029     7030     7031    7032
          151          ST     7029       40     0.50      1.5
          152          SS     7029       40     0.50      1.5
          153          SW        0       80      120      155
          154          SE     7032     7029     7029     7032

          155          KK      F15
          156          KM         ROUTE FLOW FROM POND DB F13 TO DP F15
          157          RS        1     STOR       -1
          158          RC      .04    0.035     0.04     1194      0.5
          159          RX        0       20       33       37       43      47      60      80
          160          RY     7014     7004     7004     7000     7000    7004    7004    7014

          161          KK     F-15
          162          KM         RUNOFF SUB-BASIN F-15
          163          BA    .0321
          164          LS        0       61
          165          UD      .11

          166          KK    DPF15
          167          KM         COMBINE RUNOFF FROM F15 AND SUB-BASIN F-15
```

```
              168              HC        2

              169              KK      F-12
              170              KM     SCS RUNOFF F-12
              171              BA     .2471
              172              LS        0         61
              173              UD      .33
1
PAGE   5                                                          HEC-1 INPUT

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


              174              KK      F12
              175              KM          COMBINE RUNOFF FROM F12, DP F15 AND F-12
              176              HC        3

              177              KK      F16
              178              KM          ROUTE FLOW FROM DP F12 TO DP F16
              179              RC     .04    0.035     0.04      2091     0.02
              180              RX       0       20       33        37       43        47        60        80
              181              RY    7014     7004     7004      7000     7000      7004      7004      7014

              182              KK     F-16
              183              KM          RUNOFF SUB-BASIN F-16
              184              BA    .0570
              185              LS        0        61
              186              UD      .09

              187              KK    DPF16
              188              KM          COMBINE RUNOFF FROM F16 AND F-16
              189              HC        2

              190              KK      F17
              191              KM          ROUTE FLOW FROM DP F16 TO DP F  ,
              192              RD     1950    0.025     0.04                  TRAP        20         3

              193              KK     F-17
              194              KM          RUNOFF SUB-BASIN F-17
              195              BA    .0520
              196              LS        0        61
              197              UD      .37

              198              KK      DPF
              199              KM          COMBINE RUNOFF FROM F17 AND SUB-BASIN F-17
              200              HC        2
              201              ZZ
1
                   SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE          (V) ROUTING             (--->) DIVERSION OR PUMP FLOW

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

    7            F-1
                  V
                  V
   24            1-8
                  .
                  .
   27             .          F-8
                  .            .
                  .            .
   32             1F............
                  .
                  .
   35             .          F-2
                  .            .
                  .            .
   40             .            .
```

```
                .           .           .
                .           .           .
  45            .          2F............
                .           V
                .           V
  48            .        2F-5F
                .           .
                .           .
  51            .           .          F-9
                .           .           .
                .           .           .
  56            .          5F............
                .           V
                .           V
  59            .        POND1
                .           .
                .           .
  68            .           .          F-4
                .           .           .
                .           .           .
  73            .           .           .          F-5
                .           .           .           .
                .           .           .           .
  78            .           .          3F............
                .           .           V
                .           .           V
  81            .           .        3F-6F
                .           .           .
                .           .           .
  84            .           .           .          F-10
                .           .           .           .
                .           .           .           .
  89            .           .          6F............
                .           .           .
                .           .           .
  92            .          8F............
                .           V
                .           V
  95            .        8F-9F
                .           .
                .           .
  98           F9............
                V
                V
 101           F12
                .
                .
 106            .          F-6
                .           .
                .           .
 111            .           .          F-7
                .           .           .
                .           .           .
 116            .          4F............
                .           V
                .           V
 119            .        4F-7F
                .           .
                .           .
 122            .           .          F-11
                .           .           .
                .           .           .
 127            .          7F............
                .           V
                .           V
 130            .        7F-10F
                .           .
                .           .
 133            .           .          F-14
                .           .           .
                .           .           .
```

```
 138        .         .         .      F-13
            .         .         .         .
            .         .         .         .
 143        .        F14.......................
            .         V
            .         V
 146        .      DBF13
            .         V
            .         V
 155        .        F15
            .         .
            .         .
 161        .         .       F-15
            .         .          .
            .         .          .
 166        .      DPF15...........
            .         .
            .         .
 169        .         .       F-12
            .         .          .
            .         .          .
 174       F12.......................
            V
            V
 177       F16
            .
            .
 182        .       F-16
            .          .
            .          .
 187     DPF16...........
            V
            V
 190       F17
            .
            .
 193        .       F-17
            .          .
            .          .
 198       DPF...........
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	F-1	.17	1	FLOW	10.	110.
				TIME	6.17	6.08
ROUTED TO						
+	1-8	.17	1	FLOW	9.	110.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-8	.15	1	FLOW	9.	93.
				TIME	6.17	6.17
2 COMBINED AT						
+	1F	.32	1	FLOW	14.	186.
				TIME	6.42	6.17
HYDROGRAPH AT						

+	F-2	.04	1	FLOW	3.	29.
				TIME	6.17	6.08
HYDROGRAPH AT +	F-3	.09	1	FLOW	5.	59.
				TIME	6.17	6.17
2 COMBINED AT +	2F	.14	1	FLOW	8.	87.
				TIME	6.17	6.08
ROUTED TO +	2F-5F	.14	1	FLOW	9.	85.
				TIME	6.33	6.25
HYDROGRAPH AT +	F-9	.20	1	FLOW	10.	111.
				TIME	6.25	6.17
2 COMBINED AT +	5F	.33	1	FLOW	18.	192.
				TIME	6.33	6.17
ROUTED TO +	POND1	.33	1	FLOW	18.	192.
				TIME	6.33	6.17
			** PEAK STAGES IN FEET **			
			1	STAGE	7134.09	7136.25
				TIME	7.17	6.17
HYDROGRAPH AT +	F-4	.27	1	FLOW	13.	147.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-5	.11	1	FLOW	5.	52.
				TIME	6.33	6.25
2 COMBINED AT +	3F	.38	1	FLOW	17.	196.
				TIME	6.25	6.17
ROUTED TO +	3F-6F	.38	1	FLOW	18.	196.
				TIME	6.42	6.33
HYDROGRAPH AT +	F-10	.09	1	FLOW	4.	49.
				TIME	6.25	6.17
2 COMBINED AT +	6F	.46	1	FLOW	22.	235.
				TIME	6.42	6.33
2 COMBINED AT +	8F	.80	1	FLOW	37.	407.
				TIME	6.42	6.25
ROUTED TO +	8F-9F	.80	1	FLOW	36.	398.
				TIME	6.50	6.33
2 COMBINED AT +	F9	1.11	1	FLOW	49.	570.
				TIME	6.50	6.25
ROUTED TO +	F12	1.11	1	FLOW	48.	566.
				TIME	6.75	6.42

HYDROGRAPH AT						
+	F-6	.03	1	FLOW	2.	21.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-7	.08	1	FLOW	5.	54.
				TIME	6.17	6.08
2 COMBINED AT						
+	4F	.11	1	FLOW	7.	75.
				TIME	6.17	6.08
ROUTED TO						
+	4F-7F	.11	1	FLOW	6.	74.
				TIME	6.50	6.25
HYDROGRAPH AT						
+	F-11	.11	1	FLOW	8.	86.
				TIME	6.08	6.08
2 COMBINED AT						
+	7F	.22	1	FLOW	10.	133.
				TIME	6.42	6.17
ROUTED TO						
+	7F-10F	.22	1	FLOW	11.	130.
				TIME	6.50	6.33
HYDROGRAPH AT						
+	F-14	.15	1	FLOW	7.	77.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-13	.12	1	FLOW	4.	47.
				TIME	6.50	6.33
3 COMBINED AT						
+	F14	.49	1	FLOW	20.	244.
				TIME	6.50	6.33
ROUTED TO						
+	DBF13	.49	1	FLOW	0.	29.
				TIME	.00	7.67
			** PEAK STAGES IN FEET **			
			1	STAGE	7027.97	7030.28
				TIME	24.92	7.67
ROUTED TO						
+	F15	.49	1	FLOW	0.	29.
				TIME	.00	7.75
			** PEAK STAGES IN FEET **			
			1	STAGE	7000.00	7000.20
				TIME	.00	7.67
HYDROGRAPH AT						
+	F-15	.03	1	FLOW	3.	27.
				TIME	6.08	6.00
2 COMBINED AT						
+	DPF15	.52	1	FLOW	3.	31.
				TIME	6.08	7.75
HYDROGRAPH AT						
+	F-12	.25	1	FLOW	11.	123.
				TIME	6.33	6.25
3 COMBINED AT						
+	F12	1.88	1	FLOW	55.	664.
				TIME	6.75	6.42

ROUTED TO						
+	F16	1.88	1	FLOW	48.	643.
				TIME	6.83	6.42
			** PEAK STAGES IN FEET **			
			1	STAGE	7001.13	7004.59
				TIME	6.83	6.42
HYDROGRAPH AT						
+	F-16	.06	1	FLOW	5.	53.
				TIME	6.08	6.00
2 COMBINED AT						
+	DPF16	1.94	1	FLOW	49.	650.
				TIME	6.83	6.42
ROUTED TO						
+	F17	1.94	1	FLOW	48.	644.
				TIME	7.00	6.50
HYDROGRAPH AT						
+	F-17	.05	1	FLOW	2.	24.
				TIME	6.42	6.25
2 COMBINED AT						
+	DPF	1.99	1	FLOW	49.	661.
				TIME	7.00	6.50

1

1

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION POND1
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	7133.00	7133.00	7133.00
STORAGE	0.	0.	0.
OUTFLOW	0.	0.	0.

TIME OF FAILURE HOURS	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
.00	.56	7134.09	1.09	1.	6.	19.08	7.17
.00	1.00	7136.25	3.25	2.	29.	19.25	6.17

1

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION DBF13
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	7026.00	7023.00	7023.00
STORAGE	0.	8.	8.
OUTFLOW	0.	0.	0.

TIME OF FAILURE HOURS	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
.00	.56	7027.97	.00	5.	0.	.00	.00

.00	1.00	7030.28	1.28	12.	29.	18.42	7.67

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

G-BASINS

Existing Condition

```
1***************************************
****************************************
 *                                     *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998               *
HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *
609 SECOND STREET          *
 *                                      *
DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   19JAN04  TIME  09:36:27  *
(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
PAGE  1                                    HEC-1 INPUT

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

            1          ID            Wolf Ranch Master Development Drainage Plan
            2          ID                 G Basins Existing develkopment conditions  PN 03094
            3          ID            5-year and 100 Year, 24 hr Type IIA  Storm  FN Gbas-e.dat
                       *DIAGRAM
            4          IT      5       0       0     300
            5          IO      4       0
            6          JR   PREC     .56     1.0

            7          KK   G-1
            8          KM         RUNOFF - Sub-basin G-1
            9          BA  .0808
           10          IN     15
           11          PB    4.4
           12          PC 0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120
0.0143
           13          PC 0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460
0.0530
```

```
              14            PC   0.0600   0.0750   0.1000   0.4000   0.7000   0.7250   0.7500   0.7650   0.7800
0.7900
              15            PC   0.8000   0.8100   0.8200   0.8250   0.8300   0.8350   0.8400   0.8450   0.8500
0.8550
              16            PC   0.8600   0.8638   0.8675   0.8713   0.8750   0.8788   0.8825   0.8863   0.8900
0.8938
              17            PC   0.8975   0.9013   0.9050   0.9083   0.9115   0.9148   0.9180   0.9210   0.9240
0.9270
              18            PC   0.9300   0.9325   0.9350   0.9375   0.9400   0.9425   0.9450   0.9475   0.9500
0.9525
              19            PC   0.9550   0.9575   0.9600   0.9625   0.9650   0.9675   0.9700   0.9725   0.9750
0.9775
              20            PC   0.9800   0.9813   0.9825   0.9838   0.9850   0.9863   0.9875   0.9888   0.9900
0.9913
              21            PC   0.9925   0.9938   0.9950   0.9963   0.9975   0.9988   1.0000
              22            LS        0       61
              23            UD     0.22

              24            KK       G2
              25            KM            ROUTE FLOW from SUB-BASIN G-1 TO DP G2
              26            RD     3700    0.029    0.04                TRAP        10        10

              27            KK      G-2
              28            KM            RUNOFF - Sub-basin G-2
              29            BA     .171
              30            LS        0       61
              31            UD     0.31

              32            KK     DPG2
              33            KM   COMBINE RUNOFF from G2 AND SUB-BASIN G-2
              34            HC        2

              35            KK       G3
              36            KM            ROUTE FLOW from DP G2 TO DP G
              37            RD     1850    0.028    0.04                TRAP        10        10

              38            KK      G-3
              39            KM            RUNOFF - Sub-basin G-3
              40            BA     .068
              41            LS        0       61
              42            UD     0.44
1
PAGE   2                                                 HEC-1 INPUT

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


              43            KK     DPG
              44            KM            COMBINE RUNOFF from G3 AND SUB-BASIN G-3
              45            HC        2
              46            ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE        (V) ROUTING            (--->) DIVERSION OR PUMP FLOW

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

     7        G-1
                 V
                 V
    24          G2
                 .
                 .
    27           .          G-2
                 .            .
                 .            .
    32         DPG2............
                 V
                 V
```

```
   35          G3
               .
               .
   38          .          G-3
               .           .
               .           .
   43         DPG...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
**************************************
 *                                       *                                                          *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                          *
U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998               *                                                          *
HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                          *
609 SECOND STREET          *
 *                                       *                                                          *
DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   19JAN04  TIME  09:36:27   *                                                          *
(916) 756-1104          *
 *                                       *                                                          *
*
 ****************************************
**************************************
```

```
                                   Wolf Ranch Master Development Drainage Plan
                                   G Basins Existing develkopment conditions  PN 03094
                                   5-year and 100 Year, 24 hr Type IIA  Storm  FN Gbas-e.dat

   5 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          4  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     2    0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    .08 HOURS
                     TOTAL TIME BASE  24.92 HOURS

        ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

     JP        MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

     JR         MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                    .56      1.00
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

              **************
              *            *
     7 KK     *    G-1     *
              *            *
              **************

                         RUNOFF - Sub-basin G-1

    10 IN           TIME DATA FOR INPUT TIME SERIES
                          JXMIN          15  TIME INTERVAL IN MINUTES
                         JXDATE       1   0  STARTING DATE
                         JXTIME           0  STARTING TIME

                  SUBBASIN RUNOFF DATA

     9 BA           SUBBASIN CHARACTERISTICS
                          TAREA         .08  SUBBASIN AREA

                    PRECIPITATION DATA

    11 PB                 STORM        4.40  BASIN TOTAL PRECIPITATION

    12 PI             INCREMENTAL PRECIPITATION PATTERN
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .01       .01       .01       .01       .01       .10       .10
  .10       .10
                          .10       .10       .01       .01       .01       .01       .01       .01
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
                          .00       .00       .00       .00       .00       .00       .00       .00
  .00       .00
```

```
.00       .00        .00     .00     .00     .00     .00     .00     .00     .00
.00       .00        .00     .00     .00     .00     .00     .00     .00     .00
.00       .00        .00     .00     .00     .00     .00     .00     .00     .00
.00       .00        .00     .00     .00     .00     .00     .00     .00     .00
.00       .00        .00     .00     .00     .00     .00     .00     .00     .00
.00       .00        .00     .00     .00     .00     .00     .00     .00     .00
                     .00     .00     .00     .00     .00     .00     .00     .00

 22 LS        SCS LOSS RATE
                   STRTL          1.28  INITIAL ABSTRACTION
                   CRVNBR        61.00  CURVE NUMBER
                   RTIMP           .00  PERCENT IMPERVIOUS AREA

 23 UD        SCS DIMENSIONLESS UNITGRAPH
                   TLAG            .22  LAG

                                                        ***

                                                   UNIT HYDROGRAPH
                                              15 END-OF-PERIOD ORDINATES
6.             32.     108.     149.     131.     85.      49.      30.      18.      10.
               4.      2.       1.       1.       0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***


              **************
              *            *
 24 KK        *     G2     *
              *            *
              **************

                            ROUTE FLOW from SUB-BASIN G-1 TO DP G2

               HYDROGRAPH ROUTING DATA

 26 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                           L        3700.  CHANNEL LENGTH
                           S        .0290  SLOPE
                           N         .040  CHANNEL ROUGHNESS COEFFICIENT
                          CA          .00  CONTRIBUTING AREA
                       SHAPE         TRAP  CHANNEL SHAPE
                          WD        10.00  BOTTOM WIDTH OR DIAMETER
                           Z        10.00  SIDE SLOPE

                                                        ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***


              **************
              *            *
 27 KK        *    G-2     *
              *            *
              **************

                            RUNOFF - Sub-basin G-2

               SUBBASIN RUNOFF DATA
```

28 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .47 LAG

***

UNIT HYDROGRAPH
30 END-OF-PERIOD ORDINATES

7.	19.	40.	65.	83.	88.	85.	75.	63.
47.	35.	27.	21.	16.	12.	9.	7.	5.	4.
3.	2.	2.	1.	1.	1.	1.	1.	0.	0.
0.									

1

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 .56	RATIO 2 1.00
HYDROGRAPH AT +	H-1	.04	1	FLOW	5.	41.
				TIME	6.00	6.00
HYDROGRAPH AT +	H-2	.09	1	FLOW	3.	36.
				TIME	6.50	6.42

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

29 BA SUBBASIN CHARACTERISTICS

TAREA	.17	SUBBASIN AREA

PRECIPITATION DATA

11 PB

STORM	4.40	BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.10	.10	.00	.01	.01	.01	.01	.01	.10	.10
.00	.00	.10	.10	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
		.00	.00	.00	.00	.00	.00	.00	.00

30 LS SCS LOSS RATE

STRTL	1.28	INITIAL ABSTRACTION
CRVNBR	61.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

```
 31 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG          .31  LAG

                                                                ***

                                                          UNIT HYDROGRAPH
                                                      21 END-OF-PERIOD ORDINATES
               31.      101.      196.      234.      221.      178.      118.       78.       54.
37.
               25.       17.       12.        8.        5.        4.        3.        2.        1.
1.
                0.


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

          **************
          *            *
 32 KK    *       DPG2 *
          *            *
          **************
                         COMBINE RUNOFF from G2 AND SUB-BASIN G-2

 34 HC          HYDROGRAPH COMBINATION
                     ICOMP            2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

          **************
          *            *
 35 KK    *         G3 *
          *            *
          **************
                               ROUTE FLOW from DP G2 TOA DP G

             HYDROGRAPH ROUTING DATA

 37 RD          MUSKINGUM-CUNGE CHANNEL ROUTING
                           L         1850.  CHANNEL LENGTH
                           S         .0280  SLOPE
                           N          .040  CHANNEL ROUGHNESS COEFFICIENT
                          CA           .00  CONTRIBUTING AREA
                       SHAPE          TRAP  CHANNEL SHAPE
                          WD         10.00  BOTTOM WIDTH OR DIAMETER
                           Z         10.00  SIDE SLOPE

                                                                ***


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

          **************
          *            *
 38 KK    *        G-3 *
          *            *
          **************
                               RUNOFF - Sub-basin G-3

             SUBBASIN RUNOFF DATA
```

40 BA SUBBASIN CHARACTERISTICS

TAREA	.07	SUBBASIN AREA

PRECIPITATION DATA

11 PB	STORM	4.40	BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.10	.10	.00	.01	.01	.01	.01	.01	.10	.10
.00	.00	.10	.10	.01	.01	.01	.01	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
		.00	.00	.00	.00	.00	.00	.00	.00

41 LS SCS LOSS RATE

STRTL	1.28	INITIAL ABSTRACTION
CRVNBR	61.00	CURVE NUMBER
RTIMP	.00	PERCENT IMPERVIOUS AREA

```
   42 UD          SCS DIMENSIONLESS UNITGRAPH

                                                                  ***

                                                              UNIT HYDROGRAPH
                                                          28 END-OF-PERIOD ORDINATES
              6.       17.       35.       55.       66.       68.       63.       54.       42.
 30.
             22.       17.       13.       10.        7.        6.        4.        3.        2.
  2.
              1.        1.        1.        1.        0.        0.        0.        0.

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***

              **************
              *            *
   43 KK      *     DPG    *
              *            *
              **************

                                   COMBINE RUNOFF from G3 AND SUB-BASIN G-3

   45 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

1                                                                 ***

                 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

                                                              RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA    PLAN              RATIO 1  RATIO 2
                                                           .56     1.00

 HYDROGRAPH AT
+                  G-1         .08      1     FLOW          5.      50.
                                              TIME        6.17     6.17

 ROUTED TO
+                   G2         .08      1     FLOW          6.      51.
                                              TIME        6.58     6.33

 HYDROGRAPH AT
+                  G-2         .17      1     FLOW          8.      87.
                                              TIME        6.33     6.25

  2 COMBINED AT
+                 DPG2         .25      1     FLOW         11.     130.
                                              TIME        6.58     6.25

 ROUTED TO
+                   G3         .25      1     FLOW         11.     127.
                                              TIME        6.75     6.33

 HYDROGRAPH AT
+                  G-3         .07      1     FLOW          2.      27.
                                              TIME        6.50     6.33

  2 COMBINED AT
+                  DPG         .32      1     FLOW         13.     155.
*** NORMAL END OF HEC-1 ***                   TIME        6.75     6.33
```

H-Basins
Existing Conditions

```
1***************************************
***************************************
 *                                       *
*                                                                            *
 *   FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *
U.S. ARMY CORPS OF ENGINEERS      *
 *                JUN   1998              *
HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.1                *
609 SECOND STREET          *
 *                                       *
DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   19JAN04  TIME  10:16:18   *
(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
PAGE   1                                              HEC-1 INPUT

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

            1          ID             Wolf Ranch master Development Drainage Plan
            2          ID                  H Basins Existing Development Conditions   PN 03094
            3          ID             5-year and 100 Year, 24 hr Type IIA  Storm  FN hbas-e.dat
                       *DIAGRAM
            4          IT       5       0       0     300
            5          IO       4       0
            6          JR    PREC     .56     1.0

            7          KK     H-1
            8          KM          RUNOFF FROM SUB-BASIN H-1
            9          BA   .0370
           10          IN      15
           11          PB     4.4
           12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120
0.0143
           13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460
0.0530
```

```
0.7900          14          PC   0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800
0.8550          15          PC   0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500
0.8938          16          PC   0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900
0.9270          17          PC   0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240
0.9525          18          PC   0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500
0.9775          19          PC   0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750
0.9913          20          PC   0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900
                21          PC   0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
                22          LS        0      61
                23          UD     0.05

                24          KK      H-2
                25          KM          RUNOFF FROM SUB-BASIN H-2
                26          BA    .0931
                27          LS        0      61
                28          UD      .47
                29          ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE       (V) ROUTING            (--->) DIVERSION OR PUMP FLOW

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

   7          H-1
               .
               .
  24           .          H-2

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                           *
*                                                                                *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)      *
U.S. ARMY CORPS OF ENGINEERS        *                                            *
 *               JUN   1998                  *
HYDROLOGIC ENGINEERING CENTER       *                                            *
 *            VERSION 4.1                    *
609 SECOND STREET             *                                                  *
 *                                           *
DAVIS, CALIFORNIA 95616         *                                                *
 *  RUN DATE   19JAN04  TIME  10:16:18      *
(916) 756-1104                *                                                  *
 *                                           *
*                                                                                *
 *****************************************
***************************************



                                Wolf Ranch master Development Drainage Plan
                                H Basins Existing Development Conditions  PN 03094
                                5-year and 100 Year, 24 hr Type IIA  Storm  FN hbas-e.dat

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           4  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL           0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                      NMIN            5  MINUTES IN COMPUTATION INTERVAL
```

```
                    IDATE      1    0  STARTING DATE
                    ITIME        0000  STARTING TIME
                       NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2    0  ENDING DATE
                   NDTIME        0055  ENDING TIME
                   ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

    JP            MULTI-PLAN OPTION
                        NPLAN             1  NUMBER OF PLANS

    JR            MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .56       1.00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** ***


          **************
          *            *
   7 KK   *      H-1   *
          *            *
          **************
                               RUNOFF FROM SUB-BASIN H-1

  10 IN           TIME DATA FOR INPUT TIME SERIES
                        JXMIN          15  TIME INTERVAL IN MINUTES
                       JXDATE      1    0  STARTING DATE
                       JXTIME           0  STARTING TIME

               SUBBASIN RUNOFF DATA

   9 BA           SUBBASIN CHARACTERISTICS
                        TAREA         .04  SUBBASIN AREA

                  PRECIPITATION DATA

  11 PB                 STORM        4.40  BASIN TOTAL PRECIPITATION

  12 PI             INCREMENTAL PRECIPITATION PATTERN
                        .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                        .00       .00       .00       .00       .00       .00       .00       .00
 .00       .00
                        .00       .01       .01       .01       .01       .01       .10       .10
 .10       .10
                        .10       .10       .01       .01       .01       .01       .01       .01
 .00       .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
		.00	.00	.00	.00	.00	.00	.00	.00

```
22 LS          SCS LOSS RATE
                    STRTL        1.28  INITIAL ABSTRACTION
                   CRVNBR       61.00  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

23 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .05  LAG
```

***

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES

192.	73.	17.	4.	1.

*** ***
*** *** *** *** *** *** *** ***

```
          **************
          *            *
24 KK     *     H-2    *
          *            *
          **************
```

RUNOFF FROM SUB-BASIN H-2

SUBBASIN RUNOFF DATA

26 BA SUBBASIN CHARACTERISTICS

	TAREA	.09	SUBBASIN AREA

PRECIPITATION DATA

11 PB	STORM	4.40	BASIN TOTAL PRECIPITATION

12 PI INCREMENTAL PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.01	.01	.01	.01	.01	.10	.10	.10	.10
.10	.10	.01	.01	.01	.01	.01	.01	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

27 LS SCS LOSS RATE

	STRTL	1.28	INITIAL ABSTRACTION
	CRVNBR	61.00	CURVE NUMBER
	RTIMP	.00	PERCENT IMPERVIOUS AREA

HEC-1 INPUT & OUTPUT
DEVELOPED CONDITIONS

A-Basins Developed

```
1***************************************
**************************************
 *                                      *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
CORPS OF ENGINEERS      *
 *             JUN   1998               *
ENGINEERING CENTER     *
 *           VERSION 4.1                *
SECOND STREET           *
 *                                      *
CALIFORNIA 95616        *
 * RUN DATE   19NOV04  TIME  11:51:16   *
756-1104           *
 *                                      *
*
 ***************************************
**************************************
```

```
                                                    *
                                                    *     U.S. ARMY
                                                    *     HYDROLOGIC
                                                    *           609
                                                    *        DAVIS,
                                                    *            (916)
                                                    *
```

```
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 'EC1KW.

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
PAGE 1

HEC-1 INPUT

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

   1          ID           Wolf Ranch, Master Developed Drainage Plan
   2          ID                         A Basins, future development condition
   3          ID             5-year and 100 Year, 24 hr Type IIA  Storm
             *DIAGRAM
   4          IT       5       0       0     300
   5          IO       5       0
   6          JR    PREC     .56     1.0

   7          KK     A-1
   8          KM       RUNOFF FROM SUB-BASIN A-1
   9          BA    .060
  10          IN      15
  11          PB     4.4
  12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
  13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
  14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
  15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
  16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
  17          PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

A-Basins

```
18        PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
19        PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
20        PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
21        PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
22        LS       0      61
23        UD    .292

24        KK      A3
25        KM   ROUTE FLOW FROM SUB-BASIN A-1 TO DP A3
26        RD   3500     .021     0.04               TRAP        10        4

27        KK    A-11
28        KM       RUNOFF FROM SUB-BASIN A-11
29        BA    .081
30        LS       0      78
31        UD     .19

32        KK      A11
33        KM       ROUTE RUOFF FROM SUB-BASIN A-11 TO DP A4
34        RD     980      .02     .013              CIRC        3

35        KK     A-4
36        KM   RUNOFF FROM SUB-BASIN A-4
37        BA    .0861
38        LS       0      79
39        UD    0.21

40        KK     DPA4
41        KM       COMBINE RUNOFF FROM SU-BASIN A-4 AND A4
42        HC       2
                                          HEC-1 INPUT
1
PAGE  2

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

43        KK      A4
44        KM   ROUTE FLOW FROM DP A4 TO DP A3
45        RD     450     .024     .013              CIRC      4.5

46        KK     A-3
47        KM   RUNOFF FROM SUB-BASIN A-3
48        BA   .1500
49        LS       0      76
50        UD    .221

51        KK     DPA3
52        KM   DESIGN POINT A3 COMBINE RUNOFF FROM SUB-BASIN A-3, A3 AND A4
53        HC       3

54        KK      A6
55        KM   ROUTE FLOW FROM DP A3 TO DP A6
56        RD    1550     .016     0.04              TRAP        10        4

57        KK    A-7
58        KM   RUNOFF FROM SUB-BASIN A-7
59        BA   .0500
60        LS       0    78.2
61        UD    .172

62        KK      A7
63        KM   ROUTE FLOW FROM SUB-BASIN A-7 TO DP A6
64        RD     800     0.20    0.013              CIRC       3.0

65        KK    A-6
66        KM   RUNOFF FROM SUB-BASIN A-6
67        BA    .037
68        LS       0    79.8
69        UD     .21

70        KK     DPA6
```

```
 71     KM   DESIGN POINT A6 COMBINE RUNOFF FROM SUB-BASIN A-6, A6 AND A7
 72     HC      3

 73     KK     A5
 74     KM   ROUTE FLOW FROM DESIGN POINT A6 TO DP A5
 75     RD   2200    .011    .04            TRAP     10       4

 76     KK   A-9
 77     KM   RUNOFF FROM SUB-BASIN A-9
 78     BA   .0673
 79     LS      0    72.1
 80     UD    .263

 81     KK     A9
 82     KM   ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
 83     RD    500     .02    .016           CIRC     3.5
```

1
PAGE 3

HEC-1 INPUT

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

 84     KK   A-5
 85     KM   RUNOFF FROM SUB-BASIN A-5
 86     BA   .1114
 87     LS      0    77.7
 88     UD    .209

 89     KK    DPA5
 90     KM   DESIGN POINT A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9
 91     HC      3

 92     KK     A10
 93     KM   ROUTE FLOW FROM DESIGN POINT A5 TO DESIGN POINT A
 94     RD    720    .021    .04            TRAP     15       4

 95     KK    A-10
 96     KM   RUNOFF FROM SUB-BASIN A-10
 97     BA   .0086
 98     LS      0      61
 99     UD    .231

100     KK    DPA
101     KM   DESIGN POINT A COMBINE RUNOFF SUB-BASIN A-10 AND A10
102     HC      2
103     ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   7      A-1
            V
            V
  24       A3
            .
            .
  27        .          A-11
            .            V
            .            V
  32        .           A11
            .            .
            .            .
  35        .            .         A-4
            .            .           .
            .            .           .
  40        .          DPA4...........
            .            V
            .            V
```

```
   43           .          A4
                .           .
                .           .
   46           .           .          A-3
                .           .            .
                .           .            .
   51        DPA3.........................
                V
                V
   54          A6
                .
                .
   57           .       A-7
                .           V
                .           V
   62           .          A7
                .           .
                .           .
   65           .           .       A-6
                .           .            .
                .           .            .
   70        DPA6.........................
                V
                V
   73          A5
                .
                .
   76           .       A-9
                .           V
                .           V
   81           .          A9
                .           .
                .           .
   84           .           .       A-5
                .           .            .
                .           .            .
   89        DPA5.........................
                V
                V
   92         A10
                .
                .
   95           .        A-10
                .           .
                .           .
  100         DPA............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
***************************************
 *                                       *                                                *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                *    U.S. ARMY
CORPS OF ENGINEERS      *
 *                JUN   1998             *                                                *    HYDROLOGIC
ENGINEERING CENTER    *
 *             VERSION 4.1               *                                                *         609
SECOND STREET         *
 *                                       *                                                *      DAVIS,
CALIFORNIA 95616      *
 *  RUN DATE   19NOV04  TIME  11:51:16   *                                                *          (916)
756-1104            *
 *                                       *                                                *
*
 *****************************************
***************************************
```

Wolf Ranch, Master Developed Drainage Plan
A Basins, future development condition
5-year and 100 Year, 24 hr Type IIA Storm

```
5 IO          OUTPUT CONTROL VARIABLES
                    IPRNT            5  PRINT CONTROL
                    IPLOT            0  PLOT CONTROL
                    QSCAL           0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                    NMIN             5  MINUTES IN COMPUTATION INTERVAL
                    IDATE        1   0  STARTING DATE
                    ITIME         0000  STARTING TIME
                       NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE        2   0  ENDING DATE
                   NDTIME         0055  ENDING TIME
                   ICENT            19  CENTURY MARK

               COMPUTATION INTERVAL      .08 HOURS
                    TOTAL TIME BASE    24.92 HOURS

       ENGLISH UNITS
             DRAINAGE AREA           SQUARE MILES
             PRECIPITATION DEPTH     INCHES
             LENGTH, ELEVATION       FEET
             FLOW                    CUBIC FEET PER SECOND
             STORAGE VOLUME          ACRE-FEET
             SURFACE AREA            ACRES
             TEMPERATURE             DEGREES FAHRENHEIT

  JP          MULTI-PLAN OPTION
                    NPLAN            1  NUMBER OF PLANS

  JR          MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                   .56      1.00
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	A-1	.06	1	FLOW	3.	32.
				TIME	6.25	6.17
ROUTED TO						
+	A3	.06	1	FLOW	3.	31.
				TIME	6.75	6.42
HYDROGRAPH AT						
+	A-11	.08	1	FLOW	45.	140.
				TIME	6.08	6.08
ROUTED TO						
+	A11	.08	1	FLOW	44.	138.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-4	.09	1	FLOW	49.	149.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPA4	.17	1	FLOW	92.	288.
				TIME	6.08	6.08

ROUTED TO						
+	A4	.17	1	FLOW	91.	286.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-3	.15	1	FLOW	64.	223.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA3	.38	1	FLOW	155.	509.
				TIME	6.08	6.08
ROUTED TO						
+	A6	.38	1	FLOW	154.	491.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-7	.05	1	FLOW	30.	90.
				TIME	6.08	6.08
ROUTED TO						
+	A7	.05	1	FLOW	29.	89.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-6	.04	1	FLOW	22.	66.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA6	.46	1	FLOW	199.	631.
				TIME	6.17	6.08
ROUTED TO						
+	A5	.46	1	FLOW	196.	623.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-9	.07	1	FLOW	19.	76.
				TIME	6.17	6.17
ROUTED TO						
+	A9	.07	1	FLOW	18.	76.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-5	.11	1	FLOW	57.	184.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA5	.64	1	FLOW	254.	862.
				TIME	6.25	6.17
ROUTED TO						
+	A10	.64	1	FLOW	249.	848.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-10	.01	1	FLOW	0.	5.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPA	.65	1	FLOW	250.	854.
				TIME	6.25	6.17

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

'B' BASINS
FUTURE CONDITIONS

```
1*****************************************
***************************************
 *                                           *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)       *
U.S. ARMY CORPS OF ENGINEERS      *
 *                JUN  1998                  *
HYDROLOGIC ENGINEERING CENTER    *
 *             VERSION 4.1                   *
609 SECOND STREET          *
 *                                           *
DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   03FEB04  TIME  11:18:38       *
(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

HEC-1 INPUT

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

            1          ID          Wolf Ranch Master Development Drainage Plan
            2          ID                B basins future development condition PN 03094
            3          ID          5-year and 100 Year, 24 hr Type IIA  Storm  FN bbas-f.dat
                       *DIAGRAM
            4          IT      5      0       0      300
            5          IO      5      0
            6          JR   PREC    .56     1.0

            7          KK    B-1
            8          KM        RUNOFF FOR SUB-BASIN B-1
            9          BA  .0400
           10          IN     15
           11          PB    4.4
           12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100
0.0120  0.0143
           13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390
0.0460  0.0530
           14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650
0.7800  0.7900
           15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450
0.8500  0.8550
           16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863
0.8900  0.8938
```

```
             17             PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210
0.9240  0.9270
             18             PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475
0.9500  0.9525
             19             PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725
0.9750  0.9775
             20             PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888
0.9900  0.9913
             21             PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
             22             LS       0      92
             23             UD   .1070
             24             ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7          B-1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
***************************************
 *                                       *                                        *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                        *
U.S. ARMY CORPS OF ENGINEERS     *
 *              JUN   1998               *                                        *
HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                 *                                        *
609 SECOND STREET           *
 *                                       *                                        *
DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   03FEB04  TIME  11:18:38   *                                        *
(916) 756-1104           *
 *                                       *                                        *
*
 ****************************************
***************************************



                                        Wolf Ranch Master Development Drainage Plan
                                        B basins future development condition PN 03094
                                        5-year and 100 Year, 24 hr Type IIA  Storm  FN bbas-f.dat

    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT            5  PRINT CONTROL
                        IPLOT            0  PLOT CONTROL
                        QSCAL           0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN            5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1     0  STARTING DATE
                        ITIME         0000  STARTING TIME
                           NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2     0  ENDING DATE
                       NDTIME         0055  ENDING TIME
                        ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                       NPLAN             1  NUMBER OF PLANS
```

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.56 1.00

1

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	B-1	.04	1	FLOW	60.	122.
				TIME	6.00	6.00

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

```
1*****************************************
***************************************
 *                                                                       *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                                                        *   U.S. ARMY
CORPS OF ENGINEERS        *
 *              JUN   1998                 *                                                                        *   HYDROLOGIC
ENGINEERING CENTER      *
 *            VERSION 4.1                  *                                                                        *        609
SECOND STREET            *
 *                                         *                                                                        *  .    DAVIS,
CALIFORNIA 95616         *
 *  RUN DATE   03FEB04  TIME  11:12:55     *                                                                        *
(916) 756-1104              *
 *                                         *                                                                        *
*
 *****************************************
***************************************
```

'C' Basins
Developed
Conditions

```
                                        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
PAGE  1                                             HEC-1 INPUT

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

            1           ID              Wolf Ranch Master Development Drainage Plan
            2           ID                   C basins future development condition PN 03094
            3           ID              5-year and 100 Year, 24 hr Type IIA  Storm  FN Cbas-f.dat
                        *DIAGRAM
            4           IT       5       0       0     300
            5           IO       5       0
            6           JR    PREC     .56     1.0

            7           KK     C-1
            8           KM          RUNOFF FOR SUB-BASIN C-1
            9           BA   .0460
           10           IN      15
           11           PB     4.4
           12           PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
           13           PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
           14           PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
           15           PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
           16           PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
           17           PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
 18            PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
 19            PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
 20            PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
 21            PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
 22            LS       0      79
 23            UD   .1550

 24            KK      C1
 25            KM        ROUTE FLOW FROM SUB-BASIN C-1 TO C2
 26            RD    2500    0.02    .013            CIRC      4.0

 27            KK      C2
 28            KM        ROUTE FLOW FROM C1 TO DP C
 29            RD    1450    0.02    .013            CIRC      6.0

 30            KK     C-2                                          .
 31            KM        RUNOFF FROM SUB-BASIN C-2
 32            BA   .1110
 33            LS       0    80.8
 34            UD    .098

 35            KK     DPC
 36            KM        DESIGN POINT C COMBINE RUNOFF FROM SUB-BASIN C-2 AND C2
 37            HC       2

 38            KK     C-3
 39            KM        RUNOFF FROM SUB-BASIN C-3
 40            BA   .0550
 41            LS       0      79
 42            UD    .186
 43            ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7         C-1
                V
                V
   24          C1
                V
                V
   27          C2
                .
                .
   30           .         C-2
                .           .
                .           .
   35         DPC...........
                .
                .
   38           .         C-3

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                       *                                                    *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                    *   U.S. ARMY
CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                    *   HYDROLOGIC
ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                    *          609
SECOND STREET          *
 *                                       *                                                    *       DAVIS,
CALIFORNIA 95616        *
 *  RUN DATE   03FEB04  TIME  11:12:55   *                                                    *
(916) 756-1104          *
```

*
*
*
*
****
****

Wolf Ranch Master Development Drainage Plan
C basins future development condition PN 03094
5-year and 100 Year, 24 hr Type IIA Storm FN Cbas-f.dat

```
  5 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       0055  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    .08 HOURS
                     TOTAL TIME BASE  24.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

    JP         MULTI-PLAN OPTION
                    NPLAN            1  NUMBER OF PLANS

    JR         MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                   .56      1.00
1
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	C-1	.05	1	FLOW	30.	86.
				TIME	6.08	6.08
ROUTED TO						
+	C1	.05	1	FLOW	29.	86.
				TIME	6.08	6.08
ROUTED TO						
+	C2	.05	1	FLOW	27.	84.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	C-2	.11	1	FLOW	94.	253.
				TIME	6.00	6.00

```
  2 COMBINED AT
+                 DPC        .16     1   FLOW          114.     328.
                                         TIME          6.00     6.00

 HYDROGRAPH AT
+                 C-3        .05     1   FLOW           33.     100.
                                         TIME          6.08     6.08
1
                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                              (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                INTERPOLATED TO
                                                                             COMPUTATION INTERVAL
             ISTAQ     ELEMENT       DT        PEAK    TIME TO      VOLUME        DT        PEAK    TIME TO
VOLUME
                                                         PEAK                                         PEAK

                                    (MIN)      (CFS)     (MIN)        (IN)       (MIN)      (CFS)     (MIN)        (IN)

            FOR PLAN = 1  RATIO=   .00
                   C1  MANE         1.50      29.12    367.50         .81       5.00      28.61    365.00
.81

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1995E+01 EXCESS= .0000E+00 OUTFLOW= .1995E+01 BASIN STORAGE= .2215E-03
PERCENT ERROR=     .0

            FOR PLAN = 1  RATIO=   .00
                   C1  MANE         1.75      86.16    364.00        2.29       5.00      85.58    365.00
2.29

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .5624E+01 EXCESS= .0000E+00 OUTFLOW= .5624E+01 BASIN STORAGE= .2322E-03
PERCENT ERROR=     .0

            FOR PLAN = 1  RATIO=   .00
                   C2  MANE         1.25      28.40    367.50         .81       5.00      26.94    365.00
.81

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1990E+01 EXCESS= .0000E+00 OUTFLOW= .1990E+01 BASIN STORAGE= .1307E-03
PERCENT ERROR=     .0

            FOR PLAN = 1  RATIO=   .00
                   C2  MANE         1.27      84.87    366.20        2.29       5.00      84.05    365.00
2.29

 CONTINUITY SUMMARY (AC-FT) - INFLOW= .5620E+01 EXCESS= .0000E+00 OUTFLOW= .5620E+01 BASIN STORAGE= .1300E-03
PERCENT ERROR=     .0


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

```
1****************************************
***************************************
 *                                                *
*
 *  FLOOD HYDROGRAPH PACKAGE  (HEC-1)           *
CORPS OF ENGINEERS      *
 *              JUN   1998                         *
ENGINEERING CENTER      *
 *              VERSION 4.1                        *
SECOND STREET           *
 *                                                *
CALIFORNIA 95616        *
 *  RUN DATE   03FEB04  TIME   16:50:52            *
(916) 756-1104             *
 *                                                *
*
 *****************************************
****************************************
```

D Basins
Developed
Conditions

```
*
*     U.S. ARMY
*     HYDROLOGIC
*            609
*        DAVIS,
*
*
```

```
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

PAGE 1

HEC-1 INPUT

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

  1          ID                Wolf Ranch Master Development Drainage Plan
  2          ID                     D basins future development condition PN 03094
  3          ID                5-year and 100 Year, 24 hr Type IIA  Storm  FN Dbas-f.dat
             *DIAGRAM
  4          IT       5       0       0     300
  5          IO       5       0
  6          JR    PREC     .56     1.0

  7          KK     D-1
  8          KM         RUNOFF FOR SUB-BASIN D-1
  9          BA   .0620
 10          IN      15
 11          PB     4.4
 12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
 13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
 14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
 15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
 16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
 17          PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
 18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
 19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
 20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
 21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
 22          LS       0    78.1
 23          UD    .180
```

```
         24             KK      D2
         25             KM         ROUTE FLOW FROM SUB-BASIN D-1 TO DP D2
         26             RD    1230    0.01    .013             CIRC     4.5

         27             KK     D-2
         28             KM         RUNOFF FROM SUB-BASIN D-2
         29             BA   .0360
         30             LS      0       79
         31             UD    .119

         32             KK    DPD2
         33             KM         DESIGN POINT D2 COMBINE RUNOFF FROM SUB-BASIN D-2 AND D2
         34             HC       2

         35             KK      D3
         36             KM         ROUTE FLOW FROM DP D2 TO DP D
         37             RD    3100    .026    .040             TRAP     4.0       4

         38             KK     D-3
         39             KM         RUNOFF FROM SUB-BASIN D-3
         40             BA   .0240
         41             LS      0       61
         42             UD    .380
1
PAGE  2                                            HEC-1 INPUT

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


         43             KK     DPD
         44             KM         DESIGN POINT D COMBINE RUNOFF FROM SUB-BASINS D-3 AND D2
         45             HC       2
         46             ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE        (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    7          D-1
                 V
                 V
   24           D2
                 .
                 .
   27            .          D-2
                 .            .
                 .            .
   32         DPD2............
                 V
                 V
   35           D3
                 .
                 .
   38            .          D-3
                 .            .
                 .            .
   43          DPD............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
****************************************
 *                                        *                                               *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                               *    U.S. ARMY
CORPS OF ENGINEERS       *
 *              JUN   1998                *                                               *    HYDROLOGIC
ENGINEERING CENTER     *
 *           VERSION 4.1                  *                                               *          609
SECOND STREET            *
 *                                        *                                               *       DAVIS,
CALIFORNIA 95616         *
 *  RUN DATE   03FEB04  TIME  16:50:52    *                                               *
(916) 756-1104              *
```

```
 *                                        *                                                    *
*
 ****************************************
***************************************
```

```
                                                    Wolf Ranch Master Development Drainage Plan
                                                    D basins future development condition PN 03094
                                                    5-year and 100 Year, 24 hr Type IIA  Storm  FN Dbas-f.dat

    5 IO         OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT         HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      NDTIME        0055  ENDING TIME
                       ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL     .08 HOURS
                        TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

      JP           MULTI-PLAN OPTION
                       NPLAN           1  NUMBER OF PLANS

      JR           MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                      .56       1.00
1
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	D-1	.06	1	FLOW	36.	109.
				TIME	6.08	6.08
ROUTED TO						
+	D2	.06	1	FLOW	34.	107.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	D-2	.04	1	FLOW	25.	73.
				TIME	6.00	6.00
2 COMBINED AT						
+	DPD2	.10	1	FLOW	57.	173.
				TIME	6.08	6.08
ROUTED TO						
+	D3	.10	1	FLOW	55.	170.
				TIME	6.17	6.17
HYDROGRAPH AT						

```
+                D-3        .02    1    FLOW          1.      11.
                                        TIME          6.42    6.25

 2 COMBINED AT
+                DPD        .12    1    FLOW          55.     179.
                                        TIME          6.17    6.17
1
                                        SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                            (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                 INTERPOLATED TO
                                                                              COMPUTATION INTERVAL
            ISTAQ     ELEMENT      DT        PEAK     TIME TO     VOLUME      DT       PEAK     TIME TO
VOLUME
                                                        PEAK                                      PEAK

                                  (MIN)      (CFS)      (MIN)      (IN)      (MIN)     (CFS)     (MIN)        (IN)

           FOR PLAN = 1  RATIO=   .00
                 D2  MANE          1.50      34.98     366.00       .77      5.00      33.89    365.00
.77


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2544E+01 EXCESS= .0000E+00 OUTFLOW= .2544E+01 BASIN STORAGE= .1572E-03
PERCENT ERROR=     .0


           FOR PLAN = 1  RATIO=   .00
                 D2  MANE          1.40     108.18     366.18      2.22      5.00     107.31    365.00
2.22


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .7337E+01 EXCESS= .0000E+00 OUTFLOW= .7336E+01 BASIN STORAGE= .1466E-03
PERCENT ERROR=     .0


           FOR PLAN = 1  RATIO=   .00
                 D3  MANE          1.50      55.48     372.00       .79      5.00      54.65    370.00
.79


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .4107E+01 EXCESS= .0000E+00 OUTFLOW= .4109E+01 BASIN STORAGE= .3421E-02
PERCENT ERROR=    -.1


           FOR PLAN = 1  RATIO=   .00
                 D3  MANE          1.75     171.92     367.50      2.25      5.00     169.71    370.00
2.24


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .1174E+02 EXCESS= .0000E+00 OUTFLOW= .1175E+02 BASIN STORAGE= .3457E-02
PERCENT ERROR=    -.1



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

"E" BASIN
DEVELOPED CONDITIONS

```
1***************************************
***************************************
 *                                     *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
CORPS OF ENGINEERS      *
 *            JUN   1998               *
ENGINEERING CENTER    *
 *            VERSION 4.1              *
SECOND STREET         *
 *                                     *
CALIFORNIA 95616       *
 *  RUN DATE   05FEB04  TIME  14:01:38  *
(916) 756-1104             *
 *                                     *
*
 ***************************************
***************************************
```

```
 *
 *   U.S. ARMY
     HYDROLOGIC
 *         609
 *      DAVIS,
 *
 *
```

```
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

HEC-1 INPUT

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

  1         ID              Wolf Ranch Master Development Drainage Plan
  2         ID                E basins future development condition PN 03094
  3         ID              5-year and 100 Year, 24 hr Type IIA  Storm  FN Dbas-E.dat
            *DIAGRAM
  4         IT       5       0       0     300
  5         IO       5       0
  6         JR    PREC     .56     1.0

  7         KK     E-1
  8         KM          RUNOFF FOR SUB-BASIN E-1
  9         BA   .0403
 10         IN      15
 11         PB     4.4
 12         PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
 13         PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
 14         PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
 15         PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
 16         PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
 17         PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
  18     PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
  19     PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
  20     PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
  21     PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
  22     LS       0    81.8
  23     UD   .1450

  24     KK      E5
  25     KM        ROUTE FLOW FROM SUB-BASIN E-1 TO DP E5
  26     RD     360     .010     .035              TRAP       10        4

  27     KK     E-6
  28     KM        RUNOFF FROM SUB-BASIN E-6
  29     BA   .0478
  30     LS       0       79
  31     UD    .181

  32     KK      E6
  33     KM        ROUTE FLOW FROM SUB-BASIN E-6 TO DP E5
  34     RD    1450     .010     .013              CIRC        3

  35     KK     E-5
  36     KM        RUNOFF FROM SUB-BASIN E-5
  37     BA   .0400
  38     LS       0       79
  39     UD    .119

  40     KK    DPE5
  41     KM        DESIGN POINT E5 COMBINE RUNOFF FROM SUB-BASIN E-5, E6 AND E5
  42     HC       3
1                                  HEC-1 INPUT
PAGE  2

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


  43     KK      E2
  44     KM        ROUTE FLOW FROM DESIGN POINT E5 TO DP E2
  45     RD    1850     .010     .013              CIRC      4.5

  46     KK     E-2
  47     KM        RUNOFF FROM SUB-BASIN E-2
  48     BA   .0520
  49     LS       0       79
  50     UD    .134

  51     KK    DPE2
  52     KM        DESIGN POINT E2 COMBINE RUNOFF FROM SUB-BASIN E-2 AND E2
  53     HC       2

  54     KK      E3
  55     KM        ROUTE FLOW FROM DP E2 TO DP E
  56     RD    3150     .010     .040              TRAP       10        4

  57     KK     E-3
  58     KM        RUNOFF FROM SUB-BASIN E-3
  59     BA   .0095
  60     LS       0       61
  61     UD    .397

  62     KK     DPE
  63     KM        DESIGN POINT E COMBINE RUNOFF FROM SUB-BASIN E-3 AND E3
  64     HC       2

  65     KK     E-4
  66     KM        RUNOFF FROM SUB-BASIN E-4
  67     BA   .0423
  68     LS       0       79
  69     UD    .141
  70     ZZ
1
```

```
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING            (--->) DIVERSION OR PUMP FLOW

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

   7        E-1
             V
             V
  24        E5
             .
             .
  27         .          E-6
             .           V
             .           V
  32         .          E6
             .           .
             .           .
  35         .           .          E-5
             .           .           .
             .           .           .
  40       DPE5.......................
             V
             V
  43        E2
             .
             .
  46         .          E-2
             .           .
             .           .
  51       DPE2...........
             V
             V
  54        E3
             .
             .
  57         .          E-3
             .           .
             .           .
  62        DPE...........
             .
             .
  65         .          E-4

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                           *                                   *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)       *                                   *   U.S. ARMY
CORPS OF ENGINEERS      *
 *              JUN   1998                   *                                   *   HYDROLOGIC
ENGINEERING CENTER     *
 *           VERSION 4.1                     *                                   *        609
SECOND STREET           *
 *                                           *                                   *     DAVIS,
CALIFORNIA 95616        *
 *  RUN DATE   05FEB04  TIME  14:01:38       *                                   *
(916) 756-1104             *
 *                                           *                                   *
*
 *****************************************
***************************************
```

Wolf Ranch Master Development Drainage Plan
D basins future development condition PN 03094
5-year and 100 Year, 24 hr Type IIA Storm FN Dbas-f.dat

```
5 IO          OUTPUT CONTROL VARIABLES
                   IPRNT            5  PRINT CONTROL
                   IPLOT            0  PLOT CONTROL
                   QSCAL           0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                    NMIN            5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1     0  STARTING DATE
                   ITIME         0000  STARTING TIME
                      NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      2     0  ENDING DATE
                  NDTIME         0055  ENDING TIME
                   ICENT           19  CENTURY MARK

               COMPUTATION INTERVAL     .08 HOURS
                    TOTAL TIME BASE   24.92 HOURS

       ENGLISH UNITS
            DRAINAGE AREA           SQUARE MILES
            PRECIPITATION DEPTH     INCHES
            LENGTH, ELEVATION       FEET
            FLOW                    CUBIC FEET PER SECOND
            STORAGE VOLUME          ACRE-FEET
            SURFACE AREA            ACRES
            TEMPERATURE             DEGREES FAHRENHEIT

  JP          MULTI-PLAN OPTION
                   NPLAN            1  NUMBER OF PLANS

  JR          MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                  .56      1.00
1
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	E-1	.04	1	FLOW	32.	86.
				TIME	6.08	6.00
ROUTED TO						
+	E5	.04	1	FLOW	31.	83.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	E-6	.05	1	FLOW	29.	87.
				TIME	6.08	6.08
ROUTED TO						
+	E6	.05	1	FLOW	28.	85.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	E-5	.04	1	FLOW	28.	82.
				TIME	6.00	6.00
3 COMBINED AT						
+	DPE5	.13	1	FLOW	85.	241.
				TIME	6.08	6.08
ROUTED TO						
+	E2	.13	1	FLOW	82.	240.
				TIME	6.08	6.08

```
 HYDROGRAPH AT
+                  E-2       .05     1   FLOW          34.     102.
                                         TIME         6.08     6.00

  2 COMBINED AT
+                 DPE2       .18     1   FLOW         116.     336.
                                         TIME         6.08     6.08

 ROUTED TO
+                   E3       .18     1   FLOW         111.     330.
                                         TIME         6.25     6.17

 HYDROGRAPH AT
+                  E-3       .01     1   FLOW           0.       4.
                                         TIME         6.42     6.33

  2 COMBINED AT
+                  DPE       .19     1   FLOW         111.     334.
                                         TIME         6.25     6.17

 HYDROGRAPH AT
+                  E-4       .04     1   FLOW          28.      81.
                                         TIME         6.08     6.00
1
                                         SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                             (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                               INTERPOLATED TO
                                                                           COMPUTATION INTERVAL
             ISTAQ    ELEMENT      DT       PEAK    TIME TO    VOLUME      DT      PEAK     TIME TO
VOLUME
                                                      PEAK                                    PEAK

                                  (MIN)     (CFS)    (MIN)      (IN)     (MIN)     (CFS)     (MIN)        (IN)

            FOR PLAN = 1  RATIO=  .00
                    E5  MANE      1.74     31.18    364.81       .96      5.00     31.15     365.00
.96


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2065E+01 EXCESS= .0000E+00 OUTFLOW= .2065E+01 BASIN STORAGE= .2915E-03
PERCENT ERROR=     .0


            FOR PLAN = 1  RATIO=  .00
                    E5  MANE      1.31     85.18    361.81      2.53      5.00     82.96     365.00
2.53


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .5440E+01 EXCESS= .0000E+00 OUTFLOW= .5439E+01 BASIN STORAGE= .3190E-03
PERCENT ERROR=     .0


            FOR PLAN = 1  RATIO=  .00
                    E6  MANE      1.50     28.88    367.50       .81      5.00     27.61     365.00
.81


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .2073E+01 EXCESS= .0000E+00 OUTFLOW= .2073E+01 BASIN STORAGE= .1962E-03
PERCENT ERROR=     .0


            FOR PLAN = 1  RATIO=  .00
                    E6  MANE      1.75     85.53    365.75      2.29      5.00     85.12     365.00
2.29


 CONTINUITY SUMMARY (AC-FT) - INFLOW= .5844E+01 EXCESS= .0000E+00 OUTFLOW= .5843E+01 BASIN STORAGE= .1744E-03
PERCENT ERROR=     .0
```

F-BASINS DEVELOPED

```
1****************************************
***************************************
 *                                      *                                                                        *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                                        *   U.S. ARMY
CORPS OF ENGINEERS      *
 *               JUN   1998             *                                                                        *   HYDROLOGIC
ENGINEERING CENTER    *
 *            VERSION 4.1               *                                                                        *        609
SECOND STREET          *
 *                                      *                                                                        *      DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   19NOV04  TIME  12:35:23  *                                                                        *         (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


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

   1         ID        Wolf Ranch Master Development Drainage Plan
   2         ID                        F basins future development conditions PN 03094
   3         ID            5-year and 100 year, 24hr Type IIA Storm
             *DIAGRAM
   4         IT       5       0       0     300
   5         IO       5       0
   6         JR    PREC     .56     1.0

   7         KK     F-8
   8         KM   RUNOFF FOR SUB-BASIN F-8
   9         BA   .0630
  10         IN      15
  11         PB     4.4
  12         PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
  13         PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
  14         PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
  15         PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
  16         PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
  17         PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
LS       0    69.7
UD    0.22

KK    RF-8
KM   ROUTE FLOW FROM SUB-BASIN F-8 TO DESIGN POINT F19
RD    1800   0.033    0.04             TRAP      10        6

KK     F-1
KM   RUNOFF FOR BASIN F-1
BA   .1659
LS       0       61
UD     .20

KK    RF-9
KM   ROUTE FLOW FROM SUB-BASIN F-1 TO DESIGN POINT F9
RD     700   0.037    0.04             TRAP      10        6

KK     F-9
KM   RUNOFF FOR BASIN F-9
BA   .0430
LS       0    68.2
UD     .16

KK    DPF9
KM   COMBINE FLOW FROM SUB-BASIN F-9 AND RF-9
HC       2
1                                        HEC-1 INPUT
PAGE  2

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


KK   RF-19
KM   ROUTE FLOW FROM DESIGN POINT DP F9 TO DESIGN POINT F19
RD    2300   0.035    0.04             TRAP      20        6

KK    F-19
KM   RUNOFF FOR BASIN F-19
BA   .1020
LS       0    73.2
UD     .19

KK   DPF19
KM   COMBINE FLOW FROM SUB-BASIN F-19, RF-8 AND RF19
HC       3

KK   RF-22
KM   ROUTE FLOW FROM DESIGN POINT DP F19 TO DESIGN POINT F22
RD    1800   0.033    0.04             TRAP      20        3

KK     F-2
KM   RUNOFF FOR BASIN F-2
BA   .0424
LS       0       61
UD     .19

KK   RF-10
KM   ROUTE FLOW FROM SUB-BASIN F-2 TO DESIGN POINT F10
RD     850   0.059    0.04             TRAP      10        6

KK    F-10
KM   RUNOFF FOR BASIN F-10
BA   .0180
LS       0    68.8
UD     .15

KK   DPF10
```

```
 71        KM   COMBINE FLOW FROM SUB-BASIN F-10 AND RF10
 72        HC      2

 73        KK  RF-18A
 74        KM   ROUTE FLOW FROM DESIGN POINT DP F10 TO DESIGN POINT F18
 75        RD    1800   0.037    0.04             TRAP       10        6

 76        KK     F-3
 77        KM   RUNOFF FOR SUB-BASIN F-3
 78        BA   .0942
 79        LS       0       61
 80        UD     .22

 81        KK   RF-11
 82        KM   ROUTE FLOW FROM SUB-BASIN F-3 TO DESIGN POINT F11
 83        RD     950   0.038    0.04             TRAP       10        6
```

1
PAGE 3

HEC-1 INPUT

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


 84        KK    F-11
 85        KM   RUNOFF FOR SUB-BASIN F-11
 86        BA   .0460
 87        LS       0    68.2
 88        UD     .17

 89        KK   DPF11
 90        KM   COMBINE FLOW FROM SUB-BASIN F-11 AND RF-11
 91        HC       2

 92        KK   RF-18
 93        KM   ROUTE FLOW FROM DESIGN POINT F11 TO DESIGN POINT F18
 94        RD    1800   0.037    0.04             TRAP       10        6

 95        KK     F-4
 96        KM   RUNOFF FOR SUB-BASIN F-4
 97        BA   .2681
 98        LS       0       61
 99        UD     .28

100        KK   RF-12
101        KM   ROUTE FLOW FROM SUB-BASIN F-4 TO DESIGN POINT F12
102        RD    1150   0.044    0.04             TRAP       10        6

103        KK     F-5
104        KM   RUNOFF FOR SUB-BASIN F-5
105        BA   .1073
106        LS       0       61
107        UD     .34

108        KK  RF-12A
109        KM   ROUTE FLOW FROM SUB-BASIN F-5 TO DESIGN POINT F12
110        RD    1600   0.035    0.04             TRAP       10        6

111        KK    F-12
112        KM   RUNOFF FOR SUB-BASIN F-12
113        BA   .0590
114        LS       0    69.1
115        UD     .20

116        KK   DPF12
117        KM   COMBINE FLOW FROM SUB-BASIN RF-12, RF-12A, AND F-12
118        HC       3

119        KK   RF-17
120        KM   ROUTE FLOW FROM DESIGN POINT F-12 TO DESIGN POINT F18
121        RD    1900   0.028    0.04             TRAP       10        6

122        KK    F-17
```

```
 123          KM   RUNOFF FOR SUB-BASIN F-17
 124          BA   .0380
 125          LS      0    61.6
 126          UD     .21
1                                              HEC-1 INPUT
PAGE  4

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


 127          KK    F-18
 128          KM   RUNOFF FOR SUB-BASIN F-18
 129          BA   .0980
 130          LS      0    69.7
 131          UD     .21

 132          KK   DPF18
 133          KM   COMBINE FLOW FROM SUB-BASINS F-18 AND F17, AND RF-18A, RF-18 AND RF-17
 134          HC      5

 135          KK  RF-22A
 136          KM   ROUTE FLOW FROM DESIGN POINT F-18 TO DESIGN POINT F22
 137          RD   1800   0.027    0.04            TRAP      10       6

 138          KK    F-22
 139          KM   RUNOFF FOR SUB-BASIN F-22
 140          BA   .0640
 141          LS      0    64.1
 142          UD     .21

 143          KK   DPF22
 144          KM   COMBINE FLOW FROM SUB-BASIN F-22, RF-22 AND RF-22A
 145          HC      3

 146          KK  RF-27A
 147          KM   ROUTE FLOW FROM DESIGN POINT F-22 TO DESIGN POINT F27A
 148          RD    500   0.029    0.04            TRAP      10       6

 149          KK    F-16
 150          KM   RUNOFF FOR SUB-BASIN F-16
 151          BA   .0270
 152          LS      0    69.9
 153          UD     .21

 154          KK   RF-16
 155          KM   ROUTE FLOW FROM SUB-BASIN F-16 TO DESIGN POINT F27A
 156          RD   2000   0.030    0.04            TRAP      10       6

 157          KK  DPF27A
 158          KM   COMBINE FLOW FROM RF-16 AND FR-27A
 159          HC      2

 160          KK  RF-27B
 161          KM   ROUTE FLOW FROM DESIGN POINT F27A TO DESIGN POINT F27
 162          RD   3150   0.020    0.04            TRAP      10       6

 163          KK    F-21
 164          KM   RUNOFF FOR SUB-BASIN F-21
 165          BA   .0790
 166          LS      0    89.1
 167          UD     .25
1                                              HEC-1 INPUT
PAGE  5

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


 168          KK   RF-26
 169          KM   ROUTE FLOW FROM SUB-BASIN 26 TO DESIGN POINT F26
 170          RD   1300    .028     .04            TRAP      10       6
```

```
171          KK     F-26
172          KM    RUNOFF FOR SUB-BASIN F-26
173          BA    .0520
174          LS       0    82.0
175          UD      .19

176          KK    DPF26
177          KM    COMBINE FLOW FROM RF-26 AND F-26
178          HC       2

179          KK   RF-26A
180          KM    ROUTE FLOW FROM DESIGN POINT F26 TO DESIGN POINT F27
181          RD     1600   0.013    0.04             TRAP       10        6

182          KK    DPF27
183          KM    COMBINE FLOW FROM RF-27B AND RF-26A
184          HC       2

185          KK   RF-27C
186          KM    ROUTE FLOW FROM DESIGN POINT F27 TO DESIGN POINT F28
187          RD     1400   0.019    0.04             TRAP       50        3

188          KK      F-7
189          KM    RUNOFF FOR SUB-BASIN F-7
190          BA    .0782
191          LS       0      61
192          UD      .19

193          KK     RF-7
194          KM    ROUTE FLOW FROM SUB-BASIN F-7 TO DESIGN POINT F14
195          RD     1200   0.033    0.04             TRAP       10        6

196          KK     F-14
197          KM    RUNOFF FOR SUB-BASIN F-14
198          BA    .1290
199          LS       0    73.0
200          UD      .23

201          KK      F-6
202          KM    RUNOFF FOR SUB-BASIN F-6
203          BA    .0310
204          LS       0      61
205          UD      .19

206          KK    RF-13
207          KM    ROUTE FLOW FROM SUB-BASIN F-6 TO DESIGN POINT F13
208          RD      800   0.038    0.04             TRAP       10        6
1                                                HEC-1 INPUT
PAGE  6

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


209          KK     F-13
210          KM    RUNOFF FOR SUB-BASIN F-13
211          BA    .0140
212          LS       0    60.7
213          UD      .14

214          KK    DPF13
215          KM    COMBINE FLOW FROM RF-13 AND F-13
216          HC       2

217          KK    RF-14
218          KM    ROUTE FLOW FROM DESIGN POINT F13 TO DESIGN POINT F14
219          RD     3600   0.027    0.04             TRAP       20        6

220          KK    DPF14
221          KM    COMBINE FLOW FROM RF-7, F-14, AND RF-14
222          HC       3
```

```
KK   RF-25
KM   ROUTE FLOW FROM DESIGN POINT F14 TO DESIGN POINT F25
RD    2600   0.023    0.04              TRAP     20       6

KK    F-25
KM   RUNOFF FOR SUB-BASIN F-25
BA   .0890
LS       0     73.6
UD      .28

KK   DPF25
KM   COMBINE FLOW FROM RF-25 AND RF-14
HC        2

KK   RF-30
KM   ROUTE FLOW FROM DESIGN POINT F25 TO DESIGN POINT F30
RD     900   0.027   0.024              TRAP     20       6

KK    F-15
KM   RUNOFF FOR SUB-BASIN F-15
BA    .021
LS       0     69.0
UD      .16

KK   RF-23
KM   ROUTE FLOW FROM SUB-BASIN F15 TO DESIGN POINT F23
RD    1200   0.023    0.04              TRAP     10       3

KK    F-23
KM   RUNOFF FOR SUB-BASIN F-23
BA   .0310
LS       0     73.0
UD      .18
```

1
PAGE 7

HEC-1 INPUT

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

KK   DPF23
KM   COMBINE FLOW FROM RF-23 AND F-23
HC        2

KK   RF-24
KM   ROUTE FLOW FROM DESIGN POINT F23 TO DESIGN POINT F24
RD    2250   0.026   0.04               TRAP     10       6

KK    F-24
KM   RUNOFF FOR SUB-BASIN F-24
BA   .0890
LS       0     74.8
UD      .26

KK   DPF24
KM   COMBINE FLOW FROM RF-24 AND F-24
HC        2

KK  RF-30A
KM   ROUTE FLOW FROM DESIGN POINT F24 TO DESIGN POINT F30
RD    1100   0.033   0.04               TRAP     10       6

KK    F-30
KM   RUNOFF FOR SUB-BASIN F-30
BA   .0220
LS       0     72.2
UD      .18

KK   DPF30
KM   COMBINE FLOW FROM RF-30, RF-30A, AND F-30
HC        3
```

```
275             KK   RF-29
276             KM   ROUTE FLOW FROM DESIGN POINT F30 TO DESIGN POINT F29
277             RD    2350   0.027   0.04                TRAP       6       3

278             KK    F-29
279             KM   RUNOFF FOR SUB-BASIN F-29
280             BA   .0250
281             LS      0     73.0
282             UD     .19

283             KK   DPF29
284             KM   COMBINE FLOW FROM RF-29 AND F-29
285             HC      2

286             KK   RF-28
287             KM   ROUTE FLOW FROM DESIGN POINT F29 TO DESIGN POINT F28
288             RD     750   0.015   0.04                TRAP      20       3
```

1
PAGE 8

HEC-1 INPUT

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

289             KK    F-28
290             KM   RUNOFF FOR SUB-BASIN F-28
291             BA    .042
292             LS      0     73.0
293             UD     .23

294             KK    F-27
295             KM   RUNOFF FOR SUB-BASIN F-27
296             BA    .213
297             LS      0     69.2
298             UD     .32

299             KK   DPF28
300             KM   COMBINE FLOW FROM RF-27C, RF-28, F-28 AND F-27
301             HC      4

302             KK   RF-31
303             KM   ROUTE FLOW FROM DESIGN POINT F28 TO DESIGN POINT F
304             RD    3500   0.023   0.04                TRAP     100       3

305             KK    F-31
306             KM   RUNOFF FOR SUB-BASIN F-31
307             BA   .0810
308             LS      0     65.0
309             UD     .24

310             KK    DP F
311             KM   COMBINE FLOW FROM RF-31 AND F-31
312             HC      2
313             ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   7        F-8
              V
              V
  24       RF-8
              .
              .
  27          .          F-1
              .            V
              .            V
  32          .         RF-9
              .            .
```

```
                  .           .
35                .           .         F-9
                  .           .           .
                  .           .           .
40                .        DPF9............
                  .           V
                  .           V
43                .       RF-19
                  .           .
                  .           .
46                .           .        F-19
                  .           .           .
                  .           .           .
51            DPF19........................
                  V
                  V
54            RF-22
                  .
                  .
57                .         F-2
                  .           V
                  .           V
62                .       RF-10
                  .           .
                  .           .
65                .           .        F-10
                  .           .           .
                  .           .           .
70                .       DPF10............
                  .           V
                  .           V
73                .      RF-18A
                  .           .
                  .           .
76                .           .         F-3
                  .           .           V
                  .           .           V
81                .           .       RF-11
                  .           .           .
                  .           .           .
84                .           .           .        F-11
                  .           .           .           .
                  .           .           .           .
89                .           .       DPF11............
                  .           .           V
                  .           .           V
92                .           .       RF-18
                  .           .           .
                  .           .           .
95                .           .           .         F-4
                  .           .           .           V
                  .           .           .           V
100               .           .           .       RF-12
                  .           .           .           .
                  .           .           .           .
103               .           .           .           .         F-5
                  .           .           .           .           V
                  .           .           .           .           V
108               .           .           .           .      RF-12A
                  .           .           .           .           .
                  .           .           .           .           .
111               .           .           .           .           .        F-12
                  .           .           .           .           .           .
                  .           .           .           .           .           .
116               .           .           .       DPF12........................
                  .           .           .           V
                  .           .           .           V
119               .           .           .       RF-17
                  .           .           .           .
                  .           .           .           .
122               .           .           .           .        F-17
```

```
              .           .           .           .           .
              .           .           .           .           .
127           .           .           .           .           .        F-18
              .           .           .           .           .           .
              .           .           .           .           .           .
132           .       DPF18................................................
              .           V
              .           V
135           .      RF-22A
              .           .
              .           .
138           .           .        F-22
              .           .           .
              .           .           .
143       DPF22........................
              V
              V
146      RF-27A
              .
              .
149           .        F-16
              .           V
              .           V
154           .       RF-16
              .           .
              .           .
157      DPF27A............
              V
              V
160      RF-27B
              .
              .
163           .        F-21
              .           V
              .           V
168           .       RF-26
              .           .
              .           .
171           .           .        F-26
              .           .           .
              .           .           .
176           .       DPF26............
              .           V
              .           V
179           .      RF-26A
              .           .
              .           .
182       DPF27............
              V
              V
185      RF-27C
              .
              .
188           .         F-7
              .           V
              .           V
193           .        RF-7
              .           .
              .           .
196           .           .        F-14
              .           .           .
              .           .           .
201           .           .           .         F-6
              .           .           .           V
              .           .           .           V
206           .           .           .       RF-13
              .           .           .           .
              .           .           .           .
209           .           .           .           .        F-13
              .           .           .           .           .
              .           .           .           .           .
```

```
214            .           .           .       DPF13............
               .           .           .           V
               .           .           .           V
217            .           .           .       RF-14
               .           .           .           .
               .           .           .           .
220            .       DPF14........................
               .           V
               .           V
223            .       RF-25
               .           .
               .           .
226            .           .        F-25
               .           .           .
               .           .           .
231            .       DPF25............
               .           V
               .           V
234            .       RF-30
               .           .
               .           .
237            .           .        F-15
               .           .           V
               .           .           V
242            .           .      RF-23
               .           .           .
               .           .           .
245            .           .           .        F-23
               .           .           .           .
               .           .           .           .
250            .           .       DPF23............
               .           .           V
               .           .           V
253            .           .       RF-24
               .           .           .
               .           .           .
256            .           .           .        F-24
               .           .           .           .
               .           .           .           .
261            .           .       DPF24............
               .           .           V
               .           .           V
264            .           .      RF-30A
               .           .           .
               .           .           .
267            .           .           .        F-30
               .           .           .           .
               .           .           .           .
272            .       DPF30........................
               .           V
               .           V
275            .       RF-29
               .           .
               .           .
278            .           .        F-29
               .           .           .
               .           .           .
283            .       DPF29............
               .           V
               .           V
286            .       RF-28
               .           .
               .           .
289            .           .        F-28
               .           .           .
               .           .           .
294            .           .           .        F-27
               .           .           .           .
               .           .           .           .
299        DPF28....................................
               V
```

```
             V
 302       RF-31
             .
             .
 305         .        F-31
             .           .
             .           .
 310        DP F...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1***************************************
*************************************
 *                                      *                                               *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                               *   U.S. ARMY
CORPS OF ENGINEERS     *
 *               JUN   1998             *                                               *   HYDROLOGIC
ENGINEERING CENTER    *
 *            VERSION 4.1               *                                               *         609
SECOND STREET         *
 *                                      *                                               *      DAVIS,
CALIFORNIA 95616      *
 *  RUN DATE   19NOV04  TIME  12:35:23  *                                               *          (916)
756-1104           *
 *                                      *                                               *
*
 ***************************************
*************************************



                        Wolf Ranch Master Development Drainage Plan
                                  F basins future development conditions PN 03094
                            5-year and 100 year, 24hr Type IIA Storm

   5 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE     1    0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     2    0  ENDING DATE
                      NDTIME       0055  ENDING TIME
                       ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT

    JP            MULTI-PLAN OPTION
                       NPLAN          1  NUMBER OF PLANS

    JR            MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                     .56      1.00
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT +	F-8	.06	1	FLOW	15.	69.
				TIME	6.17	6.08
ROUTED TO +	RF-8	.06	1	FLOW	15.	67.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-1	.17	1	FLOW	10.	110.
				TIME	6.17	6.08
ROUTED TO +	RF-9	.17	1	FLOW	10.	106.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-9	.04	1	FLOW	10.	50.
				TIME	6.08	6.08
2 COMBINED AT +	DPF9	.21	1	FLOW	18.	152.
				TIME	6.17	6.08
ROUTED TO +	RF-19	.21	1	FLOW	17.	148.
				TIME	6.33	6.17
HYDROGRAPH AT +	F-19	.10	1	FLOW	38.	144.
				TIME	6.08	6.08
3 COMBINED AT +	DPF19	.37	1	FLOW	56.	338.
				TIME	6.25	6.17
ROUTED TO +	RF-22	.37	1	FLOW	55.	326.
				TIME	6.33	6.17
HYDROGRAPH AT +	F-2	.04	1	FLOW	3.	29.
				TIME	6.17	6.08
ROUTED TO +	RF-10	.04	1	FLOW	3.	28.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-10	.02	1	FLOW	5.	22.
				TIME	6.08	6.08
2 COMBINED AT +	DPF10	.06	1	FLOW	6.	48.
				TIME	6.17	6.08
ROUTED TO +	RF-18A	.06	1	FLOW	6.	47.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-3	.09	1	FLOW	5.	59.

				TIME	6.17	6.17
ROUTED TO						
+	RF-11	.09	1	FLOW	5.	58.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-11	.05	1	FLOW	11.	53.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF11	.14	1	FLOW	13.	102.
				TIME	6.17	6.08
ROUTED TO						
+	RF-18	.14	1	FLOW	13.	102.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-4	.27	1	FLOW	13.	147.
				TIME	6.25	6.17
ROUTED TO						
+	RF-12	.27	1	FLOW	13.	144.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-5	.11	1	FLOW	5.	52.
				TIME	6.33	6.25
ROUTED TO						
+	RF-12A	.11	1	FLOW	5.	51.
				TIME	6.50	6.33
HYDROGRAPH AT						
+	F-12	.06	1	FLOW	13.	66.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPF12	.43	1	FLOW	24.	236.
				TIME	6.25	6.25
ROUTED TO						
+	RF-17	.43	1	FLOW	24.	234.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-17	.04	1	FLOW	3.	25.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-18	.10	1	FLOW	24.	110.
				TIME	6.17	6.08
5 COMBINED AT						
+	DPF18	.77	1	FLOW	58.	476.
				TIME	6.25	6.17
ROUTED TO						
+	RF-22A	.77	1	FLOW	57.	474.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-22	.06	1	FLOW	7.	51.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPF22	1.21	1	FLOW	116.	828.
				TIME	6.33	6.25
ROUTED TO						

+	RF-27A	1.21	1	FLOW	113.	824.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-16	.03	1	FLOW	7.	31.
				TIME	6.17	6.08
ROUTED TO						
+	RF-16	.03	1	FLOW	6.	29.
				TIME	6.25	6.25
2 COMBINED AT						
+	DPF27A	1.24	1	FLOW	119.	853.
				TIME	6.33	6.25
ROUTED TO						
+	RF-27B	1.24	1	FLOW	117.	838.
				TIME	6.50	6.33
HYDROGRAPH AT						
+	F-21	.08	1	FLOW	79.	184.
				TIME	6.08	6.08
ROUTED TO						
+	RF-26	.08	1	FLOW	79.	179.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	F-26	.05	1	FLOW	39.	105.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF26	.13	1	FLOW	112.	280.
				TIME	6.17	6.08
ROUTED TO						
+	RF-26A	.13	1	FLOW	110.	272.
				TIME	6.25	6.17
2 COMBINED AT						
+	DPF27	1.37	1	FLOW	185.	1044.
				TIME	6.42	6.33
ROUTED TO						
+	RF-27C	1.37	1	FLOW	180.	1045.
				TIME	6.50	6.33
HYDROGRAPH AT						
+	F-7	.08	1	FLOW	5.	54.
				TIME	6.17	6.08
ROUTED TO						
+	RF-7	.08	1	FLOW	5.	53.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-14	.13	1	FLOW	42.	162.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-6	.03	1	FLOW	2.	21.
				TIME	6.17	6.08
ROUTED TO						
+	RF-13	.03	1	FLOW	2.	21.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-13	.01	1	FLOW	1.	11.
				TIME	6.08	6.08

2 COMBINED AT						
+	DPF13	.05	1	FLOW	2.	30.
				TIME	6.25	6.08
ROUTED TO						
+	RF-14	.05	1	FLOW	2.	30.
				TIME	6.92	6.33
3 COMBINED AT						
+	DPF14	.25	1	FLOW	45.	210.
				TIME	6.17	6.17
ROUTED TO						
+	RF-25	.25	1	FLOW	44.	209.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-25	.09	1	FLOW	27.	106.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF25	.34	1	FLOW	66.	303.
				TIME	6.25	6.25
ROUTED TO						
+	RF-30	.34	1	FLOW	66.	303.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-15	.02	1	FLOW	6.	26.
				TIME	6.08	6.08
ROUTED TO						
+	RF-23	.02	1	FLOW	5.	24.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	F-23	.03	1	FLOW	12.	44.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF23	.05	1	FLOW	15.	68.
				TIME	6.17	6.08
ROUTED TO						
+	RF-24	.05	1	FLOW	15.	65.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-24	.09	1	FLOW	32.	115.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF24	.14	1	FLOW	44.	180.
				TIME	6.25	6.17
ROUTED TO						
+	RF-30A	.14	1	FLOW	42.	172.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-30	.02	1	FLOW	8.	30.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPF30	.50	1	FLOW	110.	488.
				TIME	6.33	6.25
ROUTED TO						
+	RF-29	.50	1	FLOW	108.	489.
				TIME	6.42	6.25

```
 HYDROGRAPH AT
+                 F-29       .03     1   FLOW           9.       35.
                                         TIME         6.08      6.08

  2 COMBINED AT
+                 DPF29      .53     1   FLOW         111.      510.
                                         TIME         6.42      6.25

 ROUTED TO
+                 RF-28      .53     1   FLOW         111.      494.
                                         TIME         6.42      6.25

 HYDROGRAPH AT
+                 F-28       .04     1   FLOW          14.       53.
                                         TIME         6.17      6.08

 HYDROGRAPH AT
+                 F-27       .21     1   FLOW          38.      183.
                                         TIME         6.25      6.17

  4 COMBINED AT
+                 DPF28     2.15     1   FLOW         323.     1719.
                                         TIME         6.42      6.33

 ROUTED TO
+                 RF-31     2.15     1   FLOW         317.     1711.
                                         TIME         6.58      6.42

 HYDROGRAPH AT
+                 F-31       .08     1   FLOW          10.       64.
                                         TIME         6.17      6.17

  2 COMBINED AT
+                 DP F      2.23     1   FLOW         321.     1740.
                                         TIME         6.58      6.42
1

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

G-BASINS DEVELOPED

```
1*****************************************
 *************************************
                                        *                                                    *
*
 *   FLOOD HYDROGRAPH PACKAGE   (HEC-1)   *                                                  *    U.S. ARMY
CORPS OF ENGINEERS      *
 *               JUN   1998               *                                                  *    HYDROLOGIC
ENGINEERING CENTER     *
 *             VERSION 4.1                *                                                  *          609
SECOND STREET          *
 *                                        *                                                  *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE    21MAY04  TIME  12:44:02   *                                                  *          (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
"EC1KW.

          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

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

           1           ID              Wolf Ranch Master Development Drainage Plan
           2           ID                    G Basins Future developed condition          PN 03094
           3           ID              5-year and 100 Year, 24 hr Type IIA  Storm  FN Gbas-f.dat
                       *DIAGRAM
           4           IT       5       0       0     300
           5           IO       4       0
           6           JR    PREC     .56     1.0

           7           KK   G-1
           8           KM       RUNOFF - Sub-basin G-1
           9           BA   .0808
          10           IN      15
          11           PB     4.4
          12           PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
          13           PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
          14           PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
          15           PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
          16           PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
          17           PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
            18              PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
            19              PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
            20              PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
            21              PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
            22              LS       0      61
            23              UD    0.22

            24              KK      G2
            25              KM         ROUTE FLOW from SUB-BASIN G-1 TO DP G3
            26              RD    3200   0.027    0.04            TRAP      10        4

            27              KK     G-2
            28              KM         RUNOFF - Sub-basin G-2
            29              BA    .035
            30              LS       0       73
            31              UD    0.22

            32              KK      G3
            33              KM         ROUTE FLOW from SUB-BASIN G-2 TO DP G3
            34              RD    2730   0.024    0.04            TRAP      10        4

            35              KK     G-3
            36              KM         RUNOFF - Sub-basin G-3
            37              BA    .177
            38              LS       0       73
            39              UD    0.29

            40              KK    DPG3
            41              KM    COMBINE RUNOFF from G2, G3 AND SUB-BASIN G-3
            42              HC       3
 1
PAGE  2                                             HEC-1 INPUT

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


            43              KK      G5
            44              KM         ROUTE FLOW from DP G3 TO DP G5
            45              RD    2200    0.02    .013            CIRC     4.5

            46              KK     G-5
            47              KM         RUNOFF - Sub-basin G-5
            48              BA    .153
            49              LS       0    78.4
            50              UD    0.26

            51              KK     DPG
            52              KM         COMBINE RUNOFF from G5 AND SUB-BASIN G-5
            53              HC       2
            54              ZZ
 1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   7        G-1
               V
               V
  24          G2
               .
               .
  27           .        G-2
               .          V
               .          V
  32           .         G3
               .          .
               .          .
  35           .          .          G-3
               .          .           .
```

```
 40        DPG3........................
             V
             V
 43         G5
             .
             .
 46          .         G-5
             .           .
             .           .
 51         DPG............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1***************************************
*************************************
 *                                    *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
CORPS OF ENGINEERS     *
 *             JUN   1998                *
ENGINEERING CENTER     *
 *          VERSION 4.1                  *
SECOND STREET          *
 *                                       *
CALIFORNIA 95616       *
 *  RUN DATE   21MAY04  TIME  12:44:02   *
756-1104           *
 *                                       *
*
 ***************************************
*************************************
```

```
*
*   U.S. ARMY
*   HYDROLOGIC
*        609
*      DAVIS,
*          (916)
*
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	G-1	.08	1	FLOW	5.	50.
				TIME	6.17	6.17
ROUTED TO						
+	G2	.08	1	FLOW	4.	50.
				TIME	6.58	6.25
HYDROGRAPH AT						
+	G-2	.04	1	FLOW	12.	45.
				TIME	6.17	6.08
ROUTED TO						
+	G3	.04	1	FLOW	12.	44.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	G-3	.18	1	FLOW	50.	200.
				TIME	6.17	6.17
3 COMBINED AT						
+	DPG3	.29	1	FLOW	57.	278.
				TIME	6.25	6.25
ROUTED TO						

+	G5	.29	1	FLOW	55.	277.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	G-5	.15	1	FLOW	74.	230.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPG	.45	1	FLOW	120.	489.
1				TIME	6.17	6.17

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

H-J Basins Developed

```
 *****************************************
 ***************************************
  *                                        *
 *
  *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
 CORPS OF ENGINEERS        *
  *              JUN   1998                *
 ENGINEERING CENTER     *
  *           VERSION 4.1                  *
 SECOND STREET          *
  *                                        *
 CALIFORNIA 95616       *
  *  RUN DATE   21MAY04  TIME  15:11:47    *
 756-1104            *
  *                                        *
 *
  *****************************************
 ***************************************
```

```
*
*    U.S. ARMY
*    HYDROLOGIC
*         609
*       DAVIS,
*          (916)
*
```

```
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

HEC-1 INPUT

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

    1        ID              Wolf Ranch master Development Drainage Plan
    2        ID                 H  AND J Basins developed conditions  PN 03094
    3        ID              5-year and 100 Year, 24 hr Type IIA  Storm  FN hjbas-f.dat
             *DIAGRAM
    4        IT       5       0       0     300
    5        IO       4       0
    6        JR    PREC     .56     1.0

    7        KK     H-1
    8        KM          RUNOFF FROM SUB-BASIN H-1
    9        BA   .0370
   10        IN      15
   11        PB     4.4
   12        PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
   13        PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
   14        PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
   15        PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
   16        PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
   17        PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
18        PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
19        PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
20        PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
21        PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
22        LS       0      73
23        UD    0.10

24        KK     H-2
25        KM          RUNOFF FROM SUB-BASIN H-2
26        BA   .0700
27        LS       0      73
28        UD     .20

29        KK     J-1
30        KM          RUNOFF FROM SUB-BASIN J-1
31        BA   .0250
32        LS       0      79
33        UD     .10

34        KK    J-2
35        KM          RUNOFF FROM SUB-BASIN J-2
36        BA   .0530
37        LS       0      77
38        UD     .15
39        ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

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

   7         H-1
              .
              .
  24          .        H-2
              .          .
              .          .
  29          .          .          J-1
              .          .           .
              .          .           .
  34          .          .           .          J-2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                       *                                                  *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *    U.S. ARMY
CORPS OF ENGINEERS      *
 *              JUN  1998                *                                                  *    HYDROLOGIC
ENGINEERING CENTER     *
 *           VERSION 4.1                 *                                                  *          609
SECOND STREET          *
 *                                       *                                                  *       DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   21MAY04  TIME  15:11:47   *                                                  *            (916)
756-1104             *
 *                                       *                                                  *
*
 *****************************************
***************************************
```

Wolf Ranch master Development Drainage Plan
H AND J Basins developed conditions PN 03094
5-year and 100 Year, 24 hr Type IIA Storm FN hjbas-f.dat

```
5 IO          OUTPUT CONTROL VARIABLES
                    IPRNT            4  PRINT CONTROL
                    IPLOT            0  PLOT CONTROL
                    QSCAL           0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                    NMIN             5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1     0  STARTING DATE
                    ITIME         0000  STARTING TIME
                       NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2     0  ENDING DATE
                   NDTIME         0055  ENDING TIME
                   ICENT            19  CENTURY MARK

               COMPUTATION INTERVAL     .08 HOURS
                    TOTAL TIME BASE   24.92 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT

  JP          MULTI-PLAN OPTION
                    NPLAN            1  NUMBER OF PLANS

  JR          MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                  .56      1.00


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** ***


              **************
              *            *
RATIOS APPLIED TO PRECIPITATION
 OPERATION        STATION     AREA     PLAN                RATIO 1   RATIO 2
                                                               .56      1.00

 HYDROGRAPH AT
+                    H-1        .04      1    FLOW             17.       63.
                                              TIME            6.00      6.00

 HYDROGRAPH AT
+                    H-2        .07      1    FLOW             25.       96.
                                              TIME            6.08      6.08

 HYDROGRAPH AT
+                    J-1        .03      1    FLOW             19.       53.
                                              TIME            6.00      6.00

 HYDROGRAPH AT
+                    J-2        .05      1    FLOW             30.       92.
                                              TIME            6.08      6.08


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

HEC-1 INPUT & OUTPUT
DEVELOPED CONDITIONS WITH DETENTION

A-Basins Detained

```
1***************************************
*************************************
 *                                      *                                                                 *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                                 *   U.S. ARMY
CORPS OF ENGINEERS     *
 *              JUN  1998               *                                                                 *   HYDROLOGIC
ENGINEERING CENTER    *
 *           VERSION 4.1                *                                                                 *         609
SECOND STREET          *
 *                                      *                                                                 *      DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   19NOV04  TIME  15:02:01  *                                                                 *         (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

HEC-1 INPUT

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

   1           ID            Wolf Ranch, Master Developed Drainage Plan
   2           ID                                   A Basins, future development condition
   3           ID               5-year and 100 Year, 24 hr Type IIA  Storm
               *DIAGRAM
   4           IT         5       0         0      300
   5           IO         5       0
   6           JR      PREC     .56       1.0

   7           KK       A-1
   8           KM          RUNOFF FROM SUB-BASIN A-1
   9           BA      .060
  10           IN        15
  11           PB       4.4
  12           PC    0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
  13           PC    0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
  14           PC    0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
  15           PC    0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
  16           PC    0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
  17           PC    0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
 18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
 19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
 20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
 21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
 22          LS       0      61
 23          UD    .292

 24          KK      A3
 25          KM   ROUTE FLOW FROM SUB-BASIN A-1 TO DP A3
 26          RD    3500    .021    0.04            TRAP      10       4

 27          KK    A-11
 28          KM       RUNOFF FROM SUB-BASIN A-11
 29          BA    .081
 30          LS       0      78
 31          UD     .19

 32          KK     A11
 33          KM       ROUTE RUNOFF FROM SB A-11 TO DP A4
 34          RD     980     .04    .013            CIRC     3.5

 35          KK     A-4
 36          KM   RUNOFF FROM SUB-BASIN A-4
 37          BA   .0861
 38          LS       0      79
 39          UD    0.21

 40          KK    DPA4
 41          KM       COMBINE RUNOFF FROM SUB-BASIN A4 AND A11
 42          HC       2
1                                       HEC-1 INPUT
PAGE  2

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


 43          KK      A4
 44          KM   ROUTE FLOW FROM DESIGN PT DPA4 TO DP A3
 45          RD     450    .024    .013            CIRC     5.5

 46          KK     A-3
 47          KM   RUNOFF FROM SUB-BASIN A-3
 48          BA   .1500
 49          LS       0      76
 50          UD    .221

 51          KK    DPA3
 52          KM   DESIGN POINT A3 COMBINE RUNOFF FROM SUB-BASIN A-3, A3 AND A4
 53          HC       3

 54          KK      A6
 55          KM   ROUTE FLOW FROM DP A3 TO DP A6
 56          RD    1550    .016    0.04            TRAP      10       4

 57          KK   A-7
 58          KM   RUNOFF FROM SUB-BASIN A-7
 59          BA   .0500
 60          LS       0    78.2
 61          UD    .172

 62          KK      A7
 63          KM   ROUTE FLOW FROM SUB-BASIN A-7 TO DP A6
 64          RD     800    0.20   0.013            CIRC     3.0

 65          KK   A-6
 66          KM   RUNOFF FROM SUB-BASIN A-6
 67          BA    .037
 68          LS       0    79.8
 69          UD     .21

 70          KK    DPA6
```

```
        71              KM   DESIGN POINT A6 COMBINE RUNOFF FROM SUB-BASIN A-6, A6 AND A7
        72              HC      3

        73              KK     A5
        74              KM   ROUTE FLOW FROM DESIGN POINT A6 TO DP A5
        75              RD    2200     .011     .04              TRAP      10       4

        76              KK   A-9
        77              KM   RUNOFF FROM SUB-BASIN A-9
        78              BA   .0673
        79              LS      0     72.1
        80              UD    .263

        81              KK     A9
        82              KM   ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
        83              RD     500      .02    .016              CIRC     3.5
1
PAGE  3                                             HEC-1 INPUT

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


        84              KK   A-5
        85              KM   RUNOFF FROM SUB-BASIN A-5
        86              BA   .1114
        87              LS      0     77.7
        88              UD    .209

        89              KK    DPA5
        90              KM   DP A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9 THIS IS INFLOW
        91              KM   TO DETENTION BASIN A
        92              HC      3

        93              KK    DBA
        94              KM   ROUTE DP A5 THROUGH DETENTION BASIN A
        95              RS      1     ELEV     100
        96              SV      0        4      10      20      40      60
        97              SE    100      102     104     106     108     110
        98              SQ      0       10      35      80     230     500

        99              KK    A10
       100              KM   ROUTE FLOW FROM DESIGN POINT A5 TO DESIGN POINT A
       101              RD     720     .021     .04              TRAP      15       4

       102              KK    A-10
       103              KM   RUNOFF FROM SUB-BASIN A-10
       104              BA   .0086
       105              LS      0       61
       106              UD    .231

       107              KK    DPA
       108              KM   DESIGN POINT A COMBINE RUNOFF SUB-BASIN A-10 AND A10
       109              HC      2
       110              ZZ
1
            SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

     7        A-1
                V
                V
    24        A3
                .
                .
    27          .          A-11
                .             V
                .             V
    32          .          A11
```

```
               .                  .
               .                  .
    35         .                  .             A-4
               .                  .               .
               .                  .               .
    40         .               DPA4...............
               .                  V
               .                  V
    43         .                 A4
               .                  .
               .                  .
    46         .                  .             A-3
               .                  .               .
               .                  .               .
    51       DPA3.........................................
               V
               V
    54        A6
               .
               .
    57         .             A-7
               .                  V
               .                  V
    62         .                 A7
               .                  .
               .                  .
    65         .                  .          A-6
               .                  .               .
               .                  .               .
    70       DPA6.........................................
               V
               V
    73        A5
               .
               .
    76         .             A-9
               .                  V
               .                  V
    81         .                 A9
               .                  .
               .                  .
    84         .                  .          A-5
               .                  .               .
               .                  .               .
    89       DPA5.........................................
               V
               V
    93        DBA
               V
               V
    99        A10
               .
               .
   102         .               A-10
               .                  .
               .                  .
   107        DPA............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1******************************************
*****************************************
 *                                         *                                          *
+
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *                                          *    U.S. ARMY
CORPS OF ENGINEERS      *
 *              JUN   1998                 *                                          *    HYDROLOGIC
ENGINEERING CENTER     *
 *            VERSION 4.1                  *                                          *          609
SECOND STREET           *
 *                                         *                                          *        DAVIS,
.LIFORNIA 95616         *
```

```
 *  RUN DATE   19NOV04  TIME  15:02:01    *                                          *         (916)
756-1104          *
 *                                        *                                          *

 ****************************************
 ***************************************
```

Wolf Ranch, Master Developed Drainage Plan
A Basins, future development condition
5-year and 100 Year, 24 hr Type IIA Storm

```
    5 IO          OUTPUT CONTROL VARIABLES
                        IPRNT             5  PRINT CONTROL
                        IPLOT             0  PLOT CONTROL
                        QSCAL            0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN             5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1      0  STARTING DATE
                        ITIME          0000  STARTING TIME
                           NQ           300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2      0  ENDING DATE
                       NDTIME          0055  ENDING TIME
                        ICENT            19  CENTURY MARK

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT

      JP          MULTI-PLAN OPTION
                        NPLAN             1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                       .56       1.00
1
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	A-1	.06	1	FLOW	3.	32.
				TIME	6.25	6.17
ROUTED TO						
+	A3	.06	1	FLOW	3.	31.
				TIME	6.75	6.42
HYDROGRAPH AT						
+	A-11	.08	1	FLOW	45.	140.
				TIME	6.08	6.08

OUTED TO

+	A11	.08	1	FLOW	44.	139.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-4	.09	1	FLOW	49.	149.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPA4	.17	1	FLOW	93.	288.
				TIME	6.08	6.08
ROUTED TO						
+	A4	.17	1	FLOW	91.	286.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-3	.15	1	FLOW	64.	223.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA3	.38	1	FLOW	155.	509.
				TIME	6.08	6.08
ROUTED TO						
+	A6	.38	1	FLOW	154.	489.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-7	.05	1	FLOW	30.	90.
				TIME	6.08	6.08
ROUTED TO						
+	A7	.05	1	FLOW	29.	89.
				TIME	6.08	6.08
HYDROGRAPH AT						
	A-6	.04	1	FLOW	22.	66.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA6	.46	1	FLOW	200.	632.
				TIME	6.17	6.08
ROUTED TO						
+	A5	.46	1	FLOW	196.	626.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-9	.07	1	FLOW	19.	76.
				TIME	6.17	6.17
ROUTED TO						
+	A9	.07	1	FLOW	18.	76.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-5	.11	1	FLOW	57.	184.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA5	.64	1	FLOW	254.	865.
				TIME	6.25	6.17
ROUTED TO						
+	DBA	.64	1	FLOW	34.	165.
				TIME	7.17	6.83
			** PEAK STAGES IN FEET **			
			1	STAGE	103.90	107.13
				TIME	7.17	6.83

```
 ROUTED TO
                       A10        .64     1    FLOW          34.      165.
                                               TIME        7.25      6.83

 HYDROGRAPH AT
+                     A-10        .01     1    FLOW           0.        5.
                                               TIME        6.17      6.17

   2 COMBINED AT
+                      DPA        .65     1    FLOW          34.      166.
                                               TIME        7.25      6.83
1
*** NORMAL END OF HEC-1 ***
```

```
1*****************************************            ***************************************
 *                                       *            *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *            *   U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998                *            *   HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                 *            *       609 SECOND STREET             *
 *                                       *            *     DAVIS, CALIFORNIA 95616         *
 * RUN DATE   06JUL04  TIME  14:18:28    *            *         (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                                              PAGE  1

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

   1           ID          Wolf Ranch Master Development Drainage Plan
   2           ID          E and D basins future development condition  pn 03094
   3           ID          5-year and 100 year, 24hr Type IIA Storm FN:E&D-DET.DAT
   4           IT       5       0       0     300
   5           IO       5       0
   6           JR    PREC     .56     1.0

   7           KK     E-1
   8           KM   RUNOFF FOR SUB-BASIN E-1
   9           BA   .0403
  10           IN      15
  11           PB     4.4
  12           PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
  13           PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
```

```
PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
LS       0    81.8
UD   .1450

KK      E5
KM   ROUTE FLOW FROM SUB-BASIN E-1 TO DP E5
RD     360   0.010    .035              TRAP      10      4

KK     E-6
KM   RUNOFF FROM SUB-BASIN E-6
BA   .0478
LS       0      79
UD    .181

KK      E6
KM   ROUTE FLOW FROM SUB-BASIN E-6 TO DP E5
RD    1450    .010    .013              CIRC       3

KK     E-5
KM   RUNOFF FROM SUB-BASIN E-5
BA   .0400
LS       0      79
UD    .119

KK    DPE5
KM   DESIGN POINT E5 COMBINE RUNOFF FROM SUB-BASIN E-5, E6 AND E5
HC       3

KK      E2
KM   ROUTE FLOW FROM DESIGN POINT E5 TO DP E2
RD    1850    .010    .013              CIRC     4.5
```

1

HEC-1 INPUT


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

KK     E-2
KM   RUNOFF FROM SUB-BASIN E-2
BA   .0520
LS       0      79
UD    .134

KK    DPE2
KM   DESIGN POINT E2 COMBINE RUNOFF FROM SUB-BASIN E-2 AND E2
HC       2
```

```
54   KK     D-1
55   KM   RUNOFF FOR SUB-BASIN D-1
56   BA   .0620
57   LS       0    78.1
58   UD    .180

59   KK      D2
60   KM   ROUTE FLOW FROM SUB-BASIN D-1 TO DP D2
61   RD    1230    0.01    .013            CIRC     4.5

62   KK     D-2
63   KM     RUNOFF FROM SUB-BASIN D-2
64   BA   .0360
65   UD    .119

66   KK    DPD2
67   KM   DESIGN POINT D2 COMBINE RUNOFF FROM SUB-BASIN D-2 AND D2
68   HC       2

69   KK   DPE-D
70   KM   DESIGN POINT DPED COMBINE DP 2 AND DP E2
71   KM   THIS IS THE INFLOW TO DETENTION BASIN E-D
72   HC       2

73   KK   DBE-D
74   KM   DESIGN POINT DPED INTO DETENTION BASIN E-D
75   KM   THIS IS THE OUTFLOW FROM DETENTION BASIN E-D
76   RS       1    ELEV      -1
77   SQ       0     2.2      11      15   109.2   162.9   179.9     509
78   SE    6952 6954.25  6954.5 6956.33    6957    6958    6959    6960
79   SA       0     1.5    2.08    3.04    3.59    3.86       4     4.2
80   SE    6952    6953    6954    6955    6957    6959    6960    6961
81   ZZ
```

```
1***************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   06JUL04  TIME  14:18:28  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Wolf Ranch Master Development Drainage Plan
E and D basins future development condition pn 03094
5-year and 100 year, 24hr Type IIA Storm FN:E&D-DET.DAT

```
 5 IO          OUTPUT CONTROL VARIABLES
                     IPRNT            5  PRINT CONTROL
                     IPLOT            0  PLOT CONTROL
                     QSCAL           0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                     NMIN             5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1     0  STARTING DATE
                     ITIME         0000  STARTING TIME
                        NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      2     0  ENDING DATE
                    NDTIME         0055  ENDING TIME
                    ICENT            19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

   JP           MULTI-PLAN OPTION
                     NPLAN            1  NUMBER OF PLANS

   JR           MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                    .56      1.00
1
```

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 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	E-1	.04	1	FLOW	32.	86.
				TIME	6.08	6.00
ROUTED TO						
+	E5	.04	1	FLOW	31.	83.
				TIME	6.08	6.08
HYDROGRAPH AT						

+	E-6	.05	1	FLOW	29.	87.
				TIME	6.08	6.08
ROUTED TO						
+	E6	.05	1	FLOW	28.	85.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	E-5	.04	1	FLOW	28.	82.
				TIME	6.00	6.00
3 COMBINED AT						
+	DPE5	.13	1	FLOW	85.	241.
				TIME	6.08	6.08
ROUTED TO						
+	E2	.13	1	FLOW	82.	240.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	E-2	.05	1	FLOW	34.	102.
				TIME	6.08	6.00
2 COMBINED AT						
+	DPE2	.18	1	FLOW	116.	336.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	D-1	.06	1	FLOW	36.	109.
				TIME	6.08	6.08
ROUTED TO						
+	D2	.06	1	FLOW	34.	107.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	D-2	.04	1	FLOW	23.	71.
				TIME	6.00	6.00
2 COMBINED AT						
+	DPD2	.10	1	FLOW	56.	171.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPE-D	.28	1	FLOW	172.	507.
				TIME	6.08	6.08
ROUTED TO						
+	DBE-D	.28	1	FLOW	13.	156.
				TIME	7.25	6.33

** PEAK STAGES IN FEET **

```
                                        1   STAGE     6955.33  6957.87
                                            TIME         7.25     6.33
1

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

F Basins Detained

```
1***************************************
**************************************
 *                                         *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
CORPS OF ENGINEERS        *
 *              JUN   1998                 *
ENGINEERING CENTER     *
 *             VERSION 4.1                 *
SECOND STREET          *
 *                                         *
CALIFORNIA 95616       *
 *  RUN DATE   19NOV04  TIME  15:55:15     *
756-1104            *
 *                                         *
*
 ***************************************
**************************************
```

```
*
*   U.S. ARMY
*   HYDROLOGIC
*        609
*      DAVIS,
*          (916)
*
```

```
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

HEC-1 INPUT

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

  1           ID           Wolf Ranch Master Development Drainage plan
  2           ID      F-Basins future developed condition with detention    PN 03094
  3           ID           5-year and 100 Year, 24 hr Type IIA  Storm  FN:  f-DET.dat
              *DIAGRAM
  4           IT       5       0       0     300
  5           IO       5       0
  6           JR    PREC     .56     1.0

  7           KK     F-8
  8           KM         RUNOFF FOR SUB-BASIN F-8
  9           BA   .0630
 10           IN      15
 11           PB     4.4
 12           PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
 13           PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
 14           PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
 15           PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
 16           PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
 17           PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
```

```
PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
LS       0    69.7
UD    0.22

KK    RF-8
KM         ROUTE FLOW FROM SUB-BASIN F-8 TO DETENTION BASIN DB 19
RD    1800   0.037    0.04              TRAP       15        4

KK     F-1
KM         RUNOFF FOR BASIN F-1
BA   .1659
LS       0       61
UD     .20

KK    RF-9
KM         ROUTE FLOW FROM SUB-BASIN F-1 TO DESIGN POINT F9
RD     700   0.037    0.04              TRAP       10        6

KK     F-9
KM         RUNOFF FOR BASIN F-9
BA   .0430
LS       0    68.2
UD     .16

KK    DPF9
KM        COMBINE FLOW FROM SUB-BASIN F-9 AND RF-9
HC       2
```

1
PAGE 2

HEC-1 INPUT

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

KK   RF-19
KM         ROUTE FLOW FROM DESIGN POINT DP F9 TO DETENTION BASIN DB 19
RD    2000   0.018    0.04              TRAP       20        4

KK    F-19
KM         RUNOFF FOR BASIN F-19
BA   .1020
LS       0    73.2
UD     .19

KK   DPF19
KM        COMBINE FLOW FROM SUB-BASIN F-19, RF-8 AND RF19
KM        THIS IS INFLOW TO DETENTION BASIN F-19
HC       3

KK   DBF19
KM   ROUTE DPF19 THROUGH DETENTION BASIN F19
KM   THIS OUTFLOW FROM DETENTION BASIN F-19
RS       1     ELEV     7140
SV       0        1        4       11     23.5       41
SE    7140     7142     7144     7146     7148     7150
SQ       0       10       55      100      200      300

KK   RF-22
KM         ROUTE FLOW FROM DESIGN POINT DPF19 TO DESIGN POINT F22
RD    1800   0.033    0.04              TRAP       20        3

KK     F-2
KM         RUNOFF FOR BASIN F-2
BA   .0424
LS       0       61
UD     .19

KK   RF-10
KM         ROUTE FLOW FROM SUB-BASIN F-2 TO DESIGN POINT F10
```

```
         72              RD     850   0.059    0.04              TRAP       10         6

         73              KK     F-10
         74              KM            RUNOFF FOR BASIN F-10
         75              BA   .0180
         76              LS       0     68.8
         77              UD     .15

         78              KK    DPF10
         79              KM          COMBINE FLOW FROM SUB-BASIN F-10 AND RF10
         80              HC       2

         81              KK  RF-18A
         82              KM          ROUTE FLOW FROM DESIGN POINT DP F10 TO DETENTION BASIN DB 18
         83              RD    1600   0.050    0.04              TRAP       15         4
```

1
PAGE 3

HEC-1 INPUT

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


         84              KK     F-3
         85              KM            RUNOFF FOR SUB-BASIN F-3
         86              BA   .0942
         87              LS       0       61
         88              UD     .22

         89              KK    RF-11
         90              KM          ROUTE FLOW FROM SUB-BASIN F-3 TO DESIGN POINT F11
         91              RD     950   0.038    0.04              TRAP       10         6

         92              KK     F-11
         93              KM            RUNOFF FOR SUB-BASIN F-11
         94              BA   .0460
         95              LS       0     68.2
         96              UD     .17

         97              KK    DPF11
         98              KM          COMBINE FLOW FROM SUB-BASIN F-11 AND RF-11
         99              HC       2

        100              KK    RF-18
        101              KM          ROUTE FLOW FROM DESIGN POINT F11 TO DETENTION BASIN DB 18
        102              RD    1600   0.029    0.04              TRAP       15         4

        103              KK     F-4
        104              KM            RUNOFF FOR SUB-BASIN F-4
        105              BA   .2681
        106              LS       0       61
        107              UD     .28

        108              KK    RF-12
        109              KM          ROUTE FLOW FROM SUB-BASIN F-4 TO DESIGN POINT F12
        110              RD    1150   0.044    0.04              TRAP       10         6

        111              KK     F-5
        112              KM            RUNOFF FOR SUB-BASIN F-5
        113              BA   .1073
        114              LS       0       61
        115              UD     .34

        116              KK  RF-12A
        117              KM          ROUTE FLOW FROM SUB-BASIN F-5 TO DESIGN POINT F12
        118              RD    1600   0.035    0.04              TRAP       10         6

        119              KK    F-12
        120              KM            RUNOFF FOR SUB-BASIN F-12
        121              BA   .0590
        122              LS       0     69.1
        123              UD     .20
```

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

 124        KK   DPF12
 125        KM        COMBINE FLOW FROM SUB-BASIN RF-12 RF-12A, AND F-12
 126        HC       3

 127        KK   RF-17
 128        KM        ROUTE FLOW FROM DESIGN POINT F-12 TO DETENTION BASIN DB 18
 129        RD    1600   0.020    0.04             TRAP      15        4

 130        KK    F-17
 131        KM         RUNOFF FOR SUB-BASIN F-17
 132        BA   .0380
 133        LS       0    61.6
 134        UD     .21

 135        KK    F-18
 136        KM         RUNOFF FOR SUB-BASIN F-18
 137        BA   .0980
 138        LS       0    69.7
 139        UD     .21

 140        KK    F-16
 141        KM         RUNOFF FOR SUB-BASIN F-16
 142        BA   .0270
 143        LS       0    69.9
 144        UD     .21

 145        KK   RF-16
 146        KM        ROUTE FLOW FROM SUB-BASIN F-16 TO DETENTION BASIN DB 18
 147        RD     600   0.020    .013             CIRC       2

 148        KK   DPF18
 149        KM        COMBINE FLOW FROM SUB-BASINS F-18, F17, RF-18A, RF-18, RF-17, AND RF-16
 150        KM        THIS IS INFLOW TO DETENTION BASIN F-18
 151        HC       6

 152        KK   DBF18
 153        KM   ROUTE DPF18 THROUGH DETENTION BASIN F-18
 154        KM   THIS IS OUTFLOW FROM DETENTION BASIN F-18
 155        RS       1    ELEV    7140
 156        SV       0       1       4      11    23.5      41
 157        SE    7140    7142    7144    7146    7148    7150
 158        SQ       0      10      55     100     200     300

 159        KK  RF-22A
 160        KM        ROUTE FLOW FROM DESIGN POINT DPF18 TO DESIGN POINT F22
 161        RD    1800   0.027    0.04             TRAP      10        6

 162        KK    F-22
 163        KM         RUNOFF FOR SUB-BASIN F-22
 164        BA   .0640
 165        LS       0    64.1
 166        UD     .21
```



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

 167        KK   DPF22
 168        KM        COMBINE FLOW FROM SUB-BASIN F-22, RF-22 AND RF-22A
 169        HC       3

 170        KK  RF-27
 171        KM        ROUTE FLOW FROM DESIGN POINT DPF22 TO DESIGN POINT F27
 172        RD    3700   0.020    0.04             TRAP      50        3
```

```
   173          KK    F-21
   174          KM         RUNOFF FOR SUB-BASIN F-21
   175          BA   .0790
   176          LS       0    89.1
   177          UD     .25

   178          KK   RF-26
   179          KM        ROUTE FLOW FROM SUB-BASIN F21 TO DESIGN POINT F26
   180          RD    1350    .018    .013            CIRC        4

   181          KK    F-26
   182          KM         RUNOFF FOR SUB-BASIN F-26
   183          BA   .0520
   184          LS       0    82.0
   185          UD     .19

   186          KK  DPF26
   187          KM        COMBINE FLOW FROM RF-26 AND F-26
   188          HC       2

   189          KK   RF-26A
   190          KM        ROUTE FLOW FROM DESIGN POINT F26 TO DESIGN POINT F27
   191          RD    1700   0.022    .013            CIRC      4.5

   192          KK  DPF27
   193          KM        COMBINE FLOW FROM RF-27B AND RF-26A
   194          HC       2

   195          KK   RF-27C
   196          KM        ROUTE FLOW FROM DESIGN POINT F27 TO DESIGN POINT F28
   197          RD    1400   0.019    0.04            TRAP       50        3

   198          KK    F-7
   199          KM         RUNOFF FOR SUB-BASIN F-7
   200          BA   .0782
   201          LS       0       61
   202          UD     .19

   203          KK   RF-7
   204          KM        ROUTE FLOW FROM SUB-BASIN F-7 TO DESIGN POINT F14
   205          RD    1200   0.033    0.04            TRAP       10        6
```

1
PAGE 6

HEC-1 INPUT

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

   206          KK    F-14
   207          KM         RUNOFF FOR SUB-BASIN F-14
   208          BA   .1290
   209          LS       0    73.0
   210          UD     .23

   211          KK    F-6
   212          KM         RUNOFF FOR SUB-BASIN F-6
   213          BA   .0310
   214          LS       0       61
   215          UD     .19

   216          KK   RF-13
   217          KM        ROUTE FLOW FROM SUB-BASIN F-6 TO DESIGN POINT F13
   218          RD     800   0.038    0.04            TRAP       10        6

   219          KK    F-13
   220          KM         RUNOFF FOR SUB-BASIN F-13
   221          BA   .0140
   222          LS       0    60.7
   223          UD     .14

   224          KK  DPF13
```

```
225           KM       COMBINE FLOW FROM RF-13 AND F-13
226           HC        2

227           KK   RF-14
228           KM   '    ROUTE FLOW FROM DESIGN POINT F13 TO DESIGN POINT F14
229           RD   3600   0.027    0.04             TRAP       20        6

230           KK  DPF14
231           KM       COMBINE FLOW FROM RF-7, F-14, AND RF-14
232           HC        3

233           KK   RF-25
234           KM       ROUTE FLOW FROM DESIGN POINT F14 TO DESIGN POINT F25
235           RD   2600   0.023    0.04             TRAP       20        6

236           KK    F-25
237           KM        RUNOFF FOR SUB-BASIN F-25
238           BA   .0890
239           LS       0    73.6
240           UD     .28

241           KK  DPF25
242           KM       COMBINE FLOW FROM RF-25 AND RF-14
243           HC        2

244           KK   RF-30
245           KM       ROUTE FLOW FROM DESIGN POINT F25 TO DESIGN POINT F30
246           RD    900   0.027    0.04             TRAP       20        6
1
PAGE  7                                      HEC-1 INPUT

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


247           KK    F-15
248           KM        RUNOFF FOR SUB-BASIN F-15
249           BA   .0210
250           LS       0    69.0
251           UD     .15

252           KK   RF-23
253           KM       ROUTE FLOW FROM SUB-BASIN F15 TO DESIGN POINT F23
254           RD   1200   0.023    0.04             TRAP       10        3

255           KK    F-23
256           KM        RUNOFF FOR SUB-BASIN F-23
257           BA   .0310
258           LS       0    73.0
259           UD     .18

260           KK  DPF23
261           KM       COMBINE FLOW FROM RF-23 AND F-23
262           HC        2

263           KK   RF-24
264           KM       ROUTE FLOW FROM DESIGN POINT F23 TO DESIGN POINT F24
265           RD   2250   0.026    0.04             TRAP       10        6

266           KK    F-24
267           KM        RUNOFF FOR SUB-BASIN F-24
268           BA   .0890
269           LS       0    74.8
270           UD     .26

271           KK  DPF24
272           KM       COMBINE FLOW FROM RF-24 AND F-24
273           HC        2

274           KK   RF-30A
275           KM       ROUTE FLOW FROM DESIGN POINT F24 TO DESIGN POINT F30
276           RD   1100   0.033    0.04             TRAP       10        6
```

```
 277          KK    F-30
 278          KM         RUNOFF FOR SUB-BASIN F-30
 279          BA   .0220
 280          LS      0     72.2
 281          UD     .18

 282          KK  DPF30
 283          KM        COMBINE FLOW FROM RF-30, RF-30A AND F-30
 284          HC       3

 285          KK   RF-29
 286          KM        ROUTE FLOW FROM DESIGN POINT F30 TO DESIGN POINT F29
 287          RD    2350   0.027    0.04            TRAP      6       3
```



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

 288          KK    F-29
 289          KM         RUNOFF FOR SUB-BASIN F-29
 290          BA   .0250
 291          LS      0     73.0
 292          UD     .19

 293          KK  DPF29
 294          KM        COMBINE FLOW FROM RF-29 AND F-29
 295          HC       2

 296          KK   RF-28
 297          KM        ROUTE FLOW FROM DESIGN POINT F29 TO DESIGN POINT F28
 298          RD     750   0.015    0.04            TRAP     20       3

 299          KK    F-28
 300          KM         RUNOFF FOR SUB-BASIN F-28
 301          BA    .042
 302          LS      0     73.0
 303          UD     .23

 304          KK    F-27
 305          KM         RUNOFF FOR SUB-BASIN F-27
 306          BA    .213
 307          LS      0     69.2
 308          UD     .32

 309          KK   DPF28
 310          KM        COMBINE FLOW FROM RF-27C, RF-28, F-28 AND F-27
 311          KM        THIS IS INFLOW TO DETENTION BASIN F-28
 312          HC       4

 313          KK   DBF28
 314          KM        ROUTE DPF28 THROUGH DETENTION BASIN F-28
 315          KM        THIS IS OUTFLOW FROM DETENTION BASIN F-28
 316          RS       1     ELEV    6960
 317          SV       0      .74    2.72    6.20   10.81   15.88   21.44   27.56   34.39   42.08
 318          SV   50.72    60.39   71.09   82.91   95.94  110.43
 319          SE    6960     6962    6964    6966    6968    6970    6972    6974    6976    6978
 320          SE    6980     6982    6984    6986    6988    6990
 321          SQ       0       10      55     100     200     300     550     560     570     580
 322          SQ     590      600     610     620     630     640

 323          KK   RF-31
 324          KM        ROUTE FLOW FROM DPF TO DESIGN POINT F
 325          RD    3500   0.023    0.04            TRAP     20       3

 326          KK    F-31
 327          KM         RUNOFF FOR SUB-BASIN F-31
 328          BA    .081
 329          LS      0     65.0
 330          UD     .24
```

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

 331          KK     DP F
 332          KM         COMBINE FLOW FROM RF-31 AND F-31
 333          HC        2
 334          ZZ
```

1

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1***************************************
*************************************
 *                                       *                                                  *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *   U.S. ARMY
CORPS OF ENGINEERS      *
 *             JUN   1998                *                                                  *   HYDROLOGIC
ENGINEERING CENTER    *
 *          VERSION 4.1                  *                                                  *        609
SECOND STREET        *
 *                                       *                                                  *      DAVIS,
CALIFORNIA 95616       *
 *  RUN DATE   19NOV04  TIME  15:55:15   *                                                  *           (916)
756-1104          *
 *                                       *                                                  *
*
 ***************************************
*************************************
```

```
                              Wolf Ranch Master Development Drainage plan
                       F-Basins future developed condition with detention    PN 03094
                              5-year and 100 Year, 24 hr Type IIA  Storm  FN:  f-DET.dat

   5 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           5  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL           0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      NDTIME        0055  ENDING TIME
                      ICENT           19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

     JP          MULTI-PLAN OPTION
                       NPLAN           1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
```

RATIOS OF PRECIPITATION
.56 1.00

1

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 .56	RATIO 2 1.00
HYDROGRAPH AT +	F-8	.06	1	FLOW	15.	69.
				TIME	6.17	6.08
ROUTED TO +	RF-8	.06	1	FLOW	14.	68.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-1	.17	1	FLOW	10.	110.
				TIME	6.17	6.08
ROUTED TO +	RF-9	.17	1	FLOW	10.	106.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-9	.04	1	FLOW	10.	50.
				TIME	6.08	6.08
2 COMBINED AT +	DPF9	.21	1	FLOW	18.	152.
				TIME	6.17	6.08
ROUTED TO +	RF-19	.21	1	FLOW	17.	147.
				TIME	6.33	6.17
HYDROGRAPH AT +	F-19	.10	1	FLOW	38.	144.
				TIME	6.08	6.08
3 COMBINED AT +	DPF19	.37	1	FLOW	53.	337.
				TIME	6.25	6.17
ROUTED TO +	DBF19	.37	1	FLOW	19.	89.
				TIME	6.67	6.58
			** PEAK STAGES IN FEET **			
			1	STAGE	7142.42	7145.52
				TIME	6.67	6.58
ROUTED TO +	RF-22	.37	1	FLOW	19.	89.
				TIME	6.83	6.67
HYDROGRAPH AT +	F-2	.04	1	FLOW	3.	29.
				TIME	6.17	6.08
ROUTED TO +	RF-10	.04	1	FLOW	3.	28.
				TIME	6.25	6.17
HYDROGRAPH AT +	F-10	.02	1	FLOW	5.	22.

				TIME	6.08	6.08
2 COMBINED AT						
+	DPF10	.06	1	FLOW	6.	48.
				TIME	6.17	6.08
ROUTED TO						
+	RF-18A	.06	1	FLOW	6.	47.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-3	.09	1	FLOW	5.	59.
				TIME	6.17	6.17
ROUTED TO						
+	RF-11	.09	1	FLOW	5.	58.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-11	.05	1	FLOW	11.	53.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF11	.14	1	FLOW	13.	102.
				TIME	6.17	6.08
ROUTED TO						
+	RF-18	.14	1	FLOW	13.	102.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-4	.27	1	FLOW	13.	147.
				TIME	6.25	6.17
ROUTED TO						
+	RF-12	.27	1	FLOW	13.	144.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-5	.11	1	FLOW	5.	52.
				TIME	6.33	6.25
ROUTED TO						
+	RF-12A	.11	1	FLOW	5.	51.
				TIME	6.50	6.33
HYDROGRAPH AT						
+	F-12	.06	1	FLOW	13.	66.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPF12	.43	1	FLOW	24.	236.
				TIME	6.25	6.25
ROUTED TO						
+	RF-17	.43	1	FLOW	24.	235.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-17	.04	1	FLOW	3.	25.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-18	.10	1	FLOW	24.	110.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-16	.03	1	FLOW	7.	31.
				TIME	6.17	6.08
ROUTED TO						

+	RF-16	.03	1	FLOW	7.	30.
				TIME	6.17	6.08
6 COMBINED AT						
+	DPF18	.80	1	FLOW	64.	509.
				TIME	6.25	6.17
ROUTED TO						
+	DBF18	.80	1	FLOW	26.	141.
				TIME	6.83	6.75
			** PEAK STAGES IN FEET **			
			1	STAGE	7142.70	7146.83
				TIME	6.83	6.75
ROUTED TO						
+	RF-22A	.80	1	FLOW	26.	141.
				TIME	6.92	6.83
HYDROGRAPH AT						
+	F-22	.06	1	FLOW	7.	51.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPF22	1.24	1	FLOW	47.	238.
				TIME	6.83	6.75
ROUTED TO						
+	RF-27	1.24	1	FLOW	47.	237.
				TIME	7.00	6.83
HYDROGRAPH AT						
+	F-21	.08	1	FLOW	79.	184.
				TIME	6.08	6.08
ROUTED TO						
+	RF-26	.08	1	FLOW	77.	180.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-26	.05	1	FLOW	39.	105.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF26	.13	1	FLOW	115.	285.
				TIME	6.08	6.08
ROUTED TO						
+	RF-26	.13	1	FLOW	111.	279.
				TIME	6.17	6.08
2 COMBINED AT						
+	DPF27	1.37	1	FLOW	111.	295.
				TIME	6.17	6.42
ROUTED TO						
+	RF-27	1.37	1	FLOW	109.	294.
				TIME	6.17	6.42
HYDROGRAPH AT						
+	F-7	.08	1	FLOW	5.	54.
				TIME	6.17	6.08
ROUTED TO						
+	RF-7	.08	1	FLOW	5.	53.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-14	.13	1	FLOW	42.	162.
				TIME	6.17	6.08

HYDROGRAPH AT						
+	F-6	.03	1	FLOW	2.	21.
				TIME	6.17	6.08
ROUTED TO						
+	RF-13	.03	1	FLOW	2.	21.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-13	.01	1	FLOW	1.	11.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF13	.05	1	FLOW	2.	30.
				TIME	6.25	6.08
ROUTED TO						
+	RF-14	.05	1	FLOW	2.	30.
				TIME	6.92	6.33
3 COMBINED AT						
+	DPF14	.25	1	FLOW	45.	210.
				TIME	6.17	6.17
ROUTED TO						
+	RF-25	.25	1	FLOW	44.	209.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-25	.09	1	FLOW	27.	106.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF25	.34	1	FLOW	66.	303.
				TIME	6.25	6.25
ROUTED TO						
+	RF-30	.34	1	FLOW	67.	304.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-15	.02	1	FLOW	6.	26.
				TIME	6.08	6.08
ROUTED TO						
+	RF-23	.02	1	FLOW	5.	25.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-23	.03	1	FLOW	12.	44.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF23	.05	1	FLOW	16.	69.
				TIME	6.17	6.08
ROUTED TO						
+	RF-24	.05	1	FLOW	15.	66.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-24	.09	1	FLOW	32.	115.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF24	.14	1	FLOW	44.	181.
				TIME	6.25	6.17
ROUTED TO						
+	RF-30	.14	1	FLOW	42.	173.
				TIME	6.25	6.17

HYDROGRAPH AT						
+	F-30	.02	1	FLOW	8.	30.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPF30	.50	1	FLOW	112.	490.
				TIME	6.33	6.25
ROUTED TO						
+	RF-29	.50	1	FLOW	109.	486.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-29	.03	1	FLOW	9.	35.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF29	.53	1	FLOW	112.	507.
				TIME	6.42	6.25
ROUTED TO						
+	RF-28	.53	1	FLOW	112.	489.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-28	.04	1	FLOW	14.	53.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-27	.21	1	FLOW	38.	183.
				TIME	6.25	6.17
4 COMBINED AT						
+	DPF28	2.15	1	FLOW	231.	983.
				TIME	6.33	6.25
ROUTED TO						
+	DBF28	2.15	1	FLOW	112.	558.
				TIME	6.75	6.67
			** PEAK STAGES IN FEET **			
			1	STAGE	6966.24	6973.52
				TIME	6.75	6.67
ROUTED TO						
+	RF-31	2.15	1	FLOW	112.	578.
				TIME	6.92	6.50
HYDROGRAPH AT						
+	F-31	.08	1	FLOW	10.	64.
				TIME	6.17	6.17
2 COMBINED AT						
+	DP F	2.23	1	FLOW	114.	600.
				TIME	6.92	6.50

1

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

G Basins Detained

```
1*****************************************
**************************************
 *                                        *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998                *
HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1                 *
609 SECOND STREET           *
 *                                        *
DAVIS, CALIFORNIA 95616      *
 *  RUN DATE   21MAY04  TIME  13:22:20    *
(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
PAGE  1

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

           1          ID             Wolf Ranch Master Development Drainage Plan
           2          ID                  G Basins Future developed condition with detention  PN
03094
           3          ID             5-year and 100 Year, 24 hr Type IIA  Storm  FN G-det.dat
                      *DIAGRAM
           4          IT       5      0       0      300
           5          IO       4      0
           6          JR    PREC    .56     1.0

           7          KK   G-1
           8          KM       RUNOFF - Sub-basin G-1
           9          BA   .0808
          10          IN      15
          11          PB     4.4
          12          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120
0.0143
```

```
            13          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460
0.0530
            14          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800
0.7900
            15          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500
0.8550
            16          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900
0.8938
            17          PC  0.8975  0.9013  0.9050  0.9083  0.9115  0.9148  0.9180  0.9210  0.9240
0.9270
            18          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500
0.9525
            19          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750
0.9775
            20          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900
0.9913
            21          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
            22          LS       0      61
            23          UD    0.22

            24          KK      G2
            25          KM        ROUTE FLOW from SUB-BASIN G-1 TO DP G3
            26          RD    3200   0.027    0.04              TRAP      10         4

            27          KK     G-2
            28          KM        RUNOFF - Sub-basin G-2
            29          BA    .035
            30          LS       0      73
            31          UD    0.22

            32          KK      G3
            33          KM        ROUTE FLOW from SUB-BASIN G-2 TO DP G3
            34          RD    2730   0.024    0.04              TRAP      10         4

            35          KK     G-3
            36          KM        RUNOFF - Sub-basin G-3
            37          BA    .177
            38          LS       0      73
            39          UD    0.29

            40          KK    DPG3
            41          KM    COMBINE RUNOFF from G2, G3 AND SUB-BASIN G-3
            42          HC       3
1                                                        HEC-1 INPUT
PAGE  2

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


            43          KK      G5
            44          KM        ROUTE FLOW from DP G3 TO DP G5
            45          RD    2200    0.02    .013              CIRC     4.5

            46          KK     G-5
            47          KM        RUNOFF - Sub-basin G-5
            48          BA    .153
            49          LS       0    78.4
            50          UD    0.26

            51          KK     DPG
            52          KM        COMBINE RUNOFF from G5 AND SUB-BASIN G-5
            53          HC       2

            54          KK    DB G
            55          KM        DESIGN POINT G NTO DETENTION BASIN G
            56          KM        THIS IS THE OUTFLOW FROM DETENTION BASIN G
            57          RS       1    ELEV       0
            58          SQ       0      10      15     130     220     250
            59          SE       0       2       4       6       8      10
            60          SV       0     5.0     9.3    17.0    24.6    33.0
```

```
             61             ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE        (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

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

    7         G-1
                  V
                  V
   24            G2
                  .
                  .
   27             .            G-2
                  .              V
                  .              V
   32             .             G3
                  .              .
                  .              .
   35             .              .           G-3
                  .              .             .
                  .              .             .
   40          DPG3.........................
                  V
                  V
   43            G5
                  .
                  .
   46             .            G-5
                  .              .
                  .              .
   51           DPG............
                  V
                  V
   54          DB G

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
***************************************
 *                                        *                                                      *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                                                      *
U.S. ARMY CORPS OF ENGINEERS      *
 *                JUN   1998              *                                                      *
HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.1                *                                                      *
609 SECOND STREET           *
 *                                        *                                                      *
DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   21MAY04  TIME  13:22:20    *                                                      *
(916) 756-1104              *
 *                                        *                                                      *
*
 *****************************************
***************************************


 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


                                                            RATIOS APPLIED TO PRECIPITATION
 OPERATION        STATION      AREA     PLAN          RATIO 1  RATIO 2
                                                          .56     1.00

 HYDROGRAPH AT
```

```
+                 G-1        .08     1   FLOW        5.      50.
                                         TIME      6.17    6.17

 ROUTED TO
+                  G2        .08     1   FLOW        4.      50.
                                         TIME      6.58    6.25

 HYDROGRAPH AT
+                 G-2        .04     1   FLOW       12.      45.
                                         TIME      6.17    6.08

 ROUTED TO
+                  G3        .04     1   FLOW       12.      44.
                                         TIME      6.33    6.25

 HYDROGRAPH AT
+                 G-3        .18     1   FLOW       50.     200.
                                         TIME      6.17    6.17

  3 COMBINED AT
+                DPG3        .29     1   FLOW       57.     278.
                                         TIME      6.25    6.25

 ROUTED TO
+                  G5        .29     1   FLOW       55.     277.
                                         TIME      6.33    6.25

 HYDROGRAPH AT
+                 G-5        .15     1   FLOW       74.     230.
                                         TIME      6.17    6.17

  2 COMBINED AT
+                 DPG        .45     1   FLOW      120.     489.
                                         TIME      6.17    6.17

 ROUTED TO
+                DB G        .45     1   FLOW       11.     140.
                                         TIME      8.25    6.67

                                    ** PEAK STAGES IN FEET **
                                     1   STAGE     2.54    6.22
                                         TIME      8.25    6.67
1

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

APPENDIX B

HYDRAULIC CALCULATIONS

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP | JOB NO. 03094 | PAGE 1
PROJECT: | DATE CHECKED: | DATE 2/2/04
DETAIL: | CHECKED BY: | COMPUTED BY RNW

Basin 'A' Hydraulics

Preliminary Detention Basin Sizing

- Detention Basin "A"

- historic data $Q_5 = \sout{39}$ 11 $Q_{100} = \sout{244}$ 157

  TSA = .42 SM = 270 Ac

  CN = 61 Runoff 5yr = .2"
  100yr = 1.02"

- "Developed": $Q_5 = \sout{221}$ 206 cfs $Q_{100} = \sout{584}$ 722 cfs

  TSA = .57 SM = 365 Ac

  Wtd CN = {61(.42) + .15(76) + .086(79) + .05(78.2) + .037(79.8) + .067(72.1) + .111(77.7) + .005(61)} ÷ (.57) = 73.9 Say 74

  Runoff: 5yr = .61"
  100yr = 1.90"

- Rainfall 5-year = 2.5"
  100-year = 4.4"

- Existing 'A' Basin Volume

  Vol(5) = 270 Ac (.2/12) = 4.5 AF

  Vol(100) = 270 Ac (1.02/12) = 23.0 AF

- Developed 'A' Basin Volume

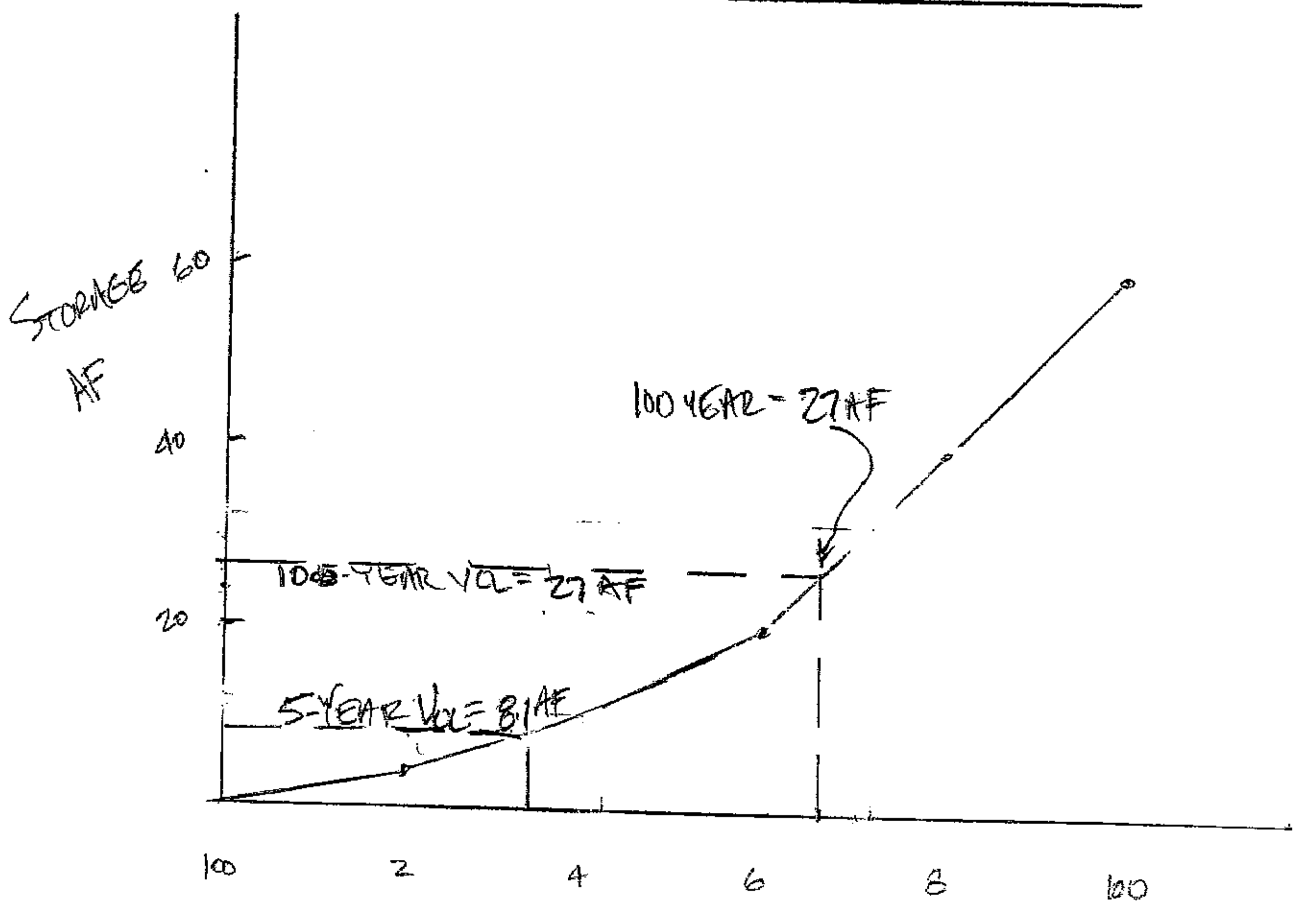
  Vol(5) = 365 (.61/12) = 18.6 AF

  Vol(100) = 365 (1.90/12) = 57.8 AF

Δ = 14.1 AF 5 year
34.8 AF = 100 yr

Detention Basin 'A'

RETAINED FLOW Q_5 = 28 cfs
Q_{100} = 166 cfs



W/ WQ & 5-YEAR
TOTAL VOL = 32 AF + 12 = 44 AF

OUTLET CULVERT FROM DET. BASIN A Q = 166 cfs 1

CURRENT DATE: 05-14-2004
CURRENT TIME: 14:35:17

FILE DATE: 05-14-2004
FILE NAME: A5

****
**************************** FHWA CULVERT ANALYSIS ****************************
**************************** HY-8, VERSION 3.2 ****************************
****

C U L V #	SITE DATA INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	97.00	200.02	1 RCB	5.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

****

SUMMARY OF CULVERT FLOWS (CFS) FILE: A5 DATE: 05-14-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.21	17	17	0	0	0	0	0	0	1
101.91	34	34	0	0	0	0	0	0	1
102.49	51	51	0	0	0	0	0	0	1
103.01	68	68	0	0	0	0	0	0	1
103.49	85	85	0	0	0	0	0	0	1
103.95	102	102	0	0	0	0	0	0	1
104.42	119	119	0	0	0	0	0	0	1
104.91	136	136	0	0	0	0	0	0	1
105.43	153	153	0	0	0	0	0	0	1
105.86	166	166	0	0	0	0	0	0	1
110.00	261	261	0	0	0	0	0	OVERTOPPING	

****

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: A5 DATE: 05-14-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.21	0.00	17	0	0.00
101.91	0.00	34	0	0.00
102.49	0.00	51	0	0.00
103.01	0.00	68	0	0.00
103.49	0.00	85	0	0.00
103.95	0.00	102	0	0.00
104.42	0.00	119	0	0.00
104.91	0.00	136	0	0.00
105.43	0.00	153	0	0.00
105.86	0.00	166	0	0.00

****

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

****

CURRENT DATE: 05-14-2004
RENT TIME: 14:35:17

FILE DATE: 05-14-2004
FILE NAME: A5

****
************************* CULVERT # 1 *************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	97.00	0.00	-3.00	0-NF	0.00	100.00	0.00	0.00
17	101.21	97.42	1.21	-0.62	6-FF	0.00	0.00	0.00	7.93
34	101.91	97.63	1.91	-0.34	6-FF	0.00	0.00	0.00	9.44
51	102.49	97.79	2.49	-0.03	6-FF	0.00	0.00	0.00	11.44
68	103.01	97.92	3.01	0.30	6-FF	0.00	0.00	0.00	12.67
85	103.49	98.04	3.49	0.67	6-FF	0.00	0.00	0.00	13.08
102	103.95	98.15	3.95	1.07	6-FF	0.00	0.00	0.00	13.62
119	104.42	98.25	4.42	1.53	6-FF	0.00	0.00	0.00	14.16
136	104.91	98.34	4.91	2.02	6-FF	0.00	0.00	0.00	14.73
153	105.43	98.42	5.43	2.56	6-FF	0.00	0.00	0.00	15.08
166	105.86	98.49	5.86	3.01	6-FF	0.00	0.00	0.00	15.43

El. inlet face invert 100.00 ft El. outlet invert 97.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	300.00
OUTLET ELEVATION (FT)	97.00
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0150
CULVERT LENGTH ALONG SLOPE (FT)	200.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	5.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

****

C''RRENT DATE: 05-14-2004 FILE DATE: 05-14-2004
(RENT TIME: 14:35:17 FILE NAME: A5

****
************************ TAILWATER ************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (FT/FT)	0.025
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	97.00
CULVERT NO.1 OUTLET INVERT ELEVATION	97.00 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	97.00	0.000	0.00	0.00
17.00	97.42	0.931	3.44	0.66
34.00	97.63	0.962	4.33	0.98
51.00	97.79	0.977	4.92	1.23
68.00	97.92	0.987	5.38	1.44
85.00	98.04	0.994	5.76	1.63
102.00	98.15	0.999	6.08	1.79
119.00	98.25	1.003	6.36	1.95
136.00	98.34	1.007	6.61	2.09
153.00	98.42	1.010	6.84	2.22
166.00	98.49	1.012	7.00	2.32

****
************************ ROADWAY OVERTOPPING DATA ************************
****

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH (FT)	20.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

Kiowa Engineering Corporation | CLIENT: WOLF RANCH | JOB NO. 03049 | PAGE 1 of 3
PROJECT: | DATE CHECKED: | DATE 5/10/04
DETAIL: MDDP | CHECKED BY: | COMPUTED BY: [illegible]

BASIN 'A'

OUTFALL CHANNELS.

- Try to achieve Velocity 5-year 5fps or less
- 100 year Velocity < 7 fps for grasslined

OUTFALL - Channel A3

$Q_5 = 3 + 64 = 67$ cfs
$Q_{100} =$ SB A1 + SB A3
$Q_{100} = 32 + 223 = 255$ cfs
conservative

- Existing slope DP A1 → A3
  L = 3700' ΔH = 7228 − 7086 = 142'
  Slope = 142/3700 = 3.8%
  @ Slope = 3.8% $V_5 = 6.5$ fps no good.

  if Slope = 1.7% $V_5 = 4.9$ ∴ ok
  $V_{100} = 7.0$ fps ∴ ok
) SEE 2 & 3 of 3

Required grade control:
L = 3700' ΔS = .038 − .017 = .021
H = 77.7' Say 78
w/ 3' each check/drop = 26 checks
Spacing = 3700/26 = 142'

Wolf Ranch MDDP
Swale Capacity Calculation

Structure A3: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	67 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	1.7 %
Depth of Flow	1.10 ft	Manning's Roughness Coef.	0.035

Channel Area	15.8 sf
Channel Wetted Perimeter	19.1 ft
Hydraulic Radius	0.83 ft

Channel Flow Velocity	4.9 ft/sec
Channel Flow Capacity	78 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	2.2 ft
Top Width	27.8 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\,S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\,S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP

Swale Capacity Calculation

Structure A3: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	255 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	1.7 %
Depth of Flow	2.10 ft	Manning's Roughness Coef.	0.035

Channel Area	38.6 sf
Channel Wetted Perimeter	27.3 ft
Hydraulic Radius	1.41 ft

Channel Flow Velocity	7.0 ft/sec
Channel Flow Capacity	270 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	3.3 ft
Top Width	36.6 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

OUTFALL CHANNEL A6.

Flow ranges DP A3 → 5B A6

$Q_5 = 112 + 22 = 134$ cfs

$Q_{100} = 371 + 66 = 437$ cfs

Existing Slope A3 → A6

$L = 1600'$ $\Delta H = 7086 - 7036 = 50'$

$S = 50/1600 = .03125$ '/'

V_5 @ $S = .03125$ '/' 6.9 ∴ no good

@ Slope = 1.4% $V_5 = 4.4$ fps ∴ ok

$V_{100} = 7.1$ fps, close, ∴ ok

Required grade control.

$L = 1600'$ $\Delta S = .03125 - .014 = .01725$

# of drops = 1600(.01725) = 27.6', say 27

w/ 3' each, need 9 drops/checks

Spacing 1600/27 = 60'

Spacing is way to close.

If sloping boulder drops used, 6' drop each

∴ spacing increases to 120'

need 14 drops

Still to close:

go to riprap side slopes.

make V_s = 7 fps

w/ BW = 40', slope = 2.7%

- V_s = 6.9 fps.
- V_{100} = 9.5
- d_{100} = 3.7 (w/ fb)

See pages 3 + 4 of 4

Riprap Size

$$\frac{VS^{.17}}{1.36} = \frac{9.5(.027)^{.17}}{1.36} = 3.8$$

Type L', close to M' use M.

Required grade control

$\Delta S = .03125 - .027 = .00425$

Total H = .00425(1600) = 6.8; say 6

∴ Need 2 - 3' drops

Spacing = 1600/2 = 800'

Wolf Ranch MDDP
Swale Capacity Calculation

Structure A6: Riprap channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	134 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	1.35 ft	Manning's Roughness Coef.	0.035

Channel Area	20.8 sf
Channel Wetted Perimeter	21.1 ft
Hydraulic Radius	0.98 ft

Channel Flow Velocity	6.9 ft/sec
Channel Flow Capacity	144 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.54 ft
Top Width	30.3 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure A6: Riprap channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	437 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	2.40 ft	Manning's Roughness Coef.	0.035

Channel Area	47.0 sf
Channel Wetted Perimeter	29.8 ft
Hydraulic Radius	1.58 ft

Channel Flow Velocity	9.5 ft/sec
Channel Flow Capacity	446 cfs
Capacity Check	Okay

Freeboard	1.3 ft
Swale Depth	3.72 ft
Top Width	39.7 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 1/3
PROJECT DATE CHECKED DATE 5/10/04
DETAIL Hydraulics CHECKED BY COMPUTED BY RNW

OUTFALL CHANNEL A5

Flow range A6 + SB A5

$Q_5 = 157 + 57 = 214$ cfs
$Q_{100} = 498 + 184 = 682$ cfs

Existing slope A6 → u/s of detention basin 'A'

$\Delta H = 7036 - 6994 = 42'$ $L = 1750'$

Slope = 42/1750 = .024 %

use riprap:

@ Slope = 2.4% V_5 = 7.1 fps close to de) see 2 of 3

V_{100} = 10.0 fps

Riprap Size = $\frac{10(.024)^{.17}}{1.36} = 3.9$ use Type 'M'

Wolf Ranch MDDP
Swale Capacity Calculation

Structure A5: Riprap channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	214 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.4 %
Depth of Flow	1.45 ft	Manning's Roughness Coef.	0.035

Channel Area	30.2 sf
Channel Wetted Perimeter	27.0 ft
Hydraulic Radius	1.12 ft

Channel Flow Velocity	7.1 ft/sec
Channel Flow Capacity	214 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.65 ft
Top Width	36.2 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure A5: Riprap channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	682 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.4 %
Depth of Flow	2.70 ft	Manning's Roughness Coef.	0.035

Channel Area	69.7 sf
Channel Wetted Perimeter	37.3 ft
Hydraulic Radius	1.87 ft

Channel Flow Velocity	10.0 ft/sec
Channel Flow Capacity	697 cfs
Capacity Check	Okay

Freeboard	1.3 ft
Swale Depth	4.05 ft
Top Width	47.4 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP | JOB NO. 03094 | PAGE 1/2
PROJECT | DATE CHECKED | DATE 5/10/04
DETAIL | CHECKED BY | COMPUTED BY RJW

Channel A10

$Q_5 = 28$ cfs
$Q_{100} = 165$ cfs
} outlet side of detention basin 'A'

L = 400' design slope = 12/400 = 3.0%

design for Q_{100} only

$V_{100} = 7.6$ fps from swale calcs (see 2/2)

$$VS^{.17}/1.36 = \frac{7.6(.03)^{.17}}{1.36} = 3.07$$ use Type 'L'

Wolf Ranch MDDP
Swale Capacity Calculation

Structure A10: Riprap channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	165 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	3.0 %
Depth of Flow	1.45 ft	Manning's Roughness Coef.	0.035

Channel Area	22.9 sf
Channel Wetted Perimeter	22.0 ft
Hydraulic Radius	1.04 ft

Channel Flow Velocity	7.6 ft/sec
Channel Flow Capacity	174 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.66 ft
Top Width	31.3 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Outfall Storm Sewers

Assume all Storm Sewers @ 2.0%, RCP

Outfall Storm Sewer A4

Q_{100} = 509 cfs (DP A3)

@ 2.0%, Q = 520 cfs for 66" RCP ∴ ok

Storm Sewer A7

Q_{100} = 90 cfs

@ 2.0%, Q = 94 cfs for 36" RCP ∴ ok

Storm Sewer A9

Q_{100} = 76 cfs

use 1.0% ± since grade may be a problem.

∴ @ 1.3%, Q = 73 cfs for 36" RCP ∴ Ok

Storm Sewer Reach 'A3' to Briargate Blvd.

Q_{100} = 223 cfs

48" @ 2.4% Q full = 223 cfs ∴ ok

Storm Sewer A4-1 @ DP A4-1

Q_{100} = 288 cfs

@ 2.0%, 54" RCP Q full = 292 cfs ∴ ok

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP | JOB NO. 03094 | PAGE 2
PROJECT: | DATE CHECKED: | DATE 11/19/04
DETAIL: Hydraulics | CHECKED BY: | COMPUTED BY: BAW

Storm Sewer A-11 @ SB A-11

Q_{100} = 140 cfs

42" RCP @ 2.0% Cap = 142 cfs ∴ ok

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP | JOB NO. 03094 | PAGE 1
PROJECT | DATE CHECKED | DATE 2/4/04
DETAIL | CHECKED BY | COMPUTED BY RJW

Detention Basin 'B'

- Historic Data

$Q_5 = 5$ cfs $Q_{100} = 55$ cfs

Drainage Area = 110 acres

CN = 61. Runoff 5-yr = .2"
100-yr = 1.02"

- Developed

$Q_5 = 60$ cfs $Q_{100} = 122$ cfs

Drainage Area = 25.6 Acres.

CN = 92

Runoff 5-year = 1.69" 100-year = 3.5"

Existing Runoff Volume

$V_5 = .2/12(110) = 1.83$ AF

$V_{100} = (1.02/12)(110) = 9.35$ AF

- Developed Runoff Volume

$V_5 = (1.69/12)(25.6) = 3.6$ AF

$V_{100} = (3.5/12)(25.6) = 7.5$ AF

- Storage Volume

5-year: 3.6 - 1.8 = 1.8 AF ←

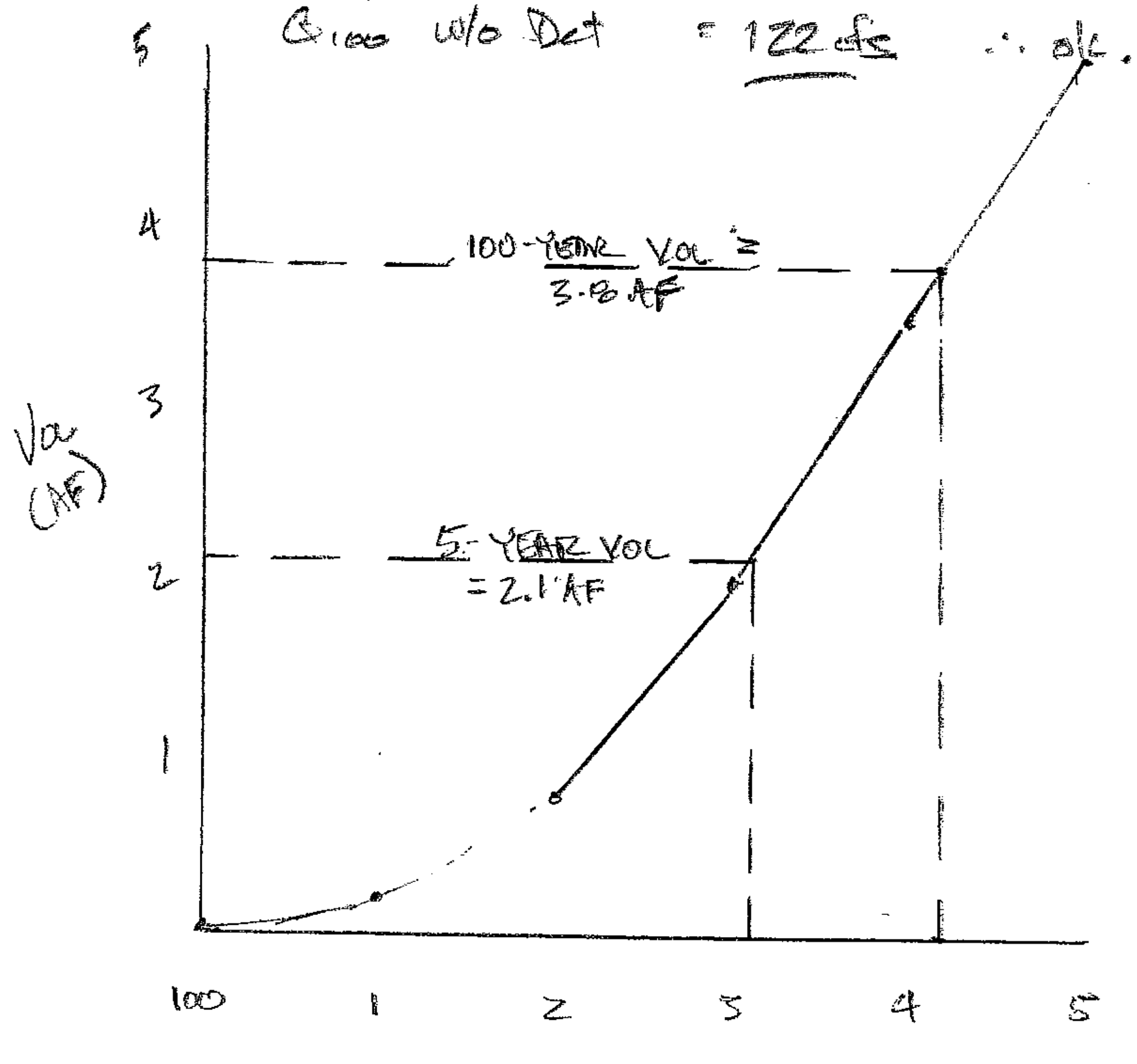
100-year 7.5 - 9.4 = -1.9 AF

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP JOB NO. 03094 PAGE 2
PROJECT: DATE CHECKED: DATE 2/4/04
DETAIL: CHECKED BY: COMPUTED BY:

May not need to detain because ex 54" RCP has adequate capacity to pickup 100-year developed flow:

Q_{cap} 54" RCP @ 1.0% = 200 cfs
Q_{100} w/o Det = 122 cfs ∴ ok.



W/ WQ ≅ 5 YEAR VOL

TOTAL VOL = 3.8 + 2.1 = 5.9 AF

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 1
PROJECT DATE CHECKED DATE 2/2/04
DETAIL CHECKED BY COMPUTED BY RJW

Detention Basin "E/D"

- Historic Data:

BA = .164 SM (SB 'E') + .32 SM (DP D2) = .48 SM = 307 A

CN = 61 Runoff 5 yr = .2" 100 yr = 1.02"

D Basin Ex Q5 = 10; Q100 = 103, E-Basin Ex: Q5 = 6 Q100 = 66

Total E&D: Q5 = 16 cfs Q100 = 169

- Developed Data:

BA = .10 SM (DP 'D2') + .18 (DP 'E2') = .28 SM = 179. Ac

CN = [.048(79) + .04(81.8) + .04(79) + .062(78.1) + .052(79) + .036(79)] / .28 = 79.2

- Existing E/D Basin Volume of Runoff

Vol(5) = 307 (.2/12) = 5.2 AF

Vol(100) = 307 (1.02/12) = 26.1 AF

- Developed E/D Volume of Runoff

Runoff 5 year = .84" 100-year = 2.29"

Vol 5 = 179 (.84/12) = 12.5 AF

Vol 100 = 179 (2.29/12) = 34.2 AF

- Required Storage

Δ Vol 5 = 12.5 - 5.2 = 7.3 AF

Δ Vol 100 = 34.2 - 26.1 = 8.1 AF

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP | JOB NO. 03094 | PAGE 2
PROJECT | DATE CHECKED | DATE 2/2/04
DETAIL | CHECKED BY | COMPUTED BY

- Required Storage Volume

Vol 5-year = 18.6 - 4.5 = 14.1 AF
Vol 100-year = 57.8 - 23.0 = 34.8 AF

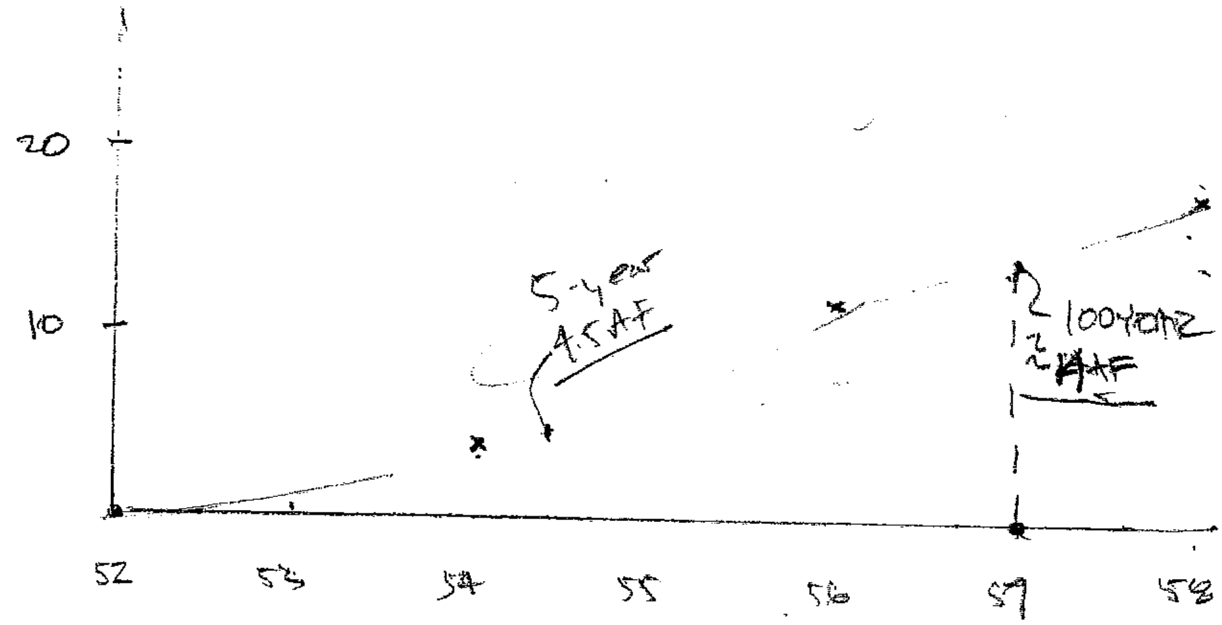
Above values are conservative & do not include channel storage due to routing.

- INFLOW TO DET. BASIN

Q_5 = 173 cfs Q_{100} = 509 cfs

- Allowable Release Rates

Q_5 = 16 cfs Q_{100} = 169 cfs.



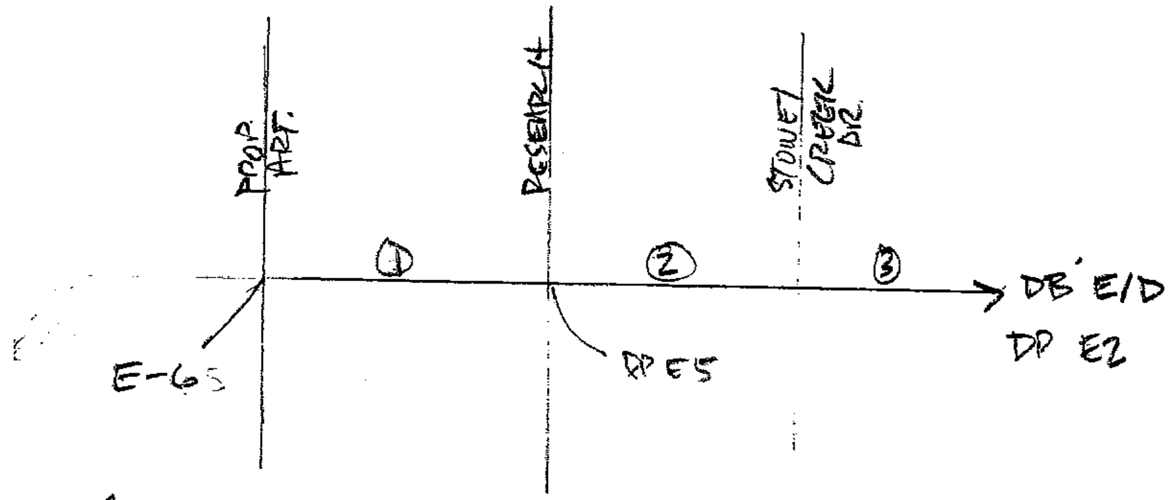
Kiowa Engineering Corporation

CLIENT: WOLF RANCH MDDP JOB NO. 03094 PAGE 3/3/04
PROJECT: DATE CHECKED: DATE:
DETAIL: CHECKED BY: COMPUTED BY:

'E/D' Basin Hydraulics

Outfall Storm Sewer Sizing

East Outfall to Detention Basin 'E/D'



Flow Summary

	Q_5	Q_{100}
@ E-6	29	87
@ DP E5	85	241
@ Stony Creek	95	270
@ DB E/D	116	336

Segment 1 E6 to Research Pkwy

Ex ground slope along prop Road = 40/1300 = .03%

use 2.5% & pick up 100-year

∴ 36" RCP @ 2% = 94 cfs ∴ OK

Kiowa Engineering Corporation | CLIENT Wolf Ranch | JOB NO. 03094 | PAGE 2
PROJECT | DATE CHECKED | DATE
DETAIL | CHECKED BY | COMPUTED BY

Segment 2 Research to Stoney Creek Q_{100} = 241 cfs
use slope of Roy Creek Street 4/140 = .029'/'
use Slope of 2.4%

∴ 48" RCP @ 2.4% = 227 cfs. probably ok since slope can probably be made steeper than 2.4%

Segment 3 Stoney Creek to D/B ED
Q_{100} = 270
· use slope from DB to int of Abby Rd & Rory Creek,
elev @ DB = 52.0 est. Elev of inv. @ intersection = 60 ∴ Slope = 60-52/350 = .023'/'

- check Rory Creek 6/330 = .019'/' use .018'/'

60" RCP @ .018 = Q = 349; too much
54" RCP @ .018 = 264 cfs, probably ok (Seg 3A)

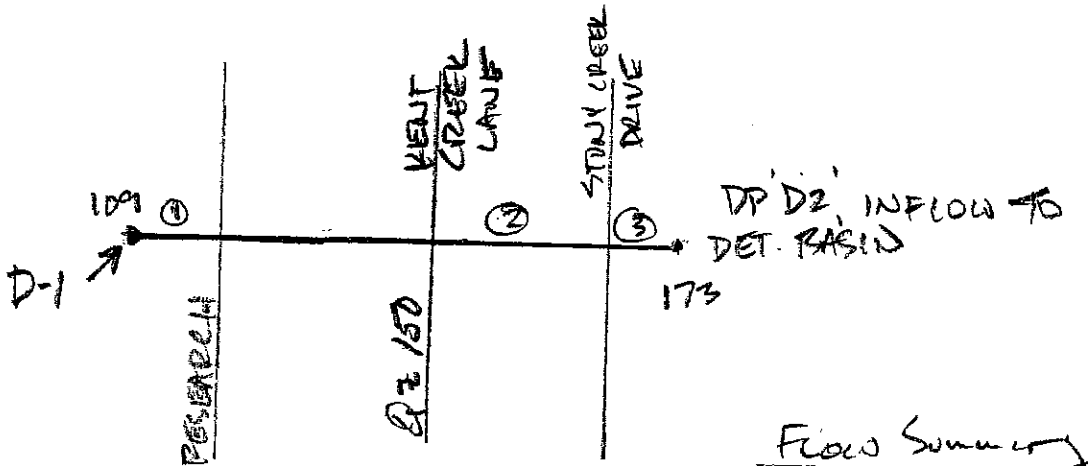
Seg 3b (Abby Road Lane) Q = 336
54" @ 2.3% Q = 305 cfs no good
60" @ 2.3% Q = 404 ok.

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP | JOB NO. 03094 | PAGE 1
PROJECT: | DATE CHECKED: | DATE: 3/3/04
DETAIL: | CHECKED BY: | COMPUTED BY: RAW

Outfall Storm Sewer Sizing

West outfall to Detention Basin E/D



Flow Summary

@ D-1	36	109
@ DPD2	57	173

Segment 1 : Q > 109 cfs

assume minimum slope of 2% across Research

∴ Need 42" RCP Q = 142 cfs ←
36" RCP Q = 94 cfs ∴ no good

Segment 2 : Kent Creek Drive to Stoney Creek Q = 150 cfs.

Use slope of Comet Lane, 2%

48" RCP @ 2% = 203 cfs ; ample ←
42" RCP @ 2% = 140 ∴ no good

Segment 3:

Stoney Creek to Det. Basin E/D Q = 170 cfs

Bottom of Pond e 52±. L = 160'
appears the slope will be 2 2/120 = .0167, say .016

48" RCP Q e 1.6% = 182 cfs ∴ ok.

Kiowa Engineering Corporation

CLIENT: WolfRanch MDDP JOB NO. 03094 PAGE 1/2
PROJECT: DATE CHECKED: DATE 5/19/04
DETAIL: CHECKED BY: COMPUTED BY: [illegible]

Basin F Hydraulics

Roadway Culverts (See HY8 results)

- DP F9 — Q_{100} = 152 cfs L = 80'
  HW/D = 4.2/4 = 1.05 ∴ ok 4'x6' CBC

- SB F8 — Q_{100} = 69 cfs L = 80'
  HW/D = 3.8/4 = .95 ∴ ok 48" RCP

DP F10 — Q_{100} = 48 cfs L = 80'
HW/D = 3.3/3.5 = .94 ∴ ok 42" RCP

DP F11 — Q_{100} = 102 cfs L = 80'
HW/D ≐ 4.25/4 = 1.06 ∴ ok 4'x4' CBC

DP F12 — Q_{100} = 286 cfs L = 80'
HW/D = 4/4 = 1 ∴ ok 4'x10' CBC

SB F15 — Q_{100} = 4 cfs use 18" RCP

DP F13 — Q_{100} = 30 cfs L = 80'
HW/D = 2.7/3 = .9 ∴ ok use 36" RCP

~~SB F20 (Briargate Blvd) — Q_{100} = 140 cfs L = 160'~~
~~HW/D = 3.97/4 = 1.0 ∴ ok use 4'x6' CBC~~

Roadway Culverts Cont'd.

DB 19 : This is outlet of Det. Basin 19 L = 240'±
Q_{100} out = 89 cfs.
Assume HW depth of 7' can be obtained
w/ 42" RCP, HW/D = 6.6/3.5 = 1.9.
6.6' HW depth consistent w/ DB 19 HW requirements.

DB 18 : This is outlet of Det. Basin 18, L = 240'±
Q_{100} Out = 141 cfs
Assume HW depth ≤ 7', same as DB 19
w/ 48" RCP, HW = 7.5' ∴ ok.
HW/D = 7.5/4 = 1.88

DP F23 : Q_{100} = 69 cfs L = 160'
(Briargate)
HW/D = 3.8/4 = .95 ∴ use 48" RCP.

DP F14 : Q_{100} = 210 cfs L = 160'
HW/D = 4.35/4 = 1.08 ∴ ok use 4'x8' CBC

DP F24 : Q_{100} = 181 cfs L = 80'
HW/D = 3.9/4 = .98 ∴ ok use 4'x8' CBC

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP JOB NO. 03094 PAGE 3/3
PROJECT: DATE CHECKED: DATE 5/19/04
DETAIL: CHECKED BY: COMPUTED BY RAW

DP F25: Q_{100} = 303 cfs L = 80'
HW/D = 4.7/5 = .94 ∴ ok 5'H x 10'W CBC

DP F30: Q_{100} = 490 cfs L = 80'
HW/D = 6.6/6 = 1.10 ∴ ok use 6'x10' CBC

DP F28: This is outlet from Det Basin DB 28 @ L = 240' ±
Research Parkway
Assume HW depth of 16' to match HEC-1
Q_{100} = 563 cfs
w/ 4' x 8' CBC HW = 16.5' ∴ ok.
use 4' x 8' CBC

AT DP F9 Upper collector

CURRENT DATE: 05-19-2004
CURRENT TIME: 13:11:37

FILE DATE: 05-19-2004
FILE NAME: F9

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCB	6.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F9 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.91	16	16	0	0	0	0	0	0	1
101.45	32	32	0	0	0	0	0	0	1
101.90	48	48	0	0	0	0	0	0	1
102.31	64	64	0	0	0	0	0	0	1
102.69	80	80	0	0	0	0	0	0	1
103.05	96	96	0	0	0	0	0	0	1
103.38	112	112	0	0	0	0	0	0	1
103.72	128	128	0	0	0	0	0	0	1
104.05	144	144	0	0	0	0	0	0	1
104.23	152	152	HW/D = 1.005 ∴ OK			0	0	0	1
110.00	334	334	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F9 DATE: 05-19-2004

HEAD ELEV (FT)	HEAD ERROR (FT)	TOTAL FLOW (CFS)	FLOW ERROR (CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.91	0.00	16	0	0.00
101.45	0.00	32	0	0.00
101.90	0.00	48	0	0.00
102.31	0.00	64	0	0.00
102.69	0.00	80	0	0.00
103.05	0.00	96	0	0.00
103.38	0.00	112	0	0.00
103.72	0.00	128	0	0.00
104.05	0.00	144	0	0.00
104.23	0.00	152	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

C''RENT DATE: 05-19-2004
(.RENT TIME: 13:11:37

FILE DATE: 05-19-2004
FILE NAME: F9

****
************************** CULVERT # 1 **************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
16	100.91	98.83	0.91	0.71	6-FF	0.00	0.00	0.00	7.91
32	101.45	99.03	1.45	0.93	6-FF	0.00	0.00	0.00	10.52
48	101.90	99.18	1.90	1.13	6-FF	0.00	0.00	0.00	10.74
64	102.31	99.31	2.31	1.35	6-FF	0.00	0.00	0.00	11.67
80	102.69	99.42	2.69	1.57	6-FF	0.00	0.00	0.00	12.45
96	103.05	99.52	3.05	1.81	6-FF	0.00	0.00	0.00	12.90
112	103.38	99.61	3.38	2.07	6-FF	0.00	0.00	0.00	13.38
128	103.72	99.69	3.72	2.35	6-FF	0.00	0.00	0.00	13.82
144	104.05	99.77	4.05	2.64	6-FF	0.00	0.00	0.00	14.18
152	104.23	99.81	4.23	2.79	6-FF	0.00	0.00	0.00	14.35

El. inlet face invert 100.00 ft El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

* -** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	6.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

****

(RENT DATE: 05-19-2004
CURRENT TIME: 13:11:37

FILE DATE: 05-19-2004
FILE NAME: F9

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
16.00	98.83	0.808	2.99	0.53
32.00	99.03	0.830	3.72	0.78
48.00	99.18	0.840	4.21	0.97
64.00	99.31	0.847	4.58	1.13
80.00	99.42	0.852	4.88	1.27
96.00	99.52	0.856	5.14	1.40
112.00	99.61	0.859	5.36	1.51
128.00	99.69	0.862	5.57	1.62
144.00	99.77	0.865	5.75	1.71
152.00	99.81	0.866	5.83	1.76

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

@ SB 8 & Upper Collector

CURRENT DATE: 05-19-2004
CURRENT TIME: 13:20:42

FILE DATE: 05-19-2004
FILE NAME: SB8

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCP	4.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: SB8 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.59	16	16	0	0	0	0	0	0	1
102.36	32	32	0	0	0	0	0	0	1
103.04	48	48	0	0	0	0	0	0	1
103.65	64	64	0	0	0	0	0	0	1
104.28	80	80	0	0	0	0	0	0	1
104.97	96	96	0	0	0	0	0	0	1
105.78	112	112	0	0	0	0	0	0	1
106.73	128	128	0	0	0	0	0	0	1
107.82	144	144	0	0	0	0	0	0	1
108.42	152	152	0	0	0	0	0	0	1
110.00	171	171	0	0	0	0	0	OVERTOPPING	

HW/D = .85

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: SB8 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.59	0.00	16	0	0.00
102.36	0.00	32	0	0.00
103.04	0.00	48	0	0.00
103.65	0.00	64	0	0.00
104.28	0.00	80	0	0.00
104.97	0.00	96	0	0.00
105.78	0.00	112	0	0.00
106.73	0.00	128	0	0.00
107.82	0.00	144	0	0.00
108.42	0.00	152	0	0.00

<1> TOLERANCE (FT) = 0.010
<2> TOLERANCE (%) = 1.000

C??RENT DATE: 05-19-2004 FILE DATE: 05-19-2004
(RENT TIME: 13:20:42 FILE NAME: SB8

****
************************** CULVERT # 1 **************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
16	101.59	98.83	1.59	1.03	6-FF	0.00	0.00	0.00	10.43
32	102.36	99.03	2.36	1.42	6-FF	0.00	0.00	0.00	11.10
48	103.04	99.18	3.04	1.85	6-FF	0.00	0.00	0.00	12.11
64	103.65	99.31	3.65	2.34	6-FF	0.00	0.00	0.00	12.87
80	104.28	99.42	4.28	2.91	6-FF	0.00	0.00	0.00	13.59
96	104.97	99.52	4.97	3.54	6-FF	0.00	0.00	0.00	14.13
112	105.78	99.61	5.78	4.26	6-FF	0.00	0.00	0.00	14.67
128	106.73	99.69	6.73	5.04	6-FF	0.00	0.00	0.00	15.23
144	107.82	99.77	7.82	5.91	6-FF	0.00	0.00	0.00	15.78
152	108.42	99.81	8.42	6.37	6-FF	0.00	0.00	0.00	16.04

El. inlet face invert 100.00 ft El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY *************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

C""RENT DATE: 05-19-2004
C RENT TIME: 13:20:42

FILE DATE: 05-19-2004
FILE NAME: SB8

****
*************************   TAILWATER   *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
16.00	98.83	0.808	2.99	0.53
32.00	99.03	0.830	3.72	0.78
48.00	99.18	0.840	4.21	0.97
64.00	99.31	0.847	4.58	1.13
80.00	99.42	0.852	4.88	1.27
96.00	99.52	0.856	5.14	1.40
112.00	99.61	0.859	5.36	1.51
128.00	99.69	0.862	5.57	1.62
144.00	99.77	0.865	5.75	1.71
152.00	99.81	0.866	5.83	1.76

****
*************************   ROADWAY OVERTOPPING DATA   *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DP F10 Upper Collector

CURRENT DATE: 05-19-2004
CURRENT TIME: 13:25:46

FILE DATE: 05-19-2004
FILE NAME: F10

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCP	3.50	3.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F10 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.99	6	6	0	0	0	0	0	0	1
101.43	12	12	0	0	0	0	0	0	1
101.77	18	18	0	0	0	0	0	0	1
102.13	24	24	0	0	0	0	0	0	1
102.45	30	30	0	0	0	0	0	0	1
102.74	36	36	0	0	0	0	0	0	1
103.02	42	42	0	0	0	0	0	0	1
103.30	48	48	0 HW/D= .94	0	0	0	0	0	1
103.58	54	54	0	0	0	0	0	0	1
103.88	60	60	0	0	0	0	0	0	1
110.00	134	134	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F10 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.99	0.00	6	0	0.00
101.43	0.00	12	0	0.00
101.77	0.00	18	0	0.00
102.13	0.00	24	0	0.00
102.45	0.00	30	0	0.00
102.74	0.00	36	0	0.00
103.02	0.00	42	0	0.00
103.30	0.00	48	0	0.00
103.58	0.00	54	0	0.00
103.88	0.00	60	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-2004
CURRENT TIME: 13:25:46

FILE DATE: 05-19-2004
FILE NAME: F10

****
************************** CULVERT # 1 **************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
6	100.99	98.64	0.99	0.53	6-FF	0.00	0.00	0.00	7.45
12	101.43	98.76	1.43	0.72	6-FF	0.00	0.00	0.00	9.15
18	101.77	98.85	1.77	0.90	6-FF	0.00	0.00	0.00	9.72
24	102.13	98.93	2.13	1.08	6-FF	0.00	0.00	0.00	10.65
30	102.45	99.00	2.45	1.28	6-FF	0.00	0.00	0.00	11.03
36	102.74	99.07	2.74	1.49	6-FF	0.00	0.00	0.00	11.67
42	103.02	99.12	3.02	1.72	6-FF	0.00	0.00	0.00	11.94
48	103.30	99.18	3.30	1.96	6-FF	0.00	0.00	0.00	12.33
54	103.58	99.23	3.58	2.22	6-FF	0.00	0.00	0.00	12.70
60	103.88	99.28	3.88	2.51	6-FF	0.00	0.00	0.00	12.94

El. inlet face invert 100.00 ft   El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft   El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 13:25:46 FILE NAME: F10

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
6.00	98.64	0.769	2.15	0.30
12.00	98.76	0.798	2.72	0.45
18.00	98.85	0.812	3.11	0.57
24.00	98.93	0.821	3.41	0.67
30.00	99.00	0.828	3.65	0.75
36.00	99.07	0.833	3.86	0.83
42.00	99.12	0.837	4.04	0.90
48.00	99.18	0.840	4.21	0.97
54.00	99.23	0.843	4.35	1.03
60.00	99.28	0.845	4.49	1.09

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DP F11 · upper collector

CURRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 13:46:47 FILE NAME: F11

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCB	4.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F11 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.93	11	11	0	0	0	0	0	0	1
101.48	22	22	0	0	0	0	0	0	1
101.94	33	33	0	0	0	0	0	0	1
102.36	44	44	0	0	0	0	0	0	1
102.75	55	55	0	0	0	0	0	0	1
103.11	66	66	0	0	0	0	0	0	1
103.46	77	77	0	0	0	0	0	0	1
103.80	88	88	0	0	0	0	0	0	1
104.15	99	99	0	0 HW/D = 1.06	0	0	0	0	1
104.25	102	102	0	0	0	0	0	0	1
110.00	223	223	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F11 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.93	0.00	11	0	0.00
101.48	0.00	22	0	0.00
101.94	0.00	33	0	0.00
102.36	0.00	44	0	0.00
102.75	0.00	55	0	0.00
103.11	0.00	66	0	0.00
103.46	0.00	77	0	0.00
103.80	0.00	88	0	0.00
104.15	0.00	99	0	0.00
104.25	0.00	102	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 13:46:47 FILE NAME: F11

****
************************ CULVERT # 1 ************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
11	100.93	98.74	0.93	0.72	6-FF	0.00	0.00	0.00	7.77
22	101.48	98.91	1.48	0.94	6-FF	0.00	0.00	0.00	10.28
33	101.94	99.04	1.94	1.16	6-FF	0.00	0.00	0.00	10.58
44	102.36	99.14	2.36	1.38	6-FF	0.00	0.00	0.00	11.52
55	102.75	99.24	2.75	1.62	6-FF	0.00	0.00	0.00	12.11
66	103.11	99.32	3.11	1.88	6-FF	0.00	0.00	0.00	12.60
77	103.46	99.40	3.46	2.15	6-FF	0.00	0.00	0.00	13.14
88	103.80	99.47	3.80	2.45	6-FF	0.00	0.00	0.00	13.47
99	104.15	99.54	4.15	2.77	6-FF	0.00	0.00	0.00	13.87
102	104.25	99.55	4.25	2.86	6-FF	0.00	0.00	0.00	13.97

El. inlet face invert 100.00 ft El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	4.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-19-2004
CURRENT TIME: 13:46:47

FILE DATE: 05-19-2004
FILE NAME: F11

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
11.00	98.74	0.795	2.65	0.43
22.00	98.91	0.819	3.31	0.63
33.00	99.04	0.830	3.76	0.79
44.00	99.14	0.838	4.10	0.93
55.00	99.24	0.843	4.38	1.04
66.00	99.32	0.848	4.62	1.15
77.00	99.40	0.851	4.83	1.25
88.00	99.47	0.854	5.01	1.33
99.00	99.54	0.857	5.18	1.42
102.00	99.55	0.857	5.23	1.44

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

F23 Brinegate Blvd

CURRENT DATE: 05-21-2004
CURRENT TIME: 09:22:08

FILE DATE: 05-19-2004
FILE NAME: F23

```
****************************************************************************
*************************   FHWA CULVERT ANALYSIS   *************************
*************************     HY-8, VERSION 3.2     *************************
****************************************************************************
```

C U L V #	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
1	100.00	96.80	160.03	1 RCP	4.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

FILE: F23 CULVERT HEADWATER ELEVATION (FT) DATE: 05-19-2004

DISCHARGE	1	2	3	4	5	6	ROADWAY
0	100.00	0.00	0.00	0.00	0.00	0.00	110.00
8	101.07	0.00	0.00	0.00	0.00	0.00	110.09
15	101.53	0.00	0.00	0.00	0.00	0.00	110.14
23	101.90	0.00	0.00	0.00	0.00	0.00	110.18
30	102.27	0.00	0.00	0.00	0.00	0.00	110.22
38	102.61	0.00	0.00	0.00	0.00	0.00	110.25
45	102.92	0.00	0.00	0.00	0.00	0.00	110.28
53	103.22	0.00	0.00	0.00	0.00	0.00	110.31
60	103.50	0.00	0.00	0.00	0.00	0.00	110.34
68	103.79	0.00	0.00	0.00	0.00	0.00	110.37
69	103.84	0.00	0.00	0.00	0.00	0.00	110.37

HW/D=.95

DP F12 Upper Collector

CURRENT DATE: 05-19-2004
CURRENT TIME: 13:52:24

FILE DATE: 05-19-2004
FILE NAME: F12

****
************************* FHWA CULVERT ANALYSIS *************************
************************* HY-8, VERSION 3.2 *************************
****

C U L V #	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCB	10.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

****

SUMMARY OF CULVERT FLOWS (CFS) FILE: F12 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.85	24	24	0	0	0	0	0	0	1
101.35	48	48	0	0	0	0	0	0	1
101.77	72	72	0	0	0	0	0	0	1
102.15	96	96	0	0	0	0	0	0	1
102.51	120	120	0	0	0	0	0	0	1
102.84	144	144	0	0	0	0	0	0	1
103.15	168	168	0	0	0	0	0	0	1
103.45	192	192	0	0	0	0	0	0	1
103.75	216	216	0	0	0	0	0	0	1
104.00	236	236	0	0	0	0	0	0	1
110.00	557	557	0	0	0	0	0	OVERTOPPING	

HW/B=4.0

****

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F12 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.85	0.00	24	0	0.00
101.35	0.00	48	0	0.00
101.77	0.00	72	0	0.00
102.15	0.00	96	0	0.00
102.51	0.00	120	0	0.00
102.84	0.00	144	0	0.00
103.15	0.00	168	0	0.00
103.45	0.00	192	0	0.00
103.75	0.00	216	0	0.00
104.00	0.00	236	0	0.00

****

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

****

C RENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 13:52:24 FILE NAME: F12

****
************************ CULVERT # 1 ************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
24	100.85	98.93	0.85	0.69	6-FF	0.00	0.00	0.00	7.19
48	101.35	99.18	1.35	0.88	6-FF	0.00	0.00	0.00	10.34
72	101.77	99.36	1.77	1.07	6-FF	0.00	0.00	0.00	10.73
96	102.15	99.52	2.15	1.25	6-FF	0.00	0.00	0.00	11.71
120	102.51	99.65	2.51	1.45	6-FF	0.00	0.00	0.00	12.34
144	102.84	99.77	2.84	1.66	6-FF	0.00	0.00	0.00	12.85
168	103.15	99.88	3.15	1.87	6-FF	0.00	0.00	0.00	13.38
192	103.45	99.98	3.45	2.10	6-FF	0.00	0.00	0.00	13.79
216	103.75	100.08	3.75	2.35	6-FF	0.00	0.00	0.00	14.18
236	104.00	100.15	4.00	2.56	6-FF	0.00	0.00	0.00	14.46

El. inlet face invert 100.00 ft El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************	
INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************	
BARREL SHAPE	BOX
BARREL SPAN	10.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

****

CU RRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
C. .ENT TIME: 13:52:24 FILE NAME: F12

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
24.00	98.93	0.821	3.41	0.67
48.00	99.18	0.840	4.21	0.97
72.00	99.36	0.850	4.73	1.20
96.00	99.52	0.856	5.14	1.40
120.00	99.65	0.861	5.47	1.56
144.00	99.77	0.865	5.75	1.71
168.00	99.88	0.868	6.00	1.85
192.00	99.98	0.872	6.22	1.98
216.00	100.08	0.874	6.42	2.09
236.00	100.15	0.876	6.58	2.18

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DP F13 upper local roadway

C RENT DATE: 05-19-2004
CURRENT TIME: 14:17:54

FILE DATE: 05-19-2004
FILE NAME: F13

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F13 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.78	4	4	0	0	0	0	0	0	1
101.12	7	7	0	0	0	0	0	0	1
101.39	11	11	0	0	0	0	0	0	1
101.66	14	14	0	0	0	0	0	0	1
101.91	18	18	0	0	0	0	0	0	1
102.14	21	21	0	0	0	0	0	0	1
102.35	25	25	0	0	0	0	0	0	1
102.56	28	28	0	0	0	0	0	0	1
102.67	30	30	0	HW/D= .9	0	0	0	0	1
102.96	35	35	0	0	0	0	0	0	1
110.00	100	100	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F13 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.78	0.00	4	0	0.00
101.12	0.00	7	0	0.00
101.39	0.00	11	0	0.00
101.66	0.00	14	0	0.00
101.91	0.00	18	0	0.00
102.14	0.00	21	0	0.00
102.35	0.00	25	0	0.00
102.56	0.00	28	0	0.00
102.67	0.00	30	0	0.00
102.96	0.00	35	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-2004
CURRENT TIME: 14:17:54

FILE DATE: 05-19-2004
FILE NAME: F13

****
************************ CULVERT # 1 ************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
4	100.78	98.58	0.78	0.20	6-FF	0.00	0.00	0.00	7.07
7	101.12	98.67	1.12	0.34	6-FF	0.00	0.00	0.00	8.51
11	101.39	98.74	1.39	0.48	6-FF	0.00	0.00	0.00	8.51
14	101.66	98.79	1.66	0.62	6-FF	0.00	0.00	0.00	8.51
18	101.91	98.85	1.91	0.75	6-FF	0.00	0.00	0.00	10.30
21	102.14	98.90	2.14	0.90	6-FF	0.00	0.00	0.00	9.88
25	102.35	98.94	2.35	1.06	6-FF	0.00	0.00	0.00	10.57
28	102.56	98.98	2.56	1.24	6-FF	0.00	0.00	0.00	10.75
30	102.67	99.00	2.67	1.34	6-FF	0.00	0.00	0.00	11.08
35	102.96	99.06	2.96	1.62	6-FF	0.00	0.00	0.00	11.32

El. inlet face invert 100.00 ft El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 14:17:54 FILE NAME: F13

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
3.50	98.58	0.744	1.78	0.22
7.00	98.67	0.776	2.27	0.33
10.50	98.74	0.793	2.61	0.42
14.00	98.79	0.804	2.87	0.49
17.50	98.85	0.811	3.08	0.56
21.00	98.90	0.817	3.27	0.62
24.50	98.94	0.822	3.43	0.67
28.00	98.98	0.826	3.57	0.73
30.00	99.00	0.828	3.65	0.75
35.00	99.06	0.832	3.83	0.82

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DB19 OUTLET OF DETENTION BASIN[1]

CURRENT DATE: 05-19-2004
CURRENT TIME: 16:28:35

FILE DATE: 05-19-2004
FILE NAME: DB19

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	95.20	240.05	1 RCP	3.50	3.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: DB19 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.29	10	10	0	0	0	0	0	0	1
101.90	20	20	0	0	0	0	0	0	1
102.45	30	30	0	0	0	0	0	0	1
102.93	40	40	0	0	0	0	0	0	1
103.39	50	50	0	0	0	0	0	0	1
103.88	60	60	0	0	0	0	0	0	1
104.42	70	70	0	0	0	0	0	0	1
105.05	80	80	0	0	0	0	0	0	1
105.76	90	90	0	0	0	0	0	0	1
106.57	100	100	0	0	0	0	0	0	1
110.00	134	134	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: DB19 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.29	0.00	10	0	0.00
101.90	0.00	20	0	0.00
102.45	0.00	30	0	0.00
102.93	0.00	40	0	0.00
103.39	0.00	50	0	0.00
103.88	0.00	60	0	0.00
104.42	0.00	70	0	0.00
105.05	0.00	80	0	0.00
105.76	0.00	90	0	0.00
106.57	0.00	100	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-2004
CURRENT TIME: 16:28:35

FILE DATE: 05-19-2004
FILE NAME: DB19

****
************************ CULVERT # 1 ************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	95.20	0.00	-4.80	0-NF	0.00	100.00	0.00	0.00
10	101.29	95.53	1.29	-2.53	6-FF	0.00	0.00	0.00	8.19
20	101.90	95.68	1.90	-2.19	6-FF	0.00	0.00	0.00	11.24
30	102.45	95.80	2.45	-1.80	6-FF	0.00	0.00	0.00	11.24
40	102.93	95.91	2.93	-1.35	6-FF	0.00	0.00	0.00	12.44
50	103.39	96.00	3.39	-0.82	6-FF	0.00	0.00	0.00	13.56
60	103.88	96.08	3.88	-0.21	6-FF	0.00	0.00	0.00	14.35
70	104.42	96.15	4.42	0.47	6-FF	0.00	0.00	0.00	14.54
80	105.05	96.22	5.05	1.24	6-FF	0.00	0.00	0.00	15.00
90	105.76	96.28	5.76	2.08	6-FF	0.00	0.00	0.00	15.44
100	106.57	96.34	6.57	3.00	6-FF	0.00	0.00	0.00	15.87

El. inlet face invert 100.00 ft El. outlet invert 95.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	340.00
OUTLET ELEVATION (FT)	95.20
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	240.05

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-19-2004
CURRENT TIME: 16:28:35

FILE DATE: 05-19-2004
FILE NAME: DB19

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	95.20
CULVERT NO.1 OUTLET INVERT ELEVATION	95.20 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	95.20	0.000	0.00	0.00
10.00	95.53	0.791	2.56	0.41
20.00	95.68	0.816	3.22	0.60
30.00	95.80	0.828	3.65	0.75
40.00	95.91	0.836	3.98	0.88
50.00	96.00	0.841	4.26	0.99
60.00	96.08	0.845	4.49	1.09
70.00	96.15	0.849	4.70	1.19
80.00	96.22	0.852	4.88	1.27
90.00	96.28	0.855	5.04	1.35
100.00	96.34	0.857	5.20	1.43

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DB 18. outlet of detention basin

CURRENT DATE: 05-19-2004
CURRENT TIME: 16:33:00

FILE DATE: 05-19-2004
FILE NAME: DB18

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	95.20	240.05	1 RCP	4.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: DB18 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.53	15	15	0	0	0	0	0	0	1
102.27	30	30	0	0	0	0	0	0	1
102.92	45	45	0	0	0	0	0	0	1
103.50	60	60	0	0	0	0	0	0	1
104.08	75	75	0	0	0	0	0	0	1
104.70	90	90	0	0	0	0	0	0	1
105.41	105	105	0	0	0	0	0	0	1
106.24	120	120	0	0	0	0	0	0	1
107.19	135	135	0	0	0	0	0	0	1
107.53	140	140	0	0	0	0	0	0	1
110.00	171	171	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: DB18 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.53	0.00	15	0	0.00
102.27	0.00	30	0	0.00
102.92	0.00	45	0	0.00
103.50	0.00	60	0	0.00
104.08	0.00	75	0	0.00
104.70	0.00	90	0	0.00
105.41	0.00	105	0	0.00
106.24	0.00	120	0	0.00
107.19	0.00	135	0	0.00
107.53	0.00	140	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

C RENT DATE: 05-21-2004 FILE DATE: 05-19-2004
RENT TIME: 09:22:08 FILE NAME: F23

****
************************* CULVERT # 1 *************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	96.80	0.00	-3.20	0-NF	0.00	100.00	0.00	0.00
8	101.07	97.08	1.07	-0.79	6-FF	0.00	0.00	0.00	8.55
15	101.53	97.21	1.53	-0.59	6-FF	0.00	0.00	0.00	10.30
23	101.90	97.32	1.90	-0.40	6-FF	0.00	0.00	0.00	11.40
30	102.27	97.40	2.27	-0.20	6-FF	0.00	0.00	0.00	12.46
38	102.61	97.48	2.61	0.00	6-FF	0.00	0.00	0.00	12.37
45	102.92	97.55	2.92	0.23	6-FF	0.00	0.00	0.00	12.87
53	103.22	97.62	3.22	0.47	6-FF	0.00	0.00	0.00	13.50
60	103.50	97.68	3.50	0.73	6-FF	0.00	0.00	0.00	13.83
68	103.79	97.73	3.79	1.01	6-FF	0.00	0.00	0.00	14.28
69	103.84	97.74	3.84	1.07	6-FF	0.00	0.00	0.00	14.37

El. inlet face invert 100.00 ft El. outlet invert 96.80 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	260.00
OUTLET ELEVATION (FT)	96.80
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	160.03

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-19-2004
CURRENT TIME: 16:33:00

FILE DATE: 05-19-2004
FILE NAME: DB18

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	95.20
CULVERT NO.1 OUTLET INVERT ELEVATION	95.20 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	95.20	0.000	0.00	0.00
15.00	95.61	0.806	2.93	0.51
30.00	95.80	0.828	3.65	0.75
45.00	95.95	0.839	4.13	0.94
60.00	96.08	0.845	4.49	1.09
75.00	96.18	0.851	4.79	1.23
90.00	96.28	0.855	5.04	1.35
105.00	96.37	0.858	5.27	1.46
120.00	96.45	0.861	5.47	1.56
135.00	96.53	0.863	5.65	1.66
140.00	96.55	0.864	5.70	1.69

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

CURRENT DATE: 05-21-2004 FILE DATE: 05-19-2004
CURRENT TIME: 09:22:08 FILE NAME: F23

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	96.80
CULVERT NO.1 OUTLET INVERT ELEVATION	96.80 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	96.80	0.000	0.00	0.00
7.50	97.08	0.779	2.32	0.35
15.00	97.21	0.806	2.93	0.51
22.50	97.32	0.819	3.34	0.64
30.00	97.40	0.828	3.65	0.75
37.50	97.48	0.834	3.91	0.85
45.00	97.55	0.839	4.13	0.94
52.50	97.62	0.842	4.32	1.02
60.00	97.68	0.845	4.49	1.09
67.50	97.73	0.848	4.65	1.16
69.00	97.74	0.849	4.68	1.18

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DP 14 Briargate Blvd.

C RENT DATE: 05-19-2004
CURRENT TIME: 17:00:28

FILE DATE: 05-19-2004
FILE NAME: F14

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	96.80	160.03	1 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F14 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.93	22	22	0	0	0	0	0	0	1
101.48	44	44	0	0	0	0	0	0	1
101.94	66	66	0	0	0	0	0	0	1
102.36	88	88	0	0	0	0	0	0	1
102.75	110	110	0	0	0	0	0	0	1
103.11	132	132	0	0	0	0	0	0	1
103.46	154	154	0	0	0	0	0	0	1
103.80	176	176	0	0	0	0	0	0	1
104.15	198	198	0	0	0	0	0	0	1
104.35	210	210	0 HW/D=	0	0	0	0	0	1
110.00	445	445	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F14 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.93	0.00	22	0	0.00
101.48	0.00	44	0	0.00
101.94	0.00	66	0	0.00
102.36	0.00	88	0	0.00
102.75	0.00	110	0	0.00
103.11	0.00	132	0	0.00
103.46	0.00	154	0	0.00
103.80	0.00	176	0	0.00
104.15	0.00	198	0	0.00
104.35	0.00	210	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-2004
CURRENT TIME: 17:00:28

FILE DATE: 05-19-2004
FILE NAME: F14

```
*******************************************************************************
*************************        CULVERT #  1        *************************
*******************************************************************************
```

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	96.80	0.00	-3.20	0-NF	0.00	100.00	0.00	0.00
22	100.93	97.31	0.93	-0.88	6-FF	0.00	0.00	0.00	8.94
44	101.48	97.54	1.48	-0.66	6-FF	0.00	0.00	0.00	9.97
66	101.94	97.72	1.94	-0.44	6-FF	0.00	0.00	0.00	12.46
88	102.36	97.87	2.36	-0.20	6-FF	0.00	0.00	0.00	13.54
110	102.75	98.00	2.75	0.04	6-FF	0.00	0.00	0.00	13.72
132	103.11	98.11	3.11	0.31	6-FF	0.00	0.00	0.00	14.51
154	103.46	98.22	3.46	0.60	6-FF	0.00	0.00	0.00	15.13
176	103.80	98.32	3.80	0.91	6-FF	0.00	0.00	0.00	15.56
198	104.15	98.41	4.15	1.24	6-FF	0.00	0.00	0.00	16.01
210	104.35	98.45	4.35	1.43	6-FF	0.00	0.00	0.00	16.26

El. inlet face invert 100.00 ft   El. outlet invert 96.80 ft
El. inlet throat invert 0.00 ft   El. inlet crest 0.00 ft

```
*******************************************************************************

***** SITE DATA ***** CULVERT INVERT **************
      INLET STATION (FT)                          100.00
      INLET ELEVATION (FT)                        100.00
      OUTLET STATION (FT)                         260.00
      OUTLET ELEVATION (FT)                        96.80
      NUMBER OF BARRELS                             1.00
      SLOPE (V-FT/H-FT)                             0.0200
      CULVERT LENGTH ALONG SLOPE (FT)             160.03

***** CULVERT DATA SUMMARY ************************
      BARREL SHAPE            BOX
      BARREL SPAN               8.00 FT
      BARREL RISE               4.00 FT
      BARREL MATERIAL         CONCRETE
      BARREL MANNING'S N      0.012
      INLET TYPE              CONVENTIONAL
      INLET EDGE AND WALL     SQUARE EDGE (30-75 DEG. FLARE)
      INLET DEPRESSION        NONE

*******************************************************************************
```

CURRENT DATE: 05-19-2004
CURRENT TIME: 17:00:28

FILE DATE: 05-19-2004
FILE NAME: F14

****
*********************** TAILWATER ***********************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	96.80
CULVERT NO.1 OUTLET INVERT ELEVATION	96.80 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	96.80	0.000	0.00	0.00
22.00	97.31	0.819	3.31	0.63
44.00	97.54	0.838	4.10	0.93
66.00	97.72	0.848	4.62	1.15
88.00	97.87	0.854	5.01	1.33
110.00	98.00	0.859	5.34	1.50
132.00	98.11	0.863	5.61	1.64
154.00	98.22	0.866	5.86	1.77
176.00	98.32	0.870	6.08	1.89
198.00	98.41	0.872	6.27	2.01
210.00	98.45	0.874	6.37	2.06

****
*********************** ROADWAY OVERTOPPING DATA ***********************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

F24 @ COLLECTOR

CURRENT DATE: 05-21-2004
CURRENT TIME: 09:29:06

FILE DATE: 05-19-2004
FILE NAME: F24

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS)   FILE: F24   DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.84	19	19	0	0	0	0	0	0	1
101.34	38	38	0	0	0	0	0	0	1
101.76	57	57	0	0	0	0	0	0	1
102.13	76	76	0	0	0	0	0	0	1
102.49	95	95	0	0	0	0	0	0	1
102.82	114	114	0	0	0	0	0	0	1
103.13	133	133	0	0	0	0	0	0	1
103.43	152	152	0	0	0	0	0	0	1
103.72	171	171	0	0	0	0	0	0	1
103.86	180	180	0	0	0 HW/D 0.98	0	0	0	1
110.00	445	445	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS   FILE: F24   DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.84	0.00	19	0	0.00
101.34	0.00	38	0	0.00
101.76	0.00	57	0	0.00
102.13	0.00	76	0	0.00
102.49	0.00	95	0	0.00
102.82	0.00	114	0	0.00
103.13	0.00	133	0	0.00
103.43	0.00	152	0	0.00
103.72	0.00	171	0	0.00
103.86	0.00	180	0	0.00

<1> TOLERANCE (FT) = 0.010   <2> TOLERANCE (%) = 1.000

C''RENT DATE: 05-21-2004
 RENT TIME: 09:29:06

FILE DATE: 05-19-2004
FILE NAME: F24

****
************************* CULVERT # 1 *************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
19	100.84	98.87	0.84	0.69	6-FF	0.00	0.00	0.00	7.00
38	101.34	99.09	1.34	0.88	6-FF	0.00	0.00	0.00	10.20
57	101.76	99.25	1.76	1.06	6-FF	0.00	0.00	0.00	10.70
76	102.13	99.39	2.13	1.25	6-FF	0.00	0.00	0.00	11.63
95	102.49	99.51	2.49	1.44	6-FF	0.00	0.00	0.00	12.16
114	102.82	99.62	2.82	1.65	6-FF	0.00	0.00	0.00	12.71
133	103.13	99.72	3.13	1.86	6-FF	0.00	0.00	0.00	13.28
152	103.43	99.81	3.43	2.09	6-FF	0.00	0.00	0.00	13.62
171	103.72	99.90	3.72	2.33	6-FF	0.00	0.00	0.00	14.05
180	103.86	99.93	3.86	2.45	6-FF	0.00	0.00	0.00	14.18

El. inlet face invert 100.00 ft El. outlet invert 98.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

****

C~~RENT DATE: 05-21-2004
(RENT TIME: 09:29:06

FILE DATE: 05-19-2004
FILE NAME: F24

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
19.00	98.87	0.814	3.16	0.59
38.00	99.09	0.834	3.92	0.86
57.00	99.25	0.844	4.42	1.06
76.00	99.39	0.851	4.81	1.24
95.00	99.51	0.856	5.12	1.39
114.00	99.62	0.860	5.39	1.52
133.00	99.72	0.863	5.62	1.65
152.00	99.81	0.866	5.83	1.76
171.00	99.90	0.869	6.03	1.87
180.00	99.93	0.870	6.11	1.91

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

F25 COLLECTOR ROAD

CURRENT DATE: 05-21-2004
CURRENT TIME: 09:25:45

FILE DATE: 05-21-2004
FILE NAME: F25

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCB	10.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F25 DATE: 05-21-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.24	31	31	0	0	0	0	0	0	1
101.60	62	62	0	0	0	0	0	0	1
102.10	93	93	0	0	0	0	0	0	1
102.54	124	124	0	0	0	0	0	0	1
102.97	155	155	0	0	0	0	0	0	1
103.36	186	186	0	0	0	0	0	0	1
103.73	217	217	0	0	0	0	0	0	1
104.09	248	248	0	0	0	0	0	0	1
104.43	279	279	0	0	0	0	0	0	1
104.74	306	306	0	0	0	0	0	0	1
110.00	663	663	0	0	0	0	0	OVERTOPPING	

HW/D=.94

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F25 DATE: 05-21-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.24	0.00	31	0	0.00
101.60	0.00	62	0	0.00
102.10	0.00	93	0	0.00
102.54	0.00	124	0	0.00
102.97	0.00	155	0	0.00
103.36	0.00	186	0	0.00
103.73	0.00	217	0	0.00
104.09	0.00	248	0	0.00
104.43	0.00	279	0	0.00
104.74	0.00	306	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-21-2004
CURRENT TIME: 09:25:45

FILE DATE: 05-21-2004
FILE NAME: F25

****
************************* CULVERT # 1 *************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
31	101.24	99.01	1.01	1.24	6-FF	0.00	0.00	0.00	4.63
62	101.60	99.29	1.60	1.47	6-FF	0.00	0.00	0.00	10.24
93	102.10	99.50	2.10	1.68	6-FF	0.00	0.00	0.00	11.65
124	102.54	99.67	2.54	1.89	6-FF	0.00	0.00	0.00	12.49
155	102.97	99.82	2.97	2.11	6-FF	0.00	0.00	0.00	13.12
186	103.36	99.96	3.36	2.34	6-FF	0.00	0.00	0.00	13.67
217	103.73	100.08	3.73	2.58	6-FF	0.00	0.00	0.00	14.19
248	104.09	100.19	4.09	2.84	6-FF	0.00	0.00	0.00	14.65
279	104.43	100.30	4.43	3.11	6-FF	0.00	0.00	0.00	15.02
306	104.74	100.38	4.74	3.35	6-FF	0.00	0.00	0.00	15.37

El. inlet face invert	100.00 ft	El. outlet invert	98.40 ft
El. inlet throat invert	0.00 ft	El. inlet crest	0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	98.40
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	80.02

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	10.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

****

C'''RENT DATE: 05-21-2004 FILE DATE: 05-21-2004
. RENT TIME: 09:25:45 FILE NAME: F25

****
************************ TAILWATER ************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
31.00	99.01	0.829	3.69	0.77
62.00	99.29	0.846	4.53	1.11
93.00	99.50	0.855	5.09	1.37
124.00	99.67	0.861	5.52	1.59
155.00	99.82	0.866	5.87	1.78
186.00	99.96	0.871	6.17	1.95
217.00	100.08	0.874	6.43	2.10
248.00	100.19	0.877	6.67	2.24
279.00	100.30	0.880	6.88	2.37
306.00	100.38	0.882	7.05	2.47

****
************************ ROADWAY OVERTOPPING DATA ************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

CURRENT DATE: 05-19-2004
CURRENT TIME: 16:33:00

FILE DATE: 05-19-2004
FILE NAME: DB18

****
************************* CULVERT # 1 *************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	95.20	0.00	-4.80	0-NF	0.00	100.00	0.00	0.00
15	101.53	95.61	1.53	-2.18	6-FF	0.00	0.00	0.00	10.30
30	102.27	95.80	2.27	-1.77	6-FF	0.00	0.00	0.00	12.46
45	102.92	95.95	2.92	-1.30	6-FF	0.00	0.00	0.00	13.15
60	103.50	96.08	3.50	-0.75	6-FF	0.00	0.00	0.00	14.37
75	104.08	96.18	4.08	-0.11	6-FF	0.00	0.00	0.00	15.08
90	104.70	96.28	4.70	0.63	6-FF	0.00	0.00	0.00	15.77
105	105.41	96.37	5.41	1.46	6-FF	0.00	0.00	0.00	16.38
120	106.24	96.45	6.24	2.38	6-FF	0.00	0.00	0.00	16.91
135	107.19	96.53	7.19	3.40	6-FF	0.00	0.00	0.00	17.34
140	107.53	96.55	7.53	3.77	6-FF	0.00	0.00	0.00	17.46

El. inlet face invert 100.00 ft El. outlet invert 95.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	340.00
OUTLET ELEVATION (FT)	95.20
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	240.05

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

F30 @ Collector

CURRENT DATE: 05-21-2004
CURRENT TIME: 09:33:34

FILE DATE: 05-19-2004
FILE NAME: F30

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	98.40	80.02	1 RCB	10.00	6.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: F30 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.88	50	50	0	0	0	0	0	0	1
102.20	100	100	0	0	0	0	0	0	1
102.88	150	150	0	0	0	0	0	0	1
103.52	200	200	0	0	0	0	0	0	1
104.09	250	250	0	0	0	0	0	0	1
104.63	300	300	0	0	0	0	0	0	1
105.15	350	350	0	0	0	0	0	0	1
105.66	400	400	0	0	0	0	0	0	1
106.18	450	450	0	0	0	0	0	0	1
106.60	490	490	0	0	HW/D=1.1	0	0	0	1
110.00	753	753	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: F30 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.88	0.00	50	0	0.00
102.20	0.00	100	0	0.00
102.88	0.00	150	0	0.00
103.52	0.00	200	0	0.00
104.09	0.00	250	0	0.00
104.63	0.00	300	0	0.00
105.15	0.00	350	0	0.00
105.66	0.00	400	0	0.00
106.18	0.00	450	0	0.00
106.60	0.00	490	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

```
CURRENT DATE: 05-21-2004                                  FILE DATE: 05-19-2004
CURRENT TIME: 09:33:34                                    FILE NAME: F30
```

```
******************************************************************************
*************************          CULVERT #  1       *************************
******************************************************************************
```

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	98.40	0.00	-1.60	0-NF	0.00	100.00	0.00	0.00
50	101.88	99.20	1.39	1.88	6-FF	0.00	0.00	0.00	5.43
100	102.20	99.54	2.20	2.20	6-FF	0.00	0.00	0.00	11.74
150	102.88	99.80	2.88	2.51	6-FF	0.00	0.00	0.00	12.99
200	103.52	100.01	3.52	2.83	6-FF	0.00	0.00	0.00	13.95
250	104.09	100.20	4.09	3.16	6-FF	0.00	0.00	0.00	14.68
300	104.63	100.36	4.63	3.52	6-FF	0.00	0.00	0.00	15.29
350	105.15	100.51	5.15	3.90	6-FF	0.00	0.00	0.00	15.82
400	105.66	100.65	5.66	4.31	6-FF	0.00	0.00	0.00	16.31
450	106.18	100.78	6.18	4.74	6-FF	0.00	0.00	0.00	16.77
490	106.60	100.87	6.60	5.11	6-FF	0.00	0.00	0.00	17.08

```
El. inlet face invert      100.00 ft   El. outlet invert     98.40 ft
El. inlet throat invert      0.00 ft   El. inlet crest        0.00 ft

******************************************************************************

***** SITE DATA ***** CULVERT INVERT **************
      INLET STATION (FT)                           100.00
      INLET ELEVATION (FT)                         100.00
      OUTLET STATION (FT)                          180.00
      OUTLET ELEVATION (FT)                         98.40
      NUMBER OF BARRELS                              1.00
      SLOPE (V-FT/H-FT)                              0.0200
      CULVERT LENGTH ALONG SLOPE (FT)               80.02

***** CULVERT DATA SUMMARY ************************
      BARREL SHAPE          BOX
      BARREL SPAN            10.00 FT
      BARREL RISE             6.00 FT
      BARREL MATERIAL       CONCRETE
      BARREL MANNING'S N    0.012
      INLET TYPE            CONVENTIONAL
      INLET EDGE AND WALL   SQUARE EDGE (30-75 DEG. FLARE)
      INLET DEPRESSION      NONE

******************************************************************************
```

C RENT DATE: 05-21-2004 FILE DATE: 05-19-2004
(RENT TIME: 09:33:34 FILE NAME: F30

****
************************* TAILWATER *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	98.40
CULVERT NO.1 OUTLET INVERT ELEVATION	98.40 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	98.40	0.000	0.00	0.00
50.00	99.20	0.841	4.26	0.99
100.00	99.54	0.857	5.20	1.43
150.00	99.80	0.865	5.81	1.75
200.00	100.01	0.872	6.29	2.02
250.00	100.20	0.878	6.68	2.25
300.00	100.36	0.882	7.01	2.45
350.00	100.51	0.886	7.31	2.64
400.00	100.65	0.889	7.57	2.81
450.00	100.78	0.892	7.80	2.97
490.00	100.87	0.894	7.98	3.09

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

DB 28 Research Parkway
outlet from det. basin

CURRENT DATE: 05-19-2004
CURRENT TIME: 18:03:27

FILE DATE: 05-19-2004
FILE NAME: DB28

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	95.20	240.05	1 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: DB28 DATE: 05-19-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
102.03	60	60	0	0	0	0	0	0	1
103.20	120	120	0	0	0	0	0	0	1
104.23	180	180	0	0	0	0	0	0	1
105.33	240	240	0	0	0	0	0	0	1
106.62	300	300	0	0	0	0	0	0	1
108.18	360	360	0	0	0	0	0	0	1
110.04	420	420	0	0	0	0	0	0	1
112.25	480	480	0	0	0	0	0	0	1
114.97	540	540	0	0	0	0	0	0	1
116.45	570	570	0	0	0	0	0	0	1
120.00	636	636	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: DB28 DATE: 05-19-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
102.03	0.00	60	0	0.00
103.20	0.00	120	0	0.00
104.23	0.00	180	0	0.00
105.33	0.00	240	0	0.00
106.62	0.00	300	0	0.00
108.18	0.00	360	0	0.00
110.04	0.00	420	0	0.00
112.25	0.00	480	0	0.00
114.97	0.00	540	0	0.00
116.45	0.00	570	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 18:03:27 FILE NAME: DB28

****
************************* CULVERT # 1 **************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	95.20	0.00	-4.80	0-NF	0.00	100.00	0.00	0.00
60	102.03	96.08	2.03	-2.08	6-FF	0.00	0.00	0.00	11.82
120	103.20	96.45	3.20	-1.37	6-FF	0.00	0.00	0.00	15.22
180	104.23	96.73	4.23	-0.47	6-FF	0.00	0.00	0.00	16.31
240	105.33	96.96	5.33	0.63	6-FF	0.00	0.00	0.00	17.63
300	106.62	97.16	6.62	1.94	6-FF	0.00	0.00	0.00	18.64
360	108.18	97.34	8.18	3.48	6-FF	0.00	0.00	0.00	19.45
420	110.04	97.50	10.04	5.04	6-FF	0.00	0.00	0.00	20.20
480	112.25	97.65	12.25	6.83	6-FF	0.00	0.00	0.00	20.91
540	114.97	97.79	14.97	8.85	6-FF	0.00	0.00	0.00	21.72
570	116.45	97.85	16.45	9.95	6-FF	0.00	0.00	0.00	22.13

El. inlet face invert 100.00 ft El. outlet invert 95.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	340.00
OUTLET ELEVATION (FT)	95.20
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	240.05

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	4.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-19-2004
RENT TIME: 18:03:27

FILE DATE: 05-19-2004
FILE NAME: DB28

****
*************************   TAILWATER   *************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	95.20
CULVERT NO.1 OUTLET INVERT ELEVATION	95.20 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	95.20	0.000	0.00	0.00
60.00	96.08	0.845	4.49	1.09
120.00	96.45	0.861	5.47	1.56
180.00	96.73	0.870	6.11	1.91
240.00	96.96	0.877	6.61	2.20
300.00	97.16	0.882	7.01	2.45
360.00	97.34	0.886	7.36	2.67
420.00	97.50	0.890	7.66	2.87
480.00	97.65	0.894	7.94	3.06
540.00	97.79	0.897	8.19	3.23
570.00	97.85	0.899	8.30	3.31

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	120.00

****

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP	JOB NO. 03094	PAGE 1
PROJECT	DATE CHECKED	DATE 5/19/04
DETAIL	CHECKED BY	COMPUTED BY TANW

Channel Design - Basin 'F'

Design guidelines.

Side Tributaries : Try to get 5-year velocity 5 fps or less for grasslined.

Try to get 100 year velocity ≤ 7 fps for grasslined /w riprap invert. > 7 fps, need riprap sides.

- Since perimeter of Wolf Ranch is low density (ie, 2.5 ac and greater lots), natural drainageways could be left as is. Check structures @ most along steep sections.

"Nat. Drainageway"	Ex. Slope	τ @ 1' depth (1)
SB F-8	.04	2.5
~~SB F-8a~~	~~.027~~	~~1.5~~
F9	.057	3.6
F10	.04	2.5
F11	.038	2.4
F12	.042	2.6
F12A	.036	2.2
F13	.05	3.1
F7	.031	1.9
F14	.042	2.6

$\tau = \gamma d s = 8 s$ for $d = 1'$

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP — JOB NO. 03094 — PAGE 2

PROJECT: — DATE CHECKED: — DATE:

DETAIL: — CHECKED BY: — COMPUTED BY:

- Channel SB F-8 Q_{100} = 69 cfs τ = 2.5 @ 12"
  69 cfs would be < 12" deep ∴ τ < 2.5
  recommend leave as is.

~~- Channel SB F-2? τ < 2.1 allowable for grassl lined~~
~~∴ leave as is.~~

- Channel F9 Q_{100} = 152 cfs
  drainageway is very wide, > 50 BW
  ∴ τ << 3.6 ∴ leave as is.

- Channel F10: Q_{100} = 48 cfs τ = 2.5 psf
  low flow, τ << 2.5 ∴ leave as is.

- Channel F11: Q_{100} = 102 cfs τ = 2.4 psf
  d << 12" ∴ τ < 2.4
  ∴ leave as is.

- Channel F12: Q_{100} = 144 cfs τ = 2.6 psf
  very broad flow path, >> 50'
  ∴ d << 12", τ << 2.6 ∴ leave as is

- Channel 12A: Q_{100} = 51 cfs τ = 2.2 psf
  very broad flow path; >> 50'
  ∴ d << 12", τ << 2.2 psf
  ∴ leave as is.

- channel F13 : Q_{100} = 21 cfs τ = 3.1
  very low flows; may be a roadside swale.
  w/ d = .5 (dc for 21 cfs) τ = 1.55 psf
  ∴ leave as is or grasslined swale.

Improved drainageways

- F8 (to confluence w/ F19)
  Q_5 range 15 → 25 cfs ±
  Q_{100} range. 69 cfs → 80 cfs ±
  Slope = .037 %
  - area has broad flow path; cutting through low density residential
  ∴ use BW 15'
  5 yr Velocity = 4.2 cfps ∴ ok for grasslined
  100 yr = 6.1 fps " need riprap inset

  No grade control proposed.

- F19 Q_5 = 18 → 56
  Q_{100} = 152 → 338 cfs S = .035 %
  Fairly defined flowpath. use BW = 20'
  @ S = .035, V_5 = 5.2 fps ∴ no good.
  Flatten w/ grade control.
  @ S = 2.5% V_5 4.8 ok, V_{100} = 8 fps ∴ no good
  flatten to 1.8% V_5 = 4 V_{100} = 7.2 ok

F19 cont'd.

Grade control. Design Slope = 1.8% L = 1850'
Ex Slope = 3.5%

∴ ΔH = 1850 (.035 - .018) = 31.5' Say 32

Assume 6' of drop into DB forebay(s)

∴ 32 - 6 = 26' 9 drops/checks

Spacing @ 3' each 1850/9 = 205'

Spacings @ 200' int.

F18A: Q_5 = 16 L = 1100'
Q_{100} = 48.

wide flow path. use BW = 15'

Slope ex. = .05'/1

100 year velocity w/ 15' BW = 5.9 ∴ ok
5 year velocity = 3.1 ∴ ok

No grade control required

F18: Q_5 = 13, Q_{100} = 102 @ u/s. L = 1500'

Q_5 = F10 + F11 = 6 + 13 = 19 cfs
Q_{100} = 48 + 102 = 150 cfs.

Slope = 50/1500 = .033'/1

Assume 6' of drop can be achieved in DB forebays

∴ ΔH = 50 - 6 = 44

∴ S = 44/1500 = .029'/1 V_5 = 3.7 fps
V_{100} = 6.9 fps ∴ ok

F17

Q_5 = 24 cfs + SB F17 = 24 + 3 = 27 cfs L = 1600'

Q_{100} = 236 cfs + 25 cfs = 261 cfs.

S = 54/1600 = .034'/'

Assume 6' of drop into DB Forebays.

∴ S_{eff} = 54-6/1600 = .03'/'

@ Slope = .03'/', V_{100} w/ 15' BW = 8.5 fps. no good.

Flatten with grade control:

@ S = .02'/', V_{100} = 7.1 fps ∴ ok,

V_5 = 3.5 fps ∴ ok

Required grade control:

ΔS = .03-.02 = .01 × L = 16'

@ 3'/drop, need 3.1 drops, say 3

Spacing = 1600/3 = 533'

E16 This would be piped to DB18

Q_{100} = 31 cfs

w/ 2% Storm Sewer Slope need 24" RCP.

Lower Portion, F14/F7

Q_5 = RF14 + RF7 = 5 + 2 = 7 cfs
Q_{100} = 53 + 30 = 83 cfs   L = 750'
S = 46.24/750' = .029'/'
w/ 10 BW, S = 2.9% V_5 = 3 fps ∴ ok
V_{100} = 7.1 fps ∴ ok

No grade control required.

F23

Q_5 = 6 → 16
Q_{100} = 26 → 69   L = 1050'
S = 28/1050 = .027'/'
w/ 10' BW, V_5 = 3.5 fps ∴ ok
V_{100} = 5.7 fps ∴ ok

no grade control req'd.

F24

Q_5 = 16 → 44
Q_{100} = 69 → 181   L = 2200'
S = 60/2200 = .027'/'
w/ 15' BW, V_5 = 4.5 fps V_{100} = 7.1 ∴ ok

no grade control req'd.

F25

$Q_5 = 45 \rightarrow 66$

$Q_{100} = 210 \rightarrow 303$ L = 2400'

S = 66/2400 = .028'/1

w/ BW = 20', S = .028, V_{100} = 8.2 ∴ no good

Try S = .018, V_{100} = 6.4 fps ∴ ok.

V_5 =

Need Grade control

ΔS = .028 - .018 = .01 x L = 24'

w/ 3' per GC, Need 8 drop/checks.

Spacing @ 300' int.

F30

Q_5 = 66 L = 900'

Q_{100} = 303

S = 28/900 = .031'/1

Use same section as F25

S req'd = 1.8% for V_{100} < 7 fps.

∴ (.031 - .018)900 = 11.7' say 12

Need 4, 3' GC/drops

Spacing 900/4 = 225'

Kiowa Engineering Corporation

CLIENT: WOLF Ranch MDDP JOB NO. 03094 PAGE 8
PROJECT: DATE CHECKED: DATE 5/19/04
DETAIL: CHECKED BY: COMPUTED BY: [illegible]

F29 $Q_5 = 112$ $Q_{100} = 490$ $L = 750'$

$S = \frac{30-00}{750} = .04'/'$

try BW = 20', Velocity$_{100}$ = 10.5 fps ∴ no good.
cut to 2%, still need riprap. V_{100} = 8.2 fps.
go with riprap swale.

GC: ΔS = .04 − .02 = .02 × L = 15'
∴ need 5, 3' drops @ 150' interval. to close.
use 2 - 6' sloping drops.
∴ Slope of channel =
750 (.04 − x) = 12'
x = .024'/'

Riprap Size
$VS^{.17}/1.36 = 8.8(.024)^{.17} / 1.36$
= 3.4
Type 'L'

~~**F21** Q_5 = 45 → 120 Q_{100} = 140 → 313 L = 1750'~~

~~S = 50/1750 = .029'/'~~

~~Try BW = 20'; @ S = .029, V_{100} = 8.2 ∴ no good~~
~~w/ S = 1.8% V_{100} = 6.9 fps ∴ ok~~

~~GC: (.029 − .018) 1750 = .011(1750) = 19.25~~
~~say 21:~~
~~w/ 3'/GC, need 7 drops : Int = 1750/7 = 250'~~

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP JOB NO. 03094 PAGE 9
PROJECT: DATE CHECKED: DATE 5/19/04
DETAIL: CHECKED BY: COMPUTED BY: [illegible]

F22 $Q_5 = 20 + 1/2\ \overset{SB}{F22} = 20 + 1/2(7) = 24$ cfs

$Q_{100} = 89 + 1/2\ \overset{SB}{F22} = 89 + 1/2(51) = 115$ cfs

$L = 1850'$ $S = 60/1850 = .032'/'$

Try $BW = 15'$, $S = .032'/'$, $V_{100} = 6.5$ ∴ ok $V_5 =$
no gc required

F22A $Q_5 = 26 + 1/2$ SB F22 $= 30$ cfs

$Q_{100} = 141 + 1/2$ SB F22 $= 167$ cfs

$L = 2050'$ $S = 60/2050 = .029'/'$

Try 20' BW, $S = .029'/'$ $V_{100} = 6.7$ ∴ ok

$V_5 = 3.7$ fps ∴ ok

No GC req'd.

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F8: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	25 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	3.7 %
Depth of Flow	0.40 ft	Manning's Roughness Coef.	0.035

Channel Area	6.6 sf
Channel Wetted Perimeter	18.3 ft
Hydraulic Radius	0.36 ft

Channel Flow Velocity	4.2 ft/sec
Channel Flow Capacity	28 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.48 ft
Top Width	26.8 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Structure F8: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	80 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	3.7 %
Depth of Flow	0.75 ft	Manning's Roughness Coef.	0.035

Channel Area	13.5 sf
Channel Wetted Perimeter	21.2 ft
Hydraulic Radius	0.64 ft

Channel Flow Velocity	6.1 ft/sec
Channel Flow Capacity	82 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.89 ft
Top Width	30.1 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Structure F19: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	56 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	1.8 %
Depth of Flow	0.65 ft	Manning's Roughness Coef.	0.035

Channel Area	14.7 sf
Channel Wetted Perimeter	25.4 ft
Hydraulic Radius	0.58 ft

Channel Flow Velocity	4.0 ft/sec
Channel Flow Capacity	58 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.74 ft
Top Width	33.9 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\,S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\,S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F19: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	338 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	1.8 %
Depth of Flow	1.80 ft	Manning's Roughness Coef.	0.035

Channel Area	49.0 sf
Channel Wetted Perimeter	34.8 ft
Hydraulic Radius	1.41 ft

Channel Flow Velocity	7.2 ft/sec
Channel Flow Capacity	351 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	3.02 ft
Top Width	44.1 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F18A: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	6 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	5.0 %
Depth of Flow	0.20 ft	Manning's Roughness Coef.	0.035

Channel Area	3.2 sf
Channel Wetted Perimeter	16.6 ft
Hydraulic Radius	0.19 ft

Channel Flow Velocity	3.1 ft/sec
Channel Flow Capacity	10 cfs
Capacity Check	Okay

Freeboard	1.0 ft
Swale Depth	1.25 ft
Top Width	25.0 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F18A: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	48 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	5.0 %
Depth of Flow	0.55 ft	Manning's Roughness Coef.	0.035

Channel Area	9.5 sf
Channel Wetted Perimeter	19.5 ft
Hydraulic Radius	0.48 ft

Channel Flow Velocity	5.9 ft/sec
Channel Flow Capacity	56 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.67 ft
Top Width	28.4 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F18: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	19 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.9 %
Depth of Flow	0.40 ft	Manning's Roughness Coef.	0.035

Channel Area	6.6 sf
Channel Wetted Perimeter	18.3 ft
Hydraulic Radius	0.36 ft

Channel Flow Velocity	3.7 ft/sec
Channel Flow Capacity	24 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.47 ft
Top Width	26.7 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F18: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	150 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.9 %
Depth of Flow	1.15 ft	Manning's Roughness Coef.	0.035

Channel Area	22.5 sf
Channel Wetted Perimeter	24.5 ft
Hydraulic Radius	0.92 ft

Channel Flow Velocity	6.9 ft/sec
Channel Flow Capacity	155 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.33 ft
Top Width	33.6 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F17: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	27 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.0 %
Depth of Flow	0.50 ft	Manning's Roughness Coef.	0.035

Channel Area	8.5 sf
Channel Wetted Perimeter	19.1 ft
Hydraulic Radius	0.44 ft

Channel Flow Velocity	3.5 ft/sec
Channel Flow Capacity	30 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.57 ft
Top Width	27.6 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F17: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	261 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.0 %
Depth of Flow	1.70 ft	Manning's Roughness Coef.	0.035

Channel Area	37.1 sf
Channel Wetted Perimeter	29.0 ft
Hydraulic Radius	1.28 ft

Channel Flow Velocity	7.1 ft/sec
Channel Flow Capacity	263 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.91 ft
Top Width	38.3 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F14: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	7 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.9 %
Depth of Flow	0.30 ft	Manning's Roughness Coef.	0.035

Channel Area	3.4 sf
Channel Wetted Perimeter	12.5 ft
Hydraulic Radius	0.27 ft

Channel Flow Velocity	3.0 ft/sec
Channel Flow Capacity	10 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.35 ft
Top Width	20.8 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\,S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\,S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F14: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	83 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.9 %
Depth of Flow	0.95 ft	Manning's Roughness Coef.	0.029

Channel Area	13.1 sf
Channel Wetted Perimeter	17.8 ft
Hydraulic Radius	0.74 ft

Channel Flow Velocity	7.1 ft/sec
Channel Flow Capacity	93 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.13 ft
Top Width	27.0 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F23: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	16 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	0.40 ft	Manning's Roughness Coef.	0.035

Channel Area	4.6 sf
Channel Wetted Perimeter	13.3 ft
Hydraulic Radius	0.35 ft

Channel Flow Velocity	3.5 ft/sec
Channel Flow Capacity	16 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.46 ft
Top Width	21.7 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\,S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\,S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F23: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	69 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	0.95 ft	Manning's Roughness Coef.	0.035

Channel Area	13.1 sf
Channel Wetted Perimeter	17.8 ft
Hydraulic Radius	0.74 ft

Channel Flow Velocity	5.7 ft/sec
Channel Flow Capacity	75 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	2.09 ft
Top Width	26.7 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F24: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	44 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	0.60 ft	Manning's Roughness Coef.	0.035

Channel Area	10.4 sf
Channel Wetted Perimeter	19.9 ft
Hydraulic Radius	0.52 ft

Channel Flow Velocity	4.5 ft/sec
Channel Flow Capacity	47 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.70 ft
Top Width	28.6 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F24: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	181 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	1.30 ft	Manning's Roughness Coef.	0.035

Channel Area	26.3 sf
Channel Wetted Perimeter	25.7 ft
Hydraulic Radius	1.02 ft

Channel Flow Velocity	7.1 ft/sec
Channel Flow Capacity	186 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.49 ft
Top Width	34.9 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP

Swale Capacity Calculation

Structure F25: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	66 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	1.8 %
Depth of Flow	0.70 ft	Manning's Roughness Coef.	0.035

Channel Area	16.0 sf
Channel Wetted Perimeter	25.8 ft
Hydraulic Radius	0.62 ft

Channel Flow Velocity	4.1 ft/sec
Channel Flow Capacity	66 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.79 ft
Top Width	34.3 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F25: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	303 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	1.8 %
Depth of Flow	1.70 ft	Manning's Roughness Coef.	0.035

Channel Area	45.6 sf
Channel Wetted Perimeter	34.0 ft
Hydraulic Radius	1.34 ft

Channel Flow Velocity	6.9 ft/sec
Channel Flow Capacity	316 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.91 ft
Top Width	43.3 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Structure F29: Riprap channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	490 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	2.4 %
Depth of Flow	2.00 ft	Manning's Roughness Coef.	0.035

Channel Area	56.0 sf
Channel Wetted Perimeter	36.5 ft
Hydraulic Radius	1.53 ft

Channel Flow Velocity	8.8 ft/sec
Channel Flow Capacity	491 cfs
Capacity Check	Okay

Freeboard	1.3 ft
Swale Depth	3.28 ft
Top Width	46.2 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F22: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	24 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	3.2 %
Depth of Flow	0.40 ft	Manning's Roughness Coef.	0.035

Channel Area	6.6 sf
Channel Wetted Perimeter	18.3 ft
Hydraulic Radius	0.36 ft

Channel Flow Velocity	3.9 ft/sec
Channel Flow Capacity	26 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.47 ft
Top Width	26.8 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F22: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	115 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	3.2 %
Depth of Flow	0.95 ft	Manning's Roughness Coef.	0.035

Channel Area	17.9 sf
Channel Wetted Perimeter	22.8 ft
Hydraulic Radius	0.78 ft

Channel Flow Velocity	6.5 ft/sec
Channel Flow Capacity	115 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.11 ft
Top Width	31.9 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\,S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\,S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F22A: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	30 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	2.9 %
Depth of Flow	0.40 ft	Manning's Roughness Coef.	0.035

Channel Area	8.6 sf
Channel Wetted Perimeter	23.3 ft
Hydraulic Radius	0.37 ft

Channel Flow Velocity	3.7 ft/sec
Channel Flow Capacity	32 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.47 ft
Top Width	31.8 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure F22A: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	167 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	2.9 %
Depth of Flow	1.05 ft	Manning's Roughness Coef.	0.035

Channel Area	25.4 sf
Channel Wetted Perimeter	28.7 ft
Hydraulic Radius	0.89 ft

Channel Flow Velocity	6.7 ft/sec
Channel Flow Capacity	170 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.22 ft
Top Width	37.8 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

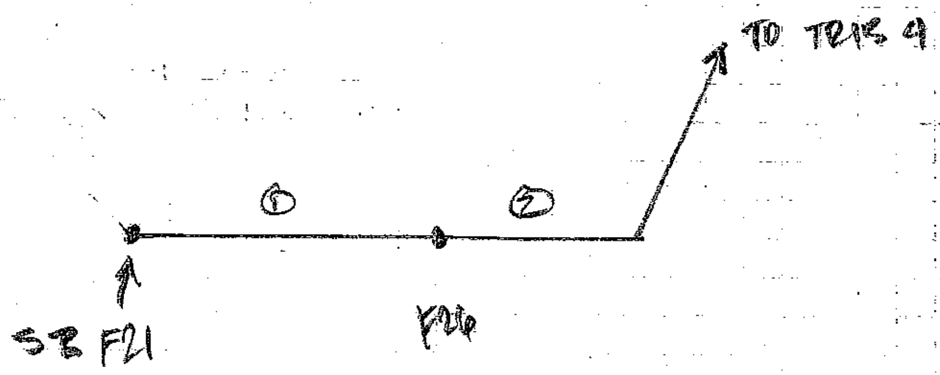
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP   JOB NO. 03094   PAGE 1
PROJECT: DATE CHECKED: DATE 5/19/04
DETAIL: CHECKED BY: COMPUTED BY: [illegible]

Outfall Storm Sewer, Basin 'F'



Flow Summary

	Q_{100}	
@ SB F21	184 cfs → 235	½ to DP F26
@ DP F26	285 cfs.	
@ DP F27	294 cfs	

Segment ① Q_{100} = 184 cfs

assume 1.8% Pipe Slope ∴ 48" RCP, Q_{full} = 193 cfs ∴ ok

Segment ② Q_{100} = 294 cfs → 285 @ Trib 4

Should be able to steepen slope to 2.5 → 3%

∴ 54" @ 2.2% ≈ Q_{full} = 292 cfs ∴ ok

~~Segment ③ Q_{100} = 110 → 313 cfs.~~

~~SB F21 @ 2.0% Q_{full} for 42" RCP = 149 cfs ∴ ok~~

~~[illegible] to [illegible] 2.0% [illegible] Q = 70 cfs. 36" RCP @ 2.0 = 91 cfs ∴ ok~~

G-Basin Detention

Total Area @ DP G : = .32 sm = 205 Ac

Q_5 Ex = 13 cfs Q_{100} Ex = 155 cfs

CN = 61   Runoff = .2" 5 year
1.02" 100 year

- Developed

Q_5 = 80 cfs Q_{100} = 305

Drainage Area .45 sm @ DP G = 288 Ac

Wtd CN: $\frac{.081(61) + .035(73) + .177(73) + .153(78.4)}{.45} = 72.0$

∴ Runoff = 5 year = .53"   100 year = 1.75"

- Existing Volume of Runoff

5 year : (205 Ac) .2"/12 = 3.4 Ac-Ft
100 year (205 Ac) 1.02"/12 = 17.4 Ac-Ft

- Developed Runoff Volume :

5-year = 288 Ac (.53/12) = 12.7 AF
100-year = 288 (1.75/12) = 42.0 AF

∴ Required Storage Volume in Basin

5 year = 12.7 - 3.4 = 9.3 AF ←
100 year = 42.0 - 17.4 = 24.6 AF ←

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 2
PROJECT DATE CHECKED DATE 5/20/04
DETAIL CHECKED BY COMPUTED BY RJW

Place Single detention basin @ DP G3

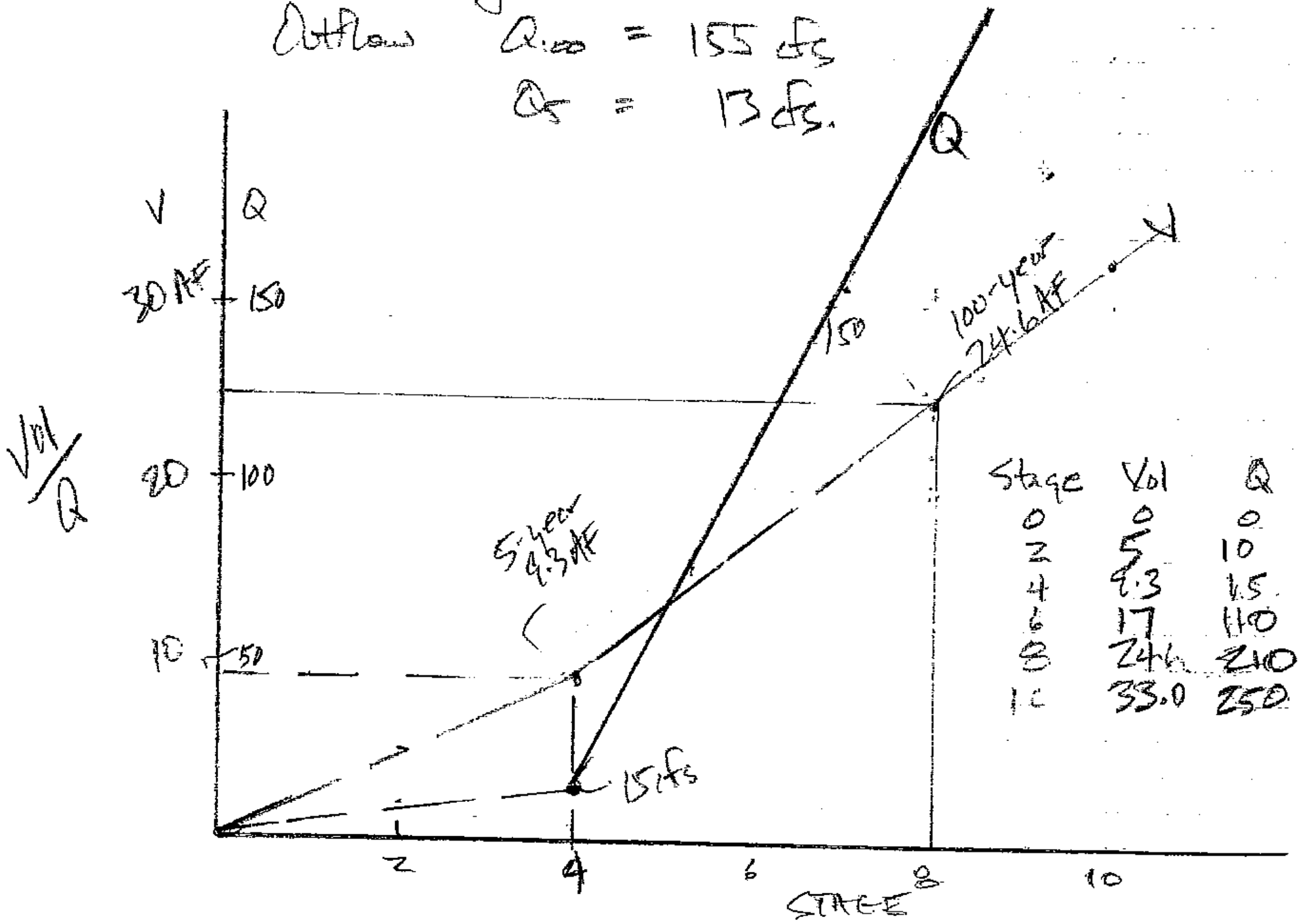
Need to reduce 100 year flow to ≥

Q_{100} @ DP G3 = 278 cfs
SB G-5 Q_{100} = 230 cfs
} DPG = 489 cfs

Required @ DP G = 155 cfs ; can't be done ∴ will need det in SB G-5

Size single facility @ DP G.

Outflow Q_{100} = 155 cfs
Q_5 = 13 cfs.



Stage	Vol	Q
0	0	0
2	5	10
4	9.3	15
6	17	110
8	24.6	210
10	33.0	250

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP   JOB NO.: 03094   PAGE: 1
PROJECT: DATE CHECKED: DATE: 5/20/05
DETAIL: CHECKED BY: COMPUTED BY: RDW

G-Basin Hydraulics

Outfall Channels

Use same criteria as previous basins.

G3

$Q_5 = 12 + 1/2(G3) = 12 + 25 = 37$ cfs

$Q_{100} = 45 + 100 = 145$ cfs

$L = 3150'$ $S = \frac{164 - 82}{3150} = .026'/1$

w/ BW = 15', S = .026 $V_{100} = 6.5$ fps ∴ ok

$V_5 = 4.2$ fps ∴ ok

No grade control required.

G2

$Q_5 = SBG1 + 1/2 G3 = 5 + 25 = 30$ cfs

$Q_{100} = 50 + 100 = 150$ cfs

$L = 3250'$ $S = (166 - 82)/3250 = .026'/1$

w/ 15' BW; S = .026'/1 $V_{100} = 6.7$ fps ∴ ok

$V_5 = 4.0$ fps ∴ ok

No grade control Req'd.

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP — JOB NO. 03041 — PAGE 2
PROJECT — DATE CHECKED — DATE 5/20/04
DETAIL — CHECKED BY — COMPUTED BY RJW

__G5__

$Q_5 = 57 + 1/2(G\cdot5) = 57+37 = 94$ cfs L=1850'

$Q_{100} = 278 + 1/2(G\cdot5) = 278+115 = 393$ cfs

$S = 50/1850 = .027'/'$

try BLW: w/ S = .027'/' V_{100} = 8.6 fps, too high

use S = .02 V > 8'

w/ S = 1.5% V_{100} = 7.0 fps ∴ ok

V_5 = 4.5 fps ∴ ok

__Grade control req'd.__

$\Delta S = .027 - .015 = .012'/' \times L = 22.2'$ say 24

w each drop = 3', 8' checks

spacing 1850/8 = 230' interval

Wolf Ranch MDDP
Swale Capacity Calculation

Structure G3: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	37 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.6 %
Depth of Flow	0.55 ft	Manning's Roughness Coef.	0.035

Channel Area	9.5 sf
Channel Wetted Perimeter	19.5 ft
Hydraulic Radius	0.48 ft

Channel Flow Velocity	4.2 ft/sec
Channel Flow Capacity	40 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.64 ft
Top Width	28.1 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure G3: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	145 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.6 %
Depth of Flow	1.15 ft	Manning's Roughness Coef.	0.035

Channel Area	22.5 sf
Channel Wetted Perimeter	24.5 ft
Hydraulic Radius	0.92 ft

Channel Flow Velocity	6.5 ft/sec
Channel Flow Capacity	146 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.32 ft
Top Width	33.6 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3}S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure G2: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	30 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.6 %
Depth of Flow	0.50 ft	Manning's Roughness Coef.	0.035

Channel Area	8.5 sf
Channel Wetted Perimeter	19.1 ft
Hydraulic Radius	0.44 ft

Channel Flow Velocity	4.0 ft/sec
Channel Flow Capacity	34 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	1.58 ft
Top Width	27.6 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\, S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\, S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure G2: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	150 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.6 %
Depth of Flow	1.20 ft	Manning's Roughness Coef.	0.035

Channel Area	23.8 sf
Channel Wetted Perimeter	24.9 ft
Hydraulic Radius	0.95 ft

Channel Flow Velocity	6.7 ft/sec
Channel Flow Capacity	158 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.38 ft
Top Width	34.0 ft

Equations:

Area (A) = b(d)
- b = width
- d = depth

Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
- z = side slope

Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
- Slope (S) = Slope of the channel
- n = Manning's number
- R_n = Hydraulic Radius (Reynold's Number)

Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$

Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure G5: Grasslined channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	94 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	1.5 %
Depth of Flow	0.95 ft	Manning's Roughness Coef.	0.035

Channel Area	22.6 sf
Channel Wetted Perimeter	27.8 ft
Hydraulic Radius	0.81 ft

Channel Flow Velocity	4.5 ft/sec
Channel Flow Capacity	103 cfs
Capacity Check	Okay

Freeboard	1.1 ft
Swale Depth	2.06 ft
Top Width	36.5 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3} S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3} S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

Structure G5: Grasslined channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	393 cfs	Channel Side Slope	4:1
Bottom Width	20.0 ft	Channel Longitudinal Slope	1.5 %
Depth of Flow	2.05 ft	Manning's Roughness Coef.	0.035

Channel Area	57.8 sf
Channel Wetted Perimeter	36.9 ft
Hydraulic Radius	1.57 ft

Channel Flow Velocity	7.0 ft/sec
Channel Flow Capacity	407 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	3.27 ft
Top Width	46.2 ft

Equations:

Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

Velocity = $(1.49/n)R_n^{2/3}\ S^{1/2}$
Slope (S) = Slope of the channel
n = Manning's number
R_n = Hydraulic Radius (Reynold's Number)
Flow = $(1.49/n)AR_n^{2/3}\ S^{1/2}$
Freeboard = $1.0+0.025(v)d^{0.33}$

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDDP JOB NO.: 03094 PAGE:
PROJECT: DATE CHECKED: DATE: 5/28/04
DETAIL: CHECKED BY: COMPUTED BY: [illegible]

Pipe Alternative, Reach G5

Q_{100} = 277 @ Research to 393 @ DB G

use RCP ; S = 2.2% same as channel.

W/ S = 2.2% 60" RCP Q_{full} = 386 cfs : ok

G3 @ Briargate Blvd.

CURRENT DATE: 05-24-2004
CURRENT TIME: 17:31:53

Q=277 cfs

FILE DATE: 05-24-2004
FILE NAME: G3

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	96.80	160.03	1 RCB	10.00	5.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: G3 DATE: 05-24-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
100.94	28	28	0	0	0	0	0	0	1
101.49	56	56	0	0	0	0	0	0	1
101.96	84	84	0	0	0	0	0	0	1
102.37	112	112	0	0	0	0	0	0	1
102.77	140	140	0	0	0	0	0	0	1
103.14	168	168	0	0	0	0	0	0	1
103.48	196	196	0	0	0	0	0	0	1
103.81	224	224	0	0	0	0	0	0	1
104.13	252	252	0	0	0	0	0	0	1
104.41	277	277	0	0	0	0	0	0	1
110.00	663	663	0	0	0	0	0	OVERTOPPING	

HW/D = .88 o.k.

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: G3 DATE: 05-24-2004

HEAD ELEV (FT)	HEAD ERROR (FT)	TOTAL FLOW (CFS)	FLOW ERROR (CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
100.94	0.00	28	0	0.00
101.49	0.00	56	0	0.00
101.96	0.00	84	0	0.00
102.37	0.00	112	0	0.00
102.77	0.00	140	0	0.00
103.14	0.00	168	0	0.00
103.48	0.00	196	0	0.00
103.81	0.00	224	0	0.00
104.13	0.00	252	0	0.00
104.41	0.00	277	0	0.00

<1> TOLERANCE (FT) = 0.010
<2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-24-2004
CURRENT TIME: 17:31:53

FILE DATE: 05-24-2004
FILE NAME: G3

************************ CULVERT # 1 ************************

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	96.80	0.00	-3.20	0-NF	0.00	100.00	0.00	0.00
28	100.94	97.38	0.94	-0.38	6-FF	0.00	0.00	0.00	10.37
56	101.49	97.64	1.49	-0.17	6-FF	0.00	0.00	0.00	10.48
84	101.96	97.84	1.96	0.03	6-FF	0.00	0.00	0.00	12.82
112	102.37	98.01	2.37	0.22	6-FF	0.00	0.00	0.00	12.94
140	102.77	98.15	2.77	0.43	6-FF	0.00	0.00	0.00	13.90
168	103.14	98.28	3.14	0.64	6-FF	0.00	0.00	0.00	14.67
196	103.48	98.40	3.48	0.86	6-FF	0.00	0.00	0.00	15.33
224	103.81	98.51	3.81	1.09	6-FF	0.00	0.00	0.00	15.92
252	104.13	98.61	4.13	1.34	6-FF	0.00	0.00	0.00	16.31
277	104.41	98.69	4.41	1.57	6-FF	0.00	0.00	0.00	16.68

El. inlet face invert 100.00 ft   El. outlet invert 96.80 ft
El. inlet throat invert 0.00 ft   El. inlet crest 0.00 ft

****

** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	260.00
OUTLET ELEVATION (FT)	96.80
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0200
CULVERT LENGTH ALONG SLOPE (FT)	160.03

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	10.00 FT
BARREL RISE	5.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

****

CURRENT DATE: 05-24-2004
CURRENT TIME: 17:31:53

FILE DATE: 05-24-2004
FILE NAME: G3

****
************************** TAILWATER **************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	96.80
CULVERT NO.1 OUTLET INVERT ELEVATION	96.80 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	96.80	0.000	0.00	0.00
28.00	97.38	0.826	3.57	0.73
56.00	97.64	0.844	4.40	1.05
84.00	97.84	0.853	4.95	1.30
112.00	98.01	0.859	5.36	1.51
140.00	98.15	0.864	5.70	1.69
168.00	98.28	0.868	6.00	1.85
196.00	98.40	0.872	6.26	2.00
224.00	98.51	0.875	6.49	2.13
252.00	98.61	0.878	6.69	2.25
277.00	98.69	0.880	6.87	2.36

****
************************** ROADWAY OVERTOPPING DATA **************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	30.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

OUTLET DBG 9
54" RCP

CURRENT DATE: 07-02-2004
CURRENT TIME: 14:59:59

FILE DATE: 07-02-2004
FILE NAME: DBGOUT

FHWA CULVERT ANALYSIS
HY-8, VERSION 3.2

CULV #	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	100.00	95.00	80.16	1 RCP	4.50	4.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: DBGOUT DATE: 07-02-2004

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0	0	0	0	0	0	0	0	1
101.42	15	15	0	0	0	0	0	0	1
102.06	30	30	0	0	0	0	0	0	1
102.64	45	45	0	0	0	0	0	0	1
103.18	60	60	0	0	0	0	0	0	1
103.67	75	75	0	0	0	0	0	0	1
104.14	90	90	0	0	0	0	0	0	1
104.63	105	105	0	0	0	0	0	0	1
105.16	120	120	0	0	0	0	0	0	1
105.75	135	135	0	0	0	0	0	0	1
105.95	140	140	0	0	0	0	0	0	1
110.00	213	213	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: DBGOUT DATE: 07-02-2004

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
100.00	0.00	0	0	0.00
101.42	0.00	15	0	0.00
102.06	0.00	30	0	0.00
102.64	0.00	45	0	0.00
103.18	0.00	60	0	0.00
103.67	0.00	75	0	0.00
104.14	0.00	90	0	0.00
104.63	0.00	105	0	0.00
105.16	0.00	120	0	0.00
105.75	0.00	135	0	0.00
105.95	0.00	140	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-02-2004 FILE DATE: 07-02-2004
CURRENT TIME: 14:59:59 FILE NAME: DBGOUT

****
************************** CULVERT # 1 ***************************
****

PERFORMANCE CURVE FOR 1 BARREL(S)

Q (cfs)	HWE (ft)	TWE (ft)	ICH (ft)	OCH (ft)	FLOW TYPE	CCE (ft)	FCE (ft)	TCE (ft)	VO (fps)
0	100.00	95.00	0.00	-5.00	0-NF	0.00	100.00	0.00	0.00
15	101.42	95.15	1.42	-2.20	6-FF	0.00	0.00	0.00	12.55
30	102.06	95.23	2.06	-1.88	6-FF	0.00	0.00	0.00	16.17
45	102.64	95.30	2.64	-1.58	6-FF	0.00	0.00	0.00	17.11
60	103.18	95.36	3.18	-1.25	6-FF	0.00	0.00	0.00	18.20
75	103.67	95.41	3.67	-0.89	6-FF	0.00	0.00	0.00	18.93
90	104.14	95.45	4.14	-0.48	6-FF	0.00	0.00	0.00	19.49
105	104.63	95.50	4.63	-0.05	6-FF	0.00	0.00	0.00	19.94
120	105.16	95.54	5.16	0.43	6-FF	0.00	0.00	0.00	20.40
135	105.75	95.58	5.75	0.94	6-FF	0.00	0.00	0.00	20.85
140	105.95	95.59	5.95	1.12	6-FF	0.00	0.00	0.00	21.00

El. inlet face invert 100.00 ft El. outlet invert 95.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

*** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	100.00
OUTLET STATION (FT)	180.00
OUTLET ELEVATION (FT)	95.00
NUMBER OF BARRELS	1.00
SLOPE (V-FT/H-FT)	0.0625
CULVERT LENGTH ALONG SLOPE (FT)	80.16

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

****

""RENT DATE: 07-02-2004
(RENT TIME: 14:59:59

FILE DATE: 07-02-2004
FILE NAME: DBGOUT

****
************************   TAILWATER   ************************
****

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH (FT)	50.00
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.025
MANNING'S N (.01-0.1)	0.035
CHANNEL INVERT ELEVATION (FT)	95.00
CULVERT NO.1 OUTLET INVERT ELEVATION	95.00 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	VEL. (FPS)	SHEAR (PSF)
0.00	95.00	0.000	0.00	0.00
15.00	95.15	0.862	1.93	0.24
30.00	95.23	0.922	2.53	0.37
45.00	95.30	0.958	2.97	0.47
60.00	95.36	0.984	3.33	0.55
75.00	95.41	1.005	3.63	0.63
90.00	95.45	1.022	3.90	0.71
105.00	95.50	1.036	4.14	0.78
120.00	95.54	1.049	4.37	0.84
135.00	95.58	1.060	4.57	0.90
140.00	95.59	1.063	4.63	0.92

****
************************ ROADWAY OVERTOPPING DATA ************************
****

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH (FT)	25.00
CREST LENGTH (FT)	100.00
OVERTOPPING CREST ELEVATION (FT)	110.00

****

Kiowa Engineering Corporation

CLIENT: Wolf Ranch MDMP JOB NO. 03094 PAGE 1
PROJECT: DATE CHECKED: DATE 5/20/04
DETAIL: CHECKED BY: COMPUTED BY BAW

H/J Basin Hydraulics

H-1 outfall to Cottonwood Creek.

Q_{100} = 63 cfs

Assume 2%± Storm Sewer

∴ Need 30" RCP @ 2.4%

H-2: direct discharge to creek via onsite detention basin outlet structure(s).

J-1 : "

J-2 : "

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 1/2
PROJECT DATE CHECKED DATE 5/10/04
DETAIL CHECKED BY COMPUTED BY KJW

Prudent Line Estimation: Tributary 4

Per page 12 of the criteria, use method outlined in 3.3.

EROS. Setback = 2 (BH + ID) + VW

This is for erosion resistant materials. Our plan would be to line the outside bends ∴ creating a "eros. resistant" bank.

Assume ID = 2' at all XSECS.

XSEC	Max BH	ID	VW	E Setback
1	22'	2	95	140'
2	36'	2	65	140
3	22	2	95	140
4	22'	2	70	~~115~~ 120
5	12'	2	85	~~130~~ 115
6	16	2	80	115
11	16	2	55	115
12	16	2	140	175
13	22	2	75	125
14	12	2	60	90
15	14	2	65	100
16	12	2	60	90
17	10	2	45	70
18	10	2	50	75
19	10	2	35	60
20	10'	2	35	60

Kiowa Engineering Corporation

CLIENT
PROJECT
DETAIL

JOB NO. 03094
DATE CHECKED
CHECKED BY

PAGE 2/2
DATE 6/10/04
COMPUTED BY RW

PRODUCT LINE: COTTONWOOD

Same "erosion-resistant assumption as Trib 4

XSEC	MaxBH	ID (1)	YW	Eros. SB
1050.1	8'	4'	55	800
50.2	16'	4'	95'	135
50.3	20'	4'	80'	130
50.4	16'	4'	85'	125
50.5	32"	4'	70	140
60.1	28	4	140'	200
60.2	10'	↓	80'	110
60.3	14	↓	90'	125
60.4	32'	↓	55'	130
60.5	18	↓	70	115
60.6	24	↓	90'	145
60.7	18	↓	40'	85

(1) Assume constant 4' for Cottonwood; w/ gradecontrol in-place.

```
1*****************************************************
 *  WATER SURFACE PROFILES                            *
 *  VERSION OF SEPTEMBER 1988                         *
 *  ERROR: 01,02                                      *
 *  UPDATED:  4 APRIL    1989                         *
 *  RUN DATE     7/12/ 4   TIME   16:41:24            *
 *****************************************************

**************************************
*  U.S. ARMY CORPS OF ENGINEERS      *
*  THE HYDROLOGIC ENGINEERING CENTER *
*  609 SECOND STREET, SUITE D        *
*  DAVIS, CALIFORNIA 95616-4687      *
*  (916) 756-1104, (916) 551-1748    *
**************************************

X     X  XXXXXXX  XXXXX          XXXXX
X     X  X        X    X        X     X
X     X  X        X                   X
XXXXXXX  XXXX     X        XXXXX  XXXXX
X     X  X        X              X
X     X  X        X    X        X
X     X  XXXXXXX  XXXXX          XXXXXXX
```

END OF BANNER

1

7/12/ 4   16:41:24   PAGE   1

THIS RUN EXECUTED 7/12/ 4   16:41:24

```
*************************************************
  HEC2 RELEASE DATED SEP 88 UPDATED APR  1989

  ERROR CORR -  01,02
  MODIFICATION -
*************************************************
```

T1   WOLF RANCH MDDP, KIOWA ENGINEERING 2004 PN 03094
T2   100-YEAR DISCHARGES FROM DBPS X-SECTIONS L TO R LOOKING UPSTREAM
T3   COTTONWOOD CREEK FILENAME CC.DAT

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	2	0	0	0	0	0	0	6810	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1	0	-1	0	0	0	0	0	0	0

QT   1   3477

NC	0.020	0.020	0.045	0.100	0.300	0	0	0	0	0
	POWERS BOULEVARD									
X1	1040.1	14	1120	1204	0	0	0	0	0	0
GR	6860	1000	6838	1055	6836	1072	6824	1100	6822	1108
GR	6820	1120	6814	1130	6814	1140	6816	1165	6818	1204
GR	6826	1240	6834	1276	6840	1310	6846	1350		
QT	1	2733								
X1	1040.2	10	1055	1078	550	550	550	0	0	0
GR	6864	1000	6824	1055	6822	1060	6824	1068	6826	1078
GR	6828	1105	6830	1118	6838	1165	6850	1198	6854	1210
X1	1040.3	14	1195	1333	675	675	675	0	0	0
GR	6870	1000	6862	1045	6854	1150	6852	1170	6840	1195
GR	6838	1222	6834	1230	6836	1240	6838	1262	6840	1333
GR	6842	1355	6850	1410	6860	1423	6870	1462		
X1	1040.4	10	1127	1250	525	525	525	0	0	0
GR	6878	1000	6870	1050	6862	1127	6850	1155	6848	1180
GR	6846	1238	6862	1250	6872	1295	6874	1310	6876	1380
X1	1040.5	12	1142	1195	550	550	550	0	0	0
GR	6884	1000	6878	1050	6862	1115	6858	1142	6856	1165
GR	6854	1170	6852	1172	6854	1180	6856	1195	6860	1215
GR	6876	1230	6880	1290						
	COWPOKE ROAD									
X1	1050.1	12	1058	1160	785	785	785	0	0	0
GR	6898	1000	6890	1030	6880	1058	6874	1080	6868	1095
GR	6868	1105	6872	1112	6876	1140	6884	1160	6892	1200
GR	6894	1215	6896	1232						

X1	1050.2	11	1124	1215	400	400	400	0	0	0
GR	6904	1000	6894	1072	6886	1090	6884	1110	6880	1124
GR	6876	1148	6872	1162	6874	1178	6880	1215	6898	1230
GR	6910	1290								
X1	1050.3	8	1090	1175	405	405	405	0	0	0
GR	6910	1000	6882	1090	6880	1120	6878	1150	6880	1158
GR	6886	1175	6900	1195	6912	1275				
QT	1	857								
X1	1050.4	13	1100	1160	540	540	540	0	0	0
GR	6920	1000	6914	1035	6896	1050	6892	1075	6912	1090
GR	6912	1100	6892	1112	6890	1120	6890	1135	6892	1160
GR	6900	1205	6912	1228	6920	1278				
X1	1050.5	15	1262	1380	490	490	490	0	0	0

GR	6930	1000	6924	1045	6923	1065	6924	1080	6926	1110
GR	6926	1142	6920	1190	6912	1262	6904	1290	6902	1302
GR	6900	1318	6900	1358	6904	1366	6910	1380	6922	1405

CSAGRICULTURAL

X1	1060.1	11	1107	1275	580	580	580	0	0	0
GR	6934	1000	6924	1075	6922	1088	6922	1107	6910	1123
GR	6908	1130	6910	1140	6910	1253	6914	1275	6924	1293
GR	6934	1345								
X1	1060.2	11	1100	1215	428	428	428	0	0	0
GR	6940	1000	6930	1085	6922	1100	6916	1140	6912	1155
GR	6914	1160	6916	1180	6918	1205	6920	1215	6930	1228
GR	6934	1268								
X1	1060.3	15	1065	1245	562	562	562	0	0	0
GR	6944	1000	6942	1025	6940	1065	6922	1098	6920	1108
GR	6922	1118	6924	1152	6926	1192	6932	1220	6934	1245
GR	6934	1300	6936	1320	6942	1340	6944	1362	6950	1410
X1	1060.4	8	1052	1136	443	443	443	0	0	0
GR	6950	1000	6948	1018	6932	1052	6930	1082	6926	1092
GR	6928	1100	6940	1136	6950	1153				
X1	1060.5	9	1026	1115	517	517	517	0	0	0
GR	6960	1000	6958	1015	6950	1026	6938	1032	6936	1040
GR	6938	1048	6940	1097	6950	1115	6956	1150		
X1	1060.6	10	1070	1111	300	300	300	0	0	0
GR	6962	1000	6950	1030	6946	1045	6942	1070	6938	1076
GR	6937	1090	6938	1105	6940	1111	6954	1145	6960	1203

X1	1060.7	10	1103	1153	314	314	314	0	0	0
GR	6970	1000	6968	1060	6966	1078	6950	1103	6942	1118
GR	6941	1121	6942	1124	6948	1128	6950	1153	6966	1170

BLACK FOREST ROAD

X1	1070.1	9	1155	1167	196	196	196	0	0	0
GR	6976	1000	6974	1135	6972	1145	6950	1155	6946	1158
GR	6946	1162	6950	1167	6972	1184	6974	1219		

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV

```
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA   LEFT/RIGHT
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST


 *PROF 1
0

 CCHV=      .100 CEHV=      .300
 *SECNO 1040.100
 3720 CRITICAL DEPTH ASSUMED
          POWERS BOULEVARD
   1040.10      5.80  6819.80  6819.80  6810.00  6821.61       1.81       .00       .00  6820.00
     3477.        0.     3409.      68.       0.      315.        7.        0.        0.   6818.00
      .00        .00     10.82     9.35     .000      .045      .020      .000   6814.00  1120.34
   .018826        0.        0.       0.        0        20        0       .00     91.76  1212.09
0
 *SECNO 1040.200
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
   1040.20      7.85  6829.85  6829.85      .00  6831.81       1.96      6.92       .05  6824.00
     2733.      283.     1332.    1118.      24.     138.        88.       4.        1.   6826.00
      .01      12.02      9.68    12.67     .020     .045       .020      .000   6822.00  1046.95
   .008293      550.      550.     550.       3        14         0       .00     70.09  1117.04
0
 *SECNO 1040.300

 3301 HV CHANGED MORE THAN HVINS

 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
   1040.30      6.59  6840.59  6840.59      .00  6841.66       1.07      8.34       .09  6840.00
     2733.        2.     2723.       9.       0.     327.         2.       8.        3.   6840.00
      .04       4.37      8.32     4.67     .020     .045       .020      .000   6834.00  1193.78
   .020369      675.      675.     675.      16        10         0       .00    145.69  1339.46
0
 *SECNO 1040.400
   1040.40      4.85  6850.85  6850.76      .00  6852.34       1.49     10.55       .12  6862.00
     2733.        0.     2733.       0.       0.     279.         0.      12.        4.   6862.00
      .05        .00      9.79      .00     .000     .045       .000      .000   6846.00  1153.02
   .019828      525.      525.     525.       7        19         0       .00     88.62  1241.64
0
 *SECNO 1040.500
 7185 MINIMUM SPECIFIC ENERGY
1
```


```
     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA   LEFT/RIGHT
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST
```

```
 3720 CRITICAL DEPTH ASSUMED
   1040.50      7.75  6859.75  6859.75       .00  6861.39      1.64      8.82       .05  6858.00
     2733.       80.    2203.     450.       10.      226.       35.       15.        5.   6856.00
       .07      7.75     9.77    12.82      .020      .045      .020      .000  6852.00  1130.21
   .013225      550.     550.     550.         5        14         0       .00    83.52  1213.73
0
 *SECNO 1050.100
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
          COWPOKE ROAD
   1050.10      7.79  6875.79  6875.79       .00  6877.70      1.91     12.70       .08  6880.00
     2733.        0.    2733.       0.        0.      246.        0.       20.        7.   6884.00
       .09       .00    11.10      .00      .000      .045      .000      .000  6868.00  1073.45
   .020229      785.     785.     785.        11         5         0       .00    65.06  1138.51
0
 *SECNO 1050.200

 3301 HV CHANGED MORE THAN HVINS


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.01

   1050.20      8.75  6880.75      .00       .00  6881.40       .64      3.57       .13  6880.00
     2733.        3.    2730.       0.        1.      424.        0.       23.        7.   6880.00
       .10      2.67     6.44     2.04      .020      .045      .020      .000  6872.00  1121.36
   .005004      400.     400.     400.         4         0         0       .00    94.27  1215.63
0
 *SECNO 1050.300

 3301 HV CHANGED MORE THAN HVINS


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .53

   1050.30      5.59  6883.59      .00       .00  6885.13      1.55      3.46       .27  6882.00
     2733.       33.    2700.       0.        4.      270.        0.       26.        8.   6886.00
       .11      8.24    10.00      .00      .020      .045      .000      .000  6878.00  1084.90
   .017840      405.     405.     405.         3         0         0       .00    83.26  1168.16
0
1
```



```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN      SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID     ENDST


 *SECNO 1050.400
```

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .39

1050.40	3.23	6893.23	6892.88	.00	6893.89	.66	8.66	.09	6912.00
857.	30.	803.	25.	5.	123.	4.	29.	9.	6892.00
.14	5.62	6.55	5.79	.020	.045	.020	.000	6890.00	1067.31
.011827	540.	540.	540.	11	11	0	.00	64.28	1166.92

0
*SECNO 1050.500
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

1050.50	2.19	6902.19	6902.19	.00	6903.11	.92	8.13	.08	6912.00
857.	0.	857.	0.	0.	111.	0.	30.	10.	6910.00
.16	.00	7.70	.00	.000	.045	.000	.000	6900.00	1300.88
.024976	490.	490.	490.	8	14	0	.00	61.49	1362.37

0
*SECNO 1060.100

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.61

CSAGRICULTURAL

1060.10	3.40	6911.40	.00	.00	6911.68	.27	8.50	.06	6922.00
857.	0.	857.	0.	0.	205.	0.	32.	11.	6914.00
.19	.00	4.17	.00	.000	.045	.000	.000	6908.00	1121.14
.009631	580.	580.	580.	6	0	0	.00	139.55	1260.69

0
*SECNO 1060.200

3301 HV CHANGED MORE THAN HVINS

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .66

1060.20	4.98	6916.98	.00	.00	6917.87	.89	6.01	.18	6922.00
857.	0.	857.	0.	0.	113.	0.	34.	12.	6920.00
.21	.00	7.55	.00	.000	.045	.000	.000	6912.00	1133.46
.022335	428.	428.	428.	4	0	0	.00	58.80	1192.26

0

*SECNO 1060.300

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.58

1060.30	5.04	6925.04	.00	.00	6925.44	.40	7.52	.05	6940.00
857.	0.	857.	0.	0.	169.	0.	36.	13.	6934.00
.24	.00	5.07	.00	.000	.045	.000	.000	6920.00	1092.43
.008900	562.	562.	562.	5	0	0	.00	80.29	1172.72

0

*SECNO 1060.400

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

1060.40	5.44	6931.44	6931.44	.00	6932.51	1.07	6.19	.20	6932.00
857.	0.	857.	0.	0.	103.	0.	37.	14.	6940.00
.26	.00	8.30	.00	.000	.045	.000	.000	6926.00	1060.38
.025000	443.	443.	443.	4	8	0	.00	49.95	1110.32

0

*SECNO 1060.500

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.44

1060.50	4.70	6940.70	.00	.00	6941.24	.54	8.68	.05	6950.00
857.	0.	857.	0.	0.	145.	0.	38.	14.	6950.00
.28	.00	5.90	.00	.000	.045	.000	.000	6936.00	1030.65
.012051	517.	517.	517.	6	0	0	.00	67.63	1098.27

0

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1060.600

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.07

1060.60	5.48	6942.48	.00	.00	6942.80	.32	1.53	.02	6942.00

```
     857.        1.       824.       32.        1.       180.        7.        40.       15.   6940.00
      .30      1.50       4.57      4.31      .020       .045      .020      .000   6937.00   1067.01
  .002806      300.       300.      300.         4          0         0       .00     50.01   1117.02
0
 *SECNO 1060.700

 3301 HV CHANGED MORE THAN HVINS

 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
   1060.70     6.50   6947.50   6947.50       .00   6949.56      2.05      2.03       .52   6950.00
     857.        0.       857.        0.        0.        75.        0.        41.       15.   6950.00
      .31       .00      11.50       .00      .000       .045      .000      .000   6941.00   1107.68
  .027701      314.       314.      314.        20         11         0       .00     19.99   1127.67
0
 *SECNO 1070.100
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
         BLACK FOREST ROAD
   1070.10     6.81   6952.81   6952.81       .00   6955.14      2.33      4.62       .08   6950.00
     857.       13.       814.       29.        2.        66.        3.        41.       15.   6950.00
      .31      7.38      12.39      9.58      .020       .045      .020      .000   6946.00   1153.72
  .020333      196.       196.      196.         1          8         0       .00     15.45   1169.17
0
1
```



```
                                                                    THIS RUN EXECUTED  7/12/ 4     16:41:24

 **************************************************
   HEC2 RELEASE DATED SEP 88 UPDATED APR  1989


   ERROR CORR -  01,02
   MODIFICATION -
 **************************************************


 NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST


 COTTONWOOD CREEK FILENAM

 SUMMARY PRINTOUT TABLE  150
```

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	1040.100	.00	.00	.00	6814.00	3477.00	6819.80	6819.80	6821.61	188.26	10.82	322.37	253.41

*	1040.200	550.00	.00	.00	6822.00	2733.00	6829.85	6829.85	6831.81	82.93	9.68	249.36	300.12
*	1040.300	675.00	.00	.00	6834.00	2733.00	6840.59	6840.59	6841.66	203.69	8.32	329.32	191.49
	1040.400	525.00	.00	.00	6846.00	2733.00	6850.85	6850.76	6852.34	198.28	9.79	279.09	194.09
*	1040.500	550.00	.00	.00	6852.00	2733.00	6859.75	6859.75	6861.39	132.25	9.77	270.96	237.65
*	1050.100	785.00	.00	.00	6868.00	2733.00	6875.79	6875.79	6877.70	202.29	11.10	246.24	192.16
*	1050.200	400.00	.00	.00	6872.00	2733.00	6880.75	.00	6881.40	50.04	6.44	424.93	386.36
*	1050.300	405.00	.00	.00	6878.00	2733.00	6883.59	.00	6885.13	178.40	10.00	274.10	204.62
*	1050.400	540.00	.00	.00	6890.00	857.00	6893.23	6892.88	6893.89	118.27	6.55	132.11	78.80
*	1050.500	490.00	.00	.00	6900.00	857.00	6902.19	6902.19	6903.11	249.76	7.70	111.33	54.23
*	1060.100	580.00	.00	.00	6908.00	857.00	6911.40	.00	6911.68	96.31	4.17	205.41	87.33
*	1060.200	428.00	.00	.00	6912.00	857.00	6916.98	.00	6917.87	223.35	7.55	113.46	57.34
*	1060.300	562.00	.00	.00	6920.00	857.00	6925.04	.00	6925.44	89.00	5.07	169.14	90.84
*	1060.400	443.00	.00	.00	6926.00	857.00	6931.44	6931.44	6932.51	250.00	8.30	103.29	54.20
*	1060.500	517.00	.00	.00	6936.00	857.00	6940.70	.00	6941.24	120.51	5.90	145.30	78.07
*	1060.600	300.00	.00	.00	6937.00	857.00	6942.48	.00	6942.80	28.06	4.57	188.29	161.79
*	1060.700	314.00	.00	.00	6941.00	857.00	6947.50	6947.50	6949.56	277.01	11.50	74.54	51.49

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	1070.100	196.00	.00	.00	6946.00	857.00	6952.81	6952.81	6955.14	203.33	12.39	70.59	60.10

COTTONWOOD CREEK FILENAM

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH

*	1040.100	3477.00	6819.80	.00	.00	9.80	91.76	.00
*	1040.200	2733.00	6829.85	.00	10.05	.00	70.09	550.00
*	1040.300	2733.00	6840.59	.00	10.73	.00	145.69	675.00
	1040.400	2733.00	6850.85	.00	10.26	.00	88.62	525.00
*	1040.500	2733.00	6859.75	.00	8.90	.00	83.52	550.00
*	1050.100	2733.00	6875.79	.00	16.04	.00	65.06	785.00
*	1050.200	2733.00	6880.75	.00	4.97	.00	94.27	400.00
*	1050.300	2733.00	6883.59	.00	2.83	.00	83.26	405.00
*	1050.400	857.00	6893.23	.00	9.64	.00	64.28	540.00
*	1050.500	857.00	6902.19	.00	8.96	.00	61.49	490.00
*	1060.100	857.00	6911.40	.00	9.22	.00	139.55	580.00
*	1060.200	857.00	6916.98	.00	5.58	.00	58.80	428.00
*	1060.300	857.00	6925.04	.00	8.05	.00	80.29	562.00
*	1060.400	857.00	6931.44	.00	6.40	.00	49.95	443.00
*	1060.500	857.00	6940.70	.00	9.26	.00	67.63	517.00
*	1060.600	857.00	6942.48	.00	1.77	.00	50.01	300.00
*	1060.700	857.00	6947.50	.00	5.03	.00	19.99	314.00
*	1070.100	857.00	6952.81	.00	5.31	.00	15.45	196.00

```
1*****************************************************                    **************************************
 *  WATER SURFACE PROFILES                            *                   *  U.S. ARMY CORPS OF ENGINEERS      *
 *  VERSION OF SEPTEMBER 1988                         *                   *  THE HYDROLOGIC ENGINEERING CENTER *
 *  ERROR: 01,02                                      *                   *  609 SECOND STREET, SUITE D        *
 *  UPDATED:  4 APRIL    1989                         *                   *  DAVIS, CALIFORNIA 95616-4687      *
 *  RUN DATE     7/12/ 4   TIME   16:39:20            *                   *  (916) 756-1104, (916) 551-1748    *
 *****************************************************                    **************************************


                                        X     X  XXXXXXX   XXXXX             XXXXX
                                        X     X  X        X     X           X     X
                                        X     X  X        X                       X
                                        XXXXXXX  XXXX     X          XXXXX   XXXXX
                                        X     X  X        X                 X
                                        X     X  X        X     X           X
                                        X     X  XXXXXXX   XXXXX            XXXXXXX
 END OF BANNER
1
    7/12/ 4      16:39:20                                                                          PAGE    1


                                                                         THIS RUN EXECUTED  7/12/ 4    16:39:20
 **************************************************
   HEC2 RELEASE DATED SEP 88 UPDATED APR  1989


   ERROR CORR -  01,02
   MODIFICATION -
 **************************************************


T1      TRIBUTARY FOUR WOLF RANCH MDDP KIOWA ENGINEERING PN 03094
T2      100-YEAR FREQUENCY DEVELOPED W/O DETETNION X-SECTIONS L TO R UPSTREA
T3      FILENAME TRIB4.DAT

J1  ICHECK    INQ      NINV      IDIR      STRT      METRIC    HVINS     Q        WSEL      FQ

       0        2        0         0        .02        0         0        0       6878       0

J2  NPROF     IPLOT    PRFVS     XSECV     XSECH     FN        ALLDC     IBW      CHNIM     ITRACE

      1         0       -1         0         0        0         0         0         0        0


QT        1        1870
```

```
NC     0.050      0.050      0.045      0.100      0.300          0          0          0          0          0
        TRIBUTARY FOUR
X1         1         12       1013       1115          0          0          0          0          0          0
GR      6910       1000       6900       1013       6892       1021       6890       1039       6892       1048
GR      6894       1080       6896       1099       6898       1108       6900       1115       6902       1120
GR      6906       1124       6910       1129

X1         2         16       1061       1177        425        425        425          0          0          0
GR      6920       1000       6918       1007       6916       1013       6914       1025       6912       1034
GR      6912       1047       6912       1058       6910       1061       6908       1067       6906       1088
GR      6904       1106       6902       1135       6900       1152       6902       1163       6910       1177
GR      6920       1186

X1         3         14       1009       1114        384        384        384          0          0          0
GR      6930       1000       6920       1009       6914       1013       6912       1014       6910       1031
GR      6911       1053       6912       1101       6914       1108       6916       1111       6918       1113
GR      6920       1114       6922       1116       6926       1118       6930       1121

X1         4         16       1023       1127        433        433        433          0          0          0
GR      6940       1000       6934       1008       6932       1010       6932       1019       6930       1023
GR      6928       1029       6926       1035       6924       1042       6922       1060       6920       1117
GR      6930       1127       6932       1129       6934       1131       6936       1135       6938       1145
GR      6940       1158

X1         5         17       1048       1176        363        363        363          0          0          0
GR      6948       1000       6946       1011       6944       1023       6942       1040       6940       1048
GR      6930       1061       6928       1067       6930       1081       6932       1133       6934       1146
GR      6936       1159       6938       1168       6940       1176       6942       1180       6944       1189
GR      6946       1197       6948       1211
1
   7/12/ 4      16:39:20                                                                            PAGE     2


X1         6         12       1016       1119        668        668        668          0          0          0
GR      6964       1000       6962       1011       6960       1016       6950       1023       6946       1025
GR      6944       1028       6946       1067       6948       1087       6950       1097       6960       1119
GR      6962       1123       6964       1135

X1         7         20       1213       1298        389        389        389          0          0          0
GR      6975       1000       6974       1017       6973       1039       6972       1075       6973       1100
GR      6972       1151       6970       1168       6968       1193       6960       1213       6956       1221
GR      6954       1283       6952       1292       6954       1293       6960       1298       6964       1300
GR      6968       1304       6970       1312       6972       1336       6974       1347       6975       1353

        SOUTH RESEARCH PARKWAY
X1         8         21       1043       1123        320        320        320          0          0          0
GR      6981       1000       6980       1005       6978       1017       6976       1028       6974       1035
GR      6972       1039       6970       1043       6964       1054       6961       1072       6961       1084
GR      6961       1091       6962       1097       6964       1108       6966       1115       6970       1123
GR      6972       1128       6974       1138       6976       1147       6978       1155       6980       1160
GR      6981       1166
```

QT	1	1830								

NORTH RESEARCH PARKWAY

X1	9	23	1086	1149	162	162	162	0	0	0
GR	6983	1000	6982	1006	6980	1018	6978	1033	6976	1059
GR	6974	1076	6972	1081	6970	1086	6968	1090	6966	1095
GR	6964	1104	6963	1112	6964	1119	6966	1141	6968	1146
GR	6970	1149	6972	1151	6974	1154	6976	1156	6978	1159
GR	6980	1161	6982	1163	6983	1164				
X1	10	20	1017	1091	411	411	411	0	0	0
GR	6990	1000	6988	1005	6986	1008	6984	1012	6982	1014
GR	6980	1017	6978	1019	6976	1024	6974	1029	6972	1037
GR	6970	1048	6972	1055	6974	1070	6976	1076	6978	1083
GR	6980	1091	6982	1099	6986	1110	6988	1126	6990	1141
X1	11	31	1048	1132	407	407	407	0	0	0
GR	7004	1000	7002	1012	7000	1018	7002	1022	7004	1025
GR	7006	1033	7008	1038	6990	1048	6988	1056	6986	1064
GR	6984	1074	6982	1081	6980	1087	6980	1090	6981	1099
GR	6980	1107	6978	1115	6978	1118	6980	1123	6982	1124
GR	6984	1126	6986	1127	6988	1129	6990	1132	6992	1135
GR	6994	1139	6996	1143	6998	1146	7000	1153	7002	1164
GR	7004	1173								
QT	1	1160								
X1	12	29	1077	1291	585	585	585	0	0	0
GR	7020	1000	7018	1015	7016	1034	7014	1048	7012	1061
GR	7010	1077	7008	1096	7006	1112	7004	1134	7004	1181
GR	7002	1198	7000	1216	7000	1238	7002	1268	7004	1275
GR	7006	1279	7008	1282	7010	1291	7012	1304	7014	1325

GR	7015	1332	7014	1340	7013	1345	7014	1346	7016	1351
GR	7018	1356	7020	1362	7021	1380	7020	1409		
X1	13	23	1018	1195	443	443	443	0	0	0
GR	7028	1000	7026	1003	7024	1008	7022	1013	7020	1018
GR	7018	1022	7016	1025	7014	1041	7012	1046	7010	1053
GR	7008	1063	7007	1077	7008	1093	7010	1119	7012	1157
GR	7014	1168	7016	1177	7018	1186	7020	1195	7022	1202
GR	7024	1213	7026	1224	7028	1237				
X1	14	22	1037	1135	634	634	634	0	0	0
GR	7042	1000	7040	1009	7038	1022	7036	1033	7034	1034
GR	7032	1036	7030	1037	7028	1038	7026	1041	7024	1048

GR	7022	1066	7023	1092	7024	1114	7026	1121	7028	1127
GR	7030	1135	7032	1144	7034	1176	7036	1191	7038	1201
GR	7040	1248	7042	1263						
X1	15	26	1112	1197	438	438	438	0	0	0
GR	7054	1000	7053	1017	7053	1043	7052	1068	7050	1070
GR	7048	1074	7046	1081	7044	1086	7044	1097	7042	1106
GR	7040	1112	7038	1118	7036	1127	7035	1139	7034	1154
GR	7035	1177	7036	1188	7038	1192	7040	1197	7042	1211
GR	7044	1225	7046	1246	7046	1291	7047	1310	7050	1358
GR	7054	1392								
X1	16	18	1161	1259	352	352	352	0	0	0
GR	7060	1000	7054	1057	7053	1104	7052	1159	7050	1161
GR	7042	1173	7040	1177	7041	1200	7042	1222	7044	1233
GR	7046	1244	7048	1252	7050	1259	7052	1267	7054	1280
GR	7056	1296	7058	1315	7060	1335				
X1	17	18	1067	1163	382	382	382	0	0	0
GR	7068	1000	7064	1034	7060	1067	7058	1079	7056	1087
GR	7054	1092	7052	1097	7050	1101	7049	1111	7048	1125
GR	7049	1137	7050	1144	7054	1152	7060	1163	7062	1180
GR	7064	1209	7066	1243	7068	1285				
X1	18	21	1165	1261	416	416	416	0	0	0
GR	7076	1000	7074	1020	7073	1042	7072	1080	7072	1136
GR	7072	1153	7070	1165	7068	1173	7060	1182	7058	1185
GR	7057	1189	7056	1195	7057	1214	7058	1228	7060	1232
GR	7066	1243	7068	1249	7070	1261	7072	1277	7074	1297
GR	7076	1307								
X1	19	27	1178	1337	480	480	480	0	0	0
GR	7088	1000	7086	1038	7084	1080	7083	1096	7083	1101
GR	7083	1140	7082	1175	7080	1178	7072	1190	7070	1198
GR	7069	1206	7068	1217	7069	1223	7070	1227	7074	1235
GR	7076	1240	7078	1248	7079	1277	7078	1314	7079	1326
GR	7080	1337	7084	1371	7085	1382	7086	1395	7086	1473
GR	7087	1505	7088	1531						

TRIBUTARY FOUR LIMITS

X1	20	19	1054	1085	363	363	363	0	0	.0
GR	7094	1000	7090	1024	7086	1040	7084	1044	7076	1054
GR	7075	1057	7074	1060	7075	1074	7076	1085	7078	1089
GR	7080	1093	7082	1096	7084	1100	7086	1104	7088	1108
GR	7090	1116	7092	1128	7093	1140	7094	1153		

```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST


*PROF 1

CCHV=      .100 CEHV=      .300
*SECNO 1.000
         TRIBUTARY FOUR
     1.00      5.35  6895.35       .00   6878.00   6896.62      1.27       .00       .00   6900.00
    1870.        0.    1870.        0.        0.      207.        0.        0.        0.   6900.00
      .00       .00     9.03       .00      .000      .045      .000      .000   6890.00   1017.65
  .020013        0.       0.        0.         0         0         8       .00     75.20   1092.84
0
*SECNO 2.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     2.00      5.24  6905.24   6905.24       .00   6906.60      1.36      8.88       .03   6910.00
    1870.        0.    1870.        0.        0.      200.        0.        2.        1.   6910.00
      .01       .00     9.36       .00      .000      .045      .000      .000   6900.00   1094.85
  .021833      425.     425.      425.         4         8         0       .00     73.82   1168.67
0
*SECNO 3.000
     3.00      3.65  6913.65       .00       .00   6914.74      1.08      8.11       .03   6920.00
    1870.        0.    1870.        0.        0.      224.        0.        4.        1.   6920.00
      .03       .00     8.36       .00      .000      .045      .000      .000   6910.00   1013.17
  .020447      384.     384.      384.         2         0         0       .00     93.63   1106.80
0
*SECNO 4.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     4.00      4.09  6924.09   6924.09       .00   6925.39      1.30      9.29       .07   6930.00
    1870.        0.    1870.        0.        0.      204.        0.        6.        2.   6930.00
      .04       .00     9.16       .00      .000      .045      .000      .000   6920.00   1041.68
  .022526      433.     433.      433.         3         8         0       .00     79.41   1121.09
0
*SECNO 5.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     5.00      5.16  6933.16   6933.16       .00   6934.43      1.27      8.28       .00   6940.00
    1870.        0.    1870.        0.        0.      207.        0.        8.        3.   6940.00
      .05       .00     9.05       .00      .000      .045      .000      .000   6928.00   1056.89
  .023082      363.     363.      363.         5        11         0       .00     83.68   1140.56
0
1
```

```
 SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
 Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA   LEFT/RIGHT
 TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN      SSTA
 SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID     ENDST


*SECNO 6.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
     6.00     4.69  6948.69  6948.69      .00  6950.17     1.47    15.16      .06  6960.00
    1870.       0.    1870.       0.       0.     192.       0.      11.       4.   6960.00
      .07      .00     9.74      .00     .000     .045     .000     .000  6944.00  1023.65
  .022331     668.     668.     668.        3       11        0      .00    66.82  1090.47
0
*SECNO 7.000
     7.00     5.48  6957.48  6957.41      .00  6958.75     1.27     8.57      .02  6960.00
    1870.       0.    1870.       0.       0.     206.       0.      13.       5.   6960.00
      .08      .00     9.06      .00     .000     .045     .000     .000  6952.00  1218.02
  .021726     389.     389.     389.        5       11        0      .00    77.88  1295.91
0
*SECNO 8.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
        SOUTH RESEARCH PARKWAY
     8.00     4.33  6965.33  6965.33      .00  6966.89     1.56     6.86      .08  6970.00
    1870.       0.    1870.       0.       0.     187.       0.      14.       5.   6970.00
      .09      .00    10.01      .00     .000     .045     .000     .000  6961.00  1051.55
  .021184     320.     320.     320.        3       15        0      .00    61.12  1112.67
0
*SECNO 9.000
        NORTH RESEARCH PARKWAY
     9.00     5.51  6968.51      .00      .00  6969.82     1.31     2.90      .03  6970.00
    1830.       0.    1830.       0.       0.     200.       0.      15.       6.   6970.00
      .09      .00     9.17      .00     .000     .045     .000     .000  6963.00  1088.98
  .015283     162.     162.     162.        2        0        0      .00    57.79  1146.77
0
*SECNO 10.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    10.00     6.10  6976.10  6976.10      .00  6977.79     1.69     7.30      .12  6980.00
    1830.       0.    1830.       0.       0.     175.       0.      16.       6.   6980.00
      .11      .00    10.44      .00     .000     .045     .000     .000  6970.00  1023.75
  .020892     411.     411.     411.        2        8        0      .00    52.61  1076.35
0
1
```



```
 SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS   BANK ELEV
```

```
 Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA   LEFT/RIGHT
 TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
 SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST


*SECNO 11.000
    11.00     6.06  6984.06       .00       .00  6985.53      1.48      7.72       .02  6990.00
    1830.       0.    1830.        0.        0.     188.        0.       18.        7.   6990.00
      .12      .00     9.75       .00      .000     .045      .000      .000   6978.00  1073.69
  .017284     407.     407.      407.         3        0         0       .00     52.34  1126.03
0
*SECNO 12.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    12.00     2.75  7002.75   7002.75       .00  7003.71       .95     11.50       .05  7010.00
    1160.       0.    1160.        0.        0.     148.        0.       20.        7.   7010.00
      .14      .00     7.84       .00      .000     .045      .000      .000   7000.00  1191.61
  .024520     585.     585.      585.        10       14         0       .00     79.02  1270.63
0
*SECNO 13.000
    13.00     3.97  7010.97       .00       .00  7011.57       .61      7.83       .03  7020.00
    1160.       0.    1160.        0.        0.     185.        0.       22.        8.   7020.00
      .16      .00     6.26       .00      .000     .045      .000      .000   7007.00  1049.61
  .013353     443.     443.      443.         5        0         0       .00     87.76  1137.38
0
*SECNO 14.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    14.00     3.09  7025.09   7025.09       .00  7026.10      1.00     11.19       .12  7030.00
    1160.       0.    1160.        0.        0.     144.        0.       25.        9.   7030.00
      .18      .00     8.04       .00      .000     .045      .000      .000   7022.00  1044.18
  .024389     634.     634.      634.        10       15         0       .00     73.65  1117.82
0
*SECNO 15.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
    15.00     3.13  7037.13   7037.13       .00  7038.17      1.04     10.47       .01  7040.00
    1160.       0.    1160.        0.        0.     142.        0.       26.       10.   7040.00
      .19      .00     8.18       .00      .000     .045      .000      .000   7034.00  1121.90
  .023422     438.     438.      438.         4        5         0       .00     68.37  1190.27
0
1
   7/12/ 4      16:39:20                                                                                          PAGE    8


 SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS   BANK ELEV
 Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA   LEFT/RIGHT
 TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
 SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST
```

```
 *SECNO 16.000
     16.00     3.92  7043.92      .00       .00  7044.77      .86      6.58       .02  7050.00
     1160.       0.    1160.       0.        0.     156.       0.       27.       11.   7050.00
       .21      .00     7.42      .00      .000     .045     .000      .000  7040.00  1170.13
   .015269     352.     352.     352.         5        0        0       .00    62.42  1232.54
0
 *SECNO 17.000
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
     17.00     3.71  7051.71  7051.71       .00  7053.01     1.30      7.04       .13  7060.00
     1160.       0.    1160.       0.        0.     127.       0.       28.       11.   7060.00
       .22      .00     9.15      .00      .000     .045     .000      .000  7048.00  1097.58
   .022673     382.     382.     382.         3       11        0       .00    49.84  1147.42
0
 *SECNO 18.000
     18.00     4.00  7060.00      .00       .00  7061.07     1.07      8.04       .02  7070.00
     1160.       0.    1160.       0.        0.     140.       0.       30.       12.   7070.00
       .23      .00     8.31      .00      .000     .045     .000      .000  7056.00  1182.00
   .016680     416.     416.     416.         5        0        0       .00    50.01  1232.00
0
 *SECNO 19.000
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
     19.00     4.46  7072.46  7072.46       .00  7073.89     1.43      9.13       .11  7080.00
     1160.       0.    1160.       0.        0.     121.       0.       31.       12.   7080.00
       .25      .00     9.60      .00      .000     .045     .000      .000  7068.00  1189.31
   .021908     480.     480.     480.        10        8        0       .00    42.62  1231.92
0
 *SECNO 20.000
        TRIBUTARY FOUR LIMITS
     20.00     4.78  7078.78      .00       .00  7080.09     1.31      6.18       .01  7076.00
     1160.      18.    1108.      35.        5.     119.       8.       32.       13.   7076.00
       .26     3.66     9.34     4.49      .050     .045     .050      .000  7074.00  1050.53
   .013610     363.     363.     363.         4        0        0       .00    40.02  1090.55
0
1
```


THIS RUN EXECUTED 7/12/ 4   16:39:20

```
**************************************************
  HEC2 RELEASE DATED SEP 88 UPDATED APR  1989


  ERROR CORR -  01,02
  MODIFICATION -
**************************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

FILENAME TRIB4.DAT

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	6890.00	1870.00	6895.35	.00	6896.62	200.13	9.03	207.07	132.18
*	2.000	425.00	.00	.00	6900.00	1870.00	6905.24	6905.24	6906.60	218.33	9.36	199.69	126.56
	3.000	384.00	.00	.00	6910.00	1870.00	6913.65	.00	6914.74	204.47	8.36	223.76	130.78
*	4.000	433.00	.00	.00	6920.00	1870.00	6924.09	6924.09	6925.39	225.26	9.16	204.15	124.60
*	5.000	363.00	.00	.00	6928.00	1870.00	6933.16	6933.16	6934.43	230.82	9.05	206.68	123.08
*	6.000	668.00	.00	.00	6944.00	1870.00	6948.69	6948.69	6950.17	223.31	9.74	192.07	125.14
	7.000	389.00	.00	.00	6952.00	1870.00	6957.48	6957.41	6958.75	217.26	9.06	206.48	126.87
*	8.000	320.00	.00	.00	6961.00	1870.00	6965.33	6965.33	6966.89	211.84	10.01	186.81	128.48
	9.000	162.00	.00	.00	6963.00	1830.00	6968.51	.00	6969.82	152.83	9.17	199.56	148.03
*	10.000	411.00	.00	.00	6970.00	1830.00	6976.10	6976.10	6977.79	208.92	10.44	175.29	126.61
	11.000	407.00	.00	.00	6978.00	1830.00	6984.06	.00	6985.53	172.84	9.75	187.74	139.20
*	12.000	585.00	.00	.00	7000.00	1160.00	7002.75	7002.75	7003.71	245.20	7.84	148.03	74.08
	13.000	443.00	.00	.00	7007.00	1160.00	7010.97	.00	7011.57	133.53	6.26	185.37	100.39
*	14.000	634.00	.00	.00	7022.00	1160.00	7025.09	7025.09	7026.10	243.89	8.04	144.27	74.28
*	15.000	438.00	.00	.00	7034.00	1160.00	7037.13	7037.13	7038.17	234.22	8.18	141.84	75.80
	16.000	352.00	.00	.00	7040.00	1160.00	7043.92	.00	7044.77	152.69	7.42	156.26	93.88
*	17.000	382.00	.00	.00	7048.00	1160.00	7051.71	7051.71	7053.01	226.73	9.15	126.83	77.04

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
18.000	416.00	.00	.00	7056.00	1160.00	7060.00	.00	7061.07	166.80	8.31	139.62	89.82

*	19.000	480.00	.00	.00	7068.00	1160.00	7072.46	7072.46	7073.89	219.08	9.60	120.83	78.37
	20.000	363.00	.00	.00	7074.00	1160.00	7078.78	.00	7080.09	136.10	9.34	131.11	99.43

FILENAME TRIB4.DAT

SUMMARY PRINTOUT TABLE 150

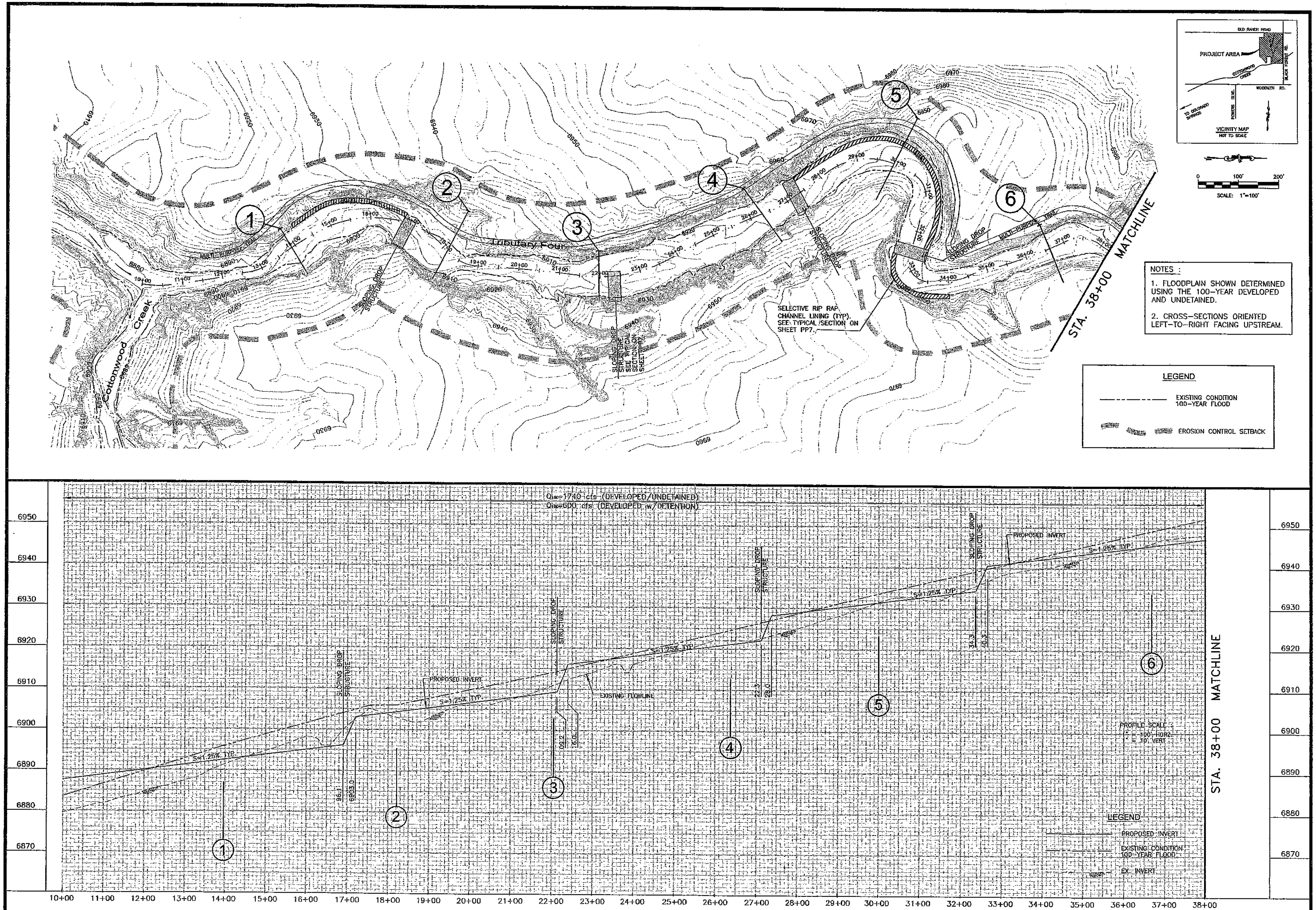
	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	1870.00	6895.35	.00	.00	17.35	75.20	.00
*	2.000	1870.00	6905.24	.00	9.89	.00	73.82	425.00
	3.000	1870.00	6913.65	.00	8.42	.00	93.63	384.00
*	4.000	1870.00	6924.09	.00	10.44	.00	79.41	433.00
*	5.000	1870.00	6933.16	.00	9.07	.00	83.68	363.00
*	6.000	1870.00	6948.69	.00	15.53	.00	66.82	668.00
	7.000	1870.00	6957.48	.00	8.79	.00	77.88	389.00
*	8.000	1870.00	6965.33	.00	7.85	.00	61.12	320.00
	9.000	1830.00	6968.51	.00	3.18	.00	57.79	162.00
*	10.000	1830.00	6976.10	.00	7.59	.00	52.61	411.00
	11.000	1830.00	6984.06	.00	7.96	.00	52.34	407.00
*	12.000	1160.00	7002.75	.00	18.70	.00	79.02	585.00
	13.000	1160.00	7010.97	.00	8.21	.00	87.76	443.00
*	14.000	1160.00	7025.09	.00	14.13	.00	73.65	634.00
*	15.000	1160.00	7037.13	.00	12.04	.00	68.37	438.00
	16.000	1160.00	7043.92	.00	6.78	.00	62.42	352.00
*	17.000	1160.00	7051.71	.00	7.79	.00	49.84	382.00
	18.000	1160.00	7060.00	.00	8.29	.00	50.01	416.00

*	19.000	1160.00	7072.46	.00	12.46	.00	42.62	480.00
	20.000	1160.00	7078.78	.00	6.32	.00	40.02	363.00

1

APPENDIX C

PLAN AND PROFILES



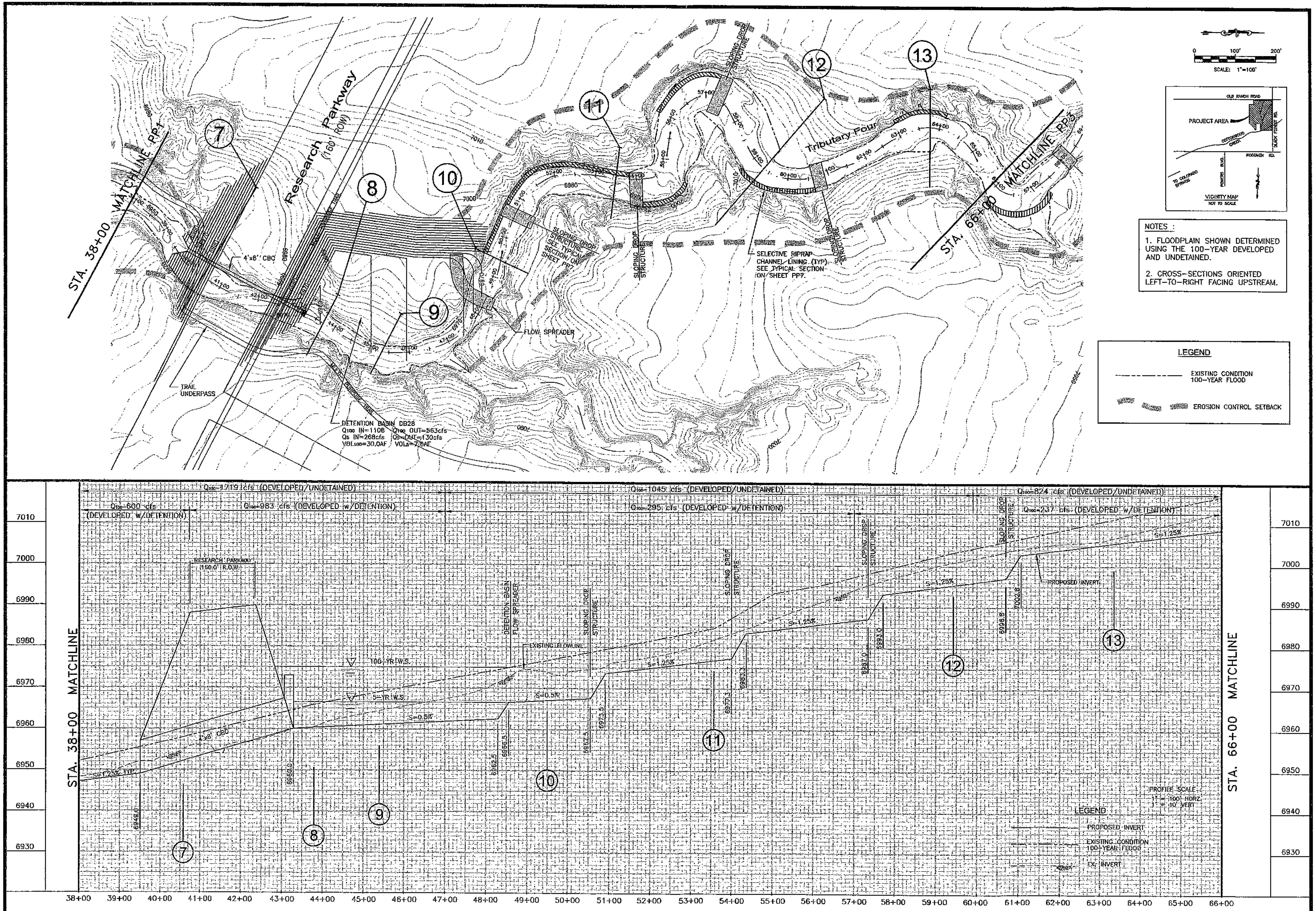
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOUR
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 02/13/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP1
OF X SHEETS

03094 pp1-3.dwg/Dec 01, 2004

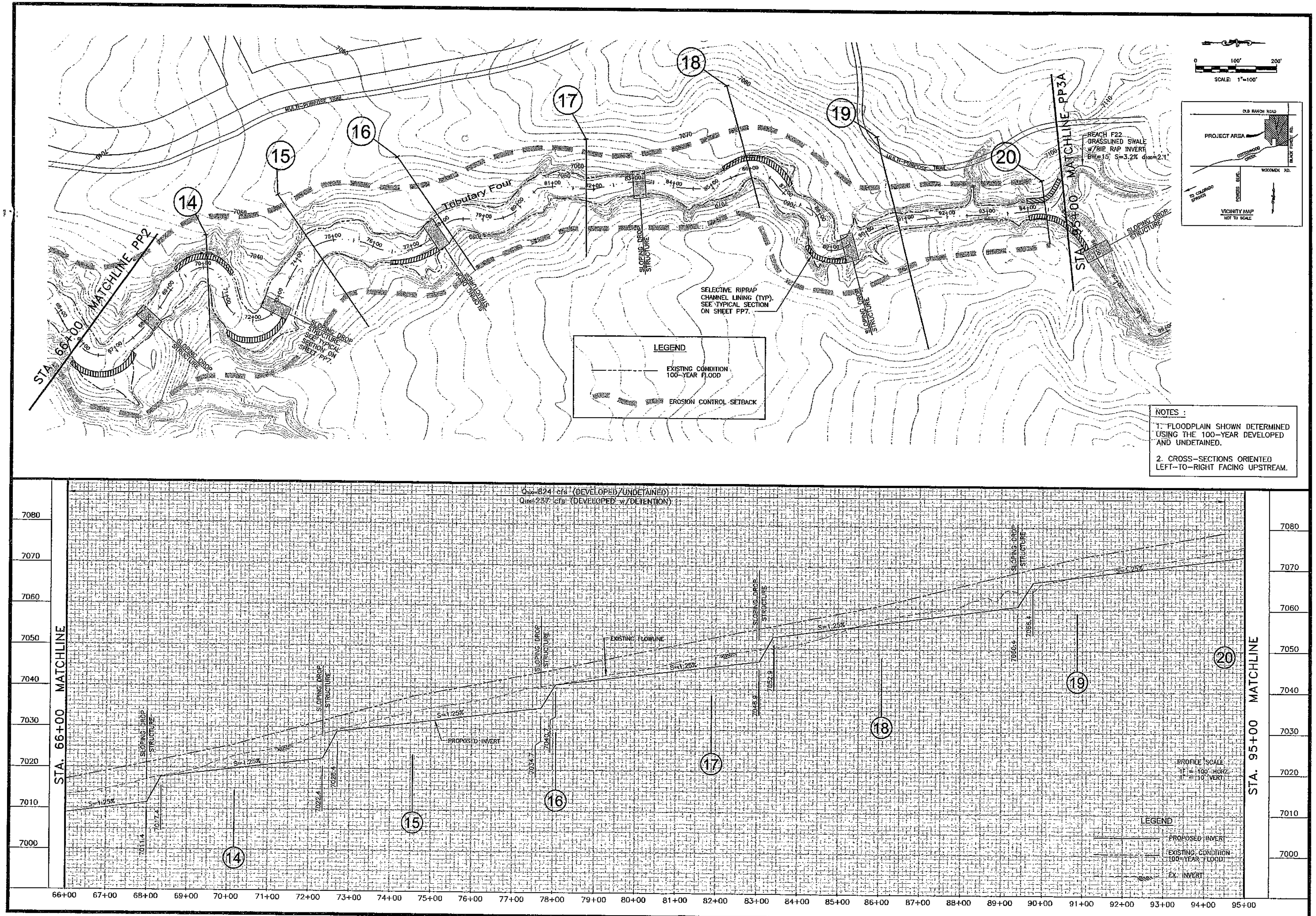


Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOUR
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 02/13/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP2
OF X SHEETS



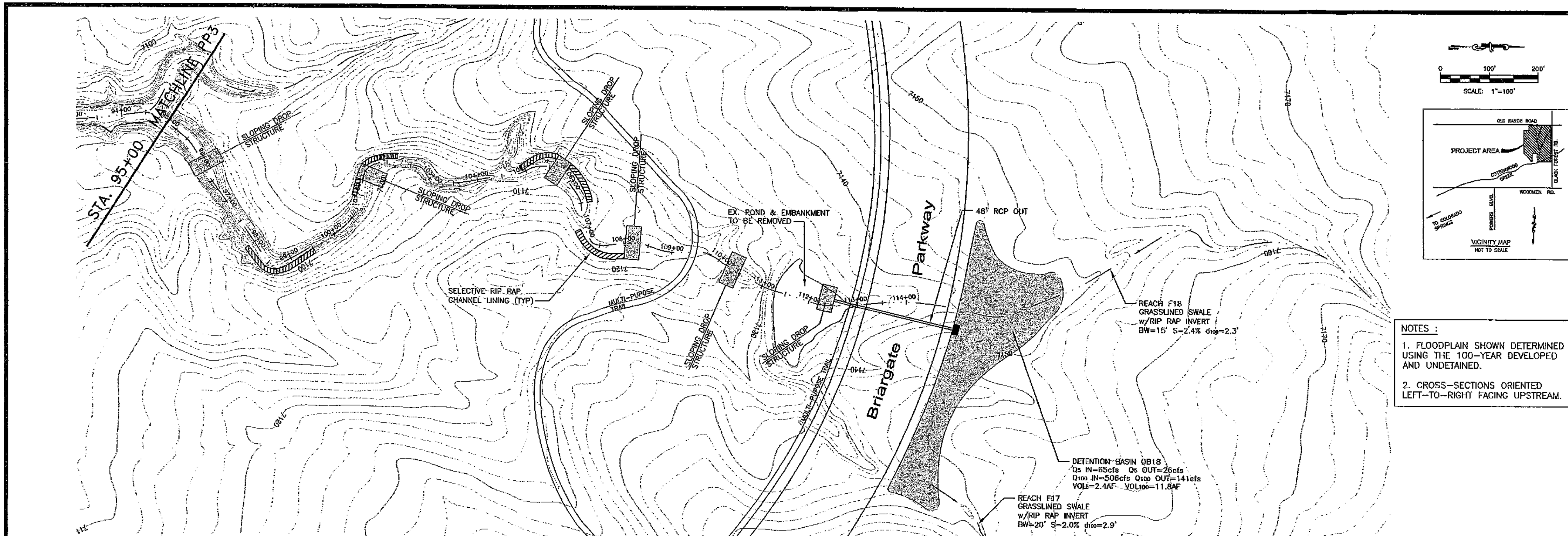
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOUR
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 02/13/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP3
OF X SHEETS

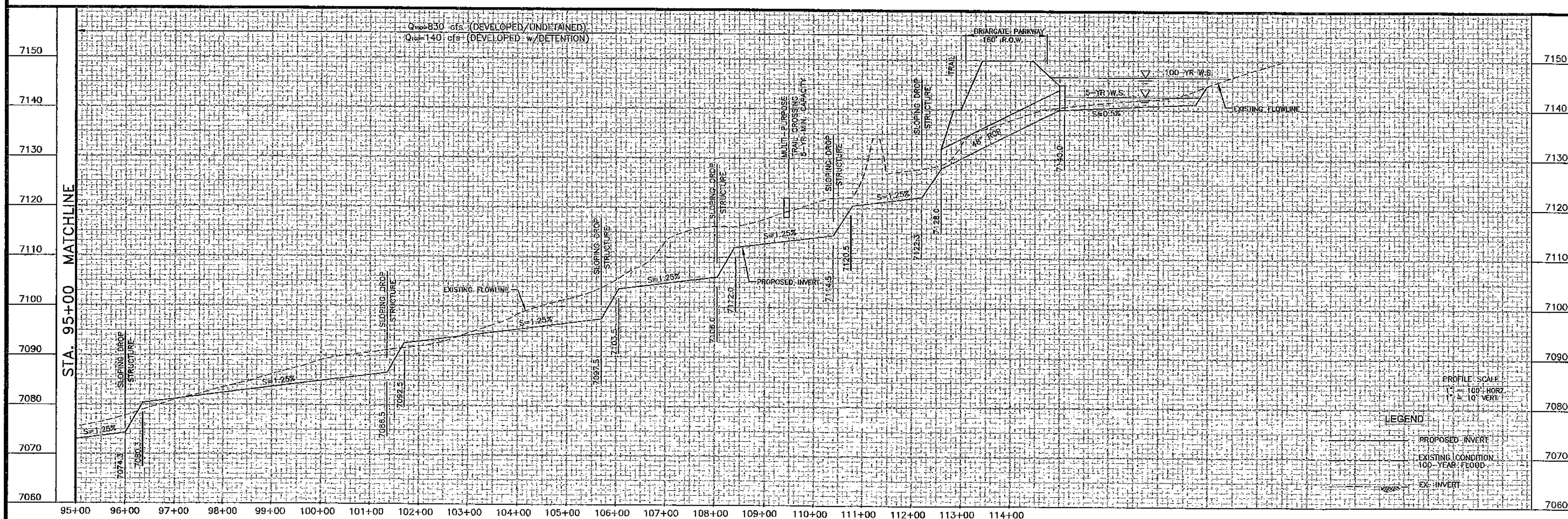
03094 pp1-3.dwg/Dec 01, 2004



NOTES :

1. FLOODPLAIN SHOWN DETERMINED USING THE 100-YEAR DEVELOPED AND UNDETAINED.

2. CROSS-SECTIONS ORIENTED LEFT-TO-RIGHT FACING UPSTREAM.



7050

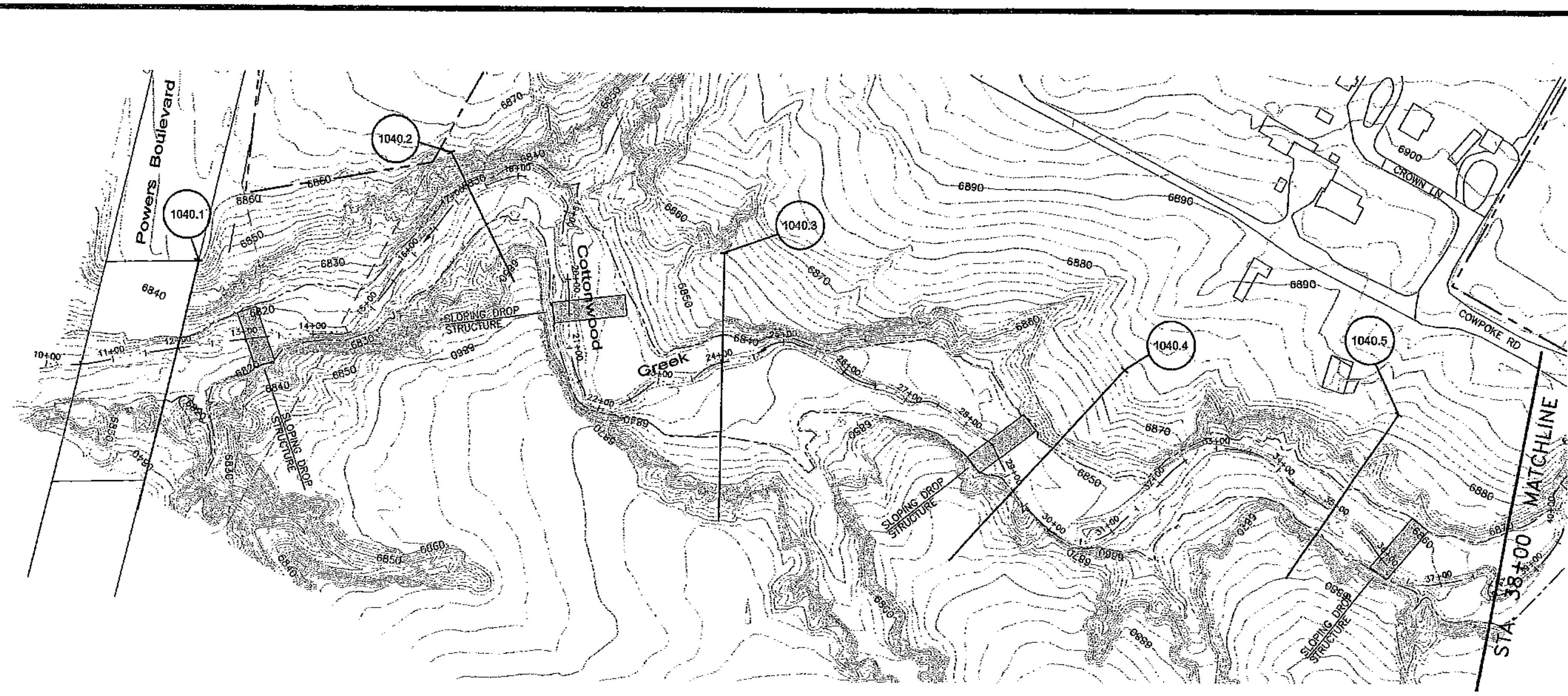
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

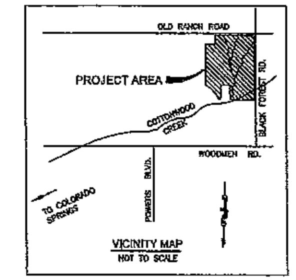
WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOURE
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	03094
Date:	02/13/04
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

SHEET
PP3A
OF X SHEETS

03094 pp3A.dwg/Dec 01, 2004





NOTES :

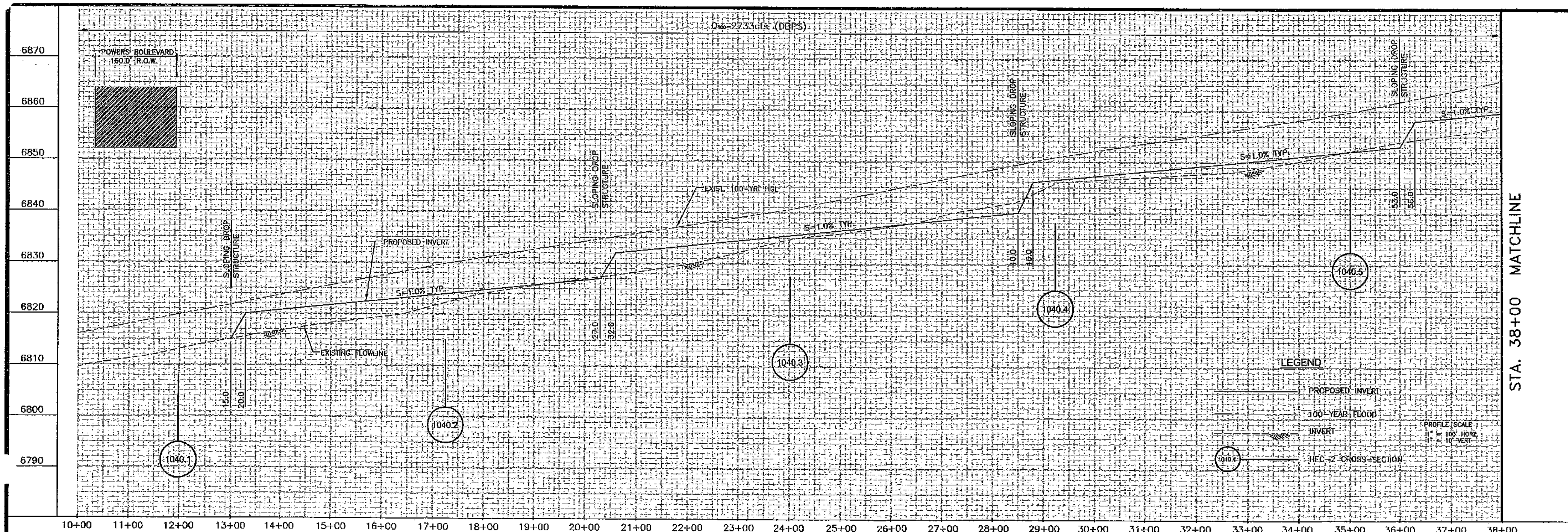
1. FLOODPLAIN SHOWN DETERMINED USING THE 100-YEAR DEVELOPED AND UNDETAINED.

2. CROSS-SECTIONS ORIENTED LEFT-TO-RIGHT FACING UPSTREAM.

LEGEND

EXISTING CONDITION 100-YEAR FLOOD

EROSION CONTROL SETBACK

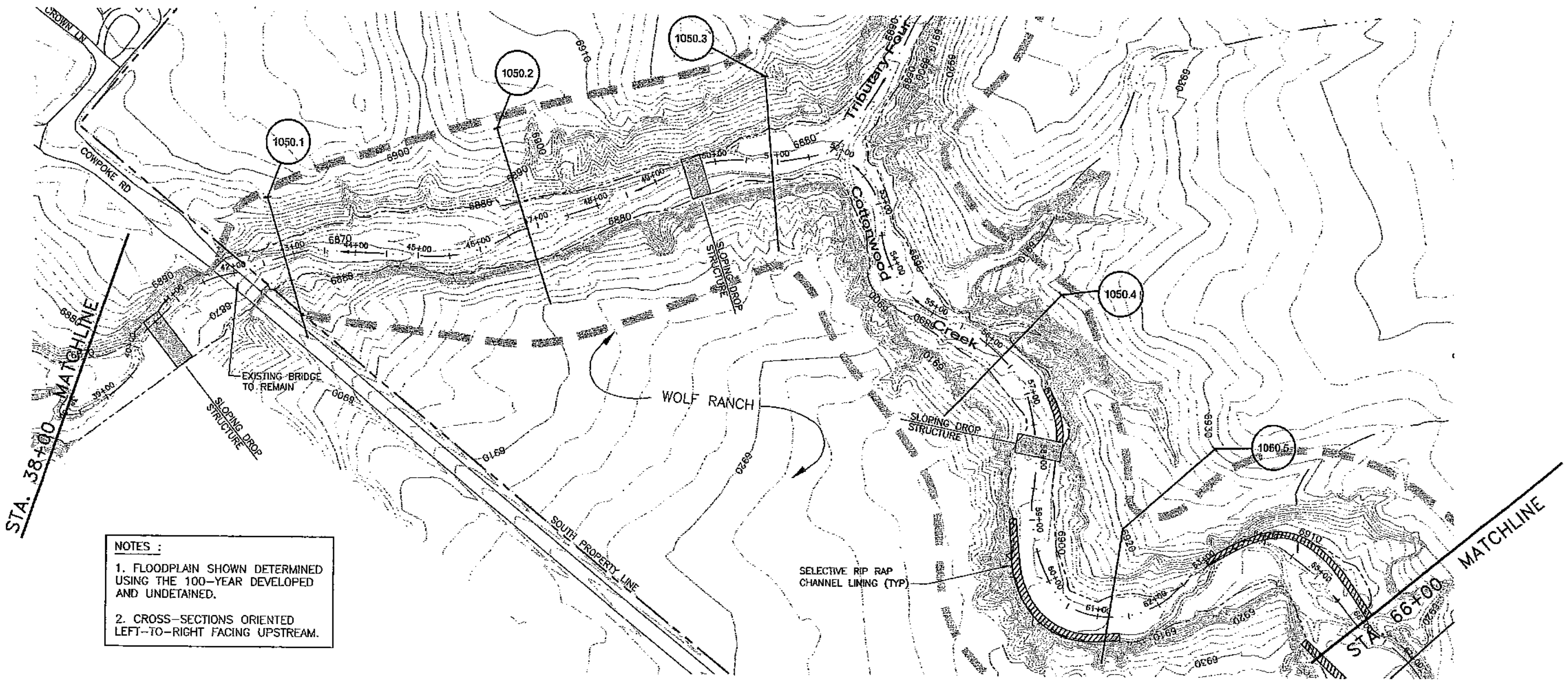


Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

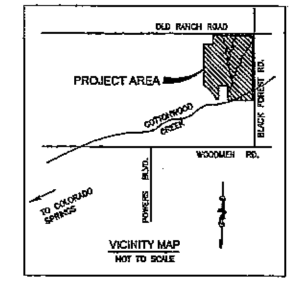
WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
COTTONWOOD CREEK
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.:	03094
Date:	02/09/04
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

SHEET
PP4
OF X SHEETS

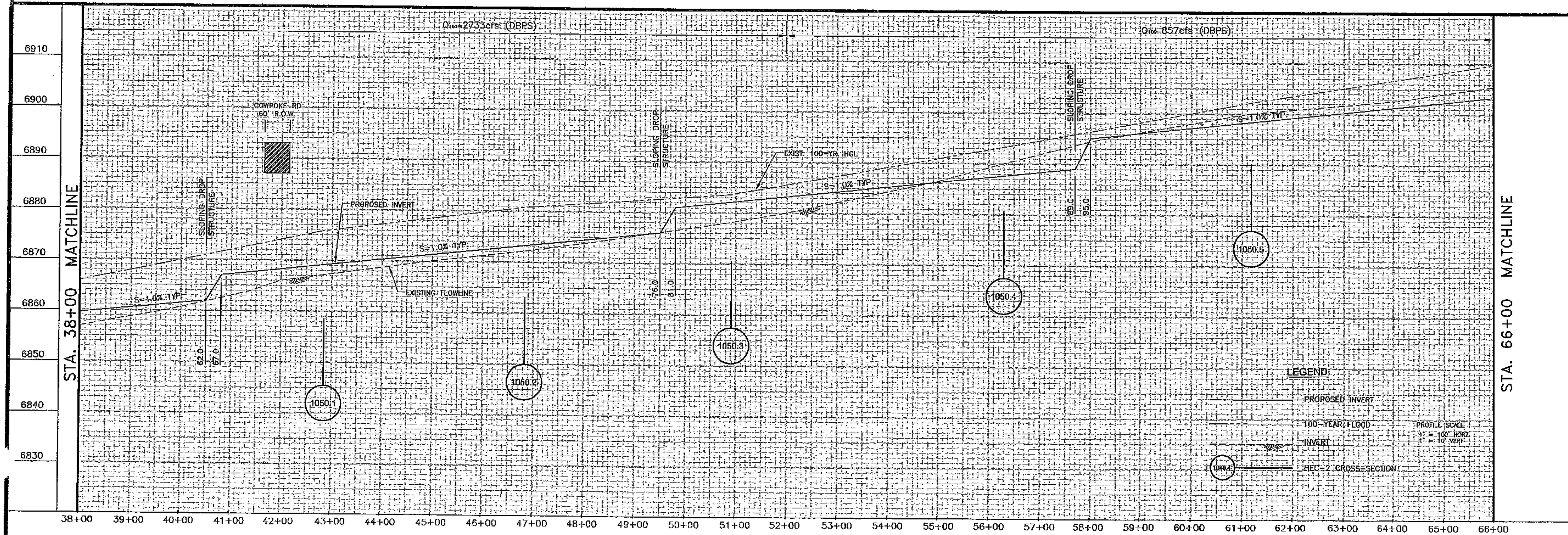


SCALE: 1"=100'



LEGEND

- EXISTING CONDITION 100-YEAR FLOOD
- EROSION CONTROL SETBACK

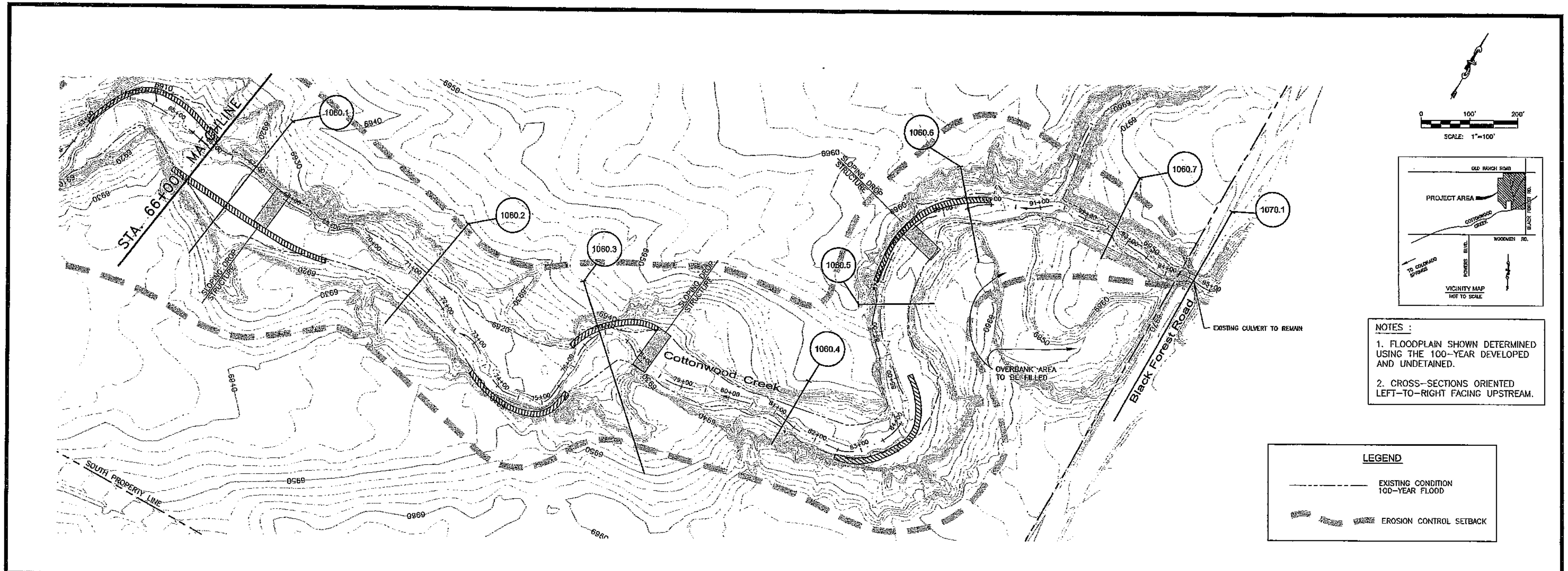


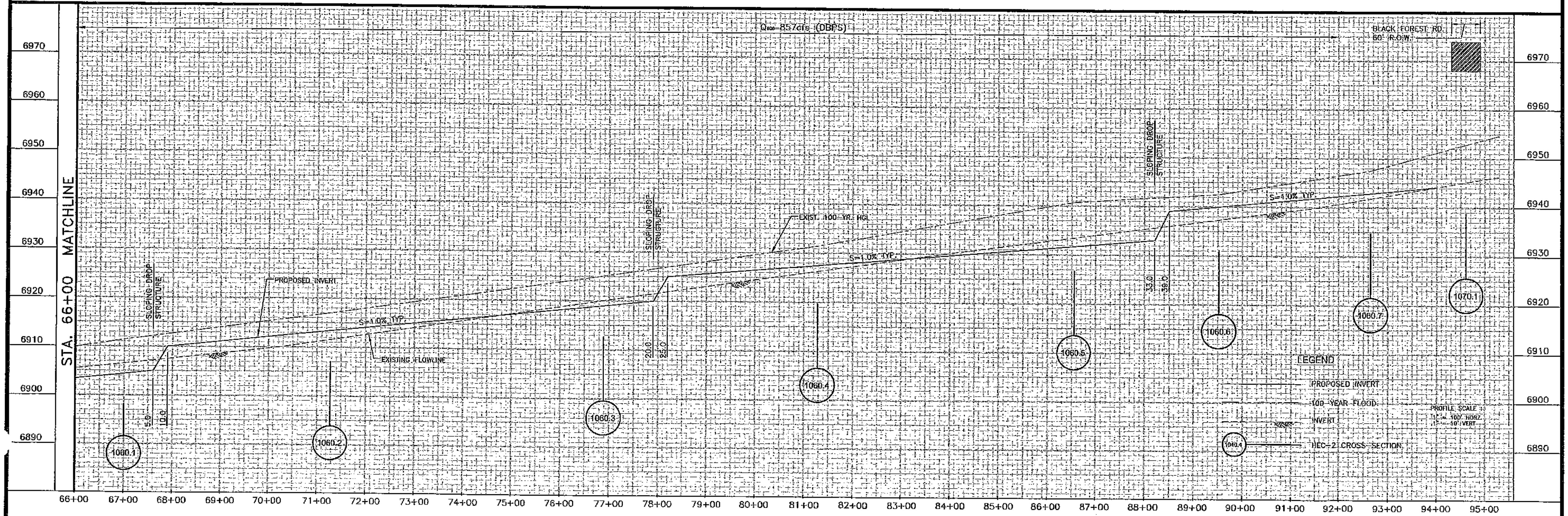
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
COTTONWOOD CREEK
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 01/29/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP5
OF X SHEETS



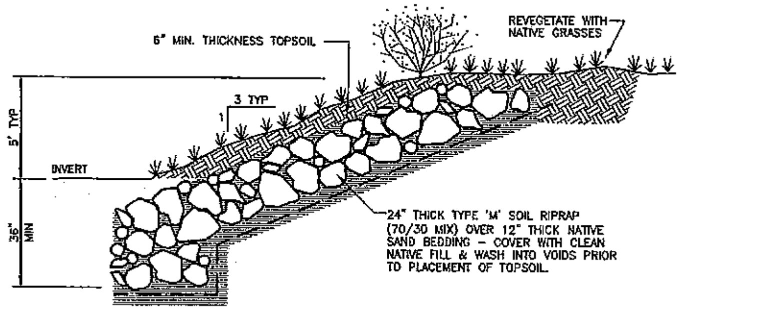


Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
COTTONWOOD CREEK
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

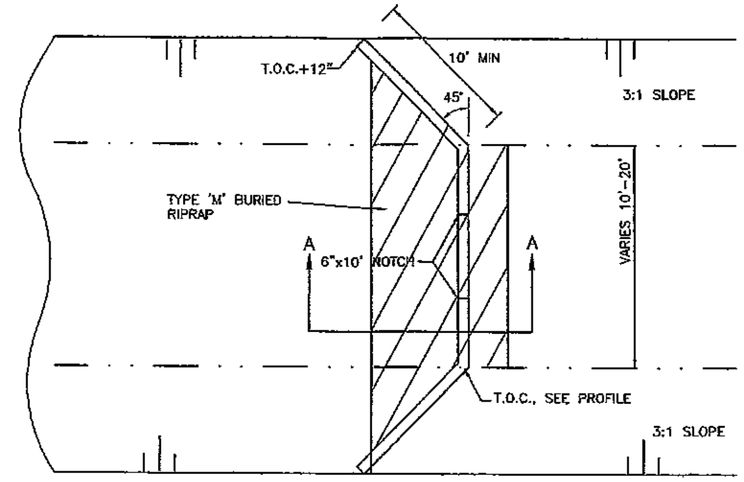
Project No.: 03094
Date: 01/29/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP6
OF X SHEETS

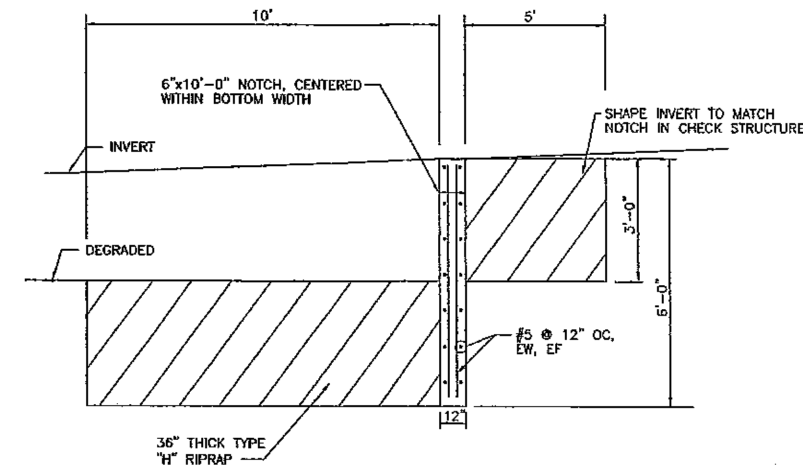


SOIL RIPRAP BANK LINING

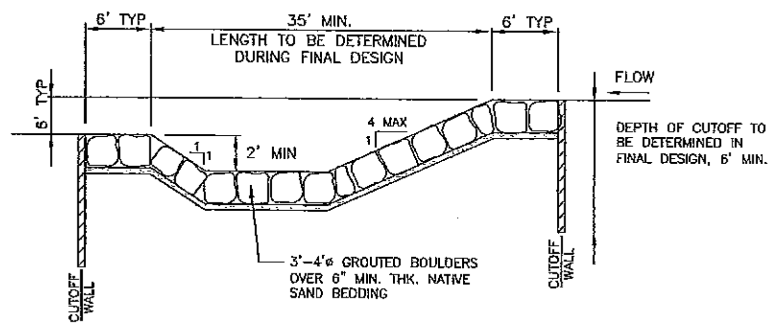
NTS



TYPICAL CHECK STRUCTURE PLAN



CHECK STRUCTURE SECTION A-A



TYPICAL GROUT SLOPING BOULDER DROP SECTION

SCALE : N.T.S.

Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904 - 4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TYPICAL DRAINAGEWAY DETAILS
COLORADO SPRINGS, COLORADO

Project No.:	03094
Date:	11/19/04
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

PP7