Rich,

We do need to get the fee issue resolved. so that the DBPS can be updated & the MDDP approved. Has Nor'wood decided how they want to proceed? Do they want me to set up a meeting with Dave L. & Cam? Does the Stormwater Enterprise have any impact on how they want to proceed.?

Master Development Drainage Plan
Wolf Ranch Development

City of Colorado Springs, Colorado

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
Revised November 2004
Revised February 15, 2005

RKM
1/16/06

14562

Page

TABLE OF CONTENTS ii

ENGINEERING STATEMENT iii

PROJECT AREA DESCRIPTION 1

PREVIOUS REPORTS 1

HYDROLOGY 3

EXISTING MAJOR SUB-WATERSHED DESCRIPTIONS 4

DEVELOPED MAJOR SUB-WATERSHEDS 9

HYDROLOGY RESULTS 9

REGIONAL DETENTION HYDROLOGY 11

HYDRAULICS 13

FLOODPLAIN STATEMENT 14

PROPOSED FACILITIES 14
- Detention 14
- Drainageways 16
- Drop and Check structures 17
- Roadway Crossings 17
- Trails 18
- Maintenance 18
- Right-of-way 19

DRAINAGE BASIN FEES 20

LIST OF TABLES

Table 1 Comparison of 100-year Peak Discharges 10
Table 2 Comparison of Existing, Future and Detained Condition Peak Discharges 12

LIST OF FIGURES

Figure 1 Vicinity Map 2
Figure 2 Hydrologic Soils Map 5
Figure 3 Hydrologic Land Use Map 6
Figure 4 Existing Condition Sub-basin Map .... MP
Figure 5 Proposed Condition Sub-basin Map .... MP
Figure 6 Proposed Facilities .... MP
Figure 7 Floodplain Information 15

Appendix A – Hydrologic Calculations
Appendix B – Hydraulic Calculations
Appendix C – Plan and Profiles

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
Plaza of the Rockies
102 South Tejon Suite 200
Colorado Springs, CO 80903

CITY OF COLORADO SPRINGS

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

________________________ ________________________

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 6th 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.

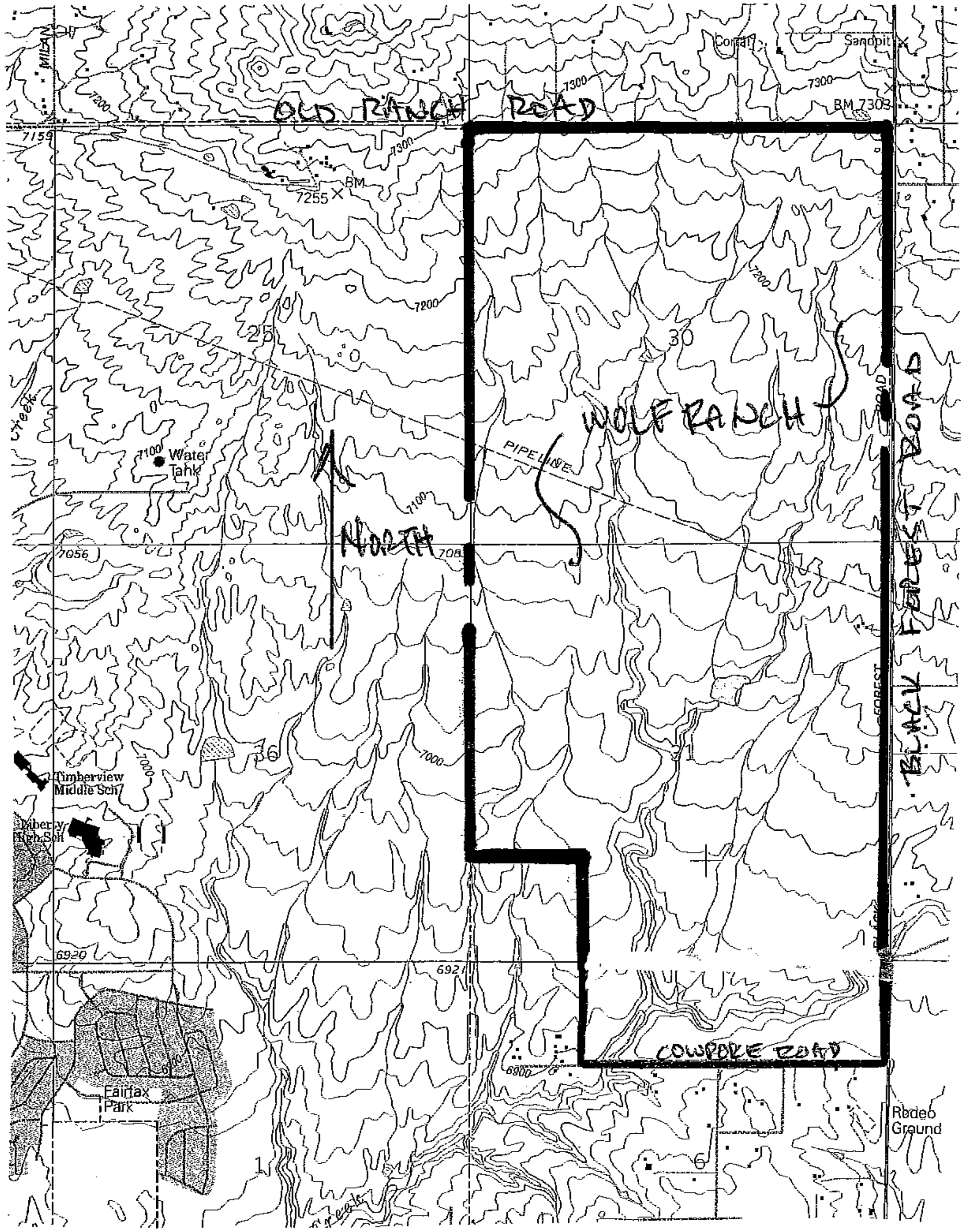


FIGURE 1
VICINITY MAP

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.

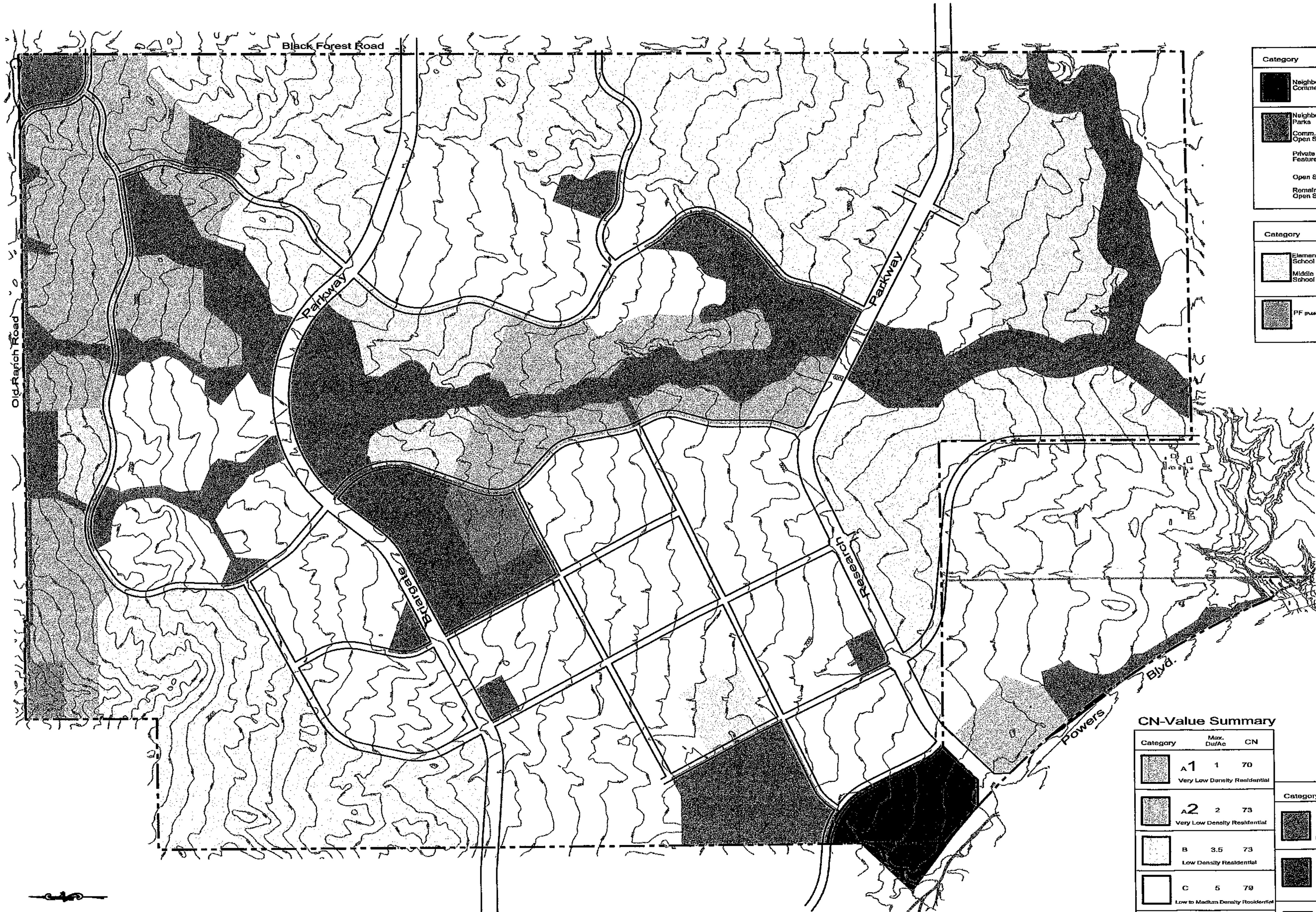
The time of concentration for each of the sub-basins modeled was estimated. The time of concentration was computed from a combination of overland flow, channel and pipe flow for each sub-basin. The time lag for each sub-basin was computed by reducing the time of concentration by 60 percent. The time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



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

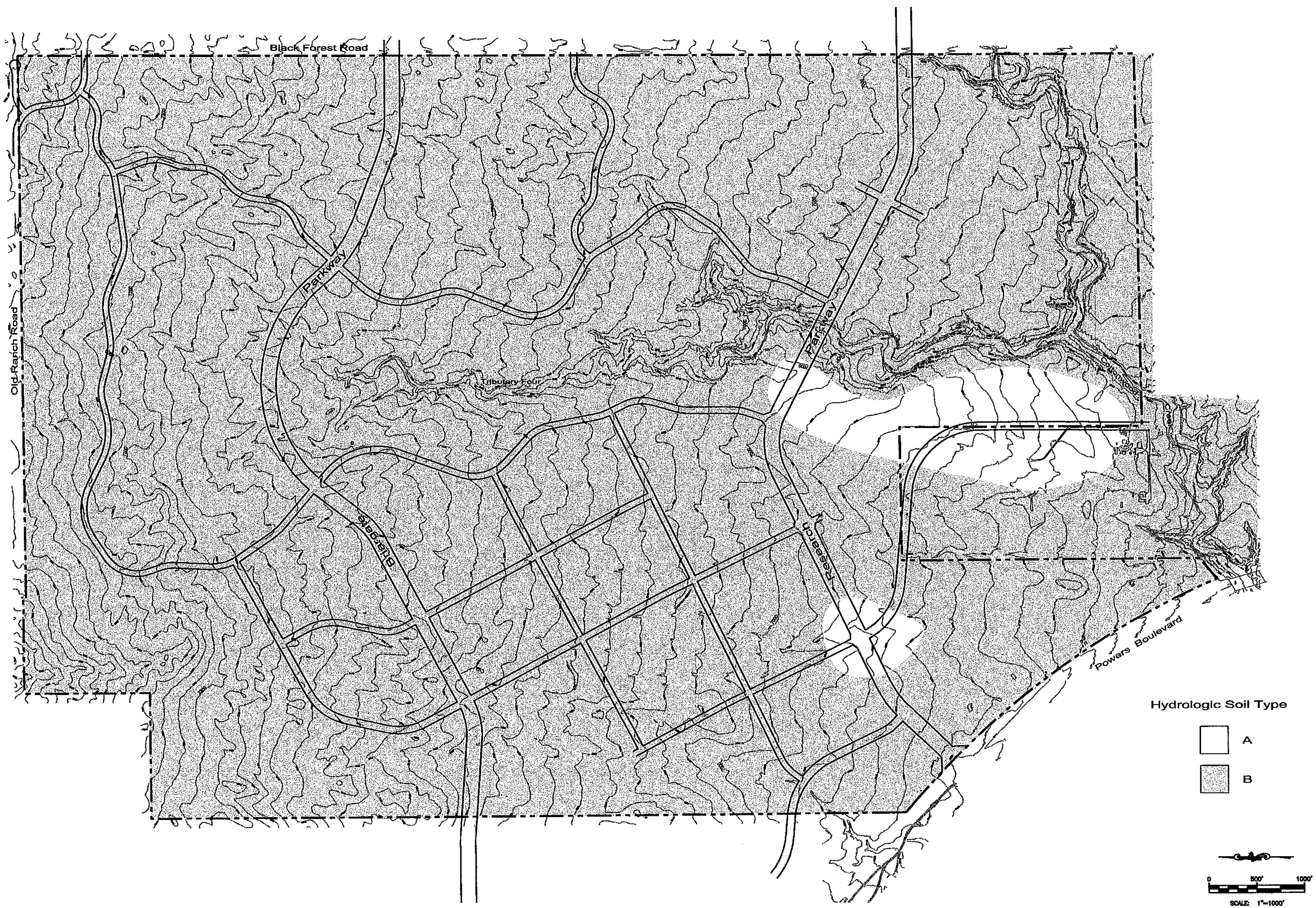
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904
(719) 630-7342

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/Feb 14, 2005



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/Feb 14, 2005

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 denser development occurs 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 61 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 1,280 cubic feet per second/square mile (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	270	930
F	n/r	1,450	310	1,650
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, DB19 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 as 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	270	933	37	138
A5	at Cross Creek Drive	N/A	N/A	273	935	273	935
A6	at existing stock pond	12	142	225	723	225	723
A3	at Briargate Boulevard	N/A	N/A	89	330	89	330
C	at Cottonwood Creek	8	94	104	314	104	314
D	at Cottonwood Creek	10	107	47	162	N/A	N/A
D2 (1)	at south property line	10	103	48	158	33	151
E	at Cottonwood Creek	11	124	94	304	N/A	N/A
E2 (1)	at south property line	6	66	98	309	33	151
F	Tributary 4 at Cottonwood Creek	49	661	307	1,654	102	565
F28	Tributary 4 at Research Parkway	55	664	304	1,659	101	554
F22	Tributary 4 1,000' south of Briargate	49	570	126	850	52	245
G	at Cottonwood Creek	13	155	129	502	40	134
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 G-5, 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

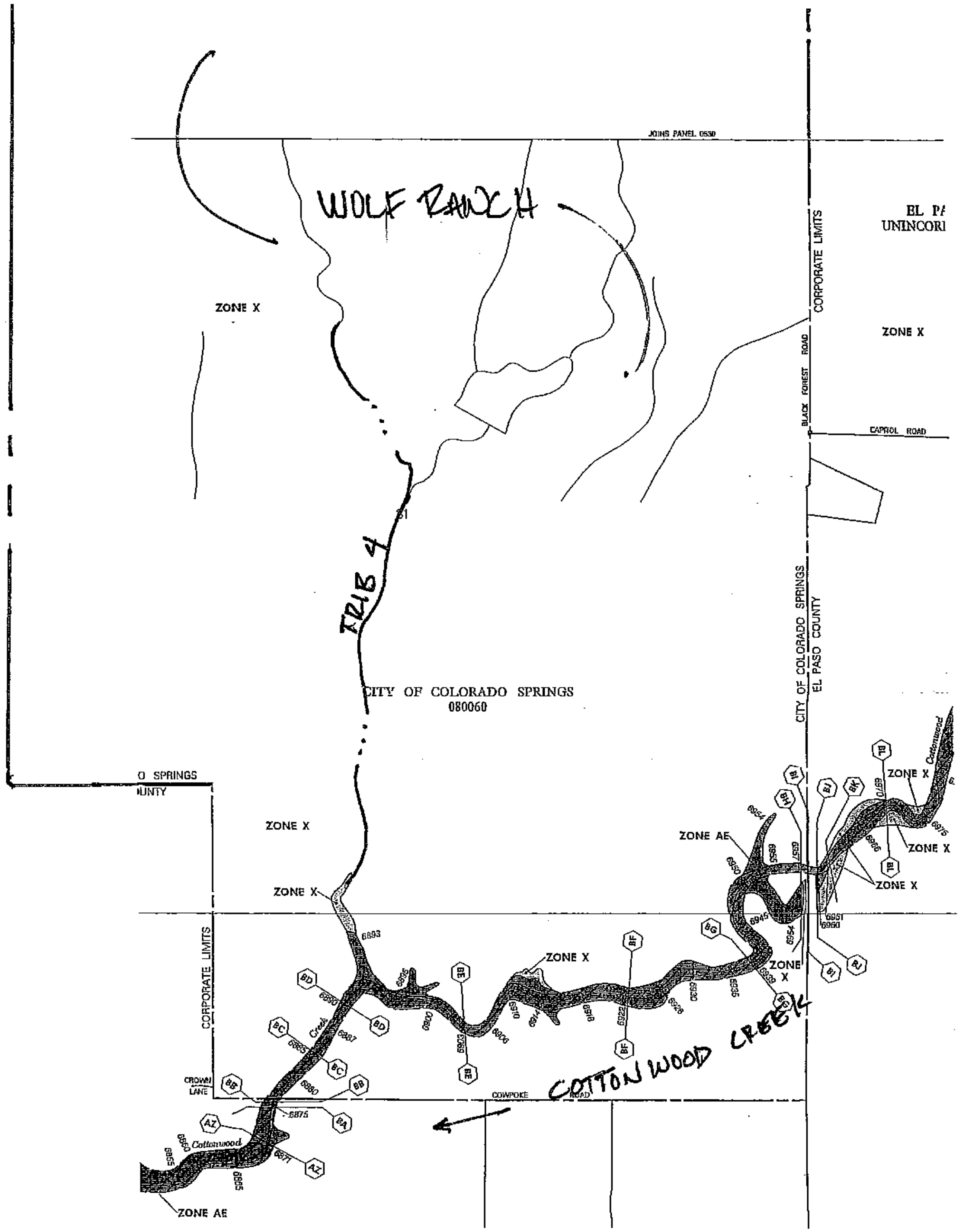


FIGURE 7
FLOODLAIN INFORMATION

E/D has been constructed with the Westcreek II subdivision. Detention basin E/D was design to function as a wetland bottom extended duration detention basin in conformance with Volume 2 of the City's Drainage Criteria Manual. 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. 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 through the platting process.

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 and on the preliminary plan and profiles of Tributary Four.

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.

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 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 repaired the wingwalls on the bridge at Black Forest Road and installed some additional riprap outlet protection. The bridge at Cowpoke Road will be removed when Tutt Boulevard is extended across Cottonwood Creek and Cowpoke Road is realigned.

As part of the annexation agreement for the Wolf Ranch property the Black Forest Road bridge 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. The hydraulic capacity of the new structure when built should be able to convey the discharges estimated in this MDDP.

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 denser land use takes place in the future, stormwater detention would be required so that an increase the rates of runoff to the Wolf Ranch property does not occur. There is however no intention to replace the existing crossing under Old Ranch Road as part of the development of 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

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.

At the present time a metropolitan district is in existence that will serve the Wolf Ranch property. The metropolitan district will be responsible for the construction and maintenance of various public facilities within the Wolf Ranch property including but not necessarily limited to common open spaces and landscaped medians, parks, roadways, major drainageways, detention basin and community centers. The exact scope of the maintenance responsibilities of the metropolitan district is still subject to refinement. Agreements between the City of Colorado Springs and the metropolitan district may need to be developed that will define the exact maintenance responsibility for the public infrastructure within Wolf Ranch. At this time it is envisioned that the major drainageway facilities shown in this MDDP along Tributary Four and drainageway A, as well as the detention basins would be subject to maintenance by the metropolitan district. If the portion of the Cottonwood Creek that lies within Wolf Ranch is closed to fee assessment and reimbursement of facilities (see discussion below), it is envisioned that the district would take over maintenance responsibilities of the major drainageway facilities and detention basin shown in this MDDP.

Has this been refined?

You will need to update DBPS & go to Drainage Board for fee adjustment

Right-of-Way

It will be required for the main drainageways that pass through the development to be located within dedicated tracts, easements or right-of-ways. Access to these tracts or easement will be granted to the metropolitan district so that routine maintenance activities can be conducted. In the case of right-of-ways and tracts, these lands would be dedicated to the metropolitan district. 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.

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 estimated cost for these facilities as presented in the DBPS was approximately $400,000. 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 reestablished. Should the closing of the basin be approved by the Drainage Board, the Cottonwood Creek DBPS would have to be updated to reflect the changes to the Cottonwood Creek basin fees and the elimination of major drainageway facilities that will be constructed within the Wolf Ranch property.

What is the latest?

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	73	0	0	0	96	0	0	0	73.0
A-4	55.1	79	73	0	0	36.9	18.2	0	0	77.0
A-5	71.3	79	61	75	0	39.2	28.5	3.6	0	71.6
A-6	23.7	79	0	0	0	23.7	0	0	0	79.0
A-7	32.0	61	79	0	0	2.7	29.3	0	0	77.5
A-8	50.6	85	88	61	0	15	30	5.6	0	84.1
A-9	43.1	79	75	0	0	32.3	10.3	0	0	77.1
A-10	5.5	92	61	0	0	3.3	2.2	0	0	79.6
A-11	51.8	61	73	79	0	3	14.1	34.7	0	76.3

Wolf Ranch Master Development Drainage Plan
Time of Concentration
A-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
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-8	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.**	A-8
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
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
Time of Concentration
B-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		
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) = $(1.49/n)R_n^{2/3}S^{1/2}$

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
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	92	61	0	35.0	21	14.4	0	79.2
C-3	35.2	79	0	0	0	35.2	0	0	0	79.0

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
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	61	0	0	36.5	2.9	0	0	77.7
D-2	23.0	73	0	0	0	23.0	0	0	0	73.0
D-3	15.4	61	0	0	0	15.4	0	0	0	61.0

Wolf Ranch Master Development Drainage Plan
Time of Concentration
D-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
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
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

E-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	
E-1	25.8	79	0	0	0	25.8	0	0	0	79.0
E-2	33.3	73	0	0	0	33.3	0	0	0	73.0
E-3	63.7	61	0	0	0	63.7	0	0	0	61.0
E-4	27.1	73	0	0	0	27.1	0	0	0	73.0
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
Time of Concentration
E-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
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
WEIGHTED CN-VALUES
FUTURE DEVELOPMENT CONDITIONS

F-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
F-1 to F-7										data taken from prior program compilations
F-8	57.8	70	73	0	0	28.9	28.9	0	0	71.5
F-9	27.5	70	0	0	0	27.5	0	0	0	70.0
F-10	11.5	61	75	0	0	6.6	4.9	0	0	67.0
F-11	29.4	61	70	0	0	5.9	23.5	0	0	68.2
F-12	37.2	61	70	0	0	3.1	34.1	0	0	69.3
F-13	9	61	0	0	0	9.0	0	0	0	61.0
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	70	73	0	0	0.9	16.4	0	0	72.8
F-17	24.9	61	70	73	0	23.1	0	1.2	0	60.1
F-18	63	61	70	79	0	9.5	22.1	31.4	0	73.1

F-19	65.3	61	73	79	0	20.9	0	44.4	0	73.2
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	79	0	0	0	57.0	0	0	0	79.0
F-25	57	61	73	79	0	6.0	29	22	0	74.1
F-26	34	0	79	0	0	0.0	34	0	0	79.0
F-27	129	61	73	92	0	26.0	65	38	0	76.2
F-28	24	61	73	79	0	13.0	5	6	0	68.0
F-29	16	61	79	0	0	8.0	8	0	0	70.0
F-30	14	79	73	0	0	11.0	3	0	0	77.7
F-31	60	61	73	79	65	33.0	6	18	3	67.8

Wolf Ranch Master Development Drainage Plan
Time of Concentration
F-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		
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-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) = $(1.49/n)R_n^{2/3}S^{1/2}$

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

Slope (S) = Slope of the channel

n = Manning's number

R_n = Hydraulic Radius (Reynold's Number)

WOLF RANCH MASTER DEVELOPMENT DRAINAGE PLAN
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	0	0	0	113.3	0	0	0	73.0
G-5	43.5	80	79	0	0	33.0	10.5	0	0	79.8

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

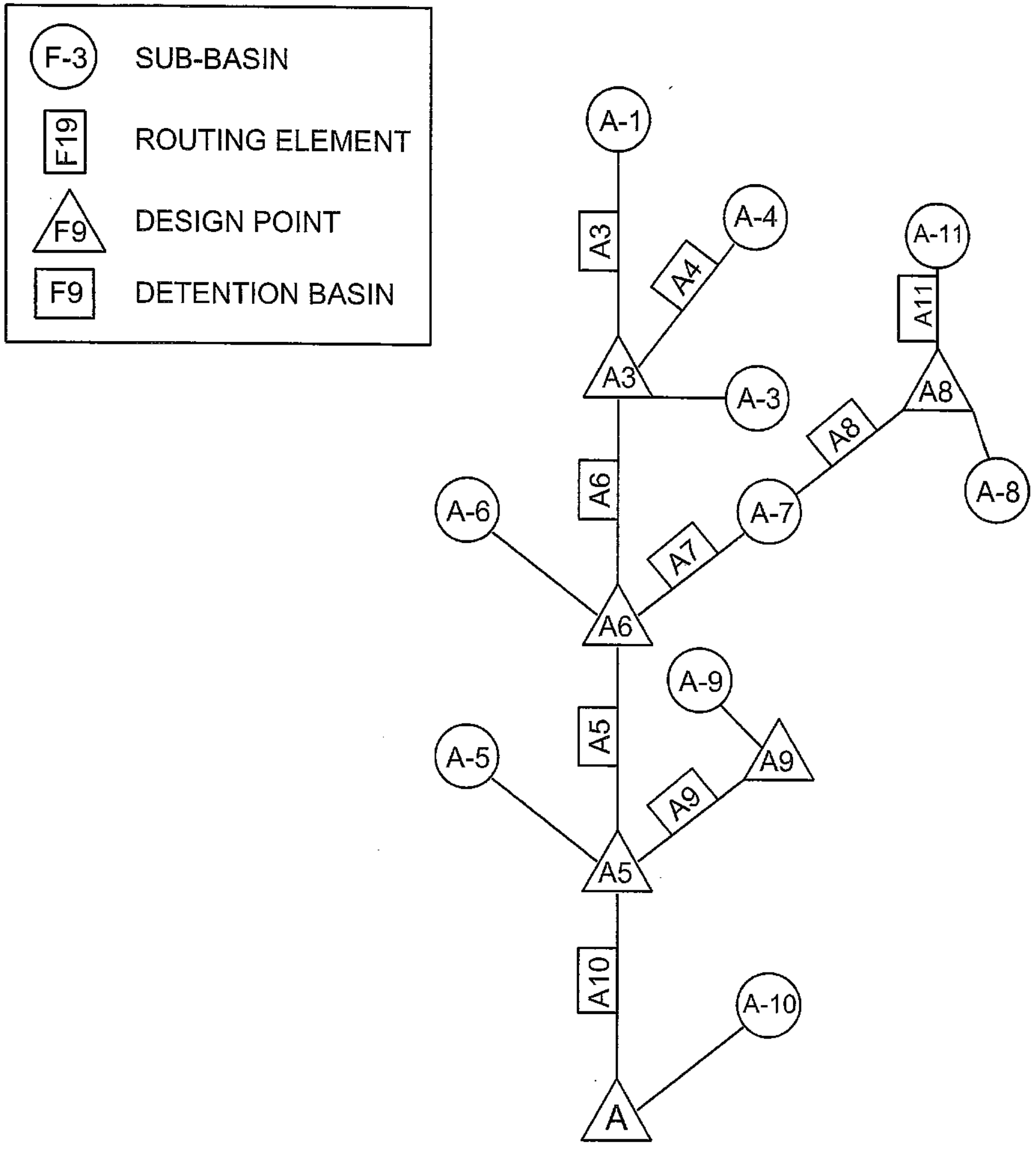
S = Slope of flow path in percent

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

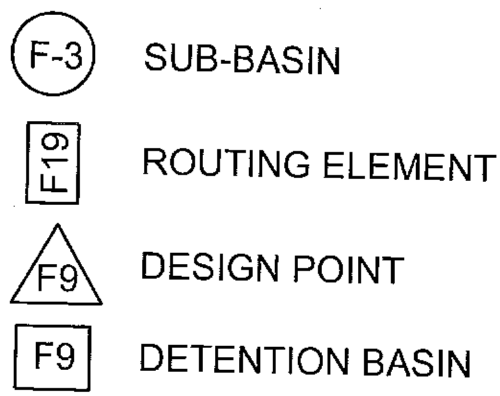
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

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



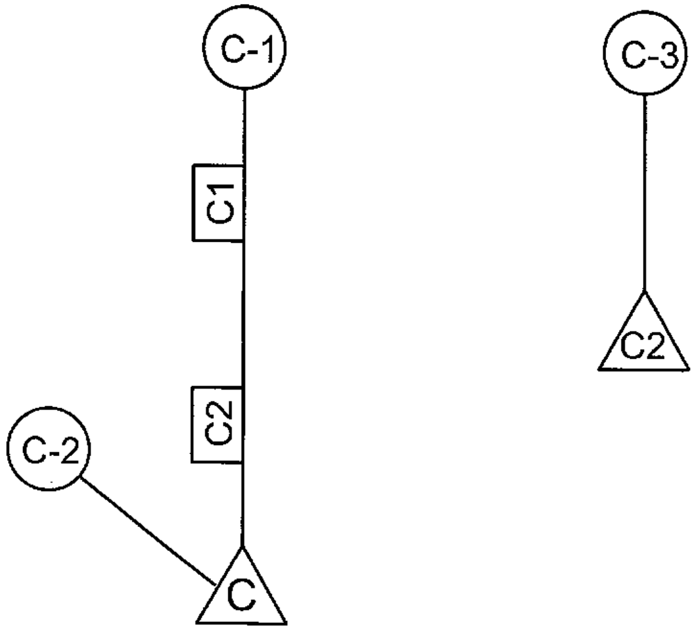
Kiowa Engineering Corporation

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

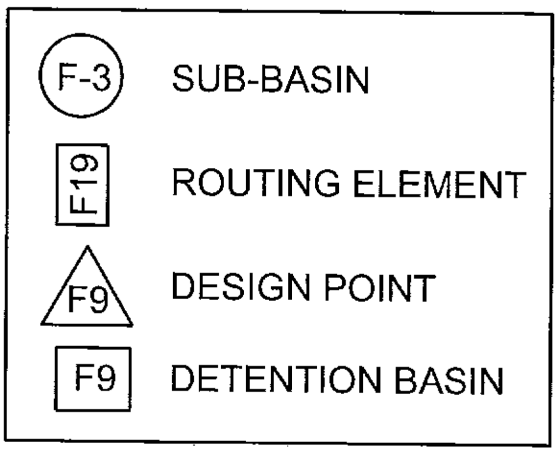
WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

FIGURE B

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



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'C' BASINS



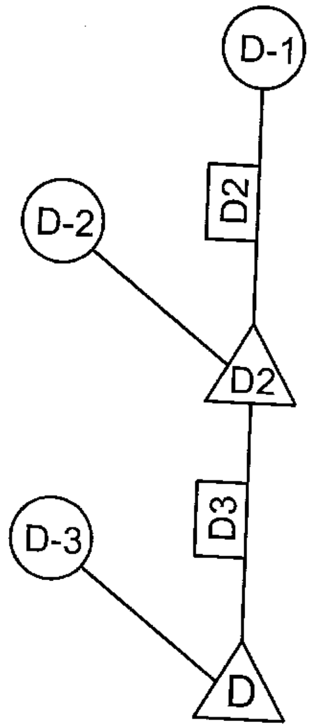
Kiowa Engineering Corporation

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

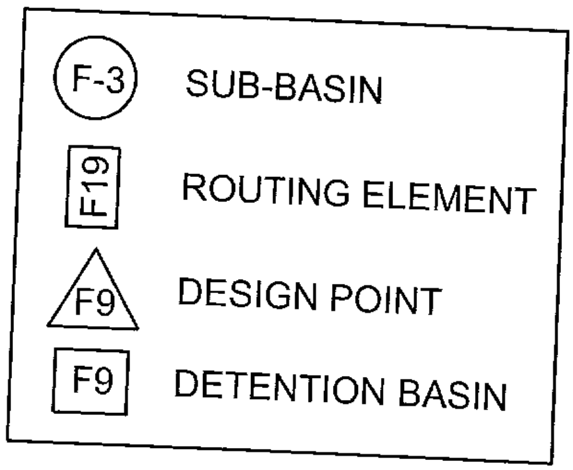
WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

FIGURE C

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



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'D' BASINS

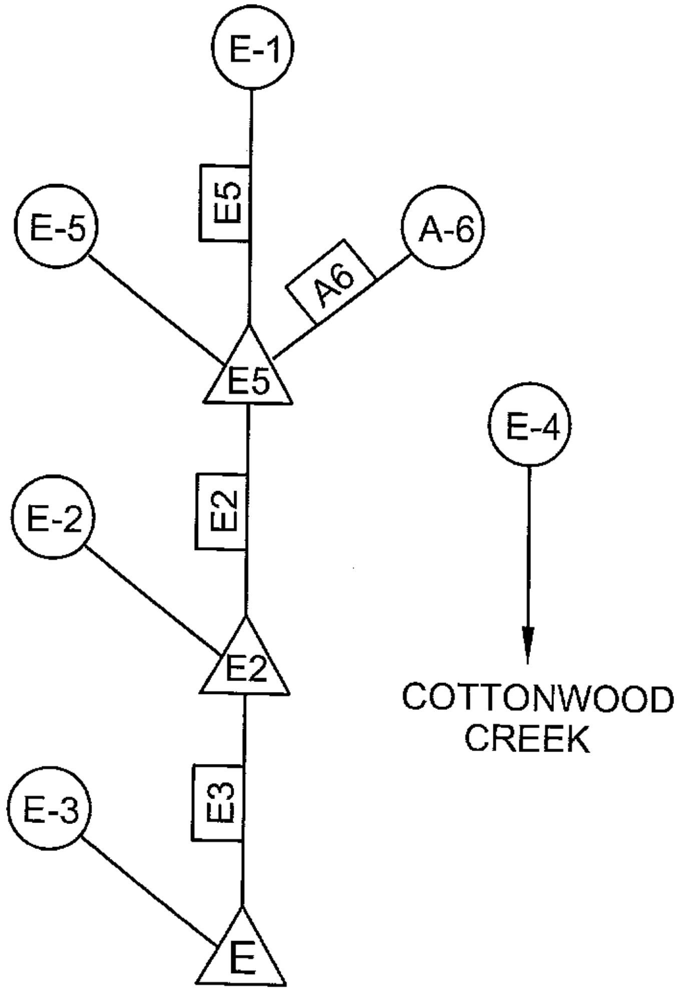


Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

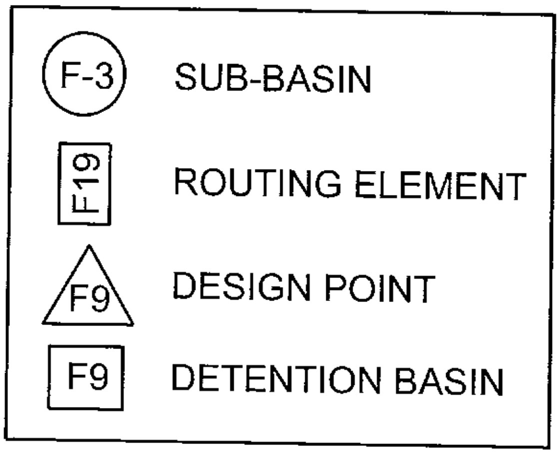
WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

FIGURE D

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



HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'E' BASINS

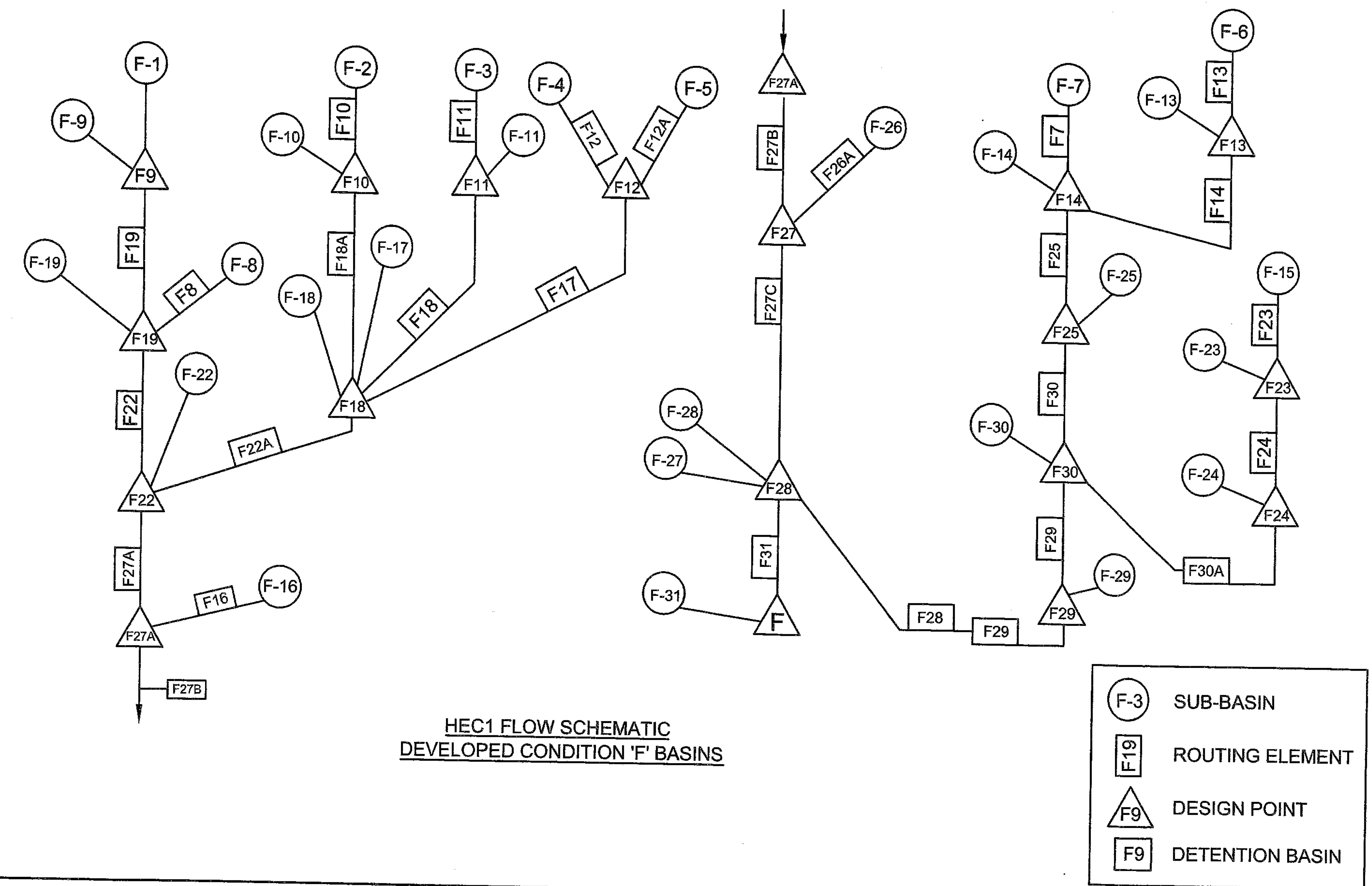


Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
HYDROLOGIC MODEL SCHEMATIC
COLORADO SPRINGS, COLORADO

FIGURE E

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



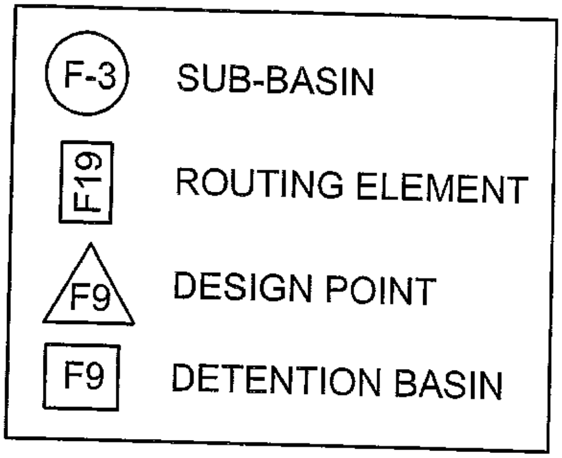
HEC1 FLOW SCHEMATIC
DEVELOPED CONDITION 'F' BASINS

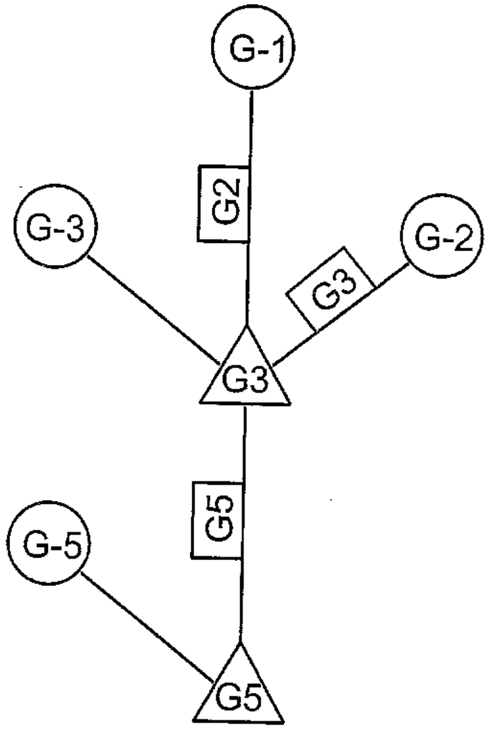
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

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/Feb 14, 2005





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


```
         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

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

KK   A-1
KM   SCS RUNOFF FOR SUB-BASIN A-1
BA   .1819
IN      15
PB     4.4
PC   0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080
0.0100  0.0120  0.0143
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      61
UD    0.36

KK   A-2
KM   RUNOFF FOR SUB-BASIN A-2
BA   .1098
LS       0      61
UD     .29

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

KK    DBA1
KM   ROUTE DP 1A THROUGH EXISTING STOCK POND DBA1
RS       1    ELEV    7040                    1
SA    0.16    0.34    0.56    0.77
SE    7040    7041    7042    7043
SS    7041      60    0.49     1.5
ST    7041      60    0.49     1.5
SW       0      10      70      90
SE    7043    7041    7041    7043

KK      A3
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
```

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 ***

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                                         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             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 ***
```

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


```
           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-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      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          .16   LAG
```

***

UNIT HYDROGRAPH
30 END-OF-PERIOD ORDINATES

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

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

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	.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)

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

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

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

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 2-100 YR

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

HEC-1 INPUT

1
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
                                                   HEC-1 INPUT
1
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

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.      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
```

	.00	.00	.00	.00	.00	.00	.00	.00	.00
'0	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.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
)0	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.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 .48	RATIO 2 .61	RATIO 3 .70	RATIO 4 .93	RATIO 5 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)   *                *   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               *
 *                                       *                *                                     *
 *****************************************                ***************************************
```

```
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 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

67.	12.	37.	77.	123.	148.	152.	141.	121.	93.
4.	50.	38.	29.	22.	16.	12.	9.	7.	5.
	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.
				TIME	6.92	6.58	6.50	6.42	6.42

1

*** 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  [illegible]
          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     .34

          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                                                 HEC-1 INPUT
PAGE  3

        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      60      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           .           .         F-3
```

```
                .           .           .
                .           .           .
  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

32.	108.	149.	131.	85.	49.	30.	18.	10.
6.								
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

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          .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
                     TLAG          .44  LAG

                                                        ***

                                                   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
```

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	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.
				TIME	6.75	6.33

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

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
                                                                                        )
```

```
            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    0.05

            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
   .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           .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
.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

27 LS SCS LOSS RATE

STRTL 1.28 INITIAL ABSTRACTION

CRVNBR 61.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

28 UD SCS DIMENSIONLESS UNITGRAPH

TLAG .47 LAG

***

UNIT HYDROGRAPH
30 END-OF-PERIOD ORDINATES

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

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						
+	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 ***

HEC-1 INPUT & OUTPUT
DEVELOPED CONDITIONS

```
1***************************************
*                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                     *
* RUN DATE   11FEB05  TIME   10:15:24  *
*                                     *
***************************************
```

```
***************************************
*                                     *
*   U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER     *
*         609 SECOND STREET           *
*     DAVIS, CALIFORNIA 95616         *
*         (916) 756-1104              *
*                                     *
***************************************
```

A-BASINS DEVELOPED

```
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 Developed Drainage Plan
   2       ID      A Basins, future development condition ABAS-F.DAT
   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-4
 28    KM   RUNOFF FROM SUB-BASIN A-4
 29    BA   .0861
 30    LS       0      77
 31    UD    0.21

 32    KK      A4
 33    KM   ROUTE FLOW FROM SB A-4 TO DP A3
 34    RD     450     .02    .013            CIRC     3.5

 35    KK     A-3
 36    KM   RUNOFF FROM SUB-BASIN A-3
 37    BA   .1500
 38    LS       0      73
 39    UD    .221

 40    KK    DPA3
 41    KM   DESIGN POINT A3 COMBINE RUNOFF FROM SUB-BASIN A-3, A3 AND A4
 42    HC       3
1                                   HEC-1 INPUT                                              PAGE  2

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

 43    KK      A6
 44    KM   ROUTE FLOW FROM DP A3 TO DP A6
 45    RD    1550    .016    0.04            TRAP      10       4

 46    KK    A-11
 47    KM   RUNOFF FROM SUB-BASIN A-11
 48    BA    .081
 49    LS       0    76.3
 50    UD     .19

 51    KK     A11
 52    KM   ROUTE RUNOFF FROM SB A-11 TO DPA8
```

```
53      RD    1400    .02    .013          CIRC     3.5

54      KK     A-8
55      KM    RUNOFF FROM SUB-BASIN A-8
56      BA    .079
57      LS       0    84.1
58      UD    .250

59      KK    DP A8
60      KM    COMBINE RUNOFF FROM SB A-8 AND A11
61      HC       2

62      KK      A8
63      KM    ROUTE RUNOFF FROM DP A8 TO DP A7
64      RD    1100    .02    .013          CIRC     4.5

65      KK    A-7
66      KM    RUNOFF FROM SUB-BASIN A-7
67      BA    .0500
68      LS       0    77.5
69      UD    .172

70      KK    DP A7
71      KM    COMBINE RUNOFF FROM SUB-BASIN A-7 AND A8
72      HC       2

73      KK      A7
74      KM    ROUTE FLOW FROM SUB-BASIN A-7 TO DP A6
75      RD     800    0.02   0.013         CIRC       5

76      KK    A-6
77      KM    RUNOFF FROM SUB-BASIN A-6
78      BA    .037
79      LS       0      79
80      UD     .21

81      KK     DPA6
82      KM    DESIGN POINT A6 COMBINE RUNOFF FROM SUB-BASIN A-6, A6 AND A7
83      HC       3
```



```
84      KK      A5
85      KM    ROUTE FLOW FROM DESIGN POINT A6 TO DP A5
86      RD    2200    .011    .04          TRAP      10       4

87      KK    A-9
88      KM    RUNOFF FROM SUB-BASIN A-9
89      BA    .0673
90      LS       0    77.1
```

```
              91           UD    .263

              92           KK     A9
              93           KM   ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
              94           RD     500      .02    .016            CIRC     3.5

              95           KK   A-5
              96           KM   RUNOFF FROM SUB-BASIN A-5
              97           BA   .1114
              98           LS       0    71.6
              99           UD    .209

             100           KK    DPA5
             101           KM   DESIGN POINT A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9
             102           HC       3

             103           KK     A10
             104           KM   ROUTE FLOW FROM DESIGN POINT A5 TO DESIGN POINT A
             105           RD     720    .021     .04             TRAP      15       4

             106           KK    A-10
             107           KM   RUNOFF FROM SUB-BASIN A-10
             108           BA   .0086
             109           LS       0    79.6
             110           UD    .231

             111           KK     DPA
             112           KM   DESIGN POINT A COMBINE RUNOFF SUB-BASIN A-10 AND A10
             113           HC       2
             114           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-4
                .            V
                .            V
    32          .           A4
                .            .
                .            .
    35          .            .          A-3
                .            .            .
                .            .            .
```

```
 40        DPA3........................
              V
              V
 43          A6
              .
              .
 46           .        A-11
              .           V
              .           V
 51           .         A11
              .           .
              .           .
 54           .           .         A-8
              .           .           .
              .           .           .
 59           .       DP A8............
              .           V
              .           V
 62           .          A8
              .           .
              .           .
 65           .           .       A-7
              .           .           .
              .           .           .
 70           .       DP A7............
              .           V
              .           V
 73           .          A7
              .           .
              .           .
 76           .           .       A-6
              .           .           .
              .           .           .
 81        DPA6........................
              V
              V
 84          A5
              .
              .
 87           .       A-9
              .           V
              .           V
 92           .          A9
              .           .
              .           .
 95           .           .       A-5
              .           .           .
              .           .           .
100        DPA5........................
              V
              V
103         A10
```

```
                .
                .
  106           .       A-10
                .          .
                .          .
  111          DPA...........

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                        *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
 *              JUN   1998                *
 *           VERSION 4.1                  *
 *                                        *
 *  RUN DATE   11FEB05  TIME  10:15:24    *
 *                                        *
 *****************************************

 *****************************************
 *                                       *
 *    U.S. ARMY CORPS OF ENGINEERS       *
 *    HYDROLOGIC ENGINEERING CENTER      *
 *          609 SECOND STREET            *
 *       DAVIS, CALIFORNIA 95616         *
 *           (916) 756-1104              *
 *                                       *
 *****************************************


                                             Wolf Ranch, Master Developed Drainage Plan
                                          A Basins, future development condition ABAS-F.DAT
                                               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-4	.09	1	FLOW	42.	137.
				TIME	6.08	6.08
ROUTED TO						
+	A4	.09	1	FLOW	41.	136.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-3	.15	1	FLOW	49.	194.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPA3	.30	1	FLOW	89.	330.
				TIME	6.17	6.08
ROUTED TO						
+	A6	.30	1	FLOW	88.	322.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-11	.08	1	FLOW	40.	131.
				TIME	6.08	6.08
ROUTED TO						
+	A11	.08	1	FLOW	37.	128.
				TIME	6.08	6.08

HYDROGRAPH AT						
+	A-8	.08	1	FLOW	58.	154.
				TIME	6.17	6.08
2 COMBINED AT						
+	DP A8	.16	1	FLOW	94.	282.
				TIME	6.08	6.08
ROUTED TO						
+	A8	.16	1	FLOW	94.	276.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-7	.05	1	FLOW	28.	87.
				TIME	6.08	6.08
2 COMBINED AT						
+	DP A7	.21	1	FLOW	119.	364.
				TIME	6.08	6.08
ROUTED TO						
+	A7	.21	1	FLOW	117.	359.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-6	.04	1	FLOW	21.	64.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA6	.54	1	FLOW	225.	723.
				TIME	6.17	6.08
ROUTED TO						
+	A5	.54	1	FLOW	221.	713.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-9	.07	1	FLOW	29.	96.
				TIME	6.17	6.17
ROUTED TO						
+	A9	.07	1	FLOW	29.	95.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-5	.11	1	FLOW	33.	139.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPA5	.72	1	FLOW	273.	935.
				TIME	6.25	6.17

```
 ROUTED TO
+                 A10       .72     1   FLOW          266.     919.
                                        TIME          6.25     6.17

 HYDROGRAPH AT
+                A-10       .01     1   FLOW            5.      15.
                                        TIME          6.08     6.08

  2 COMBINED AT
+                 DPA       .73     1   FLOW          270.     933.
                                        TIME          6.25     6.17

1
```

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00									
A3	MANE	1.25	4.28	397.50	.18	5.00	3.12	405.00	.18

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5932E+00 EXCESS= .0000E+00 OUTFLOW= .5910E+00 BASIN STORAGE= .9858E-02 PERCENT ERROR= -1.3

FOR PLAN = 1 RATIO= .00									
A3	MANE	1.75	32.23	383.25	1.02	5.00	31.41	385.00	1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3276E+01 EXCESS= .0000E+00 OUTFLOW= .3277E+01 BASIN STORAGE= .1004E-01 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= .00									
A4	MANE	.49	41.51	365.63	.72	5.00	40.75	365.00	.72

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3296E+01 EXCESS= .0000E+00 OUTFLOW= .3296E+01 BASIN STORAGE= .3985E-04 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
A4	MANE	.38	136.75	365.55	2.13	5.00	136.13	365.00	2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9780E+01 EXCESS= .0000E+00 OUTFLOW= .9780E+01 BASIN STORAGE= .3901E-04 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
A6	MANE	2.00	89.81	372.00	.52	5.00	87.95	370.00	.52

'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

```
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              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   24JAN05  TIME  09:53:48  *                          *         (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                      C basins future development condition PN 03094
         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     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
```

C-Basin Developed

```
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    79.2
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)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   24JAN05  TIME  09:53:48   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*          (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

  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	84.	240.
				TIME	6.00	6.00
2 COMBINED AT +	DPC	.16	1	FLOW	104.	314.
				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)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	DT (MIN)	INTERPOLATED TO COMPUTATION INTERVAL PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)

FOR PLAN = 1 RATIO= .00

12 PC 0.0000 0.0005 0.0015 0.0030 0.0045 0.0060 0.0080 0.0100 0.0120 0.0143

```
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   24JAN05  TIME  10:06:30  *                    *          (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 future development condition pn 03094
   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     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
```

D-Basins Developed

```
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    77.7
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      73
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

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

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)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   24JAN05  TIME  10:06:30   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (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

   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 TIME	35. 6.08	108. 6.08
ROUTED TO +	D2	.06	1	FLOW TIME	33. 6.08	105. 6.08
HYDROGRAPH AT +	D-2	.04	1	FLOW TIME	15. 6.08	57. 6.00
2 COMBINED AT +	DPD2	.10	1	FLOW TIME	48. 6.08	158. 6.08
ROUTED TO +	D3	.10	1	FLOW TIME	47. 6.17	155. 6.08
HYDROGRAPH AT +	D-3	.02	1	FLOW TIME	1. 6.42	11. 6.25

```
  2 COMBINED AT          DPD      .12     1   FLOW        47.    162.
+                                             TIME        6.17   6.08

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   24JAN05  TIME  10:25:27    *                    *         (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                                       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 basins future development condition 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     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
```

```
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      79
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
```



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

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

KK     E-2
KM   RUNOFF FROM SUB-BASIN E-2
BA   .0520
LS       0      73
UD    .134

KK    DPE2
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       73
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
```

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*              VERSION 4.1             *
*                                      *
* RUN DATE   24JAN05  TIME  10:25:27   *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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 basins future development condition 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

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	26.	77.
				TIME	6.08	6.00
ROUTED TO +	E5	.04	1	FLOW	26.	76.
				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	80.	233.
				TIME	6.08	6.08
ROUTED TO +	E2	.13	1	FLOW	76.	232.
				TIME	6.08	6.08

```
 HYDROGRAPH AT
+                    E-2        .05       1    FLOW           22.       79.
                                               TIME          6.08      6.00

  2 COMBINED AT
+                   DPE2        .18       1    FLOW           98.      309.
                                               TIME          6.08      6.08

 ROUTED TO
+                     E3        .18       1    FLOW           94.      301.
                                               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           94.      304.
                                               TIME          6.25      6.17

 HYDROGRAPH AT
+                    E-4        .04       1    FLOW           18.       63.
                                               TIME          6.08      6.08
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   24JAN05  TIME  16:15:22   *                    *        (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

                                                                                                     PAGE  1
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 future development conditions PN 03094
     3       ID             5-year and 100 year, 24hr Type IIA Storm FN: FBAS-F.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
```

F. Basins Developed

```
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    71.5
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       70
UD     .16

KK    DPF9
KM   COMBINE FLOW FROM SUB-BASIN F-9 AND RF-9
HC       2
```



```
1

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       67
UD     .15

KK   DPF10
KM   COMBINE FLOW FROM SUB-BASIN F-10 AND RF10
HC       2

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

KK     F-3
KM   RUNOFF FOR SUB-BASIN F-3
BA   .0942
LS       0       61
UD     .22

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



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

KK    F-11
KM   RUNOFF FOR SUB-BASIN F-11
BA   .0460
LS       0     68.2
UD     .17

KK   DPF11
KM   COMBINE FLOW FROM SUB-BASIN F-11 AND RF-11
```

```
HC        2

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

KK     F-4
KM   RUNOFF FOR SUB-BASIN F-4
BA   .2681
LS       0       61
UD     .28

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

KK     F-5
KM   RUNOFF FOR SUB-BASIN F-5
BA   .1073
LS       0       61
UD     .34

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

KK     F-12
KM   RUNOFF FOR SUB-BASIN F-12
BA   .0590
LS       0     69.3
UD     .20

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

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

KK     F-17
KM   RUNOFF FOR SUB-BASIN F-17
BA   .0380
LS       0     60.1
UD     .21
```



```
KK     F-18
KM   RUNOFF FOR SUB-BASIN F-18
```

```
BA   .0980
LS       0    73.1
UD     .21

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

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

KK    F-22
KM   RUNOFF FOR SUB-BASIN F-22
BA   .0640
LS       0    64.1
UD     .21

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

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

KK    F-16
KM   RUNOFF FOR SUB-BASIN F-16
BA   .0270
LS       0    72.8
UD     .21

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

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

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

KK    F-26
KM   RUNOFF FOR SUB-BASIN F-26
BA   .0520
LS       0      79
UD     .19
```

```
KK  RF-26A
KM   ROUTE FLOW FROM SUB-BASIN F-26 TO DESIGN POINT F27
RD    1250   0.013    0.04               TRAP      10        6

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

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

KK     F-7
KM   RUNOFF FOR SUB-BASIN F-7
BA   .0782
LS        0       61
UD      .19

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

KK    F-14
KM   RUNOFF FOR SUB-BASIN F-14
BA   .1290
LS        0     73.0
UD      .23

KK     F-6
KM   RUNOFF FOR SUB-BASIN F-6
BA   .0310
LS        0       61
UD      .19

KK   RF-13
KM   ROUTE FLOW FROM SUB-BASIN F-6 TO DESIGN POINT F13
RD     800   0.038    0.04               TRAP      10        6

KK    F-13
KM   RUNOFF FOR SUB-BASIN F-13
BA   .0140
LS        0       61
UD      .14

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

KK   RF-14
KM   ROUTE FLOW FROM DESIGN POINT F13 TO DESIGN POINT F14
```

```
 208          RD    3600   0.027     0.04                  TRAP       20        6
1                                           HEC-1 INPUT

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

 209          KK    DPF14
 210          KM    COMBINE FLOW FROM RF-7, F-14, AND RF-14
 211          HC        3

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

 215          KK     F-25
 216          KM    RUNOFF FOR SUB-BASIN F-25
 217          BA    .0890
 218          LS        0    74.1
 219          UD      .28

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

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

 226          KK     F-15
 227          KM    RUNOFF FOR SUB-BASIN F-15
 228          BA     .021
 229          LS        0    69.1
 230          UD      .16

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

 234          KK     F-23
 235          KM    RUNOFF FOR SUB-BASIN F-23
 236          BA    .0310
 237          LS        0    73.0
 238          UD      .18

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

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

```
245          KK     F-24
246          KM   RUNOFF FOR SUB-BASIN F-24
247          BA   .0890
248          LS       0      79
249          UD     .26
```



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

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

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

256          KK    F-30
257          KM   RUNOFF FOR SUB-BASIN F-30
258          BA   .0220
259          LS       0    77.7
260          UD     .18

261          KK   DPF30
262          KM   COMBINE FLOW FROM RF-30, RF-30A, AND F-30
263          HC       3

264          KK   RF-29
265          KM   ROUTE FLOW FROM DESIGN POINT F30 TO DESIGN POINT F29
                                                      TRAP       6       3
266          RD    2350   0.027   0.04

267          KK    F-29
268          KM   RUNOFF FOR SUB-BASIN F-29
269          BA   .0250
270          LS       0      70
271          UD     .19

272          KK   DPF29
273          KM   COMBINE FLOW FROM RF-29 AND F-29
274          HC       2

275          KK   RF-28
276          KM   ROUTE FLOW FROM DESIGN POINT F29 TO DESIGN POINT F28
                                                      TRAP      20       3
277          RD     750   0.015   0.04

278          KK    F-28
279          KM   RUNOFF FOR SUB-BASIN F-28
280          BA    .042
281          LS       0      68
282          UD     .23
```

```
      283            KK    F-27
      284            KM   RUNOFF FOR SUB-BASIN F-27
      285            BA    .213
      286            LS       0    76.2
      287            UD      .32

      288            KK   DPF28
      289            KM   COMBINE FLOW FROM RF-27C, RF-28, F-28 AND F-27
      290            HC       4
1                                          HEC-1 INPUT                                                PAGE  8

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


      291            KK   RF-31
      292            KM   ROUTE FLOW FROM DESIGN POINT F28 TO DESIGN POINT F
      293            RD    3500   0.023   0.04            TRAF     100       3

      294            KK    F-31
      295            KM   RUNOFF FOR SUB-BASIN F-31
      296            BA   .0810
      297            LS       0    67.8
      298            UD      .24

      299            KK    DP F
      300            KM   COMBINE FLOW FROM RF-31 AND F-31
      301            HC       2
      302            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-26
               .           V
               .           V
168            .      RF-26A
               .           .
               .           .
171        DPF27............
```

```
            V
            V
174  RF-27C
            .
            .
177         .      F-7
            .        V
            .        V
182         .     RF-7
            .        .
            .        .
185         .        .      F-14
            .        .         .
            .        .         .
190         .        .         .        F-6
            .        .         .          V
            .        .         .          V
195         .        .         .      RF-13
            .        .         .          .
            .        .         .          .
198         .        .         .          .      F-13
            .        .         .          .         .
            .        .         .          .         .
203         .        .         .      DPF13..........
            .        .         .          V
            .        .         .          V
206         .        .         .      RF-14
            .        .         .          .
            .        .         .          .
209         .     DPF14....................
            .        V
            .        V
212         .     RF-25
            .        .
            .        .
215         .        .      F-25
            .        .         .
            .        .         .
220         .     DPF25..........
            .        V
            .        V
223         .     RF-30
            .        .
            .        .
226         .        .      F-15
            .        .         V
            .        .         V
231         .        .     RF-23
            .        .         .
            .        .         .
234         .        .         .       F-23
            .        .         .          .
```

```
               .           .           .           .
239            .           .       DPF23............
               .           .           V
               .           .           V
242            .           .       RF-24
               .           .           .
               .           .           .
245            .           .           .        F-24
               .           .           .           .
               .           .           .           .
250            .           .       DPF24............
               .           .           V
               .           .           V
253            .           .      RF-30A
               .           .           .
               .           .           .
256            .           .           .        F-30
               .           .           .           .
               .           .           .           .
261            .       DPF30........................
               .           V
               .           V
264            .       RF-29
               .           .
               .           .
267            .           .        F-29
               .           .           .
               .           .           .
272            .       DPF29............
               .           V
               .           V
275            .       RF-28
               .           .
               .           .
278            .           .        F-28
               .           .           .
               .           .           .
283            .           .           .        F-27
               .           .           .           .
               .           .           .           .
288        DPF28....................................
               V
               V
291        RF-31
               .
               .
294            .        F-31
               .           .
               .           .
299         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   24JAN05  TIME  16:15:22   *                    *          (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 FN: FBAS-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 +	F-8	.06	1	FLOW	18.	76.
				TIME	6.17	6.08
ROUTED TO +	RF-8	.06	1	FLOW	18.	74.
				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	13.	55.
				TIME	6.08	6.08
2 COMBINED AT +	DPF9	.21	1	FLOW	20.	157.
				TIME	6.17	6.08
ROUTED TO +	RF-19	.21	1	FLOW	19.	153.
				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	61.	350.
				TIME	6.25	6.17
ROUTED TO +	RF-22	.37	1	FLOW	59.	338.
				TIME	6.25	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	4.	20.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF10	.06	1	FLOW	6.	46.
				TIME	6.17	6.08
ROUTED TO						
+	RF-18A	.06	1	FLOW	5.	45.
				TIME	6.33	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	14.	67.
				TIME	6.08	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	2.	23.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-18	.10	1	FLOW	33.	131.
				TIME	6.08	6.08
5 COMBINED AT						
+	DPF18	.77	1	FLOW	64.	490.
				TIME	6.25	6.17
ROUTED TO						
+	RF-22A	.77	1	FLOW	62.	486.
				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	126.	850.
				TIME	6.33	6.25
ROUTED TO						
+	RF-27A	1.21	1	FLOW	125.	846.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-16	.03	1	FLOW	9.	36.
				TIME	6.08	6.08
ROUTED TO						
+	RF-16	.03	1	FLOW	9.	34.
				TIME	6.25	6.17
2 COMBINED AT						
+	DPF27A	1.24	1	FLOW	133.	880.
				TIME	6.33	6.25

ROUTED TO						
+	RF-27B	1.24	1	FLOW	131.	864.
				TIME	6.42	6.33
HYDROGRAPH AT						
+	F-26	.05	1	FLOW	31.	94.
				TIME	6.08	6.08
ROUTED TO						
+	RF-26A	.05	1	FLOW	30.	90.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF27	1.29	1	FLOW	145.	916.
				TIME	6.42	6.33
ROUTED TO						
+	RF-27C	1.29	1	FLOW	142.	913.
				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	3.	30.
				TIME	6.17	6.08
ROUTED TO						
+	RF-14	.05	1	FLOW	4.	30.
				TIME	6.75	6.33

3 COMBINED AT +	DPF14	.25	1	FLOW TIME	45. 6.17	210. 6.17
ROUTED TO +	RF-25	.25	1	FLOW TIME	44. 6.33	209. 6.25
HYDROGRAPH AT +	F-25	.09	1	FLOW TIME	29. 6.17	108. 6.17
2 COMBINED AT +	DPF25	.34	1	FLOW TIME	67. 6.25	306. 6.17
ROUTED TO +	RF-30	.34	1	FLOW TIME	67. 6.33	305. 6.25
HYDROGRAPH AT +	F-15	.02	1	FLOW TIME	6. 6.08	26. 6.08
ROUTED TO +	RF-23	.02	1	FLOW TIME	5. 6.17	25. 6.17
HYDROGRAPH AT +	F-23	.03	1	FLOW TIME	12. 6.08	44. 6.08
2 COMBINED AT +	DPF23	.05	1	FLOW TIME	16. 6.17	68. 6.08
ROUTED TO +	RF-24	.05	1	FLOW TIME	15. 6.25	65. 6.17
HYDROGRAPH AT +	F-24	.09	1	FLOW TIME	45. 6.17	137. 6.17
2 COMBINED AT +	DPF24	.14	1	FLOW TIME	55. 6.25	202. 6.17
ROUTED TO +	RF-30A	.14	1	FLOW TIME	54. 6.25	196. 6.17

HYDROGRAPH AT						
+	F-30	.02	1	FLOW	12.	38.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPF30	.50	1	FLOW	124.	517.
				TIME	6.25	6.17
ROUTED TO						
+	RF-29	.50	1	FLOW	122.	514.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-29	.03	1	FLOW	7.	30.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF29	.53	1	FLOW	125.	532.
				TIME	6.33	6.25
ROUTED TO						
+	RF-28	.53	1	FLOW	123.	519.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-28	.04	1	FLOW	8.	40.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-27	.21	1	FLOW	75.	264.
				TIME	6.25	6.17
4 COMBINED AT						
+	DPF28	2.07	1	FLOW	304.	1659.
				TIME	6.42	6.33
ROUTED TO						
+	RF-31	2.07	1	FLOW	302.	1622.
				TIME	6.58	6.42
HYDROGRAPH AT						
+	F-31	.08	1	FLOW	15.	75.
				TIME	6.17	6.17
2 COMBINED AT						
+	DP F	2.15	1	FLOW	307.	1654.
				TIME	6.58	6.42

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   27JAN05  TIME  10:00:05   *                             *        (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        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
```

G-BASINS DEVELOPED

```
 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    79.8
 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)     *
*            JUN   1998                   *
*          VERSION 4.1                    *
*                                         *
*  RUN DATE   27JAN05  TIME  10:00:05     *
*                                         *
*******************************************

*******************************************
*                                         *
*    U.S. ARMY CORPS OF ENGINEERS         *
*    HYDROLOGIC ENGINEERING CENTER        *
*          609 SECOND STREET              *
*       DAVIS, CALIFORNIA 95616           *
*           (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

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	83.	243.
				TIME	6.17	6.17
2 COMBINED AT +	DPG	.45	1	FLOW	129.	502.
				TIME	6.17	6.17

1

*** 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
```

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

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

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

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

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  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)    *
CORPS OF ENGINEERS        *                                *   U.S. ARMY
 *             JUN   1998                  *
ENGINEERING CENTER      *                                  *   HYDROLOGIC
 *           VERSION 4.1                   *
SECOND STREET           *                                  *         609
 *                                         *
CALIFORNIA 95616        *                                  *    DAVIS,
 *  RUN DATE    21MAY04  TIME  15:11:47    *
756-1104             *                                     *          (916)
 *                                         *
*                                                          *
 ****************************************
***************************************
```

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

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   11FEB05  TIME  10:13:10   *
 *                                       *
 *****************************************
```

```
***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                     *
***************************************
```

A-BASIN DETAINED

```
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 Developed Drainage Plan pn 03094
  2         ID     A Basins, future development condition w/detention a-det.dat
  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-4
 28      KM   RUNOFF FROM SUB-BASIN A-4
 29      BA   .0861
 30      LS       0      77
 31      UD    0.21

 32      KK      A4
 33      KM   ROUTE RUNOFF FROM A-4 TO TO DP A3
 34      RD     450     .02    .013            CIRC     3.5

 35      KK     A-3
 36      KM   RUNOFF FROM SUB-BASIN A-3
 37      BA   .1500
 38      LS       0      73
 39      UD    .221

 40      KK    DPA3
 41      KM   DESIGN POINT A3 COMBINE RUNOFF FROM SUB-BASIN A-3, A3 AND A4
 42      HC       3
1                                  HEC-1 INPUT                                              PAGE  2

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


 43      KK      A6
 44      KM   ROUTE FLOW FROM DP A3 TO DP A6
 45      RD    1550    .016    0.04            TRAP      10       4

 46      KK    A-11
 47      KM   RUNOFF FROM SUB-BASIN A-11
 48      BA    .081
 49      LS       0    76.3
 50      UD     .19

 51      KK     A11
 52      KM   ROUTE SUB-BASIN A-11 TO DP A8
```

```
 53           RD    1400     .02    .013            CIRC     3.5

 54           KK     A-8
 55           KM   RUNOFF FROM BASIN A-8
 56           BA    .079
 57           LS       0    84.1
 58           UD    .250

 59           KK   DP A8
 60           KM   COMBINE RUNOFF FROM SB A-8 AND A11
 61           HC       2

 62           KK      A8
 63           KM   ROUTE FLOW FROM SUB-BASIN A-8 TO DP A7
 64           RD    1100     .02    .013            CIRC     4.5

 65           KK     A-7
 66           KM   RUNOFF FROM SUB-BASIN A-7
 67           BA   .0500
 68           LS       0    77.5
 69           UD    .172

 70           KK   DP A7
 71           KM   COMBINE RUNOFF FROM SUB-BASIN A-7 AND A8
 72           HC       2

 73           KK      A7
 74           KM   ROUTE FLOW FROM DP A7 TO DP A6
 75           RD     800    0.02   0.013            CIRC       5

 76           KK   A-6
 77           KM   RUNOFF FROM SUB-BASIN A-6
 78           BA    .037
 79           LS       0      79
 80           UD     .21

 81           KK    DPA6
 82           KM   DESIGN POINT A6 COMBINE RUNOFF FROM SUB-BASIN A-6, A6 AND A7
 83           HC       3
1                                          HEC-1 INPUT                                      PAGE  3

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


 84           KK      A5
 85           KM   ROUTE FLOW FROM DESIGN POINT A6 TO DP A5
 86           RD    2200    .011     .04            TRAP      10       4

 87           KK   A-9
 88           KM   RUNOFF FROM SUB-BASIN A-9
 89           BA   .0673
 90           LS       0    77.1
```

```
  91            UD    .263

  92            KK      A9
  93            KM    ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
  94            RD      500      .02     .016             CIRC      3.5

  95            KK    A-5
  96            KM    RUNOFF FROM SUB-BASIN A-5
  97            BA    .1114
  98            LS        0     71.6
  99            UD     .209

 100            KK     DPA5
 101            KM    DP A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9 THIS IS INFLOW
 102            KM    TO DETENTION BASIN A
 103            HC        3

 104            KK      DBA
 105            KM    ROUTE DP A5 THROUGH DETENTION BASIN A
 106            RS        1     ELEV      100
 107            SV        0        4       10       25       45       60
 108            SE      100      102      104      106      108      110
 109            SQ        0       10       35       80      180      500

 110            KK      A10
 111            KM    ROUTE FLOW FROM DESIGN POINT A5 TO DESIGN POINT A
 112            RD      720     .021      .04             TRAP       15        4

 113            KK     A-10
 114            KM    RUNOFF FROM SUB-BASIN A-10
 115            BA    .0096
 116            LS        0     79.6
 117            UD     .231

 118            KK      DPA
 119            KM    DESIGN POINT A COMBINE RUNOFF SUB-BASIN A-10 AND A10
 120            HC        2
 121            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-4
```

```
           .          V
           .          V
 32        .         A4
           .          .
           .          .
 35        .          .         A-3
           .          .           .
           .          .           .
 40      DPA3.............................
           V
           V
 43       A6
           .
           .
 46        .        A-11
           .           V
           .           V
 51        .         A11
           .           .
           .           .
 54        .           .        A-8
           .           .          .
           .           .          .
 59        .      DP A8.............
           .           V
           .           V
 62        .          A8
           .           .
           .           .
 65        .           .        A-7
           .           .          .
           .           .          .
 70        .      DP A7.............
           .           V
           .           V
 73        .          A7
           .           .
           .           .
 76        .           .      A-6
           .           .          .
           .           .          .
 81      DPA6..............................
           V
           V
 84       A5
           .
           .
 87        .      A-9
           .         V
           .         V
 92        .        A9
           .         .
```

```
 95         .            .       A-5
            .            .             .
            .            .             .
100       DPA5.......................
            V
            V
104        DBA
            V
            V
110        A10
            .
            .
113         .        A-10
            .            .
            .            .
118        DPA...........

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

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   11FEB05  TIME  10:13:10   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
                    Wolf Ranch, Master Developed Drainage Plan pn 03094
                  A Basins, future development condition w/detention a-det.dat
                       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-4	.09	1	FLOW	42.	137.
				TIME	6.08	6.08
ROUTED TO +	A4	.09	1	FLOW	41.	136.
				TIME	6.08	6.08
HYDROGRAPH AT +	A-3	.15	1	FLOW	49.	194.
				TIME	6.17	6.08
3 COMBINED AT +	DPA3	.30	1	FLOW	89.	330.
				TIME	6.17	6.08

ROUTED TO						
+	A6	.30	1	FLOW	88.	322.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-11	.08	1	FLOW	40.	131.
				TIME	6.08	6.08
ROUTED TO						
+	A11	.08	1	FLOW	37.	128.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-8	.08	1	FLOW	58.	154.
				TIME	6.17	6.08
2 COMBINED AT						
+	DP A8	.16	1	FLOW	94.	282.
				TIME	6.08	6.08
ROUTED TO						
+	A8	.16	1	FLOW	94.	276.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-7	.05	1	FLOW	28.	87.
				TIME	6.08	6.08
2 COMBINED AT						
+	DP A7	.21	1	FLOW	119.	364.
				TIME	6.08	6.08
ROUTED TO						
+	A7	.21	1	FLOW	117.	359.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-6	.04	1	FLOW	21.	64.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA6	.54	1	FLOW	225.	723.
				TIME	6.17	6.08
ROUTED TO						
+	A5	.54	1	FLOW	221.	713.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-9	.07	1	FLOW	29.	96.
				TIME	6.17	6.17

```
 ROUTED TO
+                    A9         .07       1   FLOW          29.       95.
                                              TIME         6.17      6.17

 HYDROGRAPH AT
+                 A-5           .11       1   FLOW          33.      139.
                                              TIME         6.17      6.08

  3 COMBINED AT
+                  DPA5         .72       1   FLOW         273.      935.
                                              TIME         6.25      6.17

 ROUTED TO
+                   DBA         .72       1   FLOW          36.      137.
                                              TIME         7.25      6.92

                                          ** PEAK STAGES IN FEET **
                                          1   STAGE      104.05    107.14
                                              TIME         7.25      6.92

 ROUTED TO
+                   A10         .72       1   FLOW          36.      137.
                                              TIME         7.25      7.00

 HYDROGRAPH AT
+                  A-10         .01       1   FLOW           5.       16.
                                              TIME         6.08      6.08

  2 COMBINED AT
+                   DPA         .73       1   FLOW          37.      138.
                                              TIME         7.17      6.92
1
*** NORMAL END OF HEC-1 ***
```

```
1****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN   1998                *
*           VERSION 4.1                 *
*                                       *
* RUN DATE   24JAN05  TIME  14:10:15    *
*                                       *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*        609 SECOND STREET             *
*     DAVIS, CALIFORNIA 95616          *
*         (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   pn 03094
  2           ID     E basins future development condition with detention
  3           ID          5-year and 100 year, 24hr Type IIA Storm fn:eddet.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
```

E/D BASIN DET

```
 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   0.010    .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
```



```
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      D-1
55          KM   SUB-BASIN D-1
56          BA    .062
57          LS       0     78.1
58          UD    .180

59          KK      D2
60          KM   ROUTE RUNOFF FROM SUB-BASIN D-1 TO DP D2
61          RD    1230      .01     .013              CIRC      4.5

62          KK      D-2
63          KM   RUNOFF FROM SUB-BASIN D-2
64          BA    .036
65          LS       0       73
66          UD    .119

67          KK     DPD2
68          KM   COMBINE RUNOFF FROM SUB-BASIN D-2 AND DP D2
69          HC        2

70          KK   DPE-D
71          KM   COMBINE RUNOFF FROM DP D2 AND DP E2
72          HC        2

73          KK   DBE-D
74          KM   DETENTION BASIN E-D
75          KM   THIS 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
```

I

```
          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.............
                  .
                  .
  54              .           D-1
                  .             V
                  .             V
  59              .            D2
                  .             .
                  .             .
  62              .             .          D-2
                  .             .            .
                  .             .            .
  67              .          DPD2.............
                  .             .
                  .             .
  70          DPE-D.............
                  V
                  V
  73          DBE-D

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

```
1***************************************
*                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                     *
*  RUN DATE   24JAN05  TIME  14:10:15  *
*                                     *
***************************************
```

```
***************************************
*                                     *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                     *
***************************************
```

```
          Wolf Ranch Master Development Drainage Plan   pn 03094
      E basins future development condition with detention
              5-year and 100 year, 24hr Type IIA Storm fn:eddet.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	15.	57.
				TIME	6.08	6.00
2 COMBINED AT						
+	DPD2	.10	1	FLOW	49.	160.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPE-D	.28	1	FLOW	165.	496.
				TIME	6.08	6.08
ROUTED TO						
+	DBE-D	.28	1	FLOW	13.	151.
				TIME	7.17	6.33

** PEAK STAGES IN FEET **

1	STAGE	6955.24	6957.78
	TIME	7.17	6.33

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   14FEB05  TIME  13:10:37   *                                            *          (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       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
 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    71.5
 23          UD    0.22

 24          KK    RF-8
 25          KM          ROUTE FLOW FROM SUB-BASIN F-8 TO DETENTION BASIN DB 19
 26          RD    1800   0.037    0.04             TRAP      15       4

 27          KK     F-1
 28          KM          RUNOFF FOR BASIN F-1
 29          BA   .1659
 30          LS       0       61
 31          UD     .20

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

 35          KK     F-9
 36          KM          RUNOFF FOR BASIN F-9
 37          BA   .0430
 38          LS       0       70
 39          UD     .16

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

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


 43          KK   RF-19
 44          KM          ROUTE FLOW FROM DESIGN POINT DP F9 TO DETENTION BASIN DB 19
 45          RD    2000   0.018    0.04             TRAP      20       4

 46          KK    F-19
 47          KM          RUNOFF FOR BASIN F-19
 48          BA   .1020
 49          LS       0    73.2
 50          UD     .19

 51          KK   DPF19
 52          KM        COMBINE FLOW FROM SUB-BASIN F-19, RF-8 AND RF19
```

```
 53          KM       THIS IS INFLOW TO DETENTION BASIN F-19
 54          HC       3

 55          KK   DBF19
 56          KM   ROUTE DPF19 THROUGH DETENTION BASIN F19
 57          KM   THIS OUTFLOW FROM DETENTION BASIN F-19
 58          RS       1    ELEV    7140
 59          SV       0       1       4      11    23.5      41
 60          SE    7140    7142    7144    7146    7148    7150
 61          SQ       0      10      55     100     200     300

 62          KK   RF-22
 63          KM        ROUTE FLOW FROM DESIGN POINT DPF19 TO DESIGN POINT F22
 64          RD    1800   0.033    0.04            TRAP      20       3

 65          KK     F-2
 66          KM        RUNOFF FOR BASIN F-2
 67          BA   .0424
 68          LS       0      61
 69          UD     .19

 70          KK   RF-10
 71          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      67
 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                                         HEC-1 INPUT                                   PAGE  3

 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     69.3
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    60.1
134            UD     .21

135            KK     F-18
136            KM          RUNOFF FOR SUB-BASIN F-18
137            BA   .0980
138            LS       0    73.1
139            UD     .21

140            KK     F-16
141            KM          RUNOFF FOR SUB-BASIN F-16
142            BA   .0270
143            LS       0    72.8
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
                                        HEC-1 INPUT                                              PAGE  5
1

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-26
174          KM            RUNOFF FOR SUB-BASIN F-26
175          BA    .0520
176          LS        0       79
177          UD      .19

178          KK    RF-26A
179          KM          ROUTE FLOW FROM SUB-BASIN F26 TO DESIGN POINT F27
180          RD    1150   0.020    .013            CIRC       2

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

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

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

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

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

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

205          KK    RF-13
206          KM          ROUTE FLOW FROM SUB-BASIN F-6 TO DESIGN POINT F13
207          RD     800   0.038    0.04            TRAP      10       6
```



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

```
KK    F-13
KM          RUNOFF FOR SUB-BASIN F-13
BA   .0140
LS       0       61
UD     .14

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

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

KK  DPF14
KM        COMBINE FLOW FROM RF-7, F-14, AND RF-14
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    74.1
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    0.04              TRAP      20       6

KK    F-15
KM          RUNOFF FOR SUB-BASIN F-15
BA   .0210
LS       0    69.1
UD     .15

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
```

```
     248            UD      .18
1                                              HEC-1 INPUT                                             PAGE  7

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


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

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

     255            KK    F-24
     256            KM          RUNOFF FOR SUB-BASIN F-24
     257            BA   .0890
     258            LS       0       79
     259            UD     .26

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

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

     266            KK    F-30
     267            KM          RUNOFF FOR SUB-BASIN F-30
     268            BA   .0220
     269            LS       0     77.7
     270            UD     .18

     271            KK  DPF30
     272            KM        COMBINE FLOW FROM RF-30, RF-30A AND F-30
     273            HC       3

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

     277            KK    F-29
     278            KM          RUNOFF FOR SUB-BASIN F-29
     279            BA   .0250
     280            LS       0       70
     281            UD     .19

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

```
285            KK   RF-28
286            KM        ROUTE FLOW FROM DESIGN POINT F29 TO DESIGN POINT F28
287            RD     750   0.015    0.04              TRAP      20       3
```
1 HEC-1 INPUT

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

288            KK     F-28
289            KM          RUNOFF FOR SUB-BASIN F-28
290            BA     .042
291            LS        0      68
292            UD      .23

293            KK     F-27
294            KM          RUNOFF FOR SUB-BASIN F-27
295            BA     .213
296            LS        0    76.2
297            UD      .32

298            KK   DPF28
299            KM        COMBINE FLOW FROM RF-27C, RF-28, F-28 AND F-27
300            KM        THIS IS INFLOW TO DETENTION BASIN F-28
301            HC        4

302            KK   DBF28
303            KM        ROUTE DPF28 THROUGH DETENTION BASIN F-28
304            KM        THIS IS OUTFLOW FROM DETENTION BASIN F-28
305            RS        1    ELEV    6960
306            SV        0     .74    2.72    6.20   10.81   15.88   21.44   27.56   34.39   42.08
307            SV    50.72   60.39   71.09   82.91   95.94  110.43
308            SE     6960    6962    6964    6966    6968    6970    6972    6974    6976    6978
309            SE     6980    6982    6984    6986    6988    6990
310            SQ        0      10      55     100     200     300     550     560     570     580
311            SQ      590     600     610     620     630     640

312            KK    RF-31
313            KM        ROUTE FLOW FROM DPF TO DESIGN POINT F
314            RD     3500   0.023    0.04              TRAP      20       3

315            KK     F-31
316            KM          RUNOFF FOR SUB-BASIN F-31
317            BA     .069
318            LS        0      61
319            UD      .24

320            KK     DP F
321            KM        COMBINE FLOW FROM RF-31 AND F-31
322            HC        2
323            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
   55       DBF19
                V
                V
   62       RF-22
                .
                .
   65           .         F-2
                .           V
                .           V
   70           .       RF-10
                .           .
                .           .
   73           .           .        F-10
                .           .           .
                .           .           .
   78           .       DPF10............
                .           V
                .           V
   81           .      RF-18A
                .           .
```

```
              .           .
  84          .           .         F-3
              .           .           V
              .           .           V
  89          .           .       RF-11
              .           .           .
              .           .           .
  92          .           .           .        F-11
              .           .           .           .
              .           .           .           .
  97          .           .       DPF11............
              .           .           V
              .           .           V
 100          .           .       RF-18
              .           .           .
              .           .           .
 103          .           .           .         F-4
              .           .           .           V
              .           .           .           V
 108          .           .           .       RF-12
              .           .           .           .
              .           .           .           .
 111          .           .           .           .         F-5
              .           .           .           .           V
              .           .           .           .           V
 116          .           .           .           .      RF-12A
              .           .           .           .           .
              .           .           .           .           .
 119          .           .           .           .           .        F-12
              .           .           .           .           .           .
              .           .           .           .           .           .
 124          .           .           .       DPF12........................
              .           .           .           V
              .           .           .           V
 127          .           .           .       RF-17
              .           .           .           .
              .           .           .           .
 130          .           .           .           .        F-17
              .           .           .           .           .
              .           .           .           .           .
 135          .           .           .           .           .        F-18
              .           .           .           .           .           .
              .           .           .           .           .           .
 140          .           .           .           .           .           .        F-16
              .           .           .           .           .           .           V
              .           .           .           .           .           .           V
 145          .           .           .           .           .           .       RF-16
              .           .           .           .           .           .           .
              .           .           .           .           .           .           .
 148          .       DPF18............................................................
              .           V
              .           V
```

```
152            .       DBF18
               .           V
               .           V
159            .      RF-22A
               .           .
               .           .
162            .           .        F-22
               .           .           .
               .           .           .
167       DPF22.........................
               V
               V
170        RF-27
               .
               .
173            .        F-26
               .           V
               .           V
178            .      RF-26
               .           .
               .           .
181      DPF27 .............
               V
               V
184      RF-27C
               .
               .
187            .        F-7
               .          V
               .          V
192            .       RF-7
               .          .
               .          .
195            .          .         F-14
               .          .            .
               .          .            .
200            .          .            .        F-6
               .          .            .          V
               .          .            .          V
205            .          .            .      RF-13
               .          .            .          .
               .          .            .          .
208            .          .            .          .        F-13
               .          .            .          .           .
               .          .            .          .           .
213            .          .            .     DPF13 ............
               .          .            .          V
               .          .            .          V
216            .          .            .      RF-14
               .          .            .          .
               .          .            .          .
219            .     DPF14 ........................
```

```
          .           V
          .           V
222       .       RF-25
          .           .
          .           .
225       .           .       F-25
          .           .          .
          .           .          .
230       .      DPF25 ...........
          .           V
          .           V
233       .       RF-30
          .           .
          .           .
236       .           .       F-15
          .           .          V
          .           .          V
241       .           .      RF-23
          .           .          .
          .           .          .
244       .           .          .      F-23
          .           .          .         .
          .           .          .         .
249       .           .     DPF23 ...........
          .           .          V
          .           .          V
252       .           .      RF-24
          .           .          .
          .           .          .
255       .           .          .      F-24
          .           .          .         .
          .           .          .         .
260       .           .     DPF24 ...........
          .           .          V
          .           .          V
263       .           .      RF-30
          .           .          .
          .           .          .
266       .           .          .      F-30
          .           .          .         .
          .           .          .         .
271       .      DPF30 .....................
          .           V
          .           V
274       .       RF-29
          .           .
          .           .
277       .           .       F-29
          .           .          .
          .           .          .
282       .      DPF29 ...........
          .           V
```

```
                       .          V
 285                   .      RF-28
                       .          .
                       .          .
 288                   .          .         F-28
                       .          .            .
                       .          .            .
 293                   .          .            .         F-27
                       .          .            .            .
                       .          .            .            .
 298               DPF28.................................
                       V
                       V
 302               DBF28
                       V
                       V
 312               RF-31
                       .
                       .
 315                   .       F-31
                       .          .
                       .          .
 320                DP F...........

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

```
1****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   14FEB05   TIME  13:10:37  *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*     U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (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	18.	76.
				TIME	6.17	6.08
ROUTED TO						
+	RF-8	.06	1	FLOW	18.	74.
				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	13.	55.

```
                                                TIME          6.08      6.08

  2 COMBINED AT
+                  DPF9         .21      1      FLOW           20.      157.
                                                TIME          6.17      6.08

 ROUTED TO
+                 RF-19         .21      1      FLOW           19.      152.
                                                TIME          6.25      6.17

 HYDROGRAPH AT
+                  F-19         .10      1      FLOW           38.      144.
                                                TIME          6.08      6.08

  3 COMBINED AT
+                 DPF19         .37      1      FLOW           61.      349.
                                                TIME          6.25      6.17

 ROUTED TO
+                 DBF19         .37      1      FLOW           21.       91.
                                                TIME          6.67      6.58

                                     ** PEAK STAGES IN FEET **
                                         1      STAGE      7142.51   7145.62
                                                TIME          6.67      6.58

 ROUTED TO
+                 RF-22         .37      1      FLOW           21.       91.
                                                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            4.       20.
                                                TIME          6.08      6.08

  2 COMBINED AT
+                 DPF10         .06      1      FLOW            6.       46.
                                                TIME          6.17      6.08

 ROUTED TO
+                RF-18A         .06      1      FLOW            5.       45.
                                                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	14.	67.
				TIME	6.08	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	2.	23.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-18	.10	1	FLOW	33.	131.

				TIME	6.08	6.08
HYDROGRAPH AT						
+	F-16	.03	1	FLOW	9.	36.
				TIME	6.08	6.08
ROUTED TO						
+	RF-16	.03	1	FLOW	9.	35.
				TIME	6.17	6.08
6 COMBINED AT						
+	DPF18	.80	1	FLOW	72.	527.
				TIME	6.25	6.17
ROUTED TO						
+	DBF18	.80	1	FLOW	29.	147.
				TIME	6.75	6.75
			** PEAK STAGES IN FEET **			
			1	STAGE	7142.85	7146.93
				TIME	6.75	6.75
ROUTED TO						
+	RF-22A	.80	1	FLOW	29.	146.
				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	52.	245.
				TIME	6.83	6.75
ROUTED TO						
+	RF-27	1.24	1	FLOW	52.	245.
				TIME	7.08	6.83
HYDROGRAPH AT						
+	F-26	.05	1	FLOW	31.	94.
				TIME	6.08	6.08
ROUTED TO						
+	RF-26	.05	1	FLOW	30.	92.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF27	1.29	1	FLOW	55.	254.
				TIME	7.08	6.83
ROUTED TO						
+	RF-27C	1.29	1	FLOW	55.	254.

				TIME	7.00	6.83
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	3.	30.
				TIME	6.17	6.08
ROUTED TO						
+	RF-14	.05	1	FLOW	4.	30.
				TIME	6.75	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	29.	108.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF25	.34	1	FLOW	67.	306.
				TIME	6.25	6.17
ROUTED TO						
+	RF-30	.34	1	FLOW	68.	305.

				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	6.	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	45.	137.
				TIME	6.17	6.17
2 COMBINED AT						
+	DPF24	.14	1	FLOW	55.	203.
				TIME	6.25	6.17
ROUTED TO						
+	RF-30	.14	1	FLOW	55.	197.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	F-30	.02	1	FLOW	12.	38.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPF30	.50	1	FLOW	124.	515.
				TIME	6.33	6.25
ROUTED TO						
+	RF-29	.50	1	FLOW	122.	517.
				TIME	6.33	6.25
HYDROGRAPH AT						
+	F-29	.03	1	FLOW	7.	30.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPF29	.53	1	FLOW	125.	535.

				TIME	6.33	6.25
ROUTED TO						
+	RF-28	.53	1	FLOW	124.	519.
				TIME	6.42	6.25
HYDROGRAPH AT						
+	F-28	.04	1	FLOW	8.	40.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	F-27	.21	1	FLOW	75.	264.
				TIME	6.25	6.17
4 COMBINED AT						
+	DPF28	2.07	1	FLOW	210.	903.
				TIME	6.33	6.25
ROUTED TO						
+	DBF28	2.07	1	FLOW	101.	554.
				TIME	7.08	6.67
			** PEAK STAGES IN FEET **			
			1	STAGE	6966.02	6972.79
				TIME	7.08	6.67
ROUTED TO						
+	RF-31	2.07	1	FLOW	101.	555.
				TIME	7.25	6.83
HYDROGRAPH AT						
+	F-31	.07	1	FLOW	4.	42.
				TIME	6.25	6.17
2 COMBINED AT						
+	DP F	2.14	1	FLOW	102.	565.
				TIME	7.25	6.58

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   14FEB05  TIME  13:40:24  *                   *         (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
```

G-BASINS DETAILED

```
 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    DB G
 44      KM  DESIGN POIUNT G3 INTO DETENTION BASIN G
 45      RS       1    ELEV       0
 46      SQ       0      10      30      80     140     200
 47      SE       0       2       4       6       8      10
 48      SV       0      .5       1       4      10      16

 49      KK      G4
 50      KM  ROUTE OUTFLOW FORM DETENTION BASIN G TO DP G
 51      RD    1450     .02    .013             CIRC       4

 52      KK     G-4
```

```
         53          KM   RUNOFF FROM SUB-BASIN G-4
         54          BA    .043
         55          LS       0      79
         56          UD    .212

         57          KK    DP G
         58          KM   COMBINE RUNOFF FROM G-4 AND G4
         59          HC       2

         60          KK     G-5
         61          KM          RUNOFF - Sub-basin G-5
         62          BA    .073
         63          LS       0    76.2
         64          UD    0.26
         65          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       DB G
             V
             V
  49        G4
             .
             .
  52         .        G-4
             .          .
             .          .
  57       DP G............
             .
             .
```

```
60          .        G-5

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   14FEB05  TIME  13:40:24   *
 *                                       *
 *****************************************

 *****************************************
 *                                       *
 *    U.S. ARMY CORPS OF ENGINEERS       *
 *    HYDROLOGIC ENGINEERING CENTER      *
 *          609 SECOND STREET            *
 *       DAVIS, CALIFORNIA 95616         *
 *          (916) 756-1104               *
 *                                       *
 *****************************************

                    Wolf Ranch Master Development Drainage Plan
                    G Basins Future developed condition with detention  PN 03094
                    5-year and 100 Year, 24 hr Type IIA  Storm  FN G-det.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

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 +	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 +	DB G	.29	1	FLOW	34.	111.
				TIME	6.58	6.58
			** PEAK STAGES IN FEET **			
			1	STAGE	4.14	7.04
				TIME	6.58	6.58
ROUTED TO +	G4	.29	1	FLOW	34.	111.
				TIME	6.58	6.58
HYDROGRAPH AT +	G-4	.04	1	FLOW	24.	74.
				TIME	6.08	6.08
2 COMBINED AT +	DP G	.34	1	FLOW	40.	134.
				TIME	6.42	6.25
HYDROGRAPH AT +	G-5	.07	1	FLOW	30.	100.

1 TIME 6.17 6.17

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

APPENDIX B

HYDRAULIC CALCULATIONS

BASIN 'A' HYDRAULICS

PRELIMINARY DETENTION BASIN SIZING

- Detention Basin "A"

- historic data $Q_5 =$ ~~39~~ 11 $Q_{100} =$ ~~244~~ 157

TBA = .42 SM = 270 Ac

CN = 61 RUNOFF 5 yr = .2"
100 yr = 1.02"

- "Developed": $Q_5 =$ ~~221~~ 206 cfs $Q_{100} =$ ~~584~~ 722 cfs

TBA = .57 SM = 365 Ac

Wtd CN = [61(.42) + .15(76) + .086(79) + .05(78.2) + .037(75.8) + .067(72.1) + .111(77.7) + .001(61)] ÷ (.57) = 73.9 Say 74

RUNOFF: 5 yr = .61"
100 yr = 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

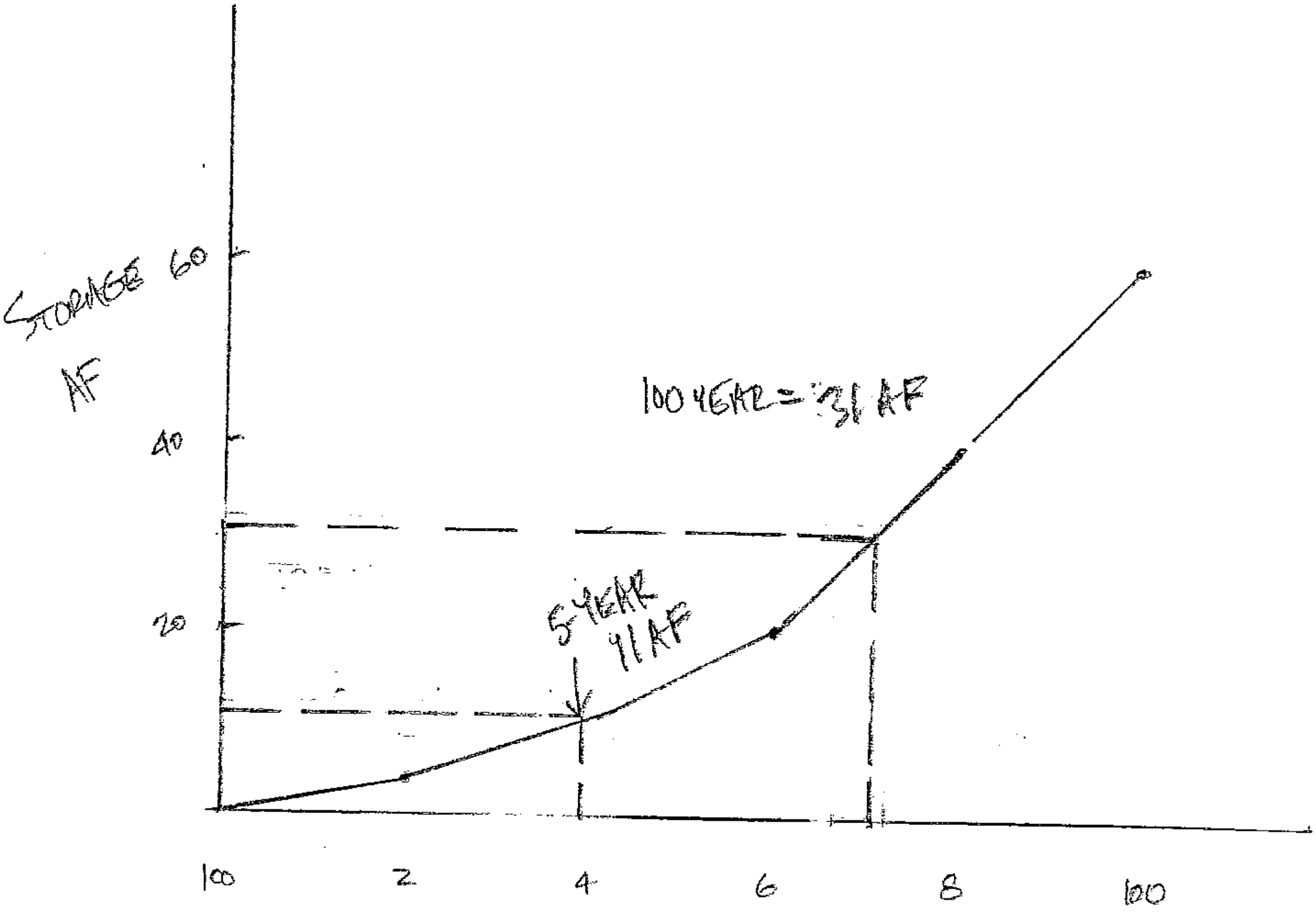
Vol(100) = 365(1.90/12) = 57.8 AF

Δ = 14.1 AF 5 YEAR
34.8 AF = 100 YR

Detention Basin 'A'

Detained Flow Q_5 = 28 cfs

Q_{100} = 165 cfs



W/ WQ & 5-YEAR

TOTAL Vol = 31 AF + 11 = 42 AF

OUTLET CULVERT FROM DET. BASIN A Q = 166 cfs

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			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	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

****

RRENT 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 RENT DATE: 05-14-2004
RENT TIME: 14:35:17

FILE DATE: 05-14-2004
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

****

BASIN 'A'

OUTFALL CHANNELS.

- Try to achieve Velocity 5-year 5 fps 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.

Flowranges DP A3 → A6 (5B)

$Q_5 = 89 + 21 = 110$ cfs

$Q_{100} = 330 + 64 = 394$ cfs

Existing Slope A3 → A6

L = 1600' ΔH = 7086 − 7036 = 50'

S = 50/1600 = .03125 '/'

V_5 @ S = .03125 '/' 6.9 ∴ no good

@ Slope = 1.4% V_5 = 4.9 fps ∴ ok

V_{100} = 7.1 fps, close, ∴ ok

Required grade control.

L = 1600' ΔS = .03125 − .014 = .01725

H 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 = 10', 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

$$\frac{VS^{.17}}{1.36} = \frac{9.3(.027)^{.17}}{1.36} = 3.9$$ 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'

3/4

Structure A6: Riprap channel 5-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	110 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	1.20 ft	Manning's Roughness Coef.	0.035

Channel Area	17.8 sf
Channel Wetted Perimeter	19.9 ft
Hydraulic Radius	0.89 ft

Channel Flow Velocity	6.5 ft/sec
Channel Flow Capacity	115 cfs
Capacity Check	Okay

Freeboard	1.2 ft
Swale Depth	2.37 ft
Top Width	29.0 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 A6: Riprap channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	394 cfs	Channel Side Slope	4:1
Bottom Width	10.0 ft	Channel Longitudinal Slope	2.7 %
Depth of Flow	2.30 ft	Manning's Roughness Coef.	0.035

Channel Area	44.2 sf
Channel Wetted Perimeter	29.0 ft
Hydraulic Radius	1.52 ft

Channel Flow Velocity	9.3 ft/sec
Channel Flow Capacity	409 cfs
Capacity Check	Okay

Freeboard	1.3 ft
Swale Depth	3.60 ft
Top Width	38.8 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 1/3
PROJECT: | DATE CHECKED: | DATE 5/10/04
DETAIL: Hydraulics | CHECKED BY: | COMPUTED BY: RMW

REV 2-10-05

OUTFALL CHANNEL A5

Flow range DPA6 + SB A5

$Q_5 = 225 + 33 = 258$ cfs
$Q_{100} = 723 + 139 = 862$ 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% $V_5 = 7.5$ fps close to de }
$V_{100} = 10.6$ fps } see 2 of 3

Riprap Size = $\frac{10.6(.024)^{.17}}{1.36} = 4.1$ 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	258 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.4 %
Depth of Flow	1.60 ft	Manning's Roughness Coef.	0.035

Channel Area	34.2 sf
Channel Wetted Perimeter	28.2 ft
Hydraulic Radius	1.21 ft

Channel Flow Velocity	7.5 ft/sec
Channel Flow Capacity	257 cfs
Capacity Check	NO

Freeboard	1.2 ft
Swale Depth	2.82 ft
Top Width	37.6 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 A5: Riprap channel 100-year

Trapezoidal Channel Capacity Calculation (Values to be Input)			
Design Flow	862 cfs	Channel Side Slope	4:1
Bottom Width	15.0 ft	Channel Longitudinal Slope	2.4 %
Depth of Flow	3.00 ft	Manning's Roughness Coef.	0.035

Channel Area	81.0 sf
Channel Wetted Perimeter	39.7 ft
Hydraulic Radius	2.04 ft

Channel Flow Velocity	10.6 ft/sec
Channel Flow Capacity	859 cfs
Capacity Check	NO

Freeboard	1.4 ft
Swale Depth	4.38 ft
Top Width	50.0 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 = $1.0+0.025(v)d^{0.33}$

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 RLW

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} = 136 cfs (DP A3)

@ 2.0%, Q = 142 cfs for 42" RCP ∴ ok

- Storm Sewer A7

Q_{100} = 360 cfs

@ 2.0%, Q = 368 cfs for 60" 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} = 194 cfs

48" @ 2.0% Q full = 203 cfs ∴ ok

✓ Storm Sewer A4-1 @ DP A4-1

Q_{100} = DP A3 + SB A4 = 194 + 137 = 331

@ 2.6% 54" RCP Q full = 317 cfs ∴ ok w/ lagging.

✓ Storm Sewer A-11 @ SB A-11

Q_{100} = 150 cfs

42" RCP @ 2.0% Cap = 142 cfs ∴ ok

✓ Storm Sewer A8

Q_{100} = 282 cfs

@ 2.0% 54" RCP Q = 278 cfs ∴ ok

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

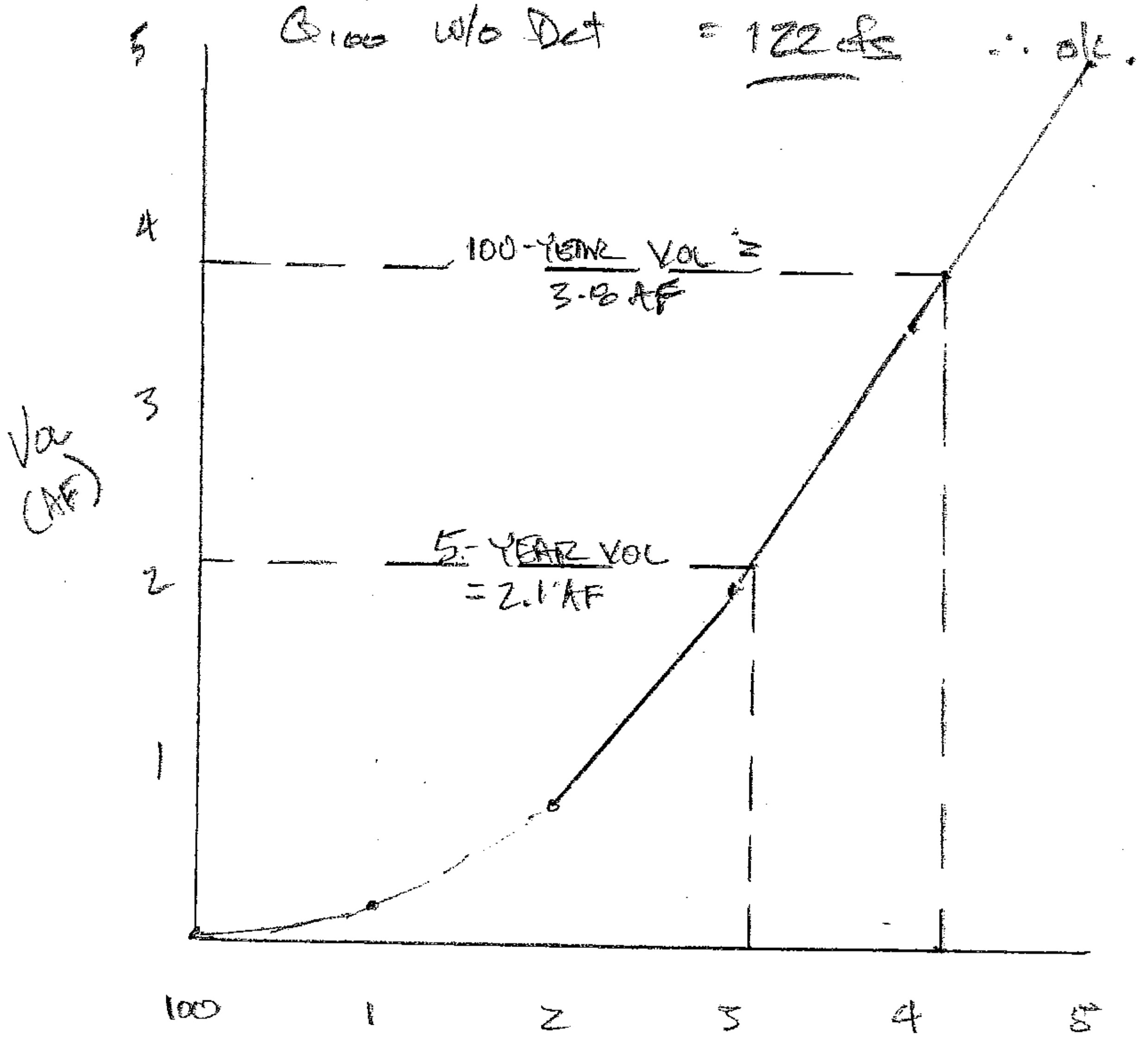
5-year: 3.6 - 1.8 = 1.8 AF ←
100-year 7.5 - 9.4 = -1.9 AF

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 2
PROJECT DATE CHECKED DATE 2/4/04
DETAIL CHECKED BY COMPUTED BY [illegible]

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

Detention "Basin" "E/D"

- Historic Data:

BA = .164 SM (SD 'E') + .32 SM (DP D2) = .48 SM = 307 A

CN = 61 Runoff 5 yr = .2" 100 yr = 1.02"

D Basin Ex Q_5 = 10; Q_{100} = 103 E-Basin Ex; Q_5 = 6 Q_{100} = 66

Total E&D: Q_5 = 16 cfs Q_{100} = 169

- Developed Data:

BA = .10 SM (DP 'D2') + .18 (DP 'E2') = .28 sm = 179 Ac

CN = [.048(78) + .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

- Required Storage Volume

Vol 5-year = 18.6 - 4.5 = 14.1 AF
Vol 100-year = 57.8 - 23.0 = 34.8 AF

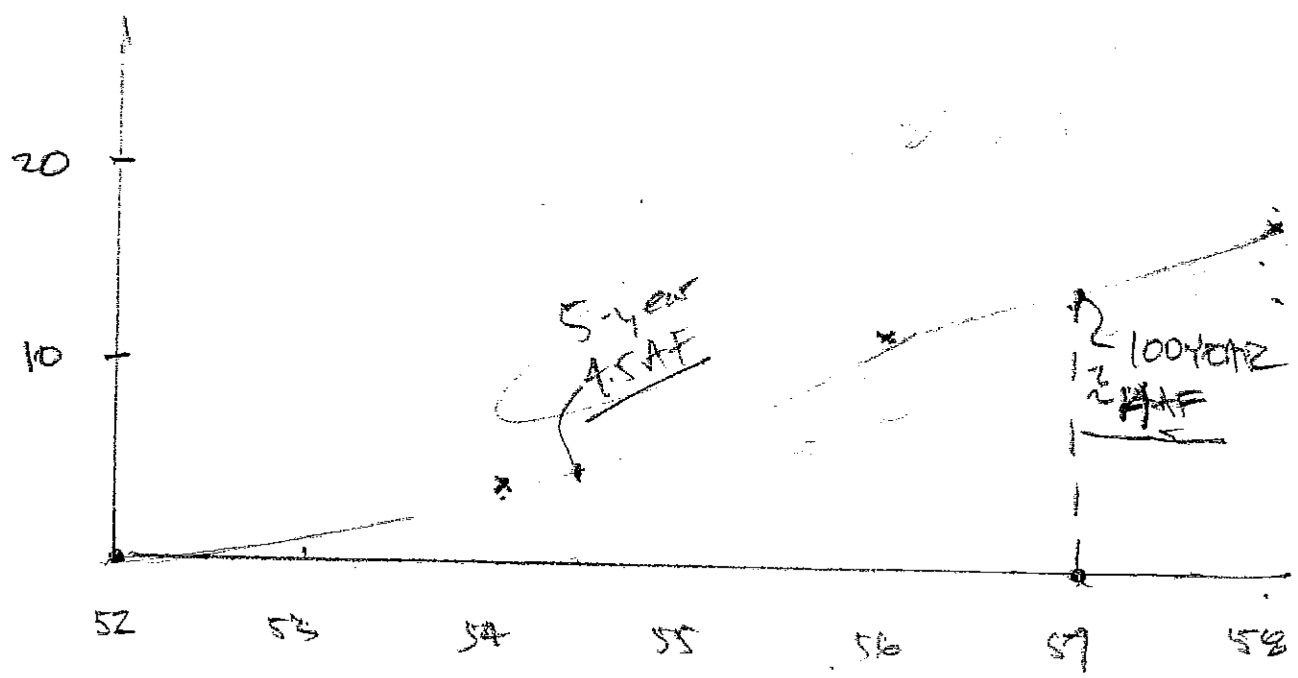
Above values are conservative & do not include channel storage due to routing.

- INFLOW TO DET. BASIN

Q_5 = 173 cfs Q_{100} = 509 cfs

- Allowable Release Rates

Q_5 = 16 cfs Q_{100} = 164 cfs.



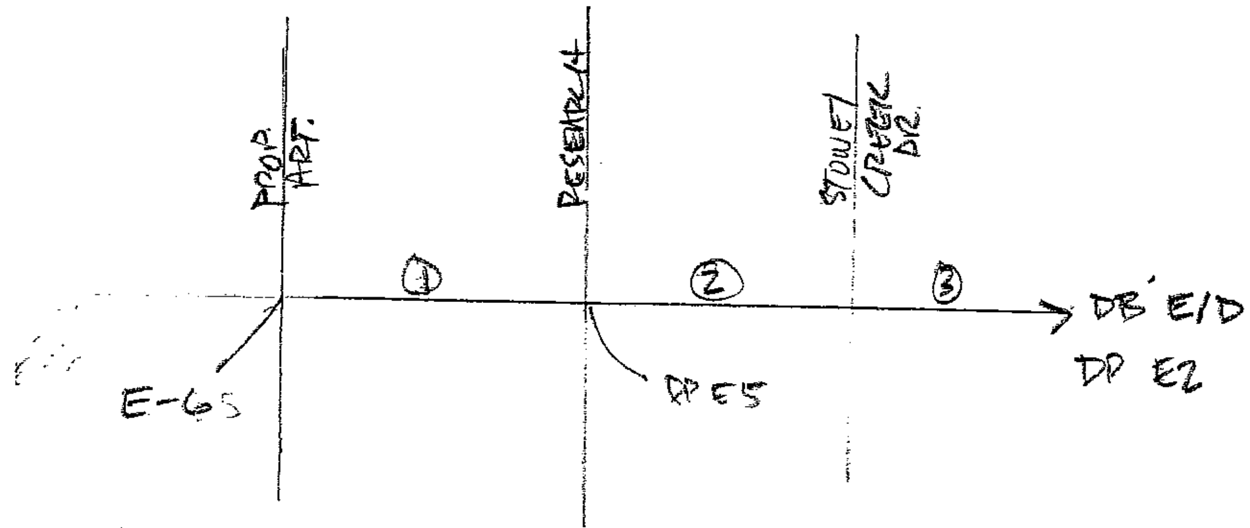
Kiowa Engineering Corporation

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'



From Sommy

	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

Segment 2 Research to Stoney Creek Q_{100} = 241 cfs
use slope of Roy Creek Street 4/140 = .029'/1
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
· note slope from DB to int of Abby Rd & Rony Creek,
Elev @ DB = 52.0 Est. Elev of inv. @ intersection = 60 ∴ Slope = 60-52/350 = .023'/1

- check Rony Creek 6/330 = .019'/1 use .018'/1

60" RCP @ .018 = Q = 349; too much
54" RCP @ .018 = 264 cfs, probably ok (Seg 3A)

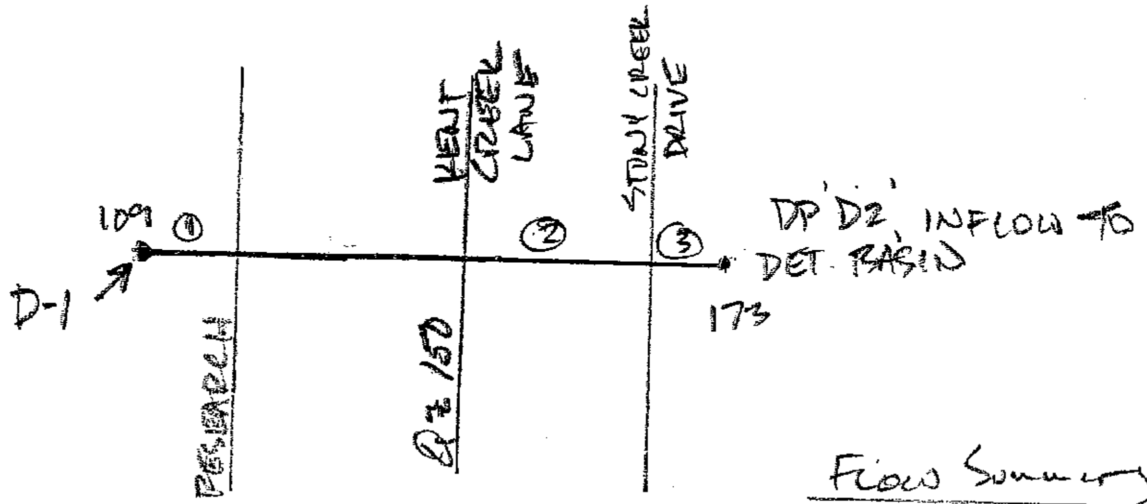
Seg 3b (Abby Road Lane) Q = 336
54" @ 2.3% Q = 305 cfs no good
60" @ 2.3% Q = 404 ok.

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP | JOB NO. 03094 | PAGE 1
PROJECT | DATE CHECKED | DATE 3/3/04
DETAIL | CHECKED BY | COMPUTED BY [illegible]

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 Court Lane, 2%

48" RCP @ 2% = 203 cfs ; ample ←

42" RCP @ 2% = 140 ∴ no good

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 2/2

PROJECT DATE CHECKED DATE

DETAIL CHECKED BY COMPUTED BY

Segment 3:

Stoney Creek to Det. Basin E/D $Q = 170$ cfs

Bottom of Pond @ 52±. L = 160'

appears the slope will be 2 2/120 = .0167, say .016

48" RCP Q @ 1.6% = 182 cfs ∴ ok.

Kiowa Engineering Corporation

CLIENT: WolfRanch MDDP　JOB NO. 03094　PAGE 1/3
PROJECT:　DATE CHECKED:　DATE 5/19/04
DETAIL:　CHECKED BY:　COMPUTED BY RWW

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} = 236 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 = 4.3/4 = 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 RAND

DP F25: Q_{100} = 303 cfs L= 80'
HW/D= 4.7/5= .94 ∴ ok 5'H×10'W CBC

DP F30: Q_{100}= 490 cfs L= 80'
HW/D= 6.6/6 = 1.10 ∴ ok use 6'×10' 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'×8' CBC HW= 16.5' ∴ ok.
use 4'×8' CBC

AT DT F9 upper collector

CURRENT DATE: 05-19-2004
~~RRENT 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=1.05 ∴ 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

CURRENT DATE: 05-19-2004
CURRENT 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

****

ꝶENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT TIME: 13:11:37 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

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 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

CURRENT DATE: 05-19-2004 FILE DATE: 05-19-2004
CURRENT 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

****

CURRENT DATE: 05-19-2004
CURRENT 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 #	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 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	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

****

ᴾRENT DATE: 05-19-2004
RENT TIME: 13:25:46

FILE DATE: 05-19-2004
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
CURRENT TIME: 13:46:47

FILE DATE: 05-19-2004
FILE NAME: F11

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	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	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	

HW/D ≈ 1.06

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
CURRENT TIME: 13:46:47

FILE DATE: 05-19-2004
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

****

C RENT DATE: 05-19-2004 FILE DATE: 05-19-2004
C RENT TIME: 13:46:47 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

****

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

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	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

****

C RENT DATE: 05-19-2004
ENT TIME: 13:52:24

FILE DATE: 05-19-2004
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

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

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 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	0	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	

HW/D = .9

****

****
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

C""RENT DATE: 05-19-2004
RENT 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	10.30
18	101.91	98.85	1.91	0.75	6-FF	0.00	0.00	0.00	9.88
21	102.14	98.90	2.14	0.90	6-FF	0.00	0.00	0.00	10.57
25	102.35	98.94	2.35	1.06	6-FF	0.00	0.00	0.00	10.75
28	102.56	98.98	2.56	1.24	6-FF	0.00	0.00	0.00	11.08
30	102.67	99.00	2.67	1.34	6-FF	0.00	0.00	0.00	11.32
35	102.96	99.06	2.96	1.62	6-FF	0.00	0.00	0.00	11.76

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

****

C RENT DATE: 05-19-2004
(RENT TIME: 14:17:54

FILE DATE: 05-19-2004
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

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

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	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	12.44
40	102.93	95.91	2.93	-1.35	6-FF	0.00	0.00	0.00	13.56
50	103.39	96.00	3.39	-0.82	6-FF	0.00	0.00	0.00	14.35
60	103.88	96.08	3.88	-0.21	6-FF	0.00	0.00	0.00	14.54
70	104.42	96.15	4.42	0.47	6-FF	0.00	0.00	0.00	15.00
80	105.05	96.22	5.05	1.24	6-FF	0.00	0.00	0.00	15.44
90	105.76	96.28	5.76	2.08	6-FF	0.00	0.00	0.00	15.87
100	106.57	96.34	6.57	3.00	6-FF	0.00	0.00	0.00	16.28

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

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	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

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

****

CURRENT DATE: 05-19-2004
RENT 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

****

F23 Briargate 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

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 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

CURRENT DATE: 05-21-2004
RENT TIME: 09:22:08

FILE DATE: 05-19-2004
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

****

C??RENT DATE: 05-21-2004
RENT TIME: 09:22:08

FILE DATE: 05-19-2004
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.

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

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	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

RENT DATE: 05-19-2004
RENT 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

****

C̄RRENT DATE: 05-19-2004
RENT 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	0	0	0	1
110.00	445	445	0	0	0	0	0	OVERTOPPING	

HW/D = 0.98

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

CURRENT DATE: 05-21-2004
CURRENT 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	10.70
95	102.49	99.51	2.49	1.44	6-FF	0.00	0.00	0.00	11.63
114	102.82	99.62	2.82	1.65	6-FF	0.00	0.00	0.00	12.16
133	103.13	99.72	3.13	1.86	6-FF	0.00	0.00	0.00	12.71
152	103.43	99.81	3.43	2.09	6-FF	0.00	0.00	0.00	13.28
171	103.72	99.90	3.72	2.33	6-FF	0.00	0.00	0.00	13.62
180	103.86	99.93	3.86	2.45	6-FF	0.00	0.00	0.00	14.05

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 #	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	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 = 0.94

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

C⁻⁻RENT DATE: 05-21-2004　　FILE DATE: 05-21-2004
(⁽ENT TIME: 09:25:45　　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

****

CᵀᴿRENT 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

****

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

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	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	0	0	0	0	1
110.00	753	753	0	0	0	0	0	OVERTOPPING	

HW/D = 1.1

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
RENT 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: 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 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

****

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-B	.04	2.5
~~SB F-B~~	~~.024~~	~~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

$\tau = \gamma d s = \gamma s$ 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-20 τ < 2.1 allowable for grassline~~
~~∴ 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.

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 3
PROJECT DATE CHECKED DATE 5/19/04
DETAIL CHECKED BY COMPUTED BY RMW

- channel F13 : Q_{100} = 21 cfs τ = 3.1
  very low flows; may be a roadside swale.
  w/ d = .5 (ok 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'
  5yr Velocity = 4.2 cfps ∴ ok for grasslined
  100yr = 6.1 fps " need riprap invert

  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

3

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'

Spacing @ 200' int.

F18A : Q_5 = 16 L = 1100'
Q_{100} = 48

wide flow path. use BW=15'

Slope ex. = .05'/'

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'/'

Assume 6' of drop can be achieved in DB forebays

∴ ΔH = 50 - 6 = 44

∴ S = 44/1500 = .029'/' 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'

F16 This would be piped to DB18

Q_{100} = 31 cfs

w/ 2% Storm Sewer Slope need. 24" RCP.

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 6
PROJECT DATE CHECKED DATE 5/19/04
DETAIL CHECKED BY COMPUTED BY BJW

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.

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 7
PROJECT DATE CHECKED DATE 5/14/04
DETAIL CHECKED BY COMPUTED BY [illegible]

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} = 6.9 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'

F29 $Q_5 = 112$ $Q_{100} = 490$ $L = 750'$

$S = \frac{30 - 0.0}{750} = .04'/1$

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: $\Delta S = .04 - .02 = .02 \times L = 15'$
∴ need 5, 3' drops @ 150' interval. to close.
use 2 - 6' sloping drops.
∴ Slope of channel =
$750(.04 - X) = 12'$
$X = .024'/1$

Riprap Size.
$VS^{.17}/1.36 = \frac{8.8(.024)^{.17}}{1.36}$
$= 3.4$
Type 'L'

~~**F21** $Q_5 = 45 \rightarrow 120$
$Q_{100} = 140 \rightarrow 313$ $L = 1750'$~~

~~$S = 50/1750 = .029'/1$~~

~~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 $Q_5 = 20 + 1/2$ SB F22 $= 20 + 1/2(7) = 24$ cfs

$Q_{100} = 89 + 1/2$ 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 = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

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 = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

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 = $1.0+0.025(v)d^{0.33}$

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 = $1.0+0.025(v)d^{0.33}$

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 = $1.0+0.025(v)d^{0.33}$

Wolf Ranch MDDP
Swale Capacity Calculation

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:

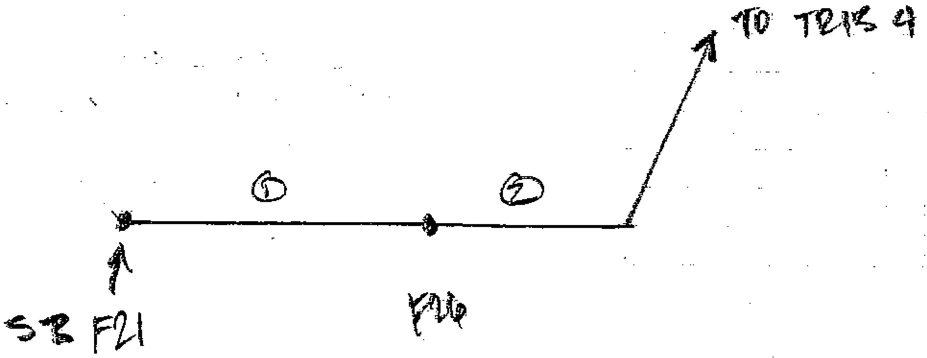
Area (A) = b(d)
b = width
d = depth
Perimeter (P) = $b+2d*(1+z^2)^{0.5}$
z = side slope
Hydraulic Radius = A/P

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:

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} = 140 → 213 cfs~~

~~SEE F21 @ 2.0% Q_{full} for 42" RCP = 149 cfs ∴ ok~~

~~SEE to SB 20 ½ way Q = 70 cfs. 36" RCP @ 2.0 = 91 cfs ∴ ok~~

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 1
PROJECT DATE CHECKED DATE 2/10/05
DETAIL CHECKED BY COMPUTED BY RNW

Detention Basin 'G' @ DP G3

INflow to Det Basin = Q_5 = 57 cfs
Q_{100} = 278 cfs

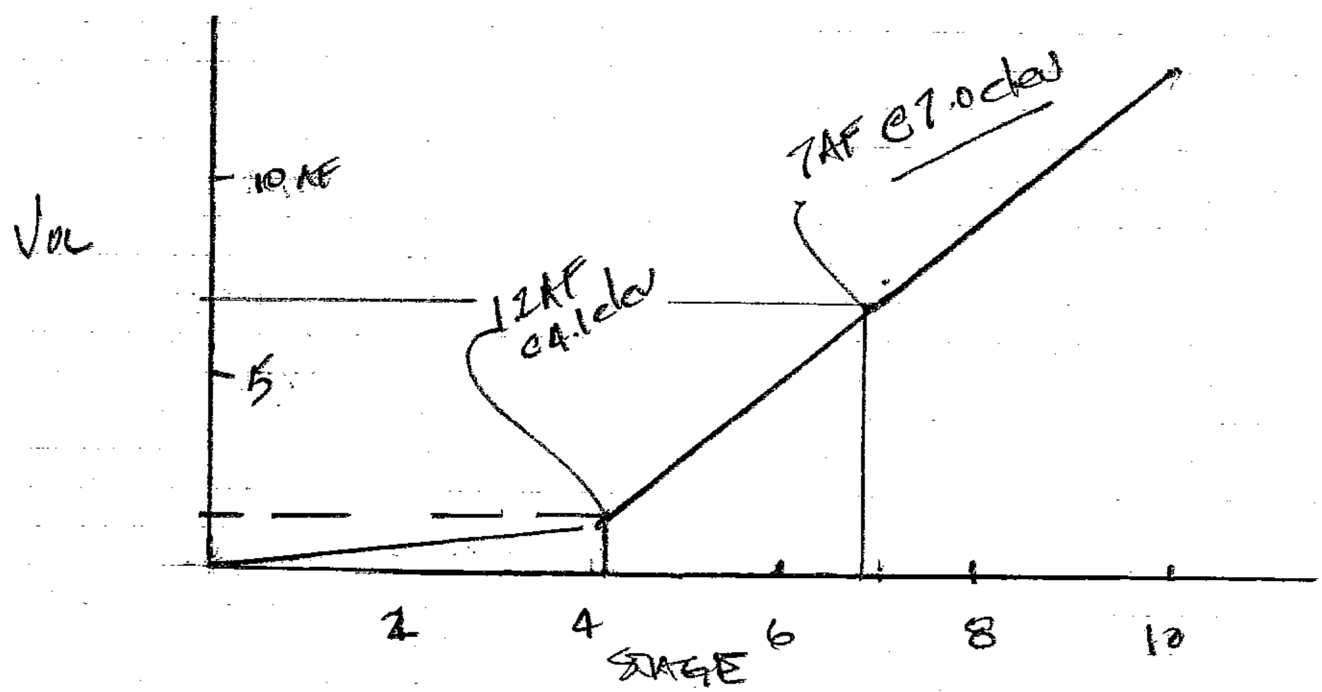
100YR Historic Flow @ DP G2 Figure 4 = 130 cfs

Make total flow to Tributary Four = G2 Historic.

∴ Flow @ outfall to Trib. Four = DBG + SBG4

Proposed Flow in SB G4 = Q_5 = 24 cfs
Q_{100} = 74 cfs

∴ Est. 100YR Discharge from detention basin G: 130 - 74 = 56 cfs



Kiowa Engineering Corporation

CLIENT: WOLF RANCH MDDP JOB NO. 03094 PAGE 1
PROJECT: DATE CHECKED: DATE 5/20/04
DETAIL: CHECKED BY: COMPUTED BY: [illegible]

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/ TBW = 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' TBW; S = .026'/1 $V_{100} = 6.7$ fps ∴ ok

$V_5 = 4.0$ fps ∴ ok

No grade control Req'd.

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 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 = $1.0+0.025(v)d^{0.33}$

Pipe Alternative, Reach G4

Q_{100} = 111 cfs out of DB 'G'

use RCP ; S = 2.8%

∴ 36" RCP @ 2.8% Q_{full} = 112 cfs ∴ ok

Culvert out of DB 'G'

CURRENT DATE: 02-14-2005
CURRENT TIME: 13:58:44

FILE DATE: 02-14-2005
FILE NAME: DBGOUT

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	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	94.00	200.09	1 RCP	3.50	3.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: DBGOUT DATE: 02-14-2005

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
100.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
101.34	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.00	1
102.11	24.0	24.0	0.0	0.0	0.0	0.0	0.0	0.00	1
102.72	36.0	36.0	0.0	0.0	0.0	0.0	0.0	0.00	1
103.28	48.0	48.0	0.0	0.0	0.0	0.0	0.0	0.00	1
103.86	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
104.52	72.0	72.0	0.0	0.0	0.0	0.0	0.0	0.00	1
105.30	84.0	84.0	0.0	0.0	0.0	0.0	0.0	0.00	1
106.22	96.0	96.0	0.0	0.0	0.0	0.0	0.0	0.00	1
107.27	108.0	108.0	0.0	0.0	0.0	0.0	0.0	0.00	1
107.55	111.0	111.0	0.0	0.0	0.0	0.0	0.0	0.00	1
110.00	134.0	134.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: DBGOUT DATE: 02-14-2005

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
100.00	0.000	0.00	0.00	0.00
101.34	0.000	12.00	0.00	0.00
102.11	0.000	24.00	0.00	0.00
102.72	0.000	36.00	0.00	0.00
103.28	0.000	48.00	0.00	0.00
103.86	0.000	60.00	0.00	0.00
104.52	0.000	72.00	0.00	0.00
105.30	0.000	84.00	0.00	0.00
106.22	0.000	96.00	0.00	0.00
107.27	0.000	108.00	0.00	0.00
107.55	0.000	111.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010

<2> TOLERANCE (%) = 1.000

C''RRENT DATE: 02-14-2005
.RENT TIME: 13:58:44

FILE DATE: 02-14-2005
FILE NAME: DBGOUT

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.50 (ft) BY 3.50 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	100.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
12.00	101.34	1.34	1.34	1-S2n	0.57	1.05	0.59	0.29	10.86	3.76
24.00	102.11	2.11	2.11	1-S2n	0.83	1.50	0.85	0.43	13.25	4.78
36.00	102.72	2.72	2.72	1-S2n	1.03	1.85	0.95	0.54	16.82	5.48
48.00	103.28	3.28	3.28	1-S2n	1.19	2.16	1.23	0.64	15.87	6.02
60.00	103.86	3.86	3.86	5-S2n	1.35	2.42	1.40	0.72	16.62	6.46
72.00	104.52	4.52	4.52	5-S2n	1.49	2.65	1.57	0.80	17.24	6.84
84.00	105.30	5.30	5.30	5-S2n	1.63	2.85	1.72	0.87	17.90	7.18
96.00	106.22	6.22	6.22	5-S2n	1.77	3.00	1.87	0.93	18.38	7.48
108.00	107.27	7.27	7.27	5-S2n	1.89	3.15	2.01	1.00	18.88	7.75
111.00	107.55	7.55	7.55	5-S2n	1.93	3.19	2.05	1.01	18.96	7.82

El. inlet face invert 100.00 ft   El. outlet invert 94.00 ft
El. inlet throat invert 0.00 ft   El. inlet crest 0.00 ft

** SITE DATA ***** CULVERT INVERT **************

INLET STATION	100.00 ft
INLET ELEVATION	100.00 ft
OUTLET STATION	300.00 ft
OUTLET ELEVATION	94.00 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0300
CULVERT LENGTH ALONG SLOPE	200.09 ft

***** 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

C‾ ‾RENT DATE: 02-14-2005
RENT TIME: 13:58:44

FILE DATE: 02-14-2005
FILE NAME: DBGOUT

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	10.00 ft
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (ft/ft)	0.035
MANNING'S n (.01-0.1)	0.030
CHANNEL INVERT ELEVATION	94.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	94.00 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	94.00	0.000	0.00	0.00	0.00
12.00	94.29	1.237	0.29	3.76	0.63
24.00	94.43	1.286	0.43	4.78	0.94
36.00	94.54	1.313	0.54	5.48	1.18
48.00	94.64	1.330	0.64	6.02	1.39
60.00	94.72	1.341	0.72	6.46	1.57
72.00	94.80	1.350	0.80	6.84	1.74
84.00	94.87	1.357	0.87	7.18	1.90
96.00	94.93	1.363	0.93	7.48	2.04
108.00	95.00	1.368	1.00	7.75	2.18
111.00	95.01	1.369	1.01	7.82	2.21

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	60.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	110.00 ft

Kiowa Engineering Corporation

CLIENT Wolf Ranch MDDP JOB NO. 03094 PAGE 1
PROJECT DATE CHECKED DATE 5/20/04
DETAIL CHECKED BY COMPUTED BY RJW

H/B Basin Hydraulics

H-1 outfall to Cottonwood Creek.

Q_{100} = 63 cfs

Assume 2% at Storm Sewer

∴ Need 30" RCP @ 2.4%

H-2: direct discharge to creek via onsite detention basin outlet structures(s).

J-1: "

J-2: "

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	14	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
     7/12/ 4      16:41:24                                                                                   PAGE     5


     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
     7/12/ 4      16:41:24                                                                                      PAGE     6


   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
    7/12/ 4      16:41:24                                                                                   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 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
    7/12/ 4      16:41:24                                                                                PAGE    9



                                                                          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

1
7/12/ 4 16:39:20 PAGE 10

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

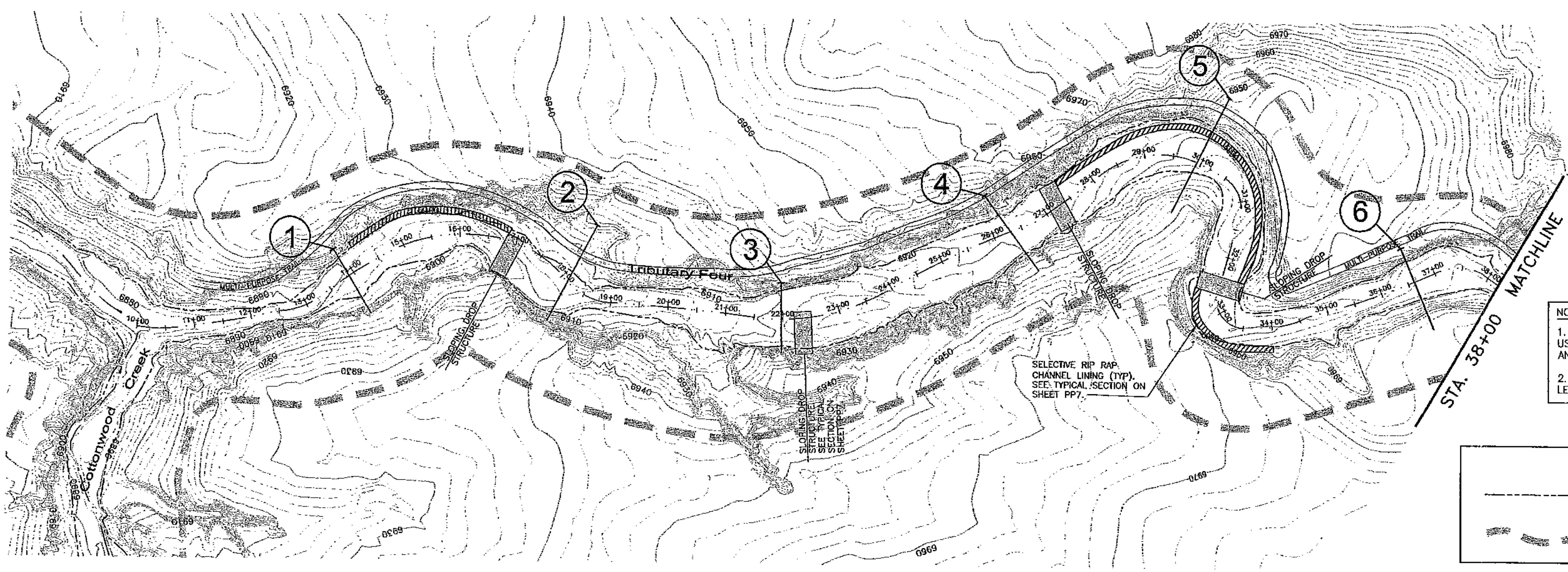
SUMMARY PRINTOUT TABLE 150

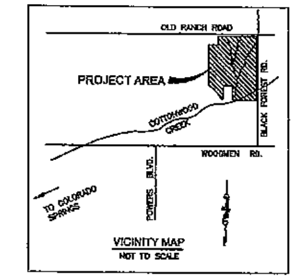
	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	1870.00	6895.35	.00	.00	17.35	75.20	.00
*	2.000	1870.00	6905.24	.00	9.89	.00	73.82	425.00
	3.000	1870.00	6913.65	.00	8.42	.00	93.63	384.00
*	4.000	1870.00	6924.09	.00	10.44	.00	79.41	433.00
*	5.000	1870.00	6933.16	.00	9.07	.00	83.68	363.00
*	6.000	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

APPENDIX C

PLAN AND PROFILES





SCALE: 1"=100'

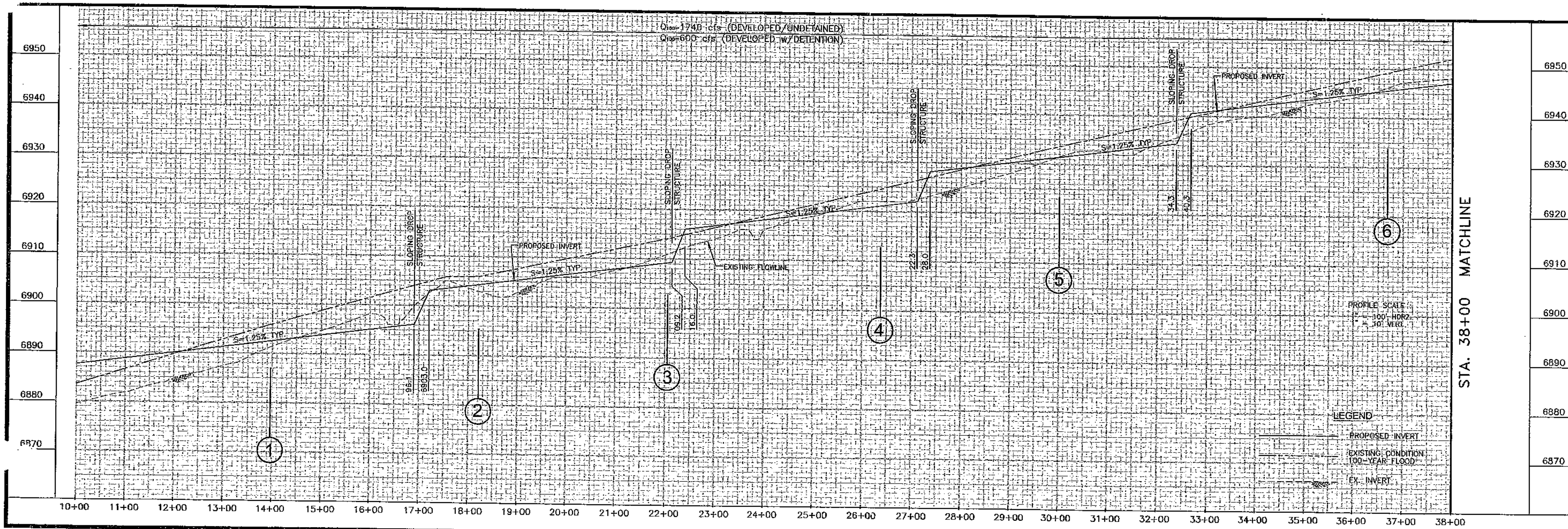
NOTES :

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

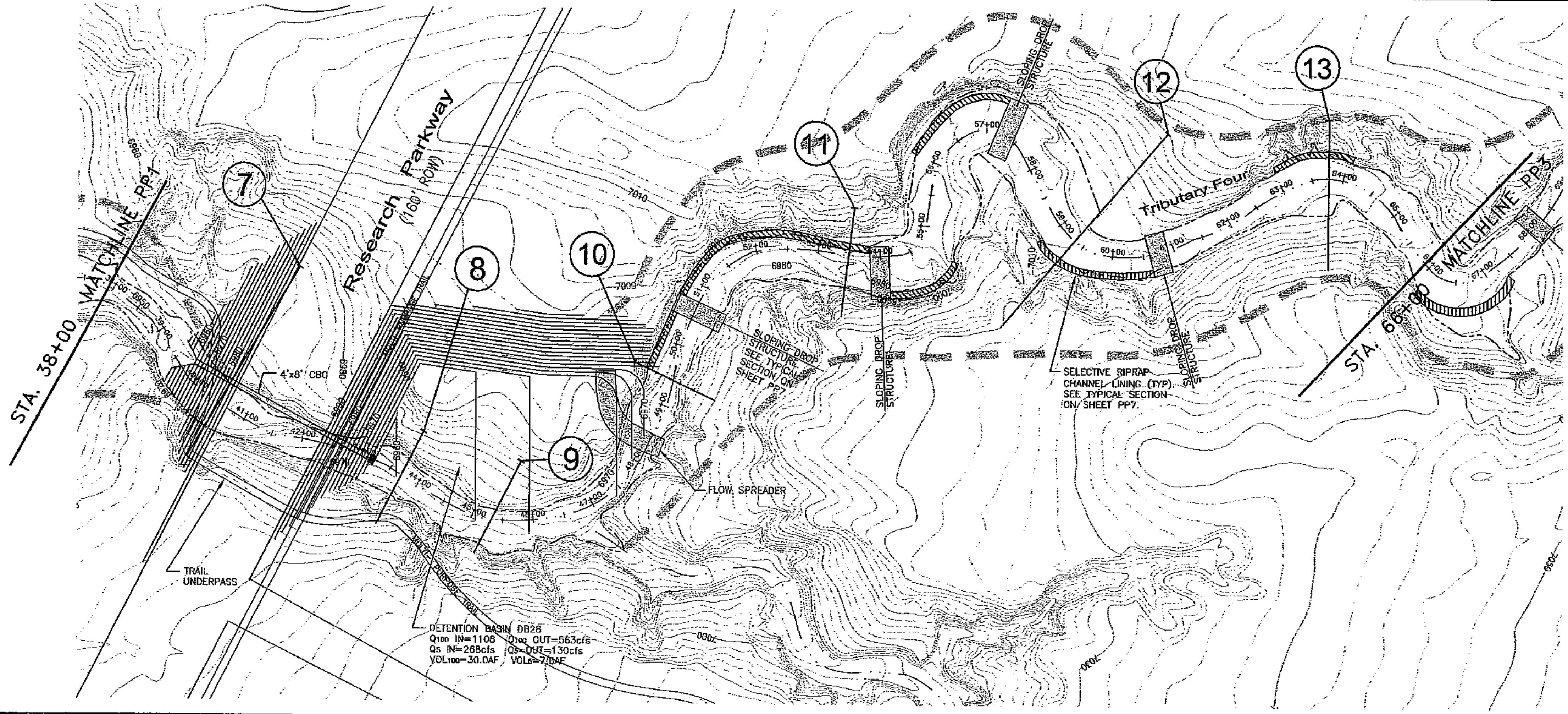


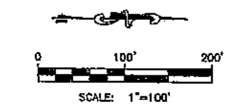
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

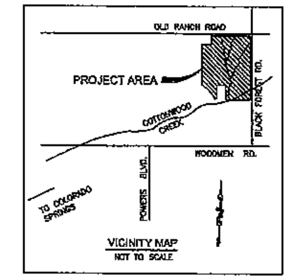
WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOUR
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 02/13/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP1
OF X SHEETS







NOTES :

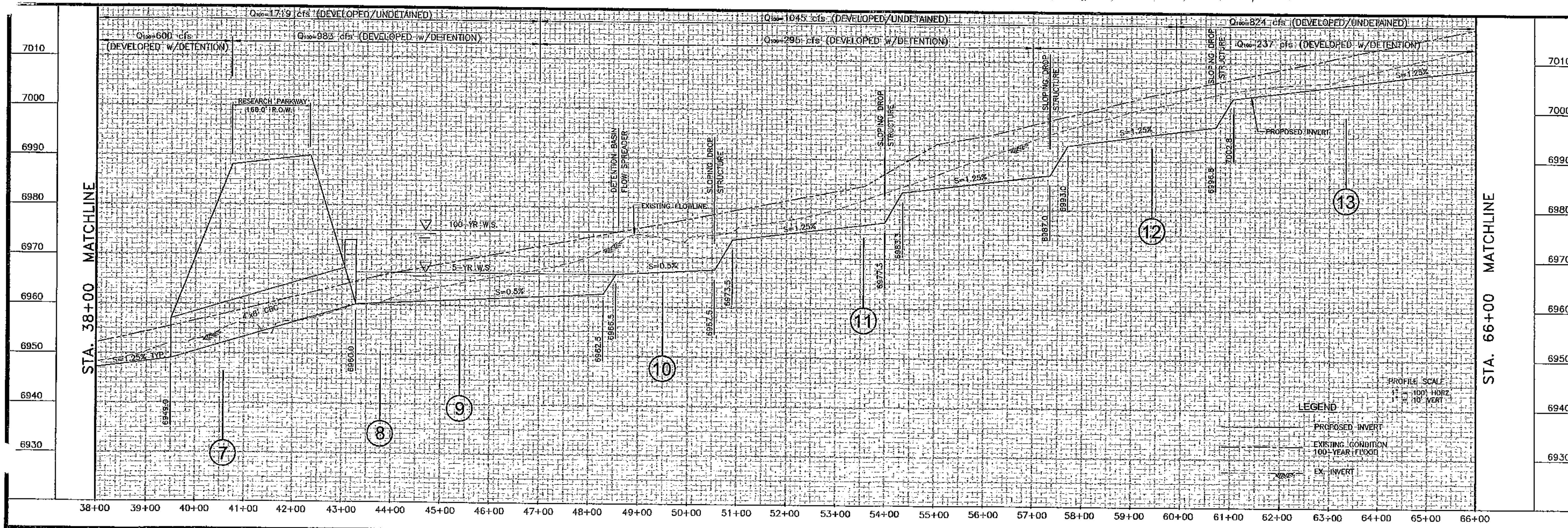
1. FLOODPLAIN SHOWN DETERMINED USING THE 100-YEAR DEVELOPED AND UNDETAINED.

2. CROSS-SECTIONS ORIENTED LEFT-TO-RIGHT FACING UPSTREAM.

LEGEND

EXISTING CONDITION 100-YEAR FLOOD

EROSION CONTROL SETBACK



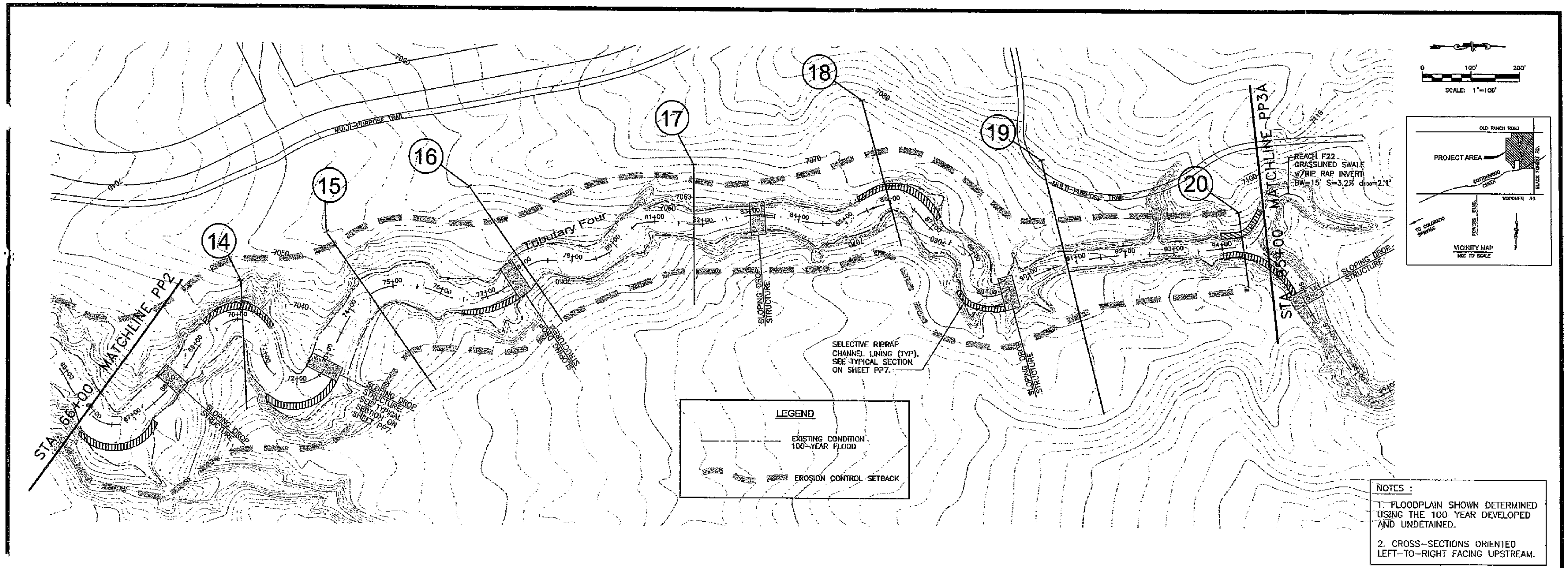
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

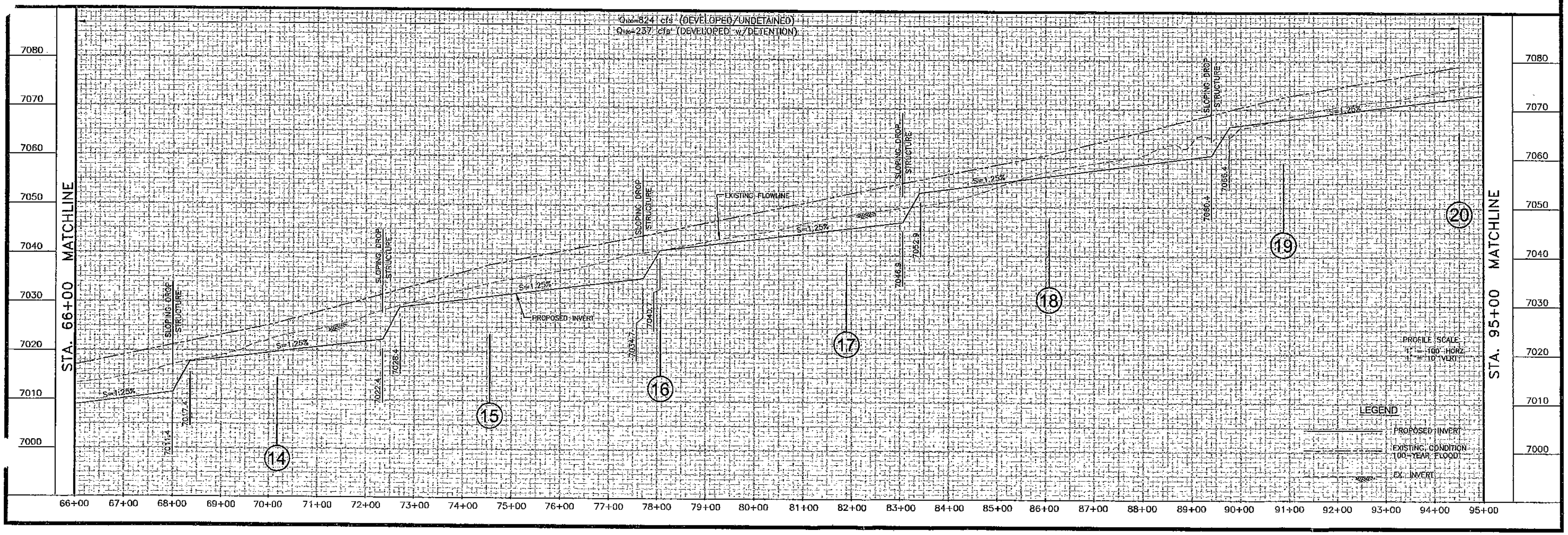
WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOUR
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 02/13/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP2
OF X SHEETS

03094 pp1-3.dwg/Dec 01, 2004



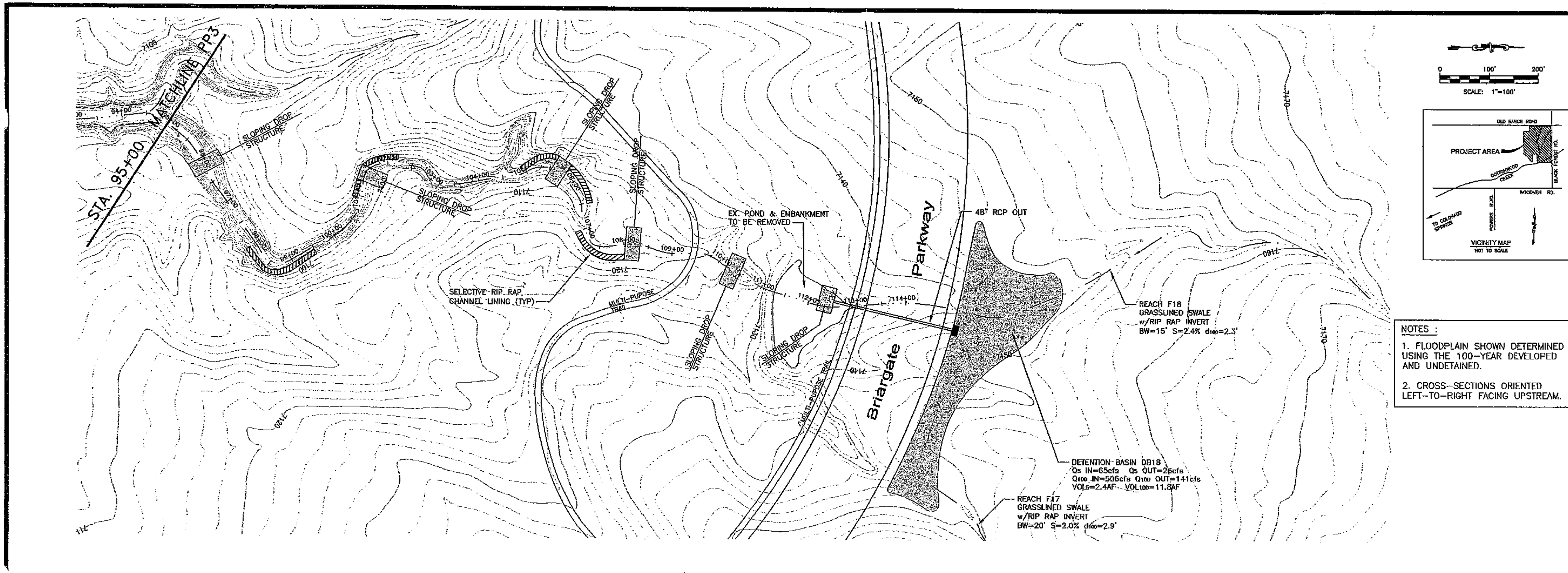


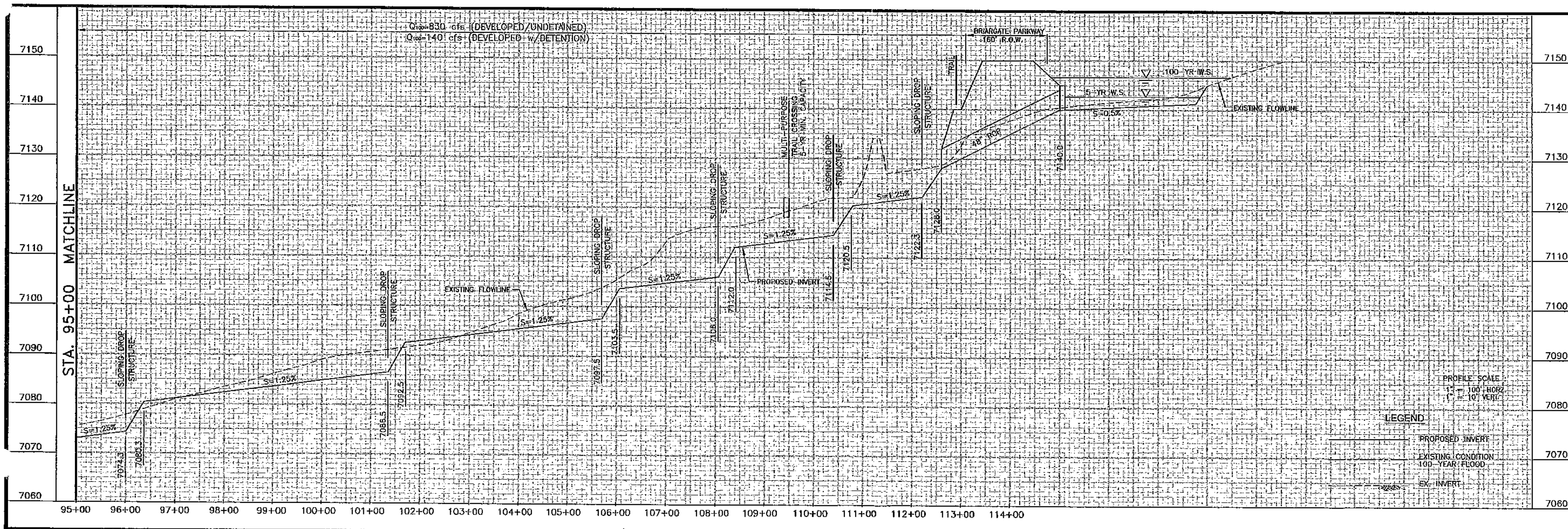
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

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
PP3
OF X SHEETS





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

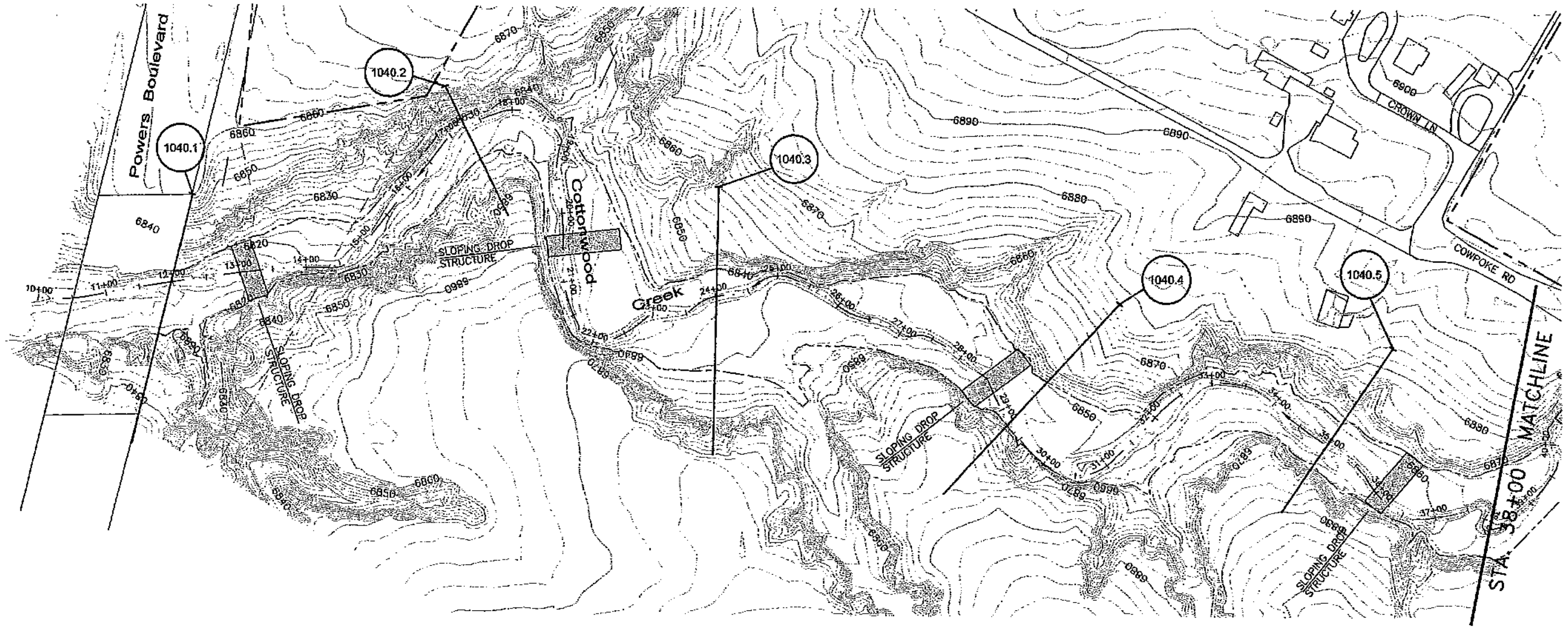
WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
TRIBUTARY FOUR
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

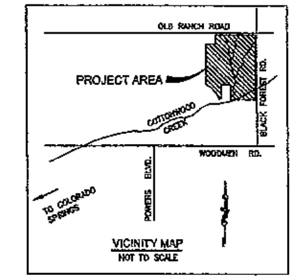
Project No.: 03094
Date: 02/13/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP3A
OF X SHEETS

03094 pp3A.dwg/Dec 01, 2004

7050





NOTES :

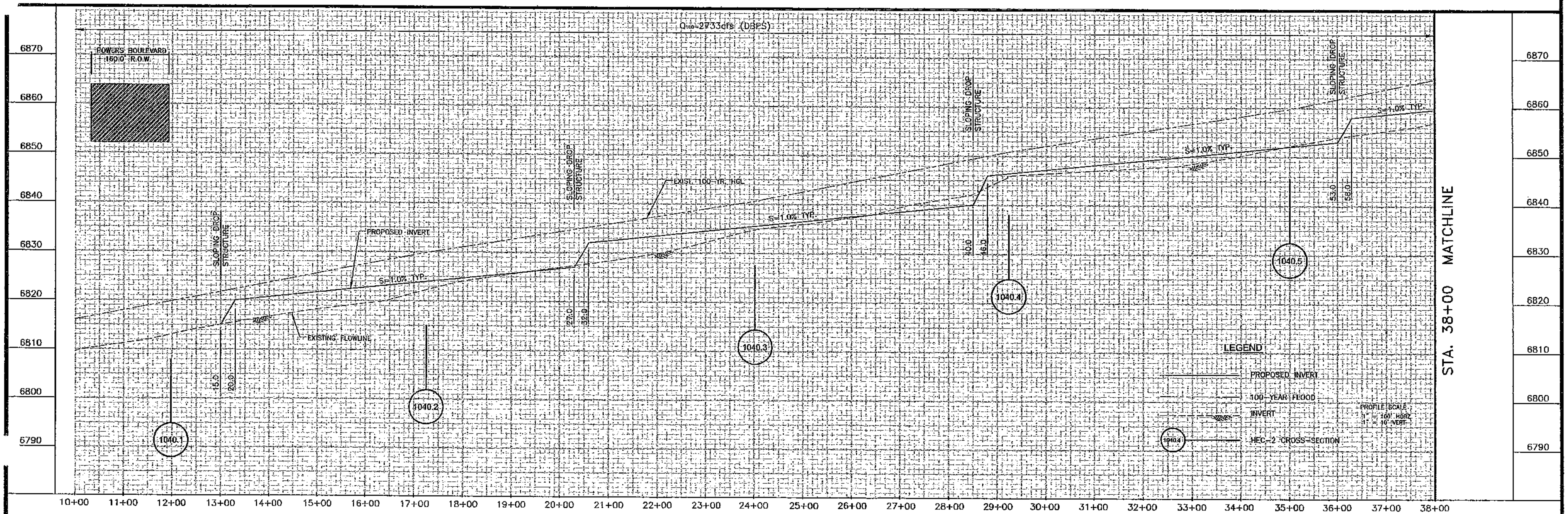
1. FLOODPLAIN SHOWN DETERMINED USING THE 100-YEAR DEVELOPED AND UNDETAINED.

2. CROSS-SECTIONS ORIENTED LEFT-TO-RIGHT FACING UPSTREAM.

LEGEND

EXISTING CONDITION 100-YEAR FLOOD

EROSION CONTROL SETBACK

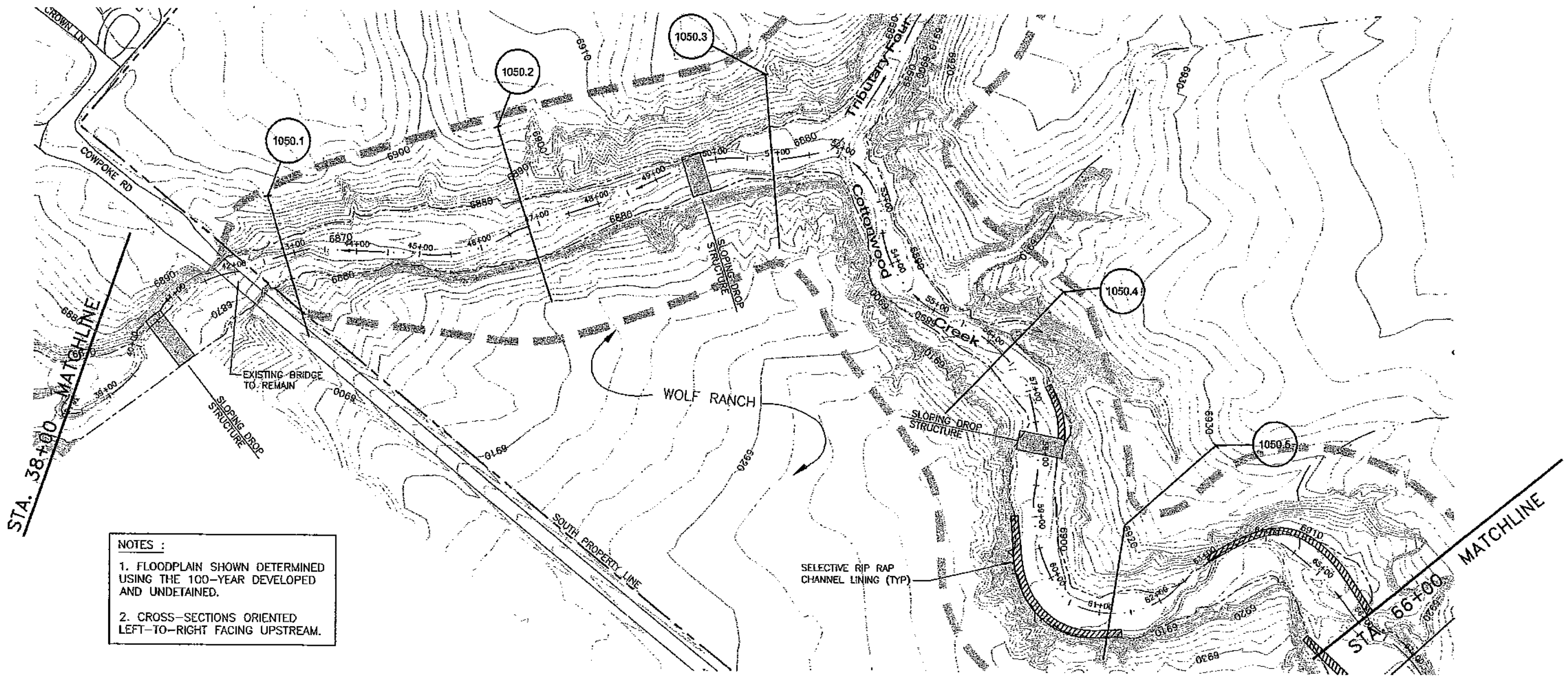


Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

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



NOTES :

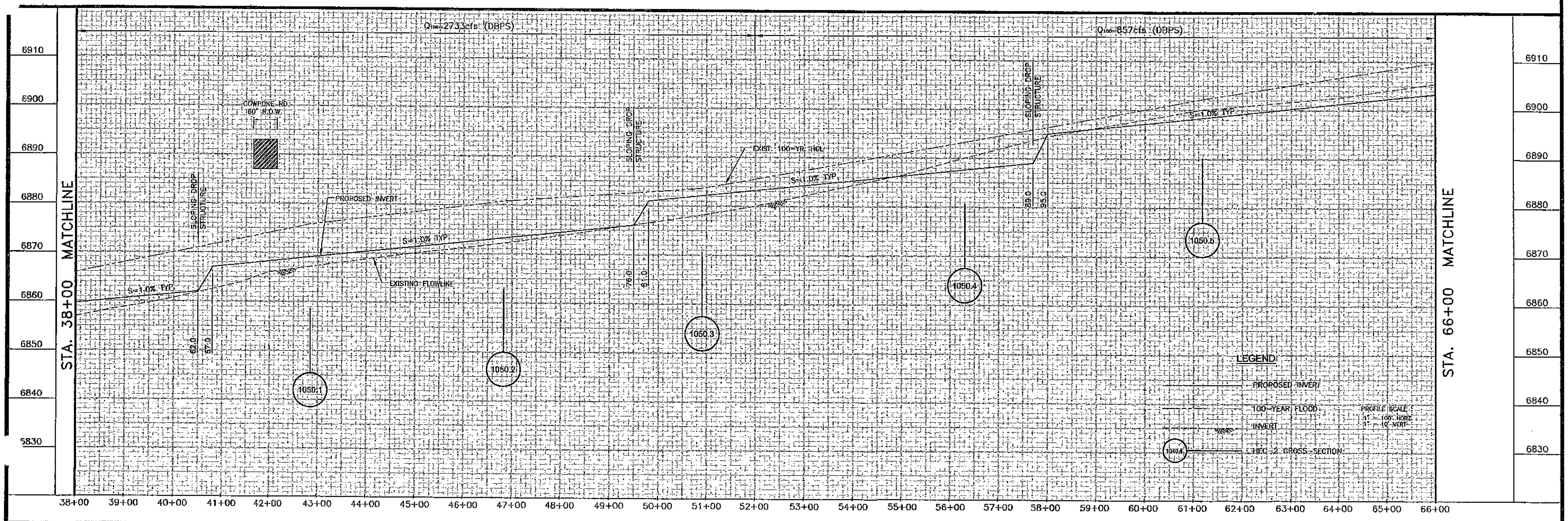
1. FLOODPLAIN SHOWN DETERMINED USING THE 100-YEAR DEVELOPED AND UNDETAINED.

2. CROSS-SECTIONS ORIENTED LEFT-TO-RIGHT FACING UPSTREAM.

LEGEND

EXISTING CONDITION 100-YEAR FLOOD

EROSION CONTROL SETBACK

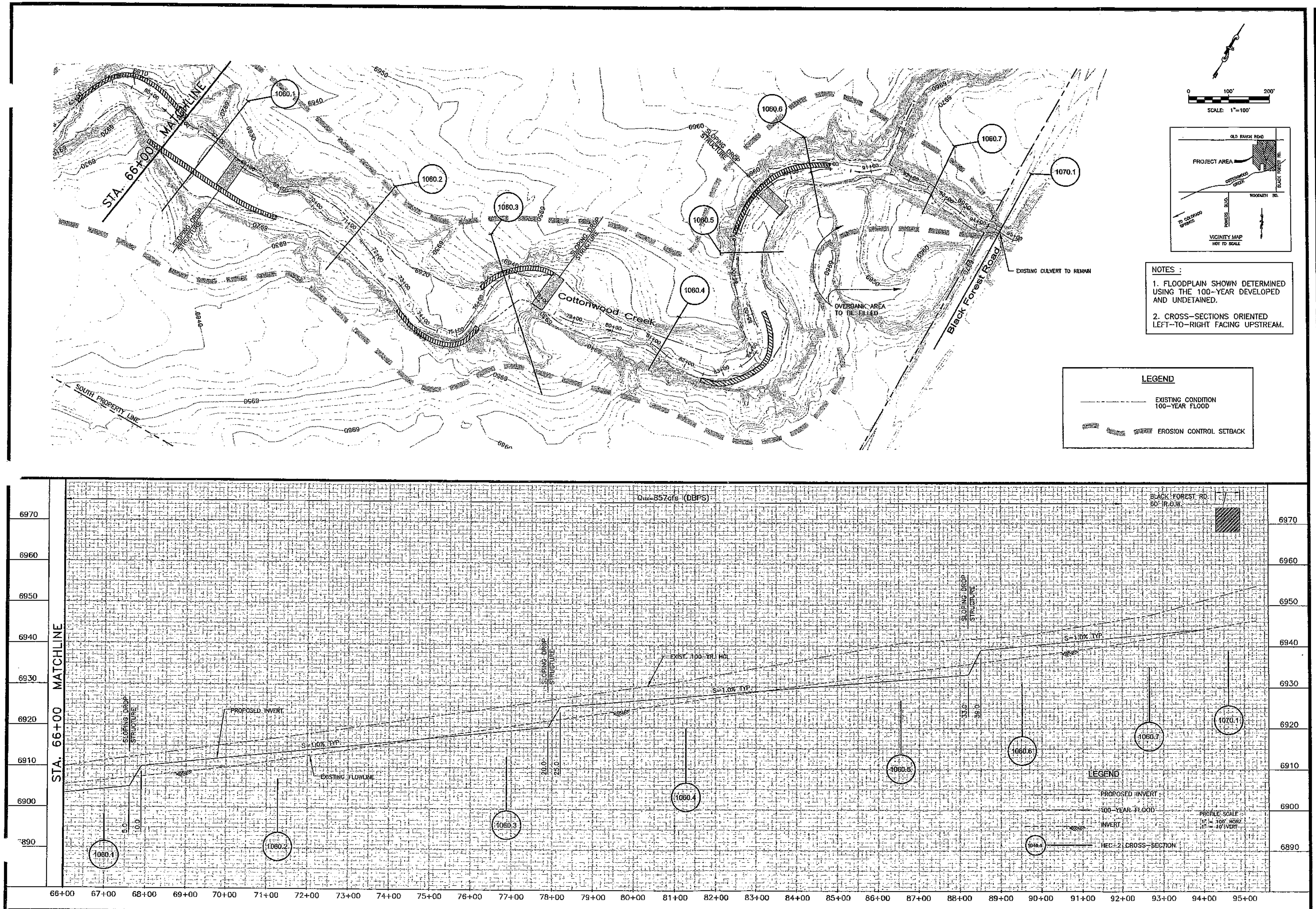


Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
COTTONWOOD CREEK
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

Project No.: 03094
Date: 01/29/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP5
OF X SHEETS



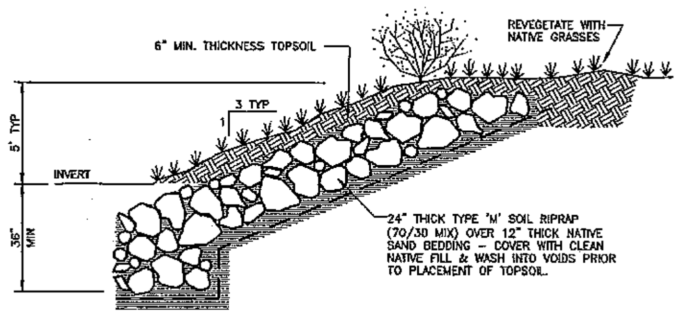
Kiowa Engineering Corporation
1604 South 21st St.
Colorado Springs, Colorado
80904-4208
(719) 630-7342

WOLF RANCH
MASTER DEVELOPMENT DRAINAGE PLAN
COTTONWOOD CREEK
PLAN & PROFILE
COLORADO SPRINGS, COLORADO

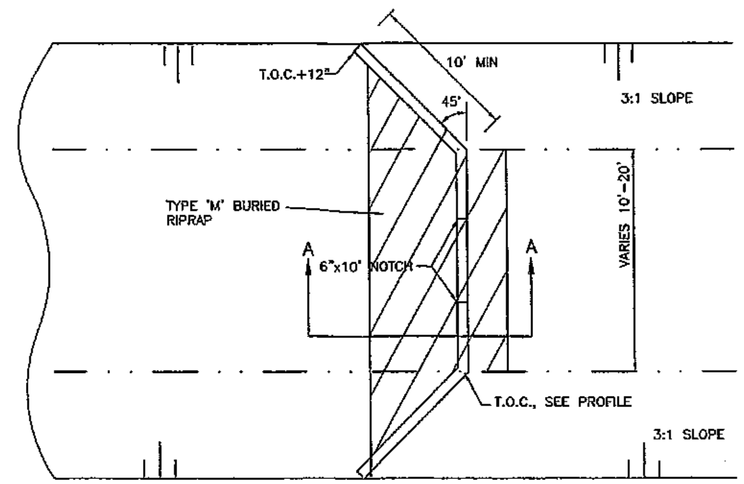
Project No.: 03094
Date: 01/29/04
Design: RNW
Drawn: JLN
Check: RNW
Revisions:

SHEET
PP6
OF X SHEETS

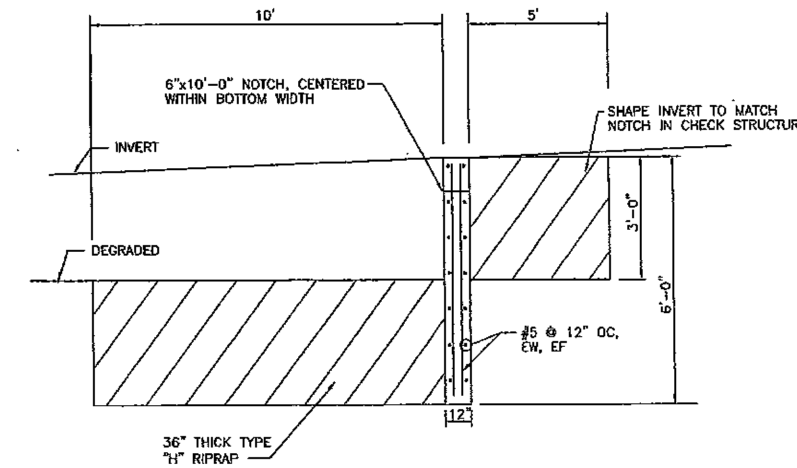
03094 pp4-6.dwg/Dec 01, 2004



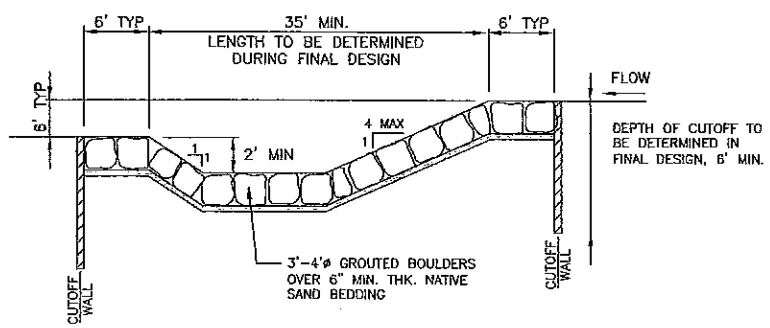
SOIL RIPRAP BANK LINING
NTS



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