Kiowa Engineering Corporation

December 27, 2005

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

RE: Wolf Ranch Detention Basin A Final Design, Colorado Springs, Colorado (Kiowa Project No. 05104)

Dear Tim:

Accompanying this letter is a set of the final design plans for the Detention Basin A in Wolf Ranch. The detention basin was shown in the Kiowa's MDDP for Wolf Ranch. I have also enclosed as set of the calculations that support the design of the detention basin.

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

Sincerely,
KIOWA ENGINEERING CORPORATION

Richard N. Wray, P.E.
Principal

Cc: Ralph Braden, Nor'wood Development
RNW/rnw
1227rnw1

file: Wolf Ranch MDDP

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

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   15DEC05  TIME  12:57:33   *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*        DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104              *
*                                       *
*****************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

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 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
```

Final Design Run

```
 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    76.3
 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
```



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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    76.8
 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     83.9
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     76.6
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       78
80          UD      .21

81          KK     DPA6
82          KM    DESIGN POINT A6 COMBINE RUNOFF FROM SUB-BASIN A-6, A6 AND A7
83          HC        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-12
88          KM    RUNOFF FROM SUB-BASIN A-12
89          BA     .048
90          LS        0       78
```

```
 91          UD    .191

 92          KK     A12
 93          KM   ROUTE RUNOFF FROM SUB-BASIN A-12 TO DP A9
 94          RD    1950     .02    .013            CIRC       3

 95          KK   A-9
 96          KM   RUNOFF FROM SUB-BASIN A-9
 97          BA   .0673
 98          LS       0    75.7
 99          UD    .263

100          KK   DP A9
101          KM   COMBINE RUNOFF FROM SUB-BASIN A-12 AND A9
102          HC       2

103          KK      A9
104          KM   ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
105          RD     500     .02    .016            CIRC       4

106          KK   A-5
107          KM   RUNOFF FROM SUB-BASIN A-5
108          BA   .1314
109          LS       0    68.6
110          UD    .209

111          KK    DPA5
112          KM   DP A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9 THIS IS INFLOW
113          KM   TO DETENTION BASIN A
114          HC       3

115          KK     DBA
116          KM   ROUTE DP A5 THROUGH DETENTION BASIN A
117          RS       1    ELEV  6977.5
118          SV       0     .17    3.05   10.15   21.87   36.27    52.1
119          SE  6977.5    6978    6980    6982    6984    6986    6988
120          SQ       0      20      40      80     120     160     900
121          SS    6987     250     2.6     1.5
122          ST    6988      15     2.6     1.5

123          KK     A10
124          KM   ROUTE FLOW FROM DESIGN POINT A5 TO DESIGN POINT A
125          RD     720    .021     .04            TRAP      15       4
```



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

126          KK    A-10
127          KM   RUNOFF FROM SUB-BASIN A-10
128          BA   .0096
129          LS       0    79.6
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130           UD     .231

131           KK      DPA
132           KM    DESIGN POINT A COMBINE RUNOFF SUB-BA$IN A-10 AND A10
133           HC        2
134           ZZ
```
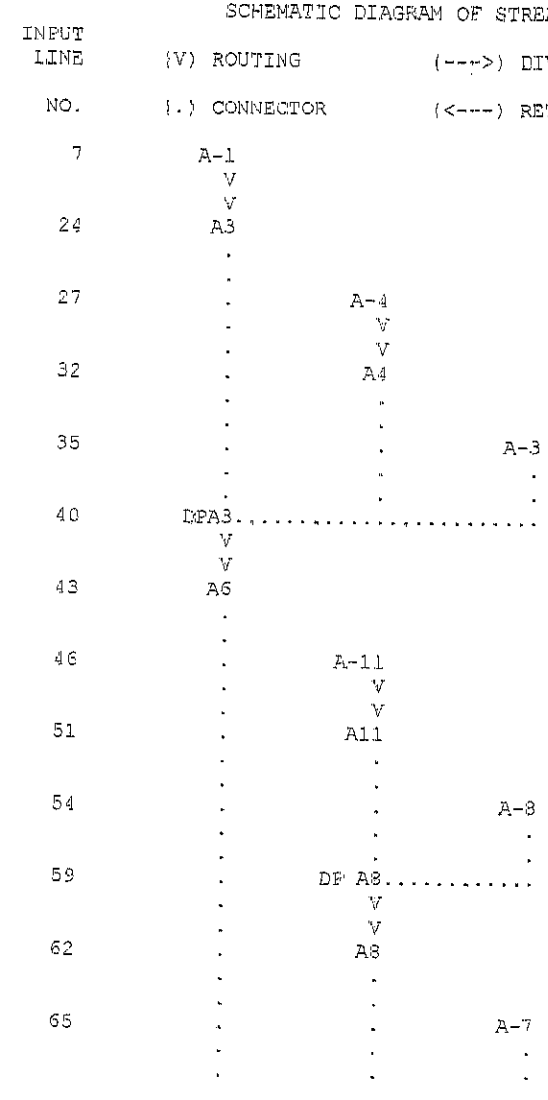
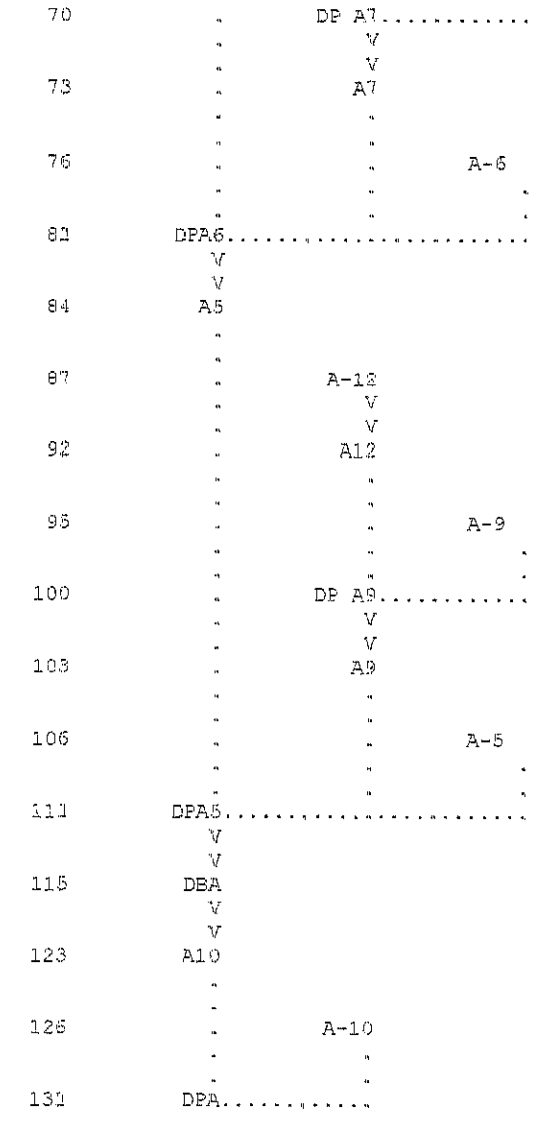

1

SCHEMATIC DIAGRAM OF STREAM NETWORK





(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*                JUN  1998              *
*                                       *
*****************************************
*                                       *
*     U.S. ARMY CORPS OF ENGINEERS      *
*     HYDROLOGIC ENGINEERING CENTER     *
*                                       *
```

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*                                          *
*            VERSION 4.1                   *
*                                          *
*  RUN DATE   15DEC05  TIME  12:57:33      *
*                                          *
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```
*                                          *
*          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-dat.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
.55 1.00

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.56	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	39.	133.
				TIME	6.08	6.08
ROUTED TO						
+	A4	.09	1	FLOW	38.	132.
				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	87.	326.
				TIME	6.17	6.08
ROUTED TO						
+	A6	.30	1	FLOW	86.	318.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-11	.08	1	FLOW	41.	134.
				TIME	6.08	6.08
ROUTED TO						
+	A11	.08	1	FLOW	39.	131.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-8	.08	1	FLOW	57.	152.
				TIME	6.17	6.08
2 COMBINED AT						
+	DP A8	.16	1	FLOW	95.	283.
				TIME	6.08	6.08
ROUTED TO						
+	A8	.16	1	FLOW	94.	278.
				TIME	6.17	6.08

HYDROGRAPH AT						
+	A-7	.05	1	FLOW	26.	84.
				TIME	6.08	6.08
2 COMBINED AT						
+	DP A7	.21	1	FLOW	118.	362.
				TIME	6.08	6.08
ROUTED TO						
+	A7	.21	1	FLOW	116.	358.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-6	.04	1	FLOW	19.	62.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA6	.54	1	FLOW	220.	715.
				TIME	6.17	6.08
ROUTED TO						
+	A5	.54	1	FLOW	216.	705.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-12	.05	1	FLOW	27.	84.
				TIME	6.08	6.08
ROUTED TO						
+	A12	.05	1	FLOW	26.	82.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-9	.07	1	FLOW	26.	90.
				TIME	6.17	6.17
2 COMBINED AT						
+	DP A9	.12	1	FLOW	51.	170.
				TIME	6.17	6.08
ROUTED TO						
+	A9	.12	1	FLOW	51.	167.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-5	.11	1	FLOW	24.	118.
				TIME	6.17	6.08
3 COMBINED AT						
+	DPA5	.77	1	FLOW	279.	979.
				TIME	6.25	6.17

ROUTED TO

+	DBA	.77	1	FLOW	68.	157.
				TIME	6.75	6.92

** PEAK STAGES IN FEET **

1	STAGE	6981.40	6985.84
	TIME	6.75	6.92

ROUTED TO

+	A10	.77	1	FLOW	68.	157.
				TIME	6.83	6.92

HYDROGRAPH AT

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

2 COMBINED AT

+	DPA	.78	1	FLOW	69.	158.
				TIME	6.83	6.83

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

Spillway Sizing

SIZE FOR Q_{100} IN = 980 cfs (UNROUTED)

@ 1.2' Depth: $Q = 2.6 L H^{3/2}$

or $L = \frac{Q}{2.6 H^{3/2}} = \frac{980}{2.6 (1.2)^{3/2}} = 286'$

To lay reverse HEC 1 to get "routed" Q_{100} inflow which accounts for storage down

Q_{100} WSEL = 85.8

PER HEC 1 - SPILLWAY RIM:

CREST @ 86.5

$L = 120'$

UPSET 1.5'

$Q_{over\ Spillway} = 540$ cfs

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*               JUN  1998               *
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*                                       *
* RUN DATE   15DEC05  TIME  12:54:21    *
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*           (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
```

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KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE 1

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  1           ID            Wolf Ranch, DETENTION BASIN A FINAL DESIGN pn 05104
  2           ID            A Basins, future development condition w/detention a-detSP.dat
  3           ID            5-year and 100 Year, 24 hr Type IIA  Storm
  4           ID            SPILLWAY SIZING RUN
              *DIAGRAM
  5           IT       5       0       0     300
  6           IO       5       0
  7           JR    PREC     .56     1.0

  8           KK     A-1
  9           KM       RUNOFF FROM SUB-BASIN A-1
 10           BA    .060
 11           IN      15
 12           PB     4.4
```

ELEV = 86.4
L = 120'

SPILLWAY SIZING RUN.

```
 13          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
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 20          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
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62          HC       2

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64          KM   ROUTE FLOW FROM SUB-BASIN A-8 TO DP A7
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67          KM   RUNOFF FROM SUB-BASIN A-7
68          BA   .0500
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88          KK    A-12
89          KM   RUNOFF FROM SUB-BASIN A-12
90          BA    .048
```

```
   91          LS       0      78
   92          UD    .181

   93          KK     A12
   94          KM   ROUTE RUNOFF FROM SUB-BASIN A-12 TO DP A9
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   97          KM   RUNOFF FROM SUB-BASIN A-9
   98          BA   .0673
   99          LS       0    75.7
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  103          HC       2

  104          KK      A9
  105          KM   ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
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  107          KK   A-5
  108          KM   RUNOFF FROM SUB-BASIN A-5
  109          BA   .1114
  110          LS       0    68.6
  111          UD    .209

  112          KK    DPA5
  113          KM   DP A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9 THIS IS INFLOW
  114          KM   TO DETENTION BASIN A
  115          HC       3

  116          KK     DBA
  117          KM   ROUTE DP A5 THROUGH DETENTION BASIN A
  118          RS       1    ELEV  6985.8
  119          SV       0       0       0       0       0       5      16      25
  120          SE  6977.5    6978    6980    6982    6984    6987    6988  6988.5
  121          SQ       0       0       0       0       0       0     310     580
  122          SS    6987     120     2.6     1.5
  123          ST  6988.5      15     2.6     1.5

  124          KK     A10
  125          KM   ROUTE FLOW FROM DESIGN POINT A5 TO DESIGN POINT A
  126          RD     720    .021     .04            TRAP      15       4
1                                      HEC-1 INPUT                                                    PAGE  4

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

  127          KK    A-10
  128          KM   RUNOFF FROM SUB-BASIN A-10
  129          BA   .0096
```
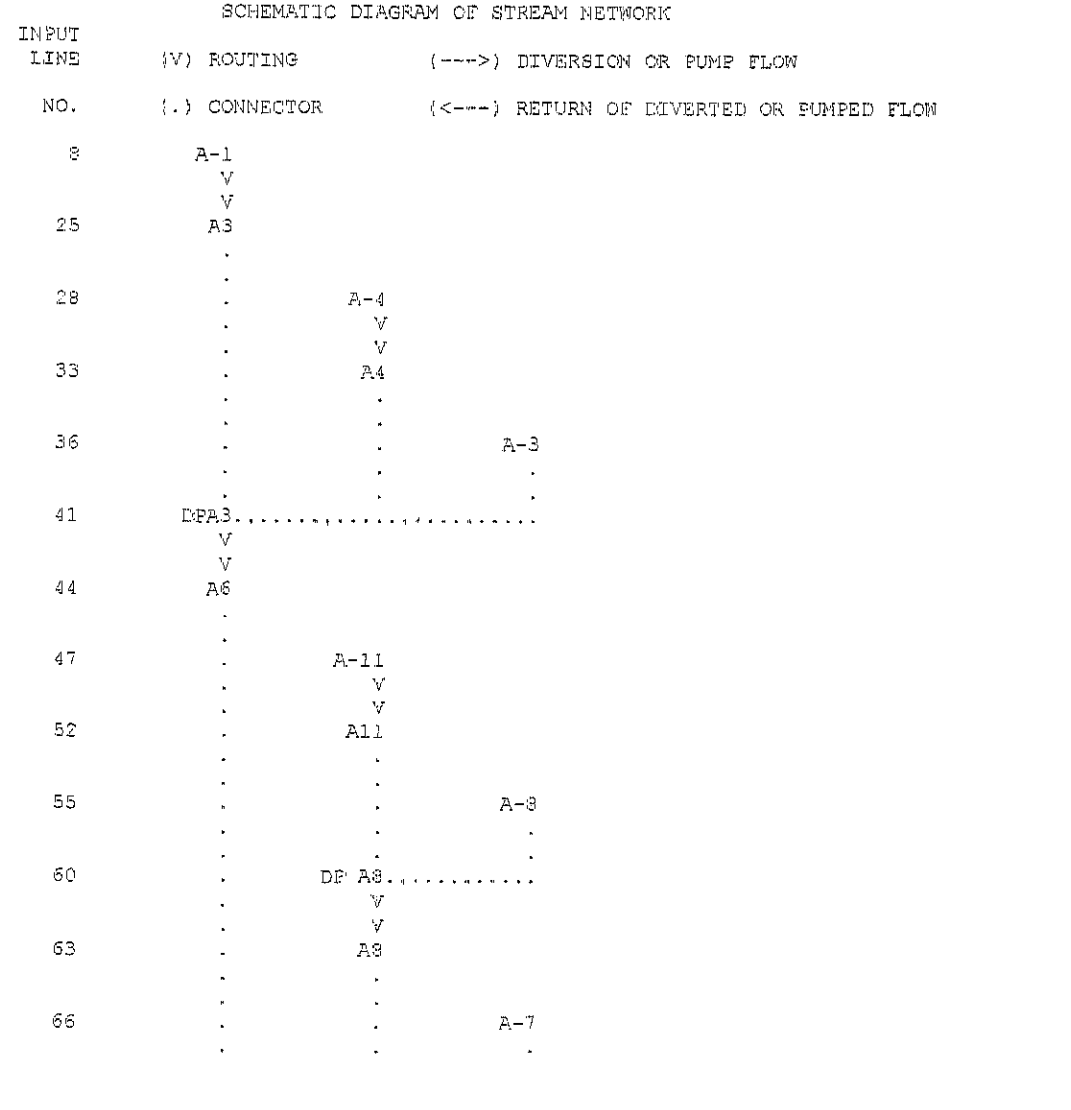
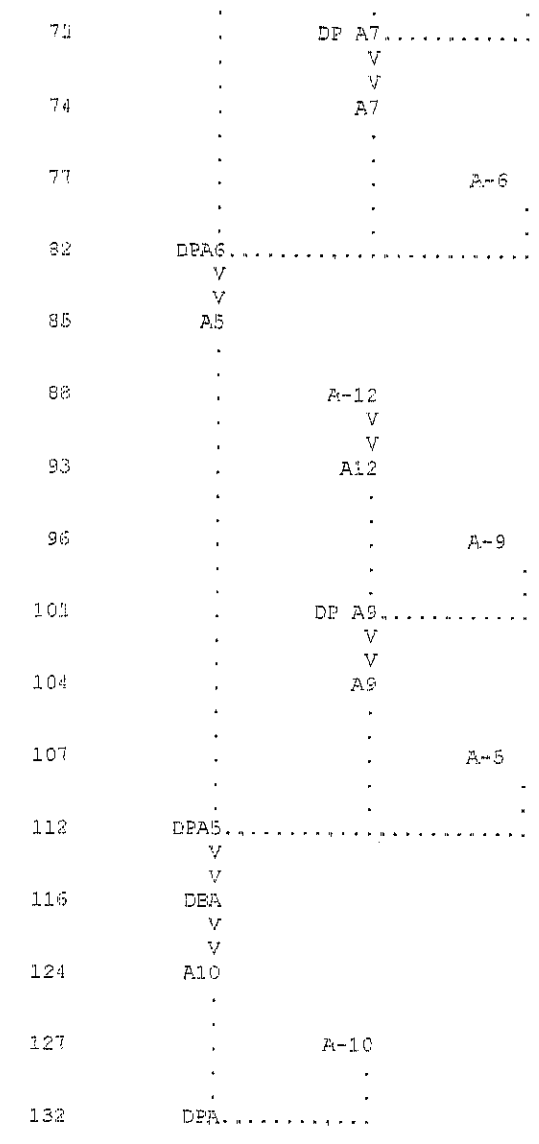

```
130           LS       0    79.6
131           UD    .231

132           KK     DPA
133           KM   DESIGN POINT A COMBINE RUNOFF SUB-BASIN A-10 AND A10
134           HC       2
135           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK





(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
**********************************************
*                                            *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)        *
```

```
**********************************************
*                                            *
*     U.S. ARMY CORPS OF ENGINEERS           *
```

```
*                JUN   1998                *
*             VERSION 4.1                  *
*                                          *
*  RUN DATE   15DEC05  TIME  12:54:21      *
*                                          *
********************************************
```


```
*     HYDROLOGIC ENGINEERING CENTER        *
*           609 SECOND STREET              *
*        DAVIS, CALIFORNIA 95616           *
*           (916) 756-1104                 *
*                                          *
********************************************
```


Wolf Ranch, DETENTION BASIN A FINAL DESIGN pn 05104
A Basins, future development condition w/detention a-detSP.dat
5-year and 100 Year, 24 hr Type IIA Storm
SPILLWAY SIZING RUN

6 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

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

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION

NPLAN	1	NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.56 1.00

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

TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	A-1	.06	1	FLOW	3.	32.
				TIME	6.25	6.17
ROUTED TO						
+	A3	.06	1	FLOW	3.	31.
				TIME	6.75	6.42
HYDROGRAPH AT						
+	A-4	.09	1	FLOW	39.	133.
				TIME	6.08	6.08
ROUTED TO						
+	A4	.09	1	FLOW	38.	132.
				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	87.	326.
				TIME	6.17	6.08
ROUTED TO						
+	A6	.30	1	FLOW	86.	318.
				TIME	6.17	6.17
HYDROGRAPH AT						
+	A-11	.08	1	FLOW	41.	134.
				TIME	6.08	6.08
ROUTED TO						
+	A11	.08	1	FLOW	39.	131.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-8	.08	1	FLOW	57.	152.
				TIME	6.17	6.08
2 COMBINED AT						
+	DP A8	.16	1	FLOW	95.	283.
				TIME	6.08	6.08
ROUTED TO						

+	A8	.16	1	FLOW	94.	278.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-7	.05	1	FLOW	26.	84.
				TIME	6.08	6.08
2 COMBINED AT						
+	DP A7	.21	1	FLOW	118.	362.
				TIME	6.08	6.08
ROUTED TO						
+	A7	.21	1	FLOW	116.	358.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-6	.04	1	FLOW	19.	62.
				TIME	6.08	6.08
3 COMBINED AT						
+	DPA6	.54	1	FLOW	220.	715.
				TIME	6.17	6.08
ROUTED TO						
+	A5	.54	1	FLOW	216.	705.
				TIME	6.25	6.17
HYDROGRAPH AT						
+	A-12	.05	1	FLOW	27.	84.
				TIME	6.08	6.08
ROUTED TO						
+	A12	.05	1	FLOW	26.	82.
				TIME	6.08	6.08
HYDROGRAPH AT						
+	A-9	.07	1	FLOW	26.	90.
				TIME	6.17	6.17
2 COMBINED AT						
+	DP A9	.12	1	FLOW	51.	170.
				TIME	6.17	6.08
ROUTED TO						
+	A9	.12	1	FLOW	51.	167.
				TIME	6.17	6.08
HYDROGRAPH AT						
+	A-5	.11	1	FLOW	24.	118.
				TIME	6.17	6.08
3 COMBINED AT						

+	DPA5	.77	1	FLOW	279.	979.
				TIME	6.25	6.17
ROUTED TO						
+	DBA	.77	1	FLOW	130.	542.
				TIME	6.50	6.42
			** PEAK STAGES IN FEET **			
			1	STAGE	6987.42	6988.43
				TIME	6.50	6.42
ROUTED TO						
+	A10	.77	1	FLOW	130.	538.
				TIME	6.50	6.42
HYDROGRAPH AT						
+	A-10	.01	1	FLOW	5.	16.
				TIME	6.08	6.08
2 COMBINED AT						
+	DPA	.78	1	FLOW	131.	544.
				TIME	6.50	6.42

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

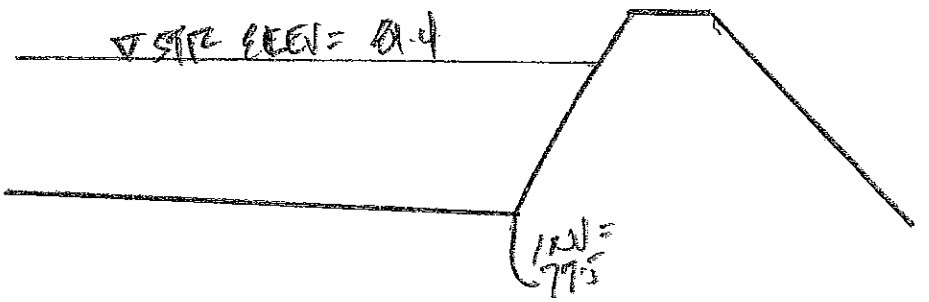
PLAN 1 .....

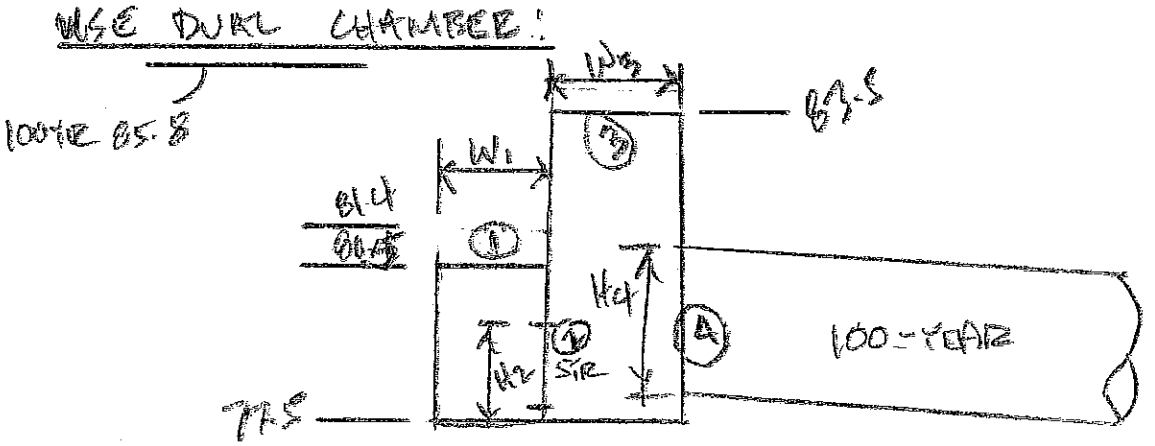
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	6985.80	6987.00	6988.50
STORAGE	3.	5.	25.
OUTFLOW	0.	0.	580.

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	TIME OF FAILURE HOURS
.56	6987.42	.00	10.	130.	.00	6.50	.00
1.00	6988.43	.00	24.	542.	.00	6.42	.00

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

5 year Outlet Design





Check opening ① :

Assume Orifice w/ $C = .63$ Bleed = 25%

$\therefore Q = C C_B A \sqrt{2gH}$ w/ $H = 1'$

$Q = .47 A (8.02) = 3.77 A$

w/ $Q = 64$ cfs $\therefore A = 64/3.77 = 17.0$ sf

w/ $W_1 = 2'$; need 8.5' opening: 2' x 8.5'

Check Opening ② (2)

Assume orifice: $C_c = .63$ Blockage: 0%

$H = 81.4 - 77.5 - 1/2 H_2$

Assume $H_2 = 2'$ ∴ $H = 81.4 - 77.5 - 1 = 2.9'$

$Q = .63 A \sqrt{2g(2.9)} = 8.6A$

w/ $Q = 64$ cfs ∴ $A = 64/8.6 = 7.44$

w/ $H_2 = 2'$ ∴ $W_2 = 7.44/2 = 3.72'$ Say 3.75'

∴ Opening in bottle wall = 2'H x 3.75' Long.

Check opening ③: 100 year.

$H = 85.8 - 83.5 = 2.3'$

$C_c = .63$ $C_B = .75$

$Q = .63(.75) A \sqrt{2g(2.3)} = 5.75 A$

w/ $Q = 157$ cfs $A = 157/5.75 = 27$ sf.

with width of structure = 8.5', ∴ $W_3 = 27/8.5'$

$= 3.2'$, Say 3.25'

Check Opening (4)

Control with pipe; assume orifice control's.

$H = 85.8 - 77.5 - \frac{1}{2}$ opng height. =

$C = .63 \quad C_B = 1.0$

$Q = .63A\sqrt{2g(H)}$

try 48" ϕ RCP ∴ $H = 8.3' - \frac{1}{2}(4) = 6.3$

$Q = .63A\sqrt{2g(6.3)} = 14.6A \quad \therefore A = 157/14.6 = 10.8$

Area of 48" Pipe = 12.57 sf: too large

try 42" RCP:

$H = 8.5 - \frac{1}{2}(3.5) = 6.55'$

$Q = .63A\sqrt{2g(6.55)} = 12.94A$

$A = 157/12.94 = 12.1$ sf.

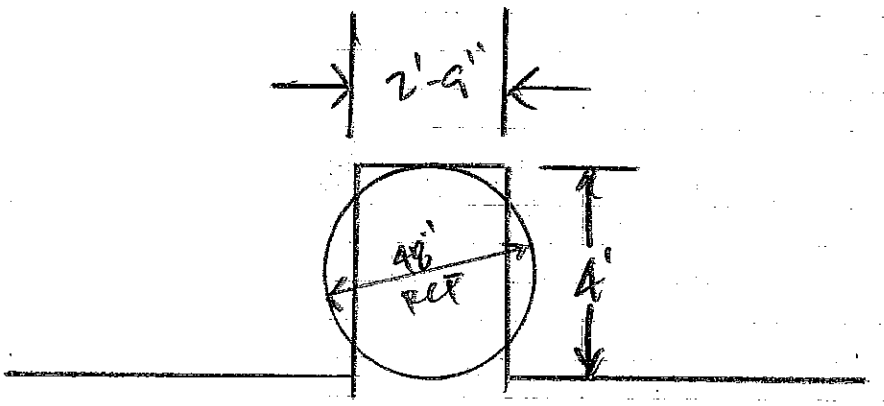
Area of 42" RCP = 9.62 sf ∴ too small

use 48" RCP w/ orifice Plate over opng.

trial $H_4 = 4'$

∴ $Q = 14.6A \quad A = 10.8$ sf

w $H_4 = 4' \therefore W_4 = 10.8/4 = 2.7'$ say 2.75'



Check minimum slope for 48" RCP to carry 157 cfs:

48" @ Qfull ; S= 1.2% min Qfull = 157 cfs

Kiowa Engineering Corporation

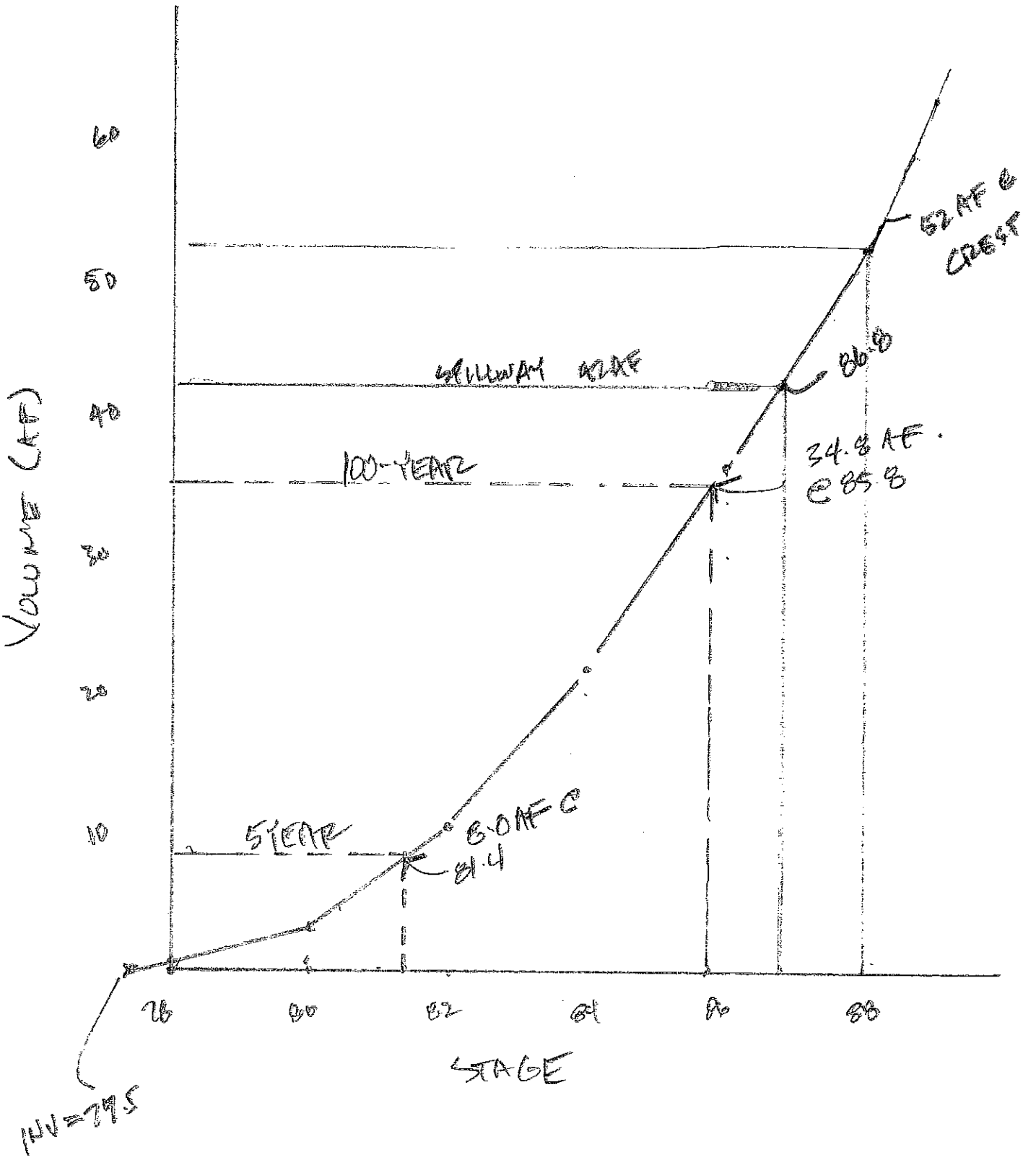
CLIENT Wulf Ranch JOB NO. 05104 PAGE 1/2
PROJECT DATE CHECKED DATE 10/11/05
DETAIL CHECKED BY COMPUTED BY TAW

Detention Basin A Storage Curve

ELEV	Area (ac)	Avg Area	ΔH	Vol (AF)	Cum Vol (AF)
6977.5	0				
		.33	.5	.17	.17
6978	.65				
		1.44	2	2.88	3.05
6980	2.23				
		3.55	2	7.10	10.15
6982	4.87				
		5.84	2	11.72	21.87
6984	6.95				
		7.2	2	14.4	36.27
6986	7.55				
		7.92	2	15.8	52.0
6988	8.28				

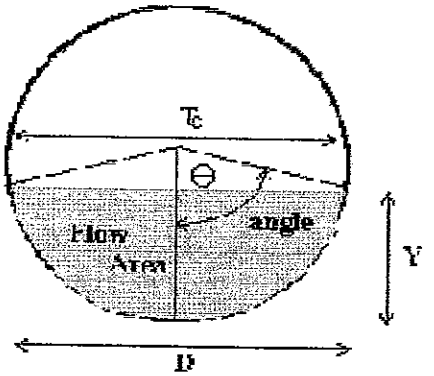
Kiowa Engineering Corporation

CLIENT Wolf Ranch | JOB NO. 05104 | PAGE 2/6
PROJECT | DATE CHECKED | DATE 10/12/05
DETAIL Det. Basin A | CHECKED BY | COMPUTED BY TJW



Circular Pipe Flow

Project: 05104 Detention basin A, Wolf Ranch
Pipe ID: outlet storm sewer 48" RCP



Design Information (Input)			
Pipe Invert Slope	So =	0.0125	ft/ft
Pipe Manning's N	N =	0.0130	
Pipe Diameter	D =	4.00	ft
Design discharge	**Q =**	**157.0**	**cfs**

MIN. SLOPE

Full-flow Capacity (Calculated)			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	rad
Full-flow capacity	**Qf =**	**161.0**	**cfs**
Calculation of Normal Flow Condition			
Half Central angle (0<Theta<3.14)	Theta =	2.21	rad
Flow area	An =	10.76	sq ft
Wetted perimeter	Pn =	8.84	ft
Flow depth	Yn =	1.60	ft
Flow velocity	Vn =	14.60	fps
Discharge	**Qn =**	**157.1**	**cfs**
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.54	rad
Critical flow area	Ac =	12.02	sq ft
Critical top width	Tc =	2.27	ft
Critical flow depth	Yc =	1.92	ft
Critical flow velocity	Vc =	13.06	fps
Froude number	**Fr =**	**1.00**	

INFLOW STRUCTURE DESIGN

Routing Element 'A5' : $Q_5 = 216$ cfs.
$Q_{100} = 705$ cfs

Count Sump Condition for D200 Inlet to Pick up 5-year :

i) Assume 2' Sump Condition.

$Q = CC_B A \sqrt{2gH}$

$C = .63$ $C_B = .80$ $\therefore CC_B = .32$

$Q = .32A\sqrt{2g(2)} = 3.63A$

Req'd Open = $216/3.63 = 59.5$ sf.
Too large for Part under.

ii) Try $H = 3'$

$\therefore Q = .32A\sqrt{2g(3)}$

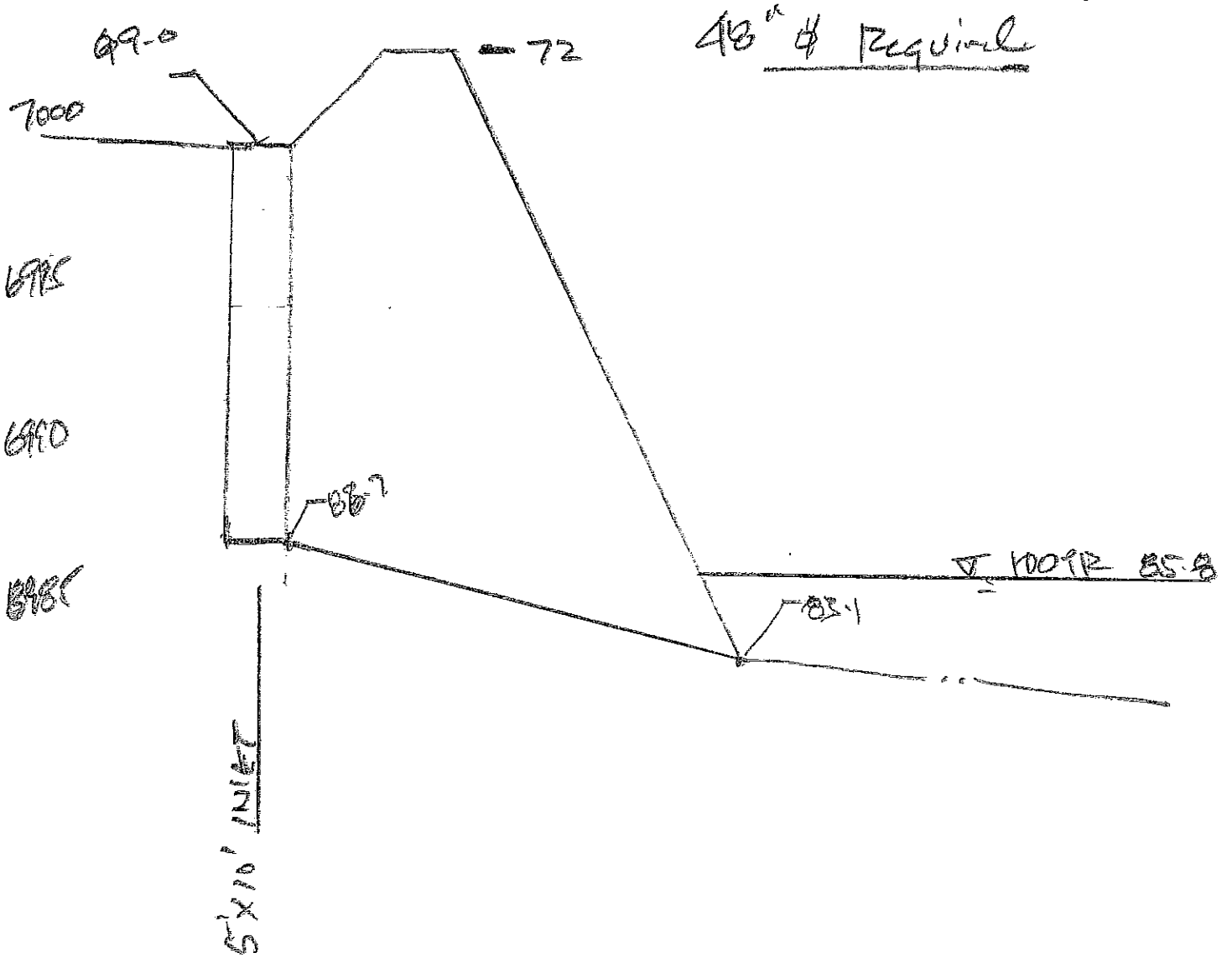
$A = 216/24.45 = 48.5$; say 50 sf

$\therefore$ 5' x 10' drop inlet.

Req'd Pipe Size est: Assume 490 cfs

∴ 42 DIA @ 4.0% = 210 cfs Full ∴ OK

Check in culvert w/ 100 year pool Full.
El = 6985.8 Under inlet control,
48" ϕ Required



Over Flow Weir.

Residual Flow over Weir : $Q_{100} - Q_r$

$705 - 216 = 489$ cfs.

w/ 1' crest .. $H = 1$

$Q = 2.6 L H^{3/2}$

$L = 489 / 2.6 = 188'$ too long

Increase to 2' H.

$\therefore Q = 2.6 L (2)^{3/2} =$

$L = 489 / 9.35 = 52'$

CURRENT DATE: 12-19-2005
CURRENT TIME: 09:27:27

FILE DATE: 12-19-2005
FILE NAME: DBAINL

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV 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	86.70	83.10	90.07	1 RCP	4.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

ok: below auto flow.

SUMMARY OF CULVERT FLOWS (cfs) FILE: DBAINL DATE: 12-19-2005

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
86.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
88.62	24.0	24.0	0.0	0.0	0.0	0.0	0.0	0.00	1
89.70	48.0	48.0	0.0	0.0	0.0	0.0	0.0	0.00	1
90.62	72.0	72.0	0.0	0.0	0.0	0.0	0.0	0.00	1
91.63	96.0	96.0	0.0	0.0	0.0	0.0	0.0	0.00	1
92.90	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.00	1
94.48	144.0	144.0	0.0	0.0	0.0	0.0	0.0	0.00	1
96.38	168.0	168.0	0.0	0.0	0.0	0.0	0.0	0.00	1
98.58	192.0	192.0	0.0	0.0	0.0	0.0	0.0	0.00	1
100.40	210.0	210.0	0.0	0.0	0.0	0.0	0.0	0.00	1
102.14	240.0	225.9	0.0	0.0	0.0	0.0	0.0	13.32	8
102.00	224.7	224.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: DBAINL DATE: 12-19-2005

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
86.70	0.000	0.00	0.00	0.00
88.62	0.000	24.00	0.00	0.00
89.70	0.000	48.00	0.00	0.00
90.62	0.000	72.00	0.00	0.00
91.63	0.000	96.00	0.00	0.00
92.90	0.000	120.00	0.00	0.00
94.48	0.000	144.00	0.00	0.00
96.38	0.000	168.00	0.00	0.00
98.58	0.000	192.00	0.00	0.00
100.40	0.000	210.00	0.00	0.00
102.14	-0.004	240.00	0.80	0.33

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-19-2005
(RENT TIME: 09:27:27

FILE DATE: 12-19-2005
FILE NAME: DBAINL

PERFORMANCE CURVE FOR CULVERT 1 - 1(4.00 (ft) BY 4.00 (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	86.70	0.00	0.00	0-NF	0.00	0.00	0.00	2.70	0.00	0.00
24.00	88.62	1.92	1.92	1-S2n	0.74	1.43	0.79	2.70	13.56	0.00
48.00	89.70	3.00	3.00	1-S2n	1.05	2.07	1.17	2.70	15.63	0.00
72.00	90.62	3.92	3.92	1-S2n	1.30	2.56	1.50	2.70	16.73	0.00
96.00	91.63	4.93	4.93	5-S2n	1.52	2.96	1.80	2.70	17.51	0.00
120.00	92.90	6.20	6.20	5-S2n	1.72	3.28	2.06	2.70	18.39	0.00
144.00	94.48	7.78	7.78	5-S2n	1.91	3.53	2.31	2.70	19.15	0.00
168.00	96.38	9.68	9.68	5-S2n	2.09	3.78	2.54	2.70	19.97	0.00
192.00	98.58	11.88	7.20	6-S2n	2.27	4.00	2.75	2.70	20.86	0.00
210.00	100.40	13.70	8.54	6-S2n	2.40	4.00	2.90	2.70	21.56	0.00
225.88	102.14	15.44	9.81	6-S2n	2.53	4.00	3.04	2.70	22.09	0.00

El. inlet face invert 86.70 ft El. outlet invert 83.10 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                         86.70 ft
       OUTLET STATION                         190.00 ft
       OUTLET ELEVATION                        83.10 ft
       NUMBER OF BARRELS                       1
       SLOPE (V/H)                             0.0400
       CULVERT LENGTH ALONG SLOPE              90.07 ft

***** 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: 12-19-2005
CURRENT TIME: 09:27:27

FILE DATE: 12-19-2005
FILE NAME: DBAINL

TAILWATER

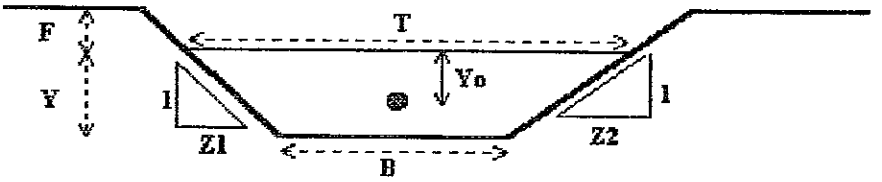
CONSTANT WATER SURFACE ELEVATION
85.80

ROADWAY OVERTOPPING DATA

WEIR COEFFICIENT	2.60
EMBANKMENT TOP WIDTH	0.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	102.00 ft

Normal Flow Analysis - Trapezoidal Channel

Project: Detention basin A, Wolf Ranch PN 05104
Channel ID: Overflow channel



Design Information (Input)		
Channel Invert Slope	So =	0.0150 ft/ft
Channel Manning's N	N =	0.035
Bottom Width	B =	25.0 ft
Left Side Slope	Z1 =	3.0 ft/ft
Right Side Slope	Z2 =	3.0 ft/ft
Freeboard Height	F =	0.0 ft
Design Water Depth	Y =	2.50 ft

Normal Flow Condtion (Calculated)		
Discharge	Q =	670.4 cfs
Froude Number	Fr =	1.02
Flow Velocity	V =	8.3 fps
Flow Area	A =	81.3 sq ft
Top Width	T =	40.0 ft
Wetted Perimeter	P =	40.8 ft
Hydraulic Radius	R =	2.0 ft
Hydraulic Depth	D =	2.0 ft
Specific Energy	Es =	3.6 ft
Centroid of Flow Area	Yo =	1.2 ft
Specific Force	Fs =	16.6 kip

```
1*************************************
 *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN  1998           *
 *            VERSION 4.1            *
 *                                   *
 *  RUN DATE   02MAY06  TIME  09:22:28   *
 *                                   *
 *************************************
```

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


```
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 DETA-FD.DAT
   3          ID            OUTFLOW FROM CORDERA DETETNION BASIN MODELED
   4          ID             5-year and 100 Year, 24 hr Type IIA  Storm
              *DIAGRAM
   5          IT       5       0       0     300
   6          IO       5       0
   7          JR    PREC       1

   8          KK     A-1
   9          KM       RUNOFF FROM SUB-BASIN A-1
  10          BA    .060
  11          IN      15
  12          PB     4.4
```

```
 13          PC  0.0000  0.0005  0.0015  0.0030  0.0045  0.0060  0.0080  0.0100  0.0120  0.0143
 14          PC  0.0165  0.0188  0.0210  0.0233  0.0255  0.0278  0.0320  0.0390  0.0460  0.0530
 15          PC  0.0600  0.0750  0.1000  0.4000  0.7000  0.7250  0.7500  0.7650  0.7800  0.7900
 16          PC  0.8000  0.8100  0.8200  0.8250  0.8300  0.8350  0.8400  0.8450  0.8500  0.8550
 17          PC  0.8600  0.8638  0.8675  0.8713  0.8750  0.8788  0.8825  0.8863  0.8900  0.8938
 18          PC  0.8975  0.9013  0.9050  0.9088  0.9115  0.9148  0.9180  0.9210  0.9240  0.9270
 19          PC  0.9300  0.9325  0.9350  0.9375  0.9400  0.9425  0.9450  0.9475  0.9500  0.9525
 20          PC  0.9550  0.9575  0.9600  0.9625  0.9650  0.9675  0.9700  0.9725  0.9750  0.9775
 21          PC  0.9800  0.9813  0.9825  0.9838  0.9850  0.9863  0.9875  0.9888  0.9900  0.9913
 22          PC  0.9925  0.9938  0.9950  0.9963  0.9975  0.9988  1.0000
 23          LS       0      61
 24          UD    .292

 25          KK      A3
 26          KM   ROUTE FLOW FROM SUB-BASIN A-1 TO DP A3
 27          RD    2700    .021    0.04            TRAP      10       4

 28          KK     A-3
 29          KM      RUNOFF FROM SUB-BASIN A-3
 30          BA     .15
 31          LS       0      73
 32          UD    .221

 33          KK    DPA3
 34          KM       COMBINE SUB-BASIN A-3 AND A3
 35          HC       2

 36          KK     A3A
 37          KM        ROUTE FLOW FROM DP A3 TO DP A4
 38          RD    1100     .02    .013            CIRC       4

 39          KK     A-4
 40          KM   RUNOFF FROM SUB-BASIN A-4
 41          BA   .0861
 42          LS       0    76.3
 43          UD    0.21
```



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

 44          KK    DPA4
 45          KM        COMBINE FLOW FROM A3A AND SUB-BASIN A-4
 46          HC       2

 47          KK      A4
 48          KM   ROUTE RUNOFF FROM DPA4 TO A6
 49          RD     450     .02    .013            CIRC     4.5

 50          KK      A6
 51          KM   ROUTE FLOW FROM A4 TO DP A6
 52          RD    1550    .016    .013            TRAP      10       4
```

```
                V
     47      53 A4        KK    A-11
             54  V        KM   RUNOFF FROM SUB-BASIN A-11
             55  V        BA    .081
     50      56 A6        LS       0    76.8
             57  .        UD     .19
                 .
     53      58  .        KK11   A11
             59  .        KM V ROUTE SUB-BASIN A-11 TO DP A8
             60  .        RD V  1400     .02    .013            CIRC     3.5
     58          .         A11
             61  .        KK .   A-8
             62  .        KM . RUNOFF FROM BASIN A-8
     61      63  .        BA .  .079   A-8
             64  .        LS .     0    83.9
             65  .        UD .  .250     .
     66          .       DP A8..........
             66  .        KK V DP A8
             67  .        KM V COMBINE RUNOFF FROM SB A-8 AND A11
     69      68  .        HCA8     2
                 .          .
             69  .        KK .    A8
     72      70  .        KM . ROUTE FLOW7FROM DES POINT A8 TO DP A7
             71  .        RD .  1100     .02    .013            CIRC     4.5
                 .          .                 .
     77      72  .       DEKA7...A-7.....
             73  .        KM V RUNOFF FROM SUB-BASIN A-7
             74  .        BA V .0500
     80      75  .        LSA7     0    76.6
             76  .        UD .  .172
                 .          .
     83      77  .        KK . DP A7   A-6
             78  .        KM . COMBINE RUNOFF FROM SUB-BASIN A-7 AND A8
             79  .        HC .     2     .
     88       DPA6.....................
             80  V        KK      A7
             81  V        KM   ROUTE FLOW FROM DP A7 TO DP A6
     91      82 A5        RD     800    0.02   0.013            CIRC       5
1                .                                    HEC-2 INPUT                                                    PAGE  3
                 .
     94     LINE .        ID12.....1.......2.......3.......4.......5.......6.......7.......8.......9......10
                 .           V
                 .           V
     99      83  .        KA12   A-6
             84  .        KM . RUNOFF FROM SUB-BASIN A-6
             85  .        BA .  .045
    102      86  .        LS .     0 A-980.8
             87  .        UD .   .21     .
                 .          .                 .
    107      88  .       DEKA9..DPA6.....
             89  .        KM V DESIGN POINT A6 COMBINE RUNOFF FROM SUB-BASIN A-6, A6 AND A7
             90  .        HC V     3
```

```
 91          KK      A5
 92          KM    ROUTE FLOW FROM DESIGN POINT A6 TO DP A5
 93          RD     2200     .011      .04             TRAP       10        4

 94          KK     A-12
 95          KM    RUNOFF FROM SUB-BASIN A-12
 96          BA     .048
 97          LS        0       78
 98          UD     .181

 99          KK      A12
100          KM    ROUTE RUNOFF FROM SUB-BASIN A-12 TO DP A9
101          RD     1950      .02     .013             CIRC        3

102          KK    A-9
103          KM    RUNOFF FROM SUB-BASIN A-9
104          BA     .059
105          LS        0     76.3
106          UD     .263

107          KK    DP A9
108          KM    COMBINE RUNOFF FROM SUB-BASIN A-9 AND A12
109          HC        2

110          KK      A9
111          KM    ROUTE FLOW FROM SUB-BASIN A-9 TO DESIGN POINT A5
112          RD      500      .02     .016             CIRC        4

113          KK    A-5
114          KM    RUNOFF FROM SUB-BASIN A-5
115          BA    .1114
116          LS        0       65
117          UD     .209

118          KK     DPA5
119          KM    DP A5 COMBINE RUNOFF FROM SUB-BASIN A-5, A5 AND A9 THIS IS INFLOW
120          KM    TO DETENTION BASIN A
121          HC        3
```



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

122          KK      DBA
123          KM    ROUTE DP A5 THROUGH DETENTION BASIN A
124          RS        1    ELEV  6977.5
125          SV        0      .17     3.05    10.15    21.87    36.27     52.1
126          SE   6977.5     6978     6980     6982     6984     6986     6988
127          SQ        0       20       40       80      120      160      900
128          SS     6987      250      2.6      1.5
129          ST     6988       15      2.6      1.5
```

```
130           KK     A10
131           KM    ROUTE FLOW FROM DET BASIN DBA TO DESIGN POINT A1
132           RD    1100    .032    .013            CIRC       4
133           QI       0       0       0       0       0       0       0       0       0       0
134           QI       0       0       0       0       0       0       0       0       0       0
135           QI       0       0       0       0       0       0       0       0       0       0
136           QI       0       0       0       0       0       5      51     122     149     136
137           QI     119     103      90      76      66      57      51      41      35      29
138           QI      26      23      21      19      17      12      10      10       9       9

139           KK    DP A1
140           KM       COMBINE OUTFLOW FROM GRAND CORDERA DETENTION BASIN AND A10
141           HC       2

142           KK     A-10
143           KM    RUNOFF FROM SUB-BASIN A-10
144           BA    .0096
145           LS       0    79.6
146           UD     .231

147           KK      DPA
148           KM    DESIGN POINT A COMBINE RUNOFF SUB-BASIN A-10 AND DP A1
149           HC       2
150           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

     8          A-1
                 V
                 V
    25          A3
                 .
                 .
    28           .          A-3
                 .            .
                 .            .
    33         DPA3............
                 V
                 V
    36         A3A
                 .
                 .
    39           .          A-4
                 .            .
                 .            .
    44         DPA4............
                 V
```

```
  110            .          A9
                 .           .
                 .           .
  113            .           .       A-5
                 .           .          .
                 .           .          .
  118         DPA5.......................
                 V
                 V
  122          DBA
                 V
                 V
  130          A10
*** HEC1 ERROR 6 *** TRIED TO COMBINE MORE HYDROGRAPHS THAN AVAILABLE
                 .
                 .
  139        DP A1
                 .
                 .
  142            .         A-10
                 .           .
                 .           .
  147          DPA............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1 ERRORS IN STREAM SYSTEM

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   02MAY06  TIME  09:22:28   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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 DETA-FD.DAT
OUTFLOW FROM CORDERA DETETNION BASIN MODELED
5-year and 100 Year, 24 hr Type IIA Storm

```
  6 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
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
					1.00
HYDROGRAPH AT					
+	A-1	.06	1	FLOW	32.
				TIME	6.17
ROUTED TO					
+	A3	.06	1	FLOW	32.
				TIME	6.33
HYDROGRAPH AT					
+	A-3	.15	1	FLOW	194.
				TIME	6.08
2 COMBINED AT					
+	DPA3	.21	1	FLOW	196.
				TIME	6.17

ROUTED TO					
+	A3A	.21	1	FLOW	195.
				TIME	6.17
HYDROGRAPH AT					
+	A-4	.09	1	FLOW	133.
				TIME	6.08
2 COMBINED AT					
+	DPA4	.30	1	FLOW	322.
				TIME	6.08
ROUTED TO					
+	A4	.30	1	FLOW	319.
				TIME	6.08
ROUTED TO					
+	A6	.30	1	FLOW	315.
				TIME	6.17
HYDROGRAPH AT					
+	A-11	.08	1	FLOW	134.
				TIME	6.08
ROUTED TO					
+	A11	.08	1	FLOW	131.
				TIME	6.08
HYDROGRAPH AT					
+	A-8	.08	1	FLOW	152.
				TIME	6.08
2 COMBINED AT					
+	DP A8	.16	1	FLOW	283.
				TIME	6.08
ROUTED TO					
+	A8	.16	1	FLOW	278.
				TIME	6.08
HYDROGRAPH AT					
+	A-7	.05	1	FLOW	84.
				TIME	6.08
2 COMBINED AT					
+	DP A7	.21	1	FLOW	362.
				TIME	6.08
ROUTED TO					
+	A7	.21	1	FLOW	358.
				TIME	6.08

```
 HYDROGRAPH AT
+                    A-6        .05     1    FLOW          84.
                                             TIME        6.08

  3 COMBINED AT
+                   DPA6        .55     1    FLOW         745.
                                             TIME        6.08

 ROUTED TO
+                     A5        .55     1    FLOW         732.
                                             TIME        6.17

 HYDROGRAPH AT
+                   A-12        .05     1    FLOW          84.
                                             TIME        6.08

 ROUTED TO
+                    A12        .05     1    FLOW          82.
                                             TIME        6.08

 HYDROGRAPH AT
+                    A-9        .06     1    FLOW          81.
                                             TIME        6.17

  2 COMBINED AT
+                  DP A9        .11     1    FLOW         161.
                                             TIME        6.08

 ROUTED TO
+                     A9        .11     1    FLOW         159.
                                             TIME        6.08

 HYDROGRAPH AT
+                    A-5        .11     1    FLOW          95.
                                             TIME        6.08

  3 COMBINED AT
+                   DPA5        .77     1    FLOW         978.
                                             TIME        6.17

 ROUTED TO
+                    DBA        .77     1    FLOW         156.
                                             TIME        6.83

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE      6985.82
                                             TIME        6.83

 HYDROGRAPH AT
+                    A10        .11     1    FLOW         149.
                                             TIME        9.50
```

2 COMBINED AT

+	DP A1	.88	1	FLOW	258.
				TIME	9.50

HYDROGRAPH AT

+	A-10	.01	1	FLOW	16.
				TIME	6.08

2 COMBINED AT

+	DPA	.89	1	FLOW	258.
				TIME	9.50

1

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

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	6977.50	6987.00	6988.00
STORAGE	0.	44.	52.
OUTFLOW	0.	530.	900.

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	TIME OF FAILURE HOURS
1.00	6985.82	.00	35.	156.	.00	6.83	.00

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