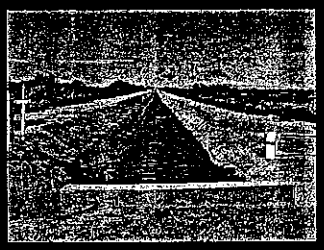
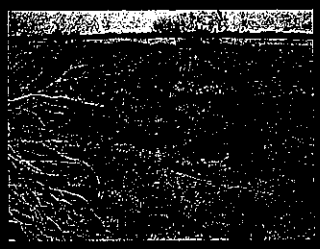
North Inlet Channel

Design Calculations and Analyses

October 2005

100%
Notebook

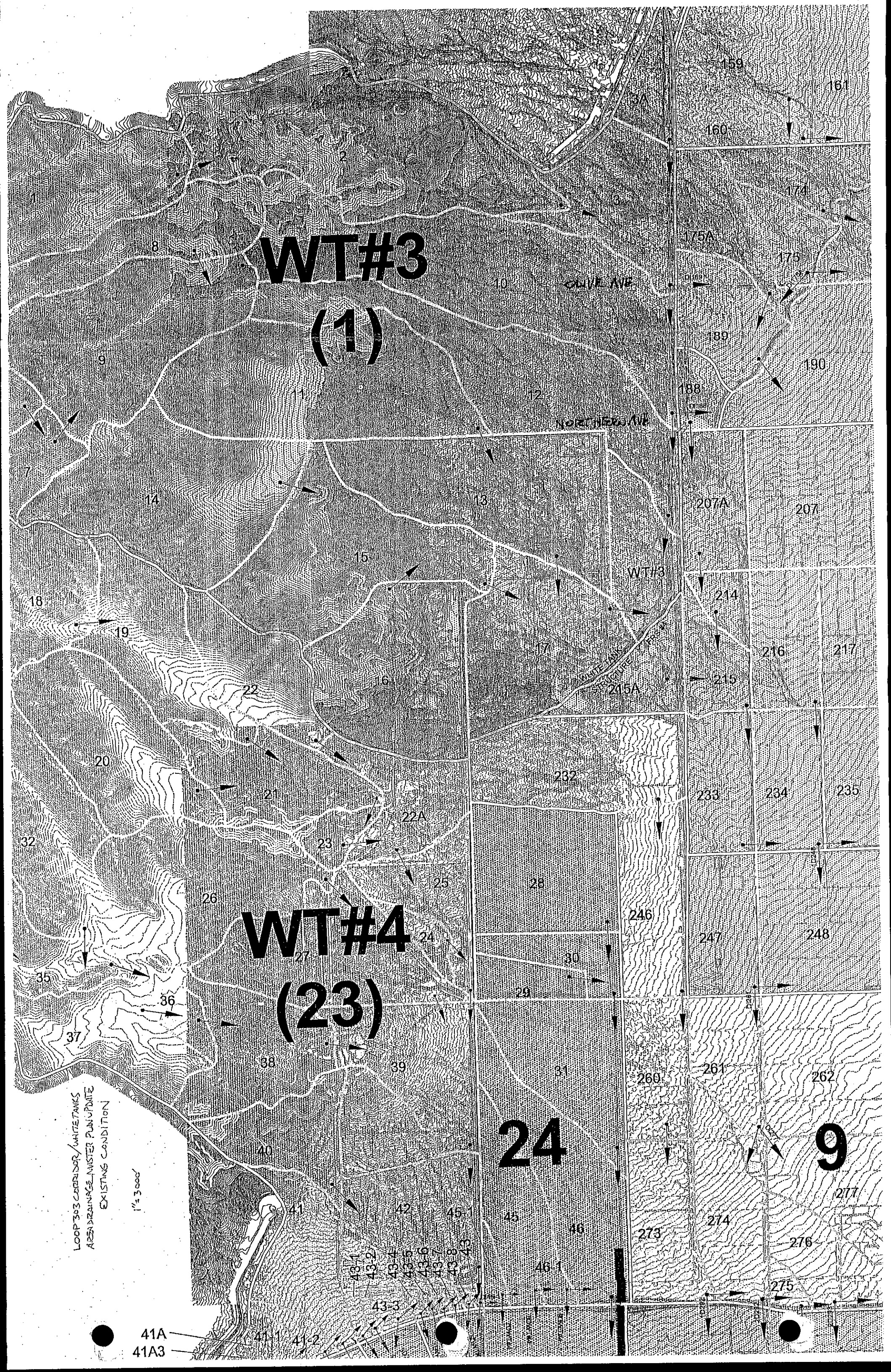



Prepared For

Flood Control District of Maricopa County

Prepared by

Kirkham Michael and Associates


WT#3
(1)
WT#4
(23)
24
9
OLIVE AVE
NORTHERN AVE
WHITE TANK
STRUCTURE
WT#3
LOOP 303 CORRIDOR/WHITE TANKS
AREA DRAINAGE MASTER PLAN UPDATE
EXISTING CONDITION
1"= 3000'
41A
41A3

Jason Kelley - RE: White Tanks Report

From: "Joe Rumann - FCDX" <jmr@mail.maricopa.gov>
To: "Jason Kelley" <jkelley@kirkham.com>
Date: 3/9/2005 1:04 PM
Subject: RE: White Tanks Report
CC: "Bobbie Ohler - FCDX" <BAO@mail.maricopa.gov>

Jason:

the report is the FRZR Basin Outlet Channel Design Report, dated 01/10/05 by Stantec. the Q from that report calculated 2722 cfs at Olive Rd. and 5563 cfs at Northern. These are the flows we should be using. If you have any questions please let me know thanks.

joe

-----Original Message-----
From: Jason Kelley [mailto:jkelley@kirkham.com]
Sent: Wednesday, March 09, 2005 12:41 PM
To: Joe Rumann - FCDX
Subject: White Tanks Report

Joe,
What is the name of the report documenting the updated hydrology for the White Tanks?

Also, were we solid that the only change to the design Q's for our North Inlet Channel project was at Olive (2722 cfs instead of 2655 cfs).

Jason

Jason K. Kelley, P.E.
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9201 North 25th Avenue, Suite 195
Phoenix, Arizona 85021

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www.kirkham.com

UPDATED FRZR BASIN OUTLET CHANNEL
HEC-1 MODEL

PEAK FLOWS OBTAINED FOR
STEADY-STATE HEC-RAS MODEL
& HYDROGRAPHS OBTAINED FOR
UNSTEADY-STATE HEC-RAS MODEL

```
1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*            JUN   1998             *
*          VERSION 4.1              *
*                                   *
* RUN DATE   07JUL05  TIME  15:10:38 *
*                                   *
*************************************
```

```
*************************************
*                                   *
*   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   FRZR Basin Outlet Channel
   2          ID   For the Flood Control District of Maricopa County, FCD 2002C009
   3          ID
   4          ID   Stantec Consulting Inc.
   5          ID   Proj No. 182000343
   6          ID   File:  Pr100-24.dat
   7          ID   Date:  01/05/05    mcg (Stantec)
   8          ID
   9          ID   The existing embankment for the remnant portion of McMicken Dam is removed.
  10          ID   The existing conveyance channel is regraded to function as a detention basin.
  11          ID   The basin outfalls to Waterfall Wash ultimately ending up in the White Tanks
  12          ID   FRS No. 3. New peak discharges at Olive Avenue and Northern Avenue due to the
  13          ID   additional contributing area from the FRZR project are computed for the
  14          ID   100-year 24-hour storm event
  15          ID
  16          ID   Rev:   07/01/05    jkk (Kirkham Michael)
  17          ID
  18          ID   Diversion at Olive Avenue (D3) updated based on current design of side weir
  19          ID   structure by Kirkham Michael. North Inlet Channel diversion (SIDEWR) returned
  20          ID   with remainder of flows from Waterfall Wash and Cholla Wash (CP10B). FRS#3
  21          ID   Channel routing (RCP10B) added to reflect proposed design
  22          ID
  23          ID   Reference correction to original FRZR Basin Outlet Channel HEC-1 Model:
  24          ID   Changed notation from "Loop303/White Tanks ADMP Update model L303M2L.DAT" to
  25          ID   determine a preliminary estimate of the diversion at Olive Avenue.
  26          ID
  27          ID   Rainfall:  100-year, 24-hour point rainfall = 4.03 inches
  28          ID   Rainfall Losses:  Green and Ampt Rainfall Losses
  29          ID   Unit Hydrograph:  Phoenix Valley and Desert/Rangeland S-Graphs
  30          ID
  31          IT       5                    2000
  32          IO       5
  33          IN      15
              *
              *DIAGRAM
              *
  34          JD    4.03    0.01
  35          PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
  36          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
  37          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  38          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
  39          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
  40          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
  41          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
  42          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
  43          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
  44          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
  45          JD   3.790   10.00
  46          JD   3.510   50.00
              *
              *  Waterfall Wash - input parameters taken from Loop303/White Tanks ADMP Update
              *  model L303M1L.DAT
              *
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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```
 47          KK      1   BASIN
 48          KM   Subbasin     1
 49          KM
 50          KM      The Phoenix Valley S-Graph is used for this basin.
 51          KM        L = 3.50 mi.   Lca = 1.5 mi.   S = 527.2 ft/mi   Kn = 0.050
 52          KM        Lag =  40.7 min
 53          KM
 54          BA   1.940
 55          LG    0.20    0.35    4.00    0.52      10
 56          UI    160.    207.    585.    790.    939.   1135.   1427.   1996.   1720.   1386.
 57          UI   1159.    946.    776.    535.    307.    267.    194.    160.     72.     49.
 58          UI    49.     49.     49.     49.      0.      0.      0.      0.      0.      0.
 59          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

 60          KK   RCP1
 61          KM       ROUTE FLOW FROM CP1 TO CP2.
 62          RS       5              -1       0
 63          RC     .06     .04     .06   17800   .0469
 64          RX    1000    1125    1300    1390    1405    1490    1590    1750
 65          RY    1440    1439    1437    1428    1428    1439    1442    1444
             *

 66          KK       2
 67          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
 68          BA    1.82
 69          LG     .18     .35    4.55     .37   12.00
 70          UI    115.    115.    259.    443.    557.    643.    728.    849.   1014.   1348.
 71          UI   1418.   1145.    985.    864.    735.    634.    545.    404.    268.    202.
 72          UI    189.    143.    115.    102.     35.     35.     35.     35.     35.     35.
 73          UI     35.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 74          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

 75          KK    MD-1   BASIN
 76          KM   Subbasin     MD-1
 77          KM
 78          KM      The Desert/Rangeland S-Graph is used for this basin.
 79          KM        L = 1.261 mi.   Lca = 0.33 mi.   S = 87.3 ft/mi   Kn = 0.030
 80          KM        Lag =  13.3 min
 81          KM
 82          BA   0.377
 83          LG    0.15    0.38    5.62    0.18       0
 84          UI     193     712     895     551     286     142      75      28      24       0
 85          UI       0       0       0       0       0       0       0       0       0       0
 86          UI       0       0       0       0       0       0       0       0       0       0
             *

 87          KK   MD-10
 88          KM   Outflow from the segemented portion of McMicken Dam
 89          KM   Low level outlet is a 36" rcp
 90          RS       1    FLOW      -1
 91          SV       0     2.0    12.9    31.8    43.2
 92          SE    1344    1346    1348    1350    1351
1                                          HEC-1 INPUT                                                    PAGE  3

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

 93          SQ       0      10      30      50      70      80
 94          SE  1343.5  1344.9  1346.5  1347.9 1350.73 1352.55
             *

 95          KK    RMD1
 96          KM        ROUTE FLOW FROM MD-1 TO CP3
 97          RS       2    FLOW      -1
 98          RC   0.045   0.045   0.045    1740   .0092
 99          RX     100     108     116     132     140     156     164     172
100          RY     108     106     104     100     100     104     106     108
             *

101          KK     CP2
102          KM   Combine routed hydrograph from the new basin with runoff from Waterfall Wash
103          HC       3
             *

104          KK    RCP2
105          KM        ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
106          RS       2              -1       0
107          RC     .06    .035     .06    4500   .0111
108          RX    1000    1100    1350    1705    1735    1780    1850    2000
109          RY    1304    1302    1302    1298    1298    1303    1302    1305
             *
             *  Beardsley Canal Wash - input parameters taken from Loop303/White Tanks ADMP
             *  Update model L303M1L.DAT
             *

110          KK      3A   BASIN
111          BA   0.290
112          LG    0.15    0.35    4.30    0.42       0
113          UI     34.     90.    165.    213.    289.    411.    312.    240.    181.    121.
114          UI     60.     47.     32.     10.     10.     10.     10.      0.      0.      0.
115          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *
```

```
116          KK   RCP3A
117          KM        ROUTE FLOW FROM CP3A TO CP3
118          RS       2              -1       0
119          RC     .03     .03     .05    5300   .0060
120          RX    1000    1023    1032    1046    1058    1067    1250    1540
121          RY    1289    1288    1286    1284    1284    1286    1288    1291
             *

122          KK       3   BASIN
123          BA   0.810
124          LG    0.15    0.35    4.45    0.38       0
125          UI     90.    226.    427.    550.    718.   1081.    912.    702.    537.    401.
126          UI    208.    151.     97.     59.     28.     28.     28.     28.      0.      0.
127          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

128          KK   I1CP3
129          KM     ADD HYDROGRAPHS AT I1CP3
130          HC       2     1.1
             *

131          KK     CP3
132          KO       2
133          KM      ADD HYDROGRAPHS AT CP3.
134          HC       2     4.86
             *
             * PER URS FLOODPLAIN ANALYSIS BY MIKE R.
             * TURN OFF DIVERT PER CULVERT IMPROVEMENT BY 'SONORAN RIDGE REALESTATE'
             * ALSO BY DIRECTION OF MIKE DUNCAN AT FCDMC PER HIS PHONE CONVERSATION
             * WITH SONORAN RIDGE ON 2-14-02.
             *
             * PER PHONE CONVERSATION WITH FCDMC - PROPOSED 2-10'X6' BOX CULVERTS WERE
             * BACKFILLED ON 11-01-02.  THERE IS ALSO AN EXISTING 7' CMP AND AN 8' CMP
             * AT THIS LOCATION
             *
             * ORIGINAL DIVERT DATA COMMENTED OUT
             *
             * KM DIVERT FLOWS THAT WILL OVERTOP THE BEARDSLEY CANAL AT OLIVE AVENUE.  THE
             * KM HEC-2 DIVERSION RATING CURVE MODELED BY THE FLOOD CONTROL DISTRICT IS
             * KM INCORPORATED HERE.
             * FOLLOWING DIVERT DATA PROVIDED BY FCDMC ON 5-14-03
             * THIS INFORMATION IS BASED ON THE CULVERT STRUCTURE CONSTRUCTED PER THE
             * SONORAN RIDGE DEVELOPMENT, SEE 'S02001035' AND 'S02002033'
             * DT DI189
             * DI      0    1432    2823    3000    4000
             * DQ      0       0     622     728    1728
             *

135          KK      D3
136          KM   NORTH INLET CHANNEL SIDE WEIR DIVERSION BY KM ON 7/06/05 AT OLIVE ANENUE
137          KM   (FROM HEC-RAS)
138          DT  SIDEWR
139          DI     600     800    1000    1200    1400    1600    2000    2200    2400    2722
140          DQ     105     163     361     498     640     792    1100    1274    1437    1626
             *
```

OLIVE SIDEWEIR RATING

```
141          KK    RCP3
142          KM        ROUTE FLOW FROM CP3 TO CP10.
143          RS       2              -1       0
144          RC     .05     .03     .05    5280   .0083
145          RX    1010    1015    1020    1050    1100    1275    1580    1750
146          RY    1251    1249    1249    1245    1245    1250    1250    1254
             *
             *  Cholla Wash - input parameters taken from Loop303/White Tanks ADMP Update
             *  model L303M1L.DAT
             *
```



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

147          KK       4
148          KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
149          BA     .30
150          LG     .20     .35    4.35     .44    9.00
151          UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
152          UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
153          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

154          KK       5
155          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
156          BA     .72
157          LG     .20     .35    4.30     .45    9.00
158          UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
159          UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
160          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *

161          KK     CP5
162          KM        ADD HYDROGRAPHS AT CP5.
```

```
163          HC      2    1.02

164          KK    RCP5
165          KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
166          RS      1              -1       0
167          RC    .08      .05     .08    2400   .0833
168          RX    955      970     985    1000    1020    1035    1050    1065
169          RY   2815     2810    2805    2800    2800    2805    2810    2815
             *

170          KK      6
171          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
172          BA    .45
173          LG    .20      .35    3.95     .53   10.00
174          UI   206.     627.   1145.    834.    421.     154.     53.     33.      0.      0.
175          UI     0.       0.      0.      0.      0.       0.      0.      0.      0.      0.
             *

176          KK    CP6
177          KM        ADD HYDROGRAPHS AT CP6.
178          HC      2    1.47
             *

179          KK    RCP6
180          KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
181          RS      1              -1       0
182          RC    .08      .05     .08    2400   .0833
183          RX    955      970     985    1000    1020    1035    1050    1065
184          RY   2815     2810    2805    2800    2800    2805    2810    2815
             *
```



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

185          KK      7
186          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
187          BA    .31
188          LG    .20      .35    3.95     .53   10.00
189          UI   124.     383.    708.    610.    347.     132.     54.     21.      0.      0.
190          UI     0.       0.      0.      0.      0.       0.      0.      0.      0.      0.
             *

191          KK    CP7
192          KM        ADD HYDROGRAPHS AT CP7.
193          HC      2    1.78
             *

194          KK    RCP7
195          KM        ROUTE COMBINED HYDROGRAPHS AT CP7 TO CP9.
196          RS      3              -1       0
197          RC    .08      .05     .08   10200  .07745
198          RX   1000     1045    1120    1195    1230     1300    1350    1450
199          RY   1910     1880    1850    1838    1838     1850    1880    1910
             *

200          KK      9
201          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 9.
202          BA   1.40
203          LG    .20      .35    4.00     .52   10.00
204          UI   155.     380.    725.    933.   1213.    1828.   1593.   1225.    939.    707.
205          UI   389.     261.    178.    116.     47.      47.     47.     47.      0.      0.
206          UI     0.       0.      0.      0.      0.       0.      0.      0.      0.      0.
             *

207          KK   I1CP9
208          KM        ADD HYDROGRAPHS AT CP9.
209          HC      2    3.18
             *

210          KK      8
211          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 8.
212          BA    .81
213          LG    .20      .35    3.95     .53   10.00
214          UI   103.     314.    536.    704.   1058.    1138.    821.    608.    420.    207.
215          UI   147.      95.     31.     31.     31.       0.      0.      0.      0.      0.
216          UI     0.       0.      0.      0.      0.       0.      0.      0.      0.      0.
             *

217          KK    CP9
218          KM        ADD HYDROGRAPHS AT CP9.
219          HC      2    3.99
             *
```



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

220          KK    RCP9
221          KM        ROUTE COMBINED HYDROGRAPHS AT CP9 TO CP10.
222          RS      8              -1       0
223          RC    .06     .035     .06   19200  .0232
224          RX   1000     1085    1310    1395    1415     1450    1630    1665
225          RY   1317     1314    1311    1308    1308     1314    1314    1317
             *
```

```
 226          KK      10
 227          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 10.
 228          BA    2.02
 229          LG     .16      .35    4.55     .36    4.00
 230          UI    119.     119.    219.    428.    547.    632.    709.    813.    930.   1153.
 231          UI   1500.    1391.   1155.   1006.    893.    765.    668.    577.    473.    323.
 232          UI    210.     201.    191.    119.    119.     84.     36.     36.     36.     36.
 233          UI     36.      36.     36.     36.      0.      0.      0.      0.      0.      0.
 234          UI      0.       0.      0.      0.      0.      0.      0.      0.      0.      0.
              *

 235          KK  I1CP10
 236          KO       2
 237          KM        ADD HYDROGRAPHS AT I1CP10 (CHOLLA WASH)
 238          HC       2    6.01
              *

 239          KK    CP10
 240          KM        ADD HYDROGRAPHS AT CP10 (AT NORTHERN AVENUE)
 241          HC       2   10.87
              *
              * ************************************************************************
              * Original diversions left in but commented out for comparison with URS
              * Loop303/White Tanks ADMP Update model L303M1L.DAT
              *
              * KK  1D10
              * KM  PER URS FLOODPLAIN STUDY BY MIKE R. AND BOB D. ON 2-14-02
              * DT1DI188
              * DI     0    6483    9725
              * DQ     0     951    1475
              *
              * KK  2D10
              * KM       FLOW TO WHITE TANKS #3 UNDER NORTHERN AVE.  THE HEC-2 DIVERSION RATING
              * KM       CURVE MODELED BY THE FLOOD CONTROL DISTRICT IS INCORPORATED HERE.
              * DT2DI188
              * DI     0    1000    3000    4497    5000    6000    8000   10000
              * DQ     0       0     770    1277    1450    1710    2470    3240
              *
              * ************************************************************************
              *
 242          KM   FLOWS DIVERTED THRU SIDEWEIR AT OLIVE RETURNED JUST SOUTH OF NORTHERN AVE
1                                          HEC-1 INPUT                                          PAGE  8

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

 243          KK     NIC
 244          DR  SIDEWR
              *

 245          KK   CP10B
 246          KM        ADD HYDROGRAPHS AT CP10B (IMMEDIATELY DOWNSTREAM OF NORTHERN AVENUE)
 247          HC       2   10.87
              *

 248          KK  RCP10B
 249          KM        ROUTE FLOW AT CP10B TO CP12 (PROBABLE DESIGN OF THE FRS#3 CHANNEL)
 250          RS       1              -1       0
 251          RC     .06    .032     .06    3866   .0044
 252          RX     950    1000    1015    1043    1093    1121    1136    1186
 253          RY    1230    1225    1224    1210    1210    1224    1225    1230
              *

 254          KK      12
 255          KO       2
 256          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 12.
 257          BA    1.38
 258          LG     .16      .35    4.80     .31    3.00
 259          UI    111.     129.    394.    536.    636.    759.    932.   1314.   1276.   1007.
 260          UI    850.     696.    573.    444.    263.    191.    169.    111.     91.     34.
 261          UI     34.      34.     34.     34.     34.      0.      0.      0.      0.      0.
 262          UI      0.       0.      0.      0.      0.      0.      0.      0.      0.      0.
              *

 263          KK    CP12
 264          KM        ADD HYDROGRAPHS AT CP12.
 265          HC       2   12.25
              *
 266          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   47          1
               V
               V
   60        RCP1
               .
               .
   66          .          2
               .          .
```

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75                          MD-1
                              V
                              V
87                          MD-10
                              V
                              V
95                          RMD1
                              .
                              .
101        CP2.......................
             V
             V
104        RCP2
             .
             .
110             3A
                V
                V
116         RCP3A
                .
                .
122                             3
                .               .
                .               .
128         I1CP3............
                .
                .
131        CP3............
             .
             .
138           .-------> SIDEWR <-
135          D3 -
              V
              V
141        RCP3
             .
             .
147             4
                .
                .
154                             5
                .               .
                .               .
161         CP5............
                V
                V
164         RCP5
                .
                .
170                             6
                .               .
                .               .
176         CP6............
                V
                V
179         RCP6
                .
                .
185                             7
                .               .
                .               .
191         CP7............
                V
                V
194         RCP7
                .
                .
200                             9
                .               .
                .               .
207         I1CP9............
                .
                .
210                             8
                .               .
                .               .
217         CP9............
                V
                V
220         RCP9
                .
                .
226                             10
                .               .
                .               .
235         I1CP10...........
                .
                .
239        CP10...........
             .
             .
244             .<-------- SIDEWR
243             NIC
                .
```

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 245        CP10B............
                V
                V
 248       RCP10B
                .
                .
 254            .          12
                .           .
                .           .
 263        CP12............

(***) 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   07JUL05  TIME  15:10:38  *                                    *         (916) 756-1104               *
*                                      *                                    *                                      *
****************************************                                    ****************************************
```

FRZR Basin Outlet Channel
For the Flood Control District of Maricopa County, FCD 2002C009

Stantec Consulting Inc.
Proj No. 182000343
File: Pr100-24.dat
Date: 01/05/05 mcg (Stantec)

The existing embankment for the remnant portion of McMicken Dam is removed. The existing conveyance channel is regraded to function as a detention basin. The basin outfalls to Waterfall Wash ultimately ending up in the White Tanks FRS No. 3. New peak discharges at Olive Avenue and Northern Avenue due to the additional contributing area from the FRZR project are computed for the 100-year 24-hour storm event

Rev: 07/01/05 jkk (Kirkham Michael)

Diversion at Olive Avenue (D3) updated based on current design of side weir structure by Kirkham Michael. North Inlet Channel diversion (SIDEWR) returned with remainder of flows from Waterfall Wash and Cholla Wash (CP10B). FRS#3 Channel routing (RCP10B) added to reflect proposed design

Reference correction to original FRZR Basin Outlet Channel HEC-1 Model: Changed notation from "Loop303/White Tanks ADMP Update model L303M2L.DAT" to determine a preliminary estimate of the diversion at Olive Avenue.

Rainfall: 100-year, 24-hour point rainfall = 4.03 inches
Rainfall Losses: Green and Ampt Rainfall Losses
Unit Hydrograph: Phoenix Valley and Desert/Rangeland S-Graphs

```
 32 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       2000  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      7   0  ENDING DATE
                    NDTIME       2235  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE  166.58 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

 34 JD          INDEX STORM NO. 1
                      STRM        4.03  PRECIPITATION DEPTH
                      TRDA         .01  TRANSPOSITION DRAINAGE AREA

 35 PI            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	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.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	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.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
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

45 JD INDEX STORM NO. 2

STRM 3.79 PRECIPITATION DEPTH

TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI 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
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.01	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

46 JD INDEX STORM NO. 3

STRM 3.51 PRECIPITATION DEPTH

TRDA 50.00 TRANSPOSITION DRAINAGE AREA

0 PI 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	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.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	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.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
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

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

            **************
            *            *
131 KK      *      CP3   *
            *            *
            **************

132 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          2  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                           ADD HYDROGRAPHS AT CP3.

134 HC          HYDROGRAPH COMBINATION
                     ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                          ***

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

                       HYDROGRAPH AT STATION      CP3
                     TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2989.     12.92                665.        182.         61.          26.
                         (INCHES)  1.273       1.396       1.398        1.398
                         (AC-FT)   330.        362.        362.         362.

                       CUMULATIVE AREA =    4.86 SQ MI

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

                       HYDROGRAPH AT STATION      CP3
                     TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2691.     12.92                605.        166.         55.          24.
                         (INCHES)  1.157       1.270       1.272        1.272
                         (AC-FT)   300.        329.        330.         330.

                       CUMULATIVE AREA =    4.86 SQ MI

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

                       HYDROGRAPH AT STATION      CP3
                     TRANSPOSITION AREA     50.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+    2325.     12.92                534.        147.         49.          21.
                         (INCHES)  1.021       1.122       1.123        1.123
                         (AC-FT)   265.        291.        291.         291.

                       CUMULATIVE AREA =    4.86 SQ MI

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

                                    INTERPOLATED HYDROGRAPH AT      CP3

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

DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	*	2		1740	501	0.	*	4		1120	1001	0.	*	6		0500	1501	0.
1		0005	2	0.	*	2		1745	502	0.	*	4		1125	1002	0.	*	6		0505	1502	0.
1		0010	3	0.	*	2		1750	503	0.	*	4		1130	1003	0.	*	6		0510	1503	0.
1		0015	4	0.	*	2		1755	504	0.	*	4		1135	1004	0.	*	6		0515	1504	0.
1		0020	5	0.	*	2		1800	505	0.	*	4		1140	1005	0.	*	6		0520	1505	0.
1		0025	6	0.	*	2		1805	506	0.	*	4		1145	1006	0.	*	6		0525	1506	0.
1		0030	7	0.	*	2		1810	507	0.	*	4		1150	1007	0.	*	6		0530	1507	0.
1		0035	8	0.	*	2		1815	508	0.	*	4		1155	1008	0.	*	6		0535	1508	0.
1		0040	9	0.	*	2		1820	509	0.	*	4		1200	1009	0.	*	6		0540	1509	0.
1		0045	10	0.	*	2		1825	510	0.	*	4		1205	1010	0.	*	6		0545	1510	0.
1		0050	11	0.	*	2		1830	511	0.	*	4		1210	1011	0.	*	6		0550	1511	0.
1		0055	12	1.	*	2		1835	512	0.	*	4		1215	1012	0.	*	6		0555	1512	0.
1		0100	13	1.	*	2		1840	513	0.	*	4		1220	1013	0.	*	6		0600	1513	0.
1		0105	14	1.	*	2		1845	514	0.	*	4		1225	1014	0.	*	6		0605	1514	0.
1		0110	15	2.	*	2		1850	515	0.	*	4		1230	1015	0.	*	6		0610	1515	0.
1		0115	16	2.	*	2		1855	516	0.	*	4		1235	1016	0.	*	6		0615	1516	0.
1		0120	17	2.	*	2		1900	517	0.	*	4		1240	1017	0.	*	6		0620	1517	0.
1		0125	18	3.	*	2		1905	518	0.	*	4		1245	1018	0.	*	6		0625	1518	0.

1	0130	19	3.	*	2	1910	519	0.	*	4	1250	1019	0.	*	6	0630	1519	0.
1	0135	20	4.	*	2	1915	520	0.	*	4	1255	1020	0.	*	6	0635	1520	0.
1	0140	21	4.	*	2	1920	521	0.	*	4	1300	1021	0.	*	6	0640	1521	0.
1	0145	22	5.	*	2	1925	522	0.	*	4	1305	1022	0.	*	6	0645	1522	0.
1	0150	23	6.	*	2	1930	523	0.	*	4	1310	1023	0.	*	6	0650	1523	0.
1	0155	24	6.	*	2	1935	524	0.	*	4	1315	1024	0.	*	6	0655	1524	0.
1	0200	25	7.	*	2	1940	525	0.	*	4	1320	1025	0.	*	6	0700	1525	0.
1	0205	26	7.	*	2	1945	526	0.	*	4	1325	1026	0.	*	6	0705	1526	0.
1	0210	27	8.	*	2	1950	527	0.	*	4	1330	1027	0.	*	6	0710	1527	0.
1	0215	28	8.	*	2	1955	528	0.	*	4	1335	1028	0.	*	6	0715	1528	0.
1	0220	29	9.	*	2	2000	529	0.	*	4	1340	1029	0.	*	6	0720	1529	0.
1	0225	30	9.	*	2	2005	530	0.	*	4	1345	1030	0.	*	6	0725	1530	0.
1	0230	31	9.	*	2	2010	531	0.	*	4	1350	1031	0.	*	6	0730	1531	0.
1	0235	32	10.	*	2	2015	532	0.	*	4	1355	1032	0.	*	6	0735	1532	0.
1	0240	33	10.	*	2	2020	533	0.	*	4	1400	1033	0.	*	6	0740	1533	0.
1	0245	34	10.	*	2	2025	534	0.	*	4	1405	1034	0.	*	6	0745	1534	0.
1	0250	35	11.	*	2	2030	535	0.	*	4	1410	1035	0.	*	6	0750	1535	0.
1	0255	36	11.	*	2	2035	536	0.	*	4	1415	1036	0.	*	6	0755	1536	0.
1	0300	37	11.	*	2	2040	537	0.	*	4	1420	1037	0.	*	6	0800	1537	0.
1	0305	38	11.	*	2	2045	538	0.	*	4	1425	1038	0.	*	6	0805	1538	0.
1	0310	39	11.	*	2	2050	539	0.	*	4	1430	1039	0.	*	6	0810	1539	0.
1	0315	40	11.	*	2	2055	540	0.	*	4	1435	1040	0.	*	6	0815	1540	0.
1	0320	41	12.	*	2	2100	541	0.	*	4	1440	1041	0.	*	6	0820	1541	0.
1	0325	42	12.	*	2	2105	542	0.	*	4	1445	1042	0.	*	6	0825	1542	0.
1	0330	43	12.	*	2	2110	543	0.	*	4	1450	1043	0.	*	6	0830	1543	0.
1	0335	44	12.	*	2	2115	544	0.	*	4	1455	1044	0.	*	6	0835	1544	0.
1	0340	45	12.	*	2	2120	545	0.	*	4	1500	1045	0.	*	6	0840	1545	0.
1	0345	46	12.	*	2	2125	546	0.	*	4	1505	1046	0.	*	6	0845	1546	0.
1	0350	47	12.	*	2	2130	547	0.	*	4	1510	1047	0.	*	6	0850	1547	0.
1	0355	48	12.	*	2	2135	548	0.	*	4	1515	1048	0.	*	6	0855	1548	0.
1	0400	49	12.	*	2	2140	549	0.	*	4	1520	1049	0.	*	6	0900	1549	0.
1	0405	50	12.	*	2	2145	550	0.	*	4	1525	1050	0.	*	6	0905	1550	0.
1	0410	51	12.	*	2	2150	551	0.	*	4	1530	1051	0.	*	6	0910	1551	0.
1	0415	52	12.	*	2	2155	552	0.	*	4	1535	1052	0.	*	6	0915	1552	0.
1	0420	53	12.	*	2	2200	553	0.	*	4	1540	1053	0.	*	6	0920	1553	0.
1	0425	54	12.	*	2	2205	554	0.	*	4	1545	1054	0.	*	6	0925	1554	0.
1	0430	55	12.	*	2	2210	555	0.	*	4	1550	1055	0.	*	6	0930	1555	0.
1	0435	56	12.	*	2	2215	556	0.	*	4	1555	1056	0.	*	6	0935	1556	0.
1	0440	57	12.	*	2	2220	557	0.	*	4	1600	1057	0.	*	6	0940	1557	0.
1	0445	58	13.	*	2	2225	558	0.	*	4	1605	1058	0.	*	6	0945	1558	0.
1	0450	59	13.	*	2	2230	559	0.	*	4	1610	1059	0.	*	6	0950	1559	0.
1	0455	60	13.	*	2	2235	560	0.	*	4	1615	1060	0.	*	6	0955	1560	0.
1	0500	61	13.	*	2	2240	561	0.	*	4	1620	1061	0.	*	6	1000	1561	0.
1	0505	62	13.	*	2	2245	562	0.	*	4	1625	1062	0.	*	6	1005	1562	0.
1	0510	63	13.	*	2	2250	563	0.	*	4	1630	1063	0.	*	6	1010	1563	0.
1	0515	64	13.	*	2	2255	564	0.	*	4	1635	1064	0.	*	6	1015	1564	0.
1	0520	65	14.	*	2	2300	565	0.	*	4	1640	1065	0.	*	6	1020	1565	0.
1	0525	66	14.	*	2	2305	566	0.	*	4	1645	1066	0.	*	6	1025	1566	0.
1	0530	67	14.	*	2	2310	567	0.	*	4	1650	1067	0.	*	6	1030	1567	0.
1	0535	68	14.	*	2	2315	568	0.	*	4	1655	1068	0.	*	6	1035	1568	0.
1	0540	69	14.	*	2	2320	569	0.	*	4	1700	1069	0.	*	6	1040	1569	0.
1	0545	70	15.	*	2	2325	570	0.	*	4	1705	1070	0.	*	6	1045	1570	0.
1	0550	71	15.	*	2	2330	571	0.	*	4	1710	1071	0.	*	6	1050	1571	0.
1	0555	72	15.	*	2	2335	572	0.	*	4	1715	1072	0.	*	6	1055	1572	0.
1	0600	73	15.	*	2	2340	573	0.	*	4	1720	1073	0.	*	6	1100	1573	0.
1	0605	74	15.	*	2	2345	574	0.	*	4	1725	1074	0.	*	6	1105	1574	0.
1	0610	75	15.	*	2	2350	575	0.	*	4	1730	1075	0.	*	6	1110	1575	0.
1	0615	76	15.	*	2	2355	576	0.	*	4	1735	1076	0.	*	6	1115	1576	0.
1	0620	77	16.	*	3	0000	577	0.	*	4	1740	1077	0.	*	6	1120	1577	0.
1	0625	78	16.	*	3	0005	578	0.	*	4	1745	1078	0.	*	6	1125	1578	0.
1	0630	79	16.	*	3	0010	579	0.	*	4	1750	1079	0.	*	6	1130	1579	0.
1	0635	80	16.	*	3	0015	580	0.	*	4	1755	1080	0.	*	6	1135	1580	0.
1	0640	81	16.	*	3	0020	581	0.	*	4	1800	1081	0.	*	6	1140	1581	0.
1	0645	82	16.	*	3	0025	582	0.	*	4	1805	1082	0.	*	6	1145	1582	0.
1	0650	83	16.	*	3	0030	583	0.	*	4	1810	1083	0.	*	6	1150	1583	0.
1	0655	84	16.	*	3	0035	584	0.	*	4	1815	1084	0.	*	6	1155	1584	0.
1	0700	85	16.	*	3	0040	585	0.	*	4	1820	1085	0.	*	6	1200	1585	0.
1	0705	86	17.	*	3	0045	586	0.	*	4	1825	1086	0.	*	6	1205	1586	0.
1	0710	87	17.	*	3	0050	587	0.	*	4	1830	1087	0.	*	6	1210	1587	0.
1	0715	88	17.	*	3	0055	588	0.	*	4	1835	1088	0.	*	6	1215	1588	0.
1	0720	89	17.	*	3	0100	589	0.	*	4	1840	1089	0.	*	6	1220	1589	0.
1	0725	90	17.	*	3	0105	590	0.	*	4	1845	1090	0.	*	6	1225	1590	0.
1	0730	91	17.	*	3	0110	591	0.	*	4	1850	1091	0.	*	6	1230	1591	0.
1	0735	92	18.	*	3	0115	592	0.	*	4	1855	1092	0.	*	6	1235	1592	0.
1	0740	93	18.	*	3	0120	593	0.	*	4	1900	1093	0.	*	6	1240	1593	0.
1	0745	94	18.	*	3	0125	594	0.	*	4	1905	1094	0.	*	6	1245	1594	0.
1	0750	95	18.	*	3	0130	595	0.	*	4	1910	1095	0.	*	6	1250	1595	0.
1	0755	96	18.	*	3	0135	596	0.	*	4	1915	1096	0.	*	6	1255	1596	0.
1	0800	97	19.	*	3	0140	597	0.	*	4	1920	1097	0.	*	6	1300	1597	0.
1	0805	98	19.	*	3	0145	598	0.	*	4	1925	1098	0.	*	6	1305	1598	0.
1	0810	99	19.	*	3	0150	599	0.	*	4	1930	1099	0.	*	6	1310	1599	0.
1	0815	100	19.	*	3	0155	600	0.	*	4	1935	1100	0.	*	6	1315	1600	0.
1	0820	101	19.	*	3	0200	601	0.	*	4	1940	1101	0.	*	6	1320	1601	0.
1	0825	102	19.	*	3	0205	602	0.	*	4	1945	1102	0.	*	6	1325	1602	0.
1	0830	103	20.	*	3	0210	603	0.	*	4	1950	1103	0.	*	6	1330	1603	0.
1	0835	104	20.	*	3	0215	604	0.	*	4	1955	1104	0.	*	6	1335	1604	0.
1	0840	105	20.	*	3	0220	605	0.	*	4	2000	1105	0.	*	6	1340	1605	0.
1	0845	106	20.	*	3	0225	606	0.	*	4	2005	1106	0.	*	6	1345	1606	0.
1	0850	107	20.	*	3	0230	607	0.	*	4	2010	1107	0.	*	6	1350	1607	0.
1	0855	108	20.	*	3	0235	608	0.	*	4	2015	1108	0.	*	6	1355	1608	0.
1	0900	109	20.	*	3	0240	609	0.	*	4	2020	1109	0.	*	6	1400	1609	0.
1	0905	110	21.	*	3	0245	610	0.	*	4	2025	1110	0.	*	6	1405	1610	0.
1	0910	111	21.	*	3	0250	611	0.	*	4	2030	1111	0.	*	6	1410	1611	0.
1	0915	112	21.	*	3	0255	612	0.	*	4	2035	1112	0.	*	6	1415	1612	0.
1	0920	113	22.	*	3	0300	613	0.	*	4	2040	1113	0.	*	6	1420	1613	0.

1	0925	114	22.	*	3	0305	614	0.	*	4	2045	1114	0.	*	6	1425	1614	0.
1	0930	115	22.	*	3	0310	615	0.	*	4	2050	1115	0.	*	6	1430	1615	0.
1	0935	116	23.	*	3	0315	616	0.	*	4	2055	1116	0.	*	6	1435	1616	0.
1	0940	117	23.	*	3	0320	617	0.	*	4	2100	1117	0.	*	6	1440	1617	0.
1	0945	118	24.	*	3	0325	618	0.	*	4	2105	1118	0.	*	6	1445	1618	0.
1	0950	119	24.	*	3	0330	619	0.	*	4	2110	1119	0.	*	6	1450	1619	0.
1	0955	120	24.	*	3	0335	620	0.	*	4	2115	1120	0.	*	6	1455	1620	0.
1	1000	121	25.	*	3	0340	621	0.	*	4	2120	1121	0.	*	6	1500	1621	0.
1	1005	122	25.	*	3	0345	622	0.	*	4	2125	1122	0.	*	6	1505	1622	0.
1	1010	123	26.	*	3	0350	623	0.	*	4	2130	1123	0.	*	6	1510	1623	0.
1	1015	124	27.	*	3	0355	624	0.	*	4	2135	1124	0.	*	6	1515	1624	0.
1	1020	125	27.	*	3	0400	625	0.	*	4	2140	1125	0.	*	6	1520	1625	0.
1	1025	126	28.	*	3	0405	626	0.	*	4	2145	1126	0.	*	6	1525	1626	0.
1	1030	127	28.	*	3	0410	627	0.	*	4	2150	1127	0.	*	6	1530	1627	0.
1	1035	128	29.	*	3	0415	628	0.	*	4	2155	1128	0.	*	6	1535	1628	0.
1	1040	129	29.	*	3	0420	629	0.	*	4	2200	1129	0.	*	6	1540	1629	0.
1	1045	130	30.	*	3	0425	630	0.	*	4	2205	1130	0.	*	6	1545	1630	0.
1	1050	131	31.	*	3	0430	631	0.	*	4	2210	1131	0.	*	6	1550	1631	0.
1	1055	132	32.	*	3	0435	632	0.	*	4	2215	1132	0.	*	6	1555	1632	0.
1	1100	133	32.	*	3	0440	633	0.	*	4	2220	1133	0.	*	6	1600	1633	0.
1	1105	134	34.	*	3	0445	634	0.	*	4	2225	1134	0.	*	6	1605	1634	0.
1	1110	135	35.	*	3	0450	635	0.	*	4	2230	1135	0.	*	6	1610	1635	0.
1	1115	136	37.	*	3	0455	636	0.	*	4	2235	1136	0.	*	6	1615	1636	0.
1	1120	137	39.	*	3	0500	637	0.	*	4	2240	1137	0.	*	6	1620	1637	0.
1	1125	138	40.	*	3	0505	638	0.	*	4	2245	1138	0.	*	6	1625	1638	0.
1	1130	139	42.	*	3	0510	639	0.	*	4	2250	1139	0.	*	6	1630	1639	0.
1	1135	140	49.	*	3	0515	640	0.	*	4	2255	1140	0.	*	6	1635	1640	0.
1	1140	141	64.	*	3	0520	641	0.	*	4	2300	1141	0.	*	6	1640	1641	0.
1	1145	142	91.	*	3	0525	642	0.	*	4	2305	1142	0.	*	6	1645	1642	0.
1	1150	143	149.	*	3	0530	643	0.	*	4	2310	1143	0.	*	6	1650	1643	0.
1	1155	144	256.	*	3	0535	644	0.	*	4	2315	1144	0.	*	6	1655	1644	0.
1	1200	145	442.	*	3	0540	645	0.	*	4	2320	1145	0.	*	6	1700	1645	0.
1	1205	146	658.	*	3	0545	646	0.	*	4	2325	1146	0.	*	6	1705	1646	0.
1	1210	147	915.	*	3	0550	647	0.	*	4	2330	1147	0.	*	6	1710	1647	0.
1	1215	148	1232.	*	3	0555	648	0.	*	4	2335	1148	0.	*	6	1715	1648	0.
1	1220	149	1525.	*	3	0600	649	0.	*	4	2340	1149	0.	*	6	1720	1649	0.
1	1225	150	1751.	*	3	0605	650	0.	*	4	2345	1150	0.	*	6	1725	1650	0.
1	1230	151	1868.	*	3	0610	651	0.	*	4	2350	1151	0.	*	6	1730	1651	0.
1	1235	152	2039.	*	3	0615	652	0.	*	4	2355	1152	0.	*	6	1735	1652	0.
1	1240	153	2248.	*	3	0620	653	0.	*	5	0000	1153	0.	*	6	1740	1653	0.
1	1245	154	2489.	*	3	0625	654	0.	*	5	0005	1154	0.	*	6	1745	1654	0.
1	1250	155	2663.	*	3	0630	655	0.	*	5	0010	1155	0.	*	6	1750	1655	0.
1	1255	156	2722.	*	3	0635	656	0.	*	5	0015	1156	0.	*	6	1755	1656	0.
1	1300	157	2617.	*	3	0640	657	0.	*	5	0020	1157	0.	*	6	1800	1657	0.
1	1305	158	2412.	*	3	0645	658	0.	*	5	0025	1158	0.	*	6	1805	1658	0.
1	1310	159	2181.	*	3	0650	659	0.	*	5	0030	1159	0.	*	6	1810	1659	0.
1	1315	160	1934.	*	3	0655	660	0.	*	5	0035	1160	0.	*	6	1815	1660	0.
1	1320	161	1677.	*	3	0700	661	0.	*	5	0040	1161	0.	*	6	1820	1661	0.
1	1325	162	1436.	*	3	0705	662	0.	*	5	0045	1162	0.	*	6	1825	1662	0.
1	1330	163	1205.	*	3	0710	663	0.	*	5	0050	1163	0.	*	6	1830	1663	0.
1	1335	164	1012.	*	3	0715	664	0.	*	5	0055	1164	0.	*	6	1835	1664	0.
1	1340	165	860.	*	3	0720	665	0.	*	5	0100	1165	0.	*	6	1840	1665	0.
1	1345	166	729.	*	3	0725	666	0.	*	5	0105	1166	0.	*	6	1845	1666	0.
1	1350	167	620.	*	3	0730	667	0.	*	5	0110	1167	0.	*	6	1850	1667	0.
1	1355	168	535.	*	3	0735	668	0.	*	5	0115	1168	0.	*	6	1855	1668	0.
1	1400	169	457.	*	3	0740	669	0.	*	5	0120	1169	0.	*	6	1900	1669	0.
1	1405	170	390.	*	3	0745	670	0.	*	5	0125	1170	0.	*	6	1905	1670	0.
1	1410	171	339.	*	3	0750	671	0.	*	5	0130	1171	0.	*	6	1910	1671	0.
1	1415	172	303.	*	3	0755	672	0.	*	5	0135	1172	0.	*	6	1915	1672	0.
1	1420	173	276.	*	3	0800	673	0.	*	5	0140	1173	0.	*	6	1920	1673	0.
1	1425	174	254.	*	3	0805	674	0.	*	5	0145	1174	0.	*	6	1925	1674	0.
1	1430	175	233.	*	3	0810	675	0.	*	5	0150	1175	0.	*	6	1930	1675	0.
1	1435	176	213.	*	3	0815	676	0.	*	5	0155	1176	0.	*	6	1935	1676	0.
1	1440	177	194.	*	3	0820	677	0.	*	5	0200	1177	0.	*	6	1940	1677	0.
1	1445	178	176.	*	3	0825	678	0.	*	5	0205	1178	0.	*	6	1945	1678	0.
1	1450	179	161.	*	3	0830	679	0.	*	5	0210	1179	0.	*	6	1950	1679	0.
1	1455	180	148.	*	3	0835	680	0.	*	5	0215	1180	0.	*	6	1955	1680	0.
1	1500	181	137.	*	3	0840	681	0.	*	5	0220	1181	0.	*	6	2000	1681	0.
1	1505	182	129.	*	3	0845	682	0.	*	5	0225	1182	0.	*	6	2005	1682	0.
1	1510	183	123.	*	3	0850	683	0.	*	5	0230	1183	0.	*	6	2010	1683	0.
1	1515	184	116.	*	3	0855	684	0.	*	5	0235	1184	0.	*	6	2015	1684	0.
1	1520	185	110.	*	3	0900	685	0.	*	5	0240	1185	0.	*	6	2020	1685	0.
1	1525	186	105.	*	3	0905	686	0.	*	5	0245	1186	0.	*	6	2025	1686	0.
1	1530	187	100.	*	3	0910	687	0.	*	5	0250	1187	0.	*	6	2030	1687	0.
1	1535	188	95.	*	3	0915	688	0.	*	5	0255	1188	0.	*	6	2035	1688	0.
1	1540	189	91.	*	3	0920	689	0.	*	5	0300	1189	0.	*	6	2040	1689	0.
1	1545	190	87.	*	3	0925	690	0.	*	5	0305	1190	0.	*	6	2045	1690	0.
1	1550	191	84.	*	3	0930	691	0.	*	5	0310	1191	0.	*	6	2050	1691	0.
1	1555	192	81.	*	3	0935	692	0.	*	5	0315	1192	0.	*	6	2055	1692	0.
1	1600	193	79.	*	3	0940	693	0.	*	5	0320	1193	0.	*	6	2100	1693	0.
1	1605	194	76.	*	3	0945	694	0.	*	5	0325	1194	0.	*	6	2105	1694	0.
1	1610	195	74.	*	3	0950	695	0.	*	5	0330	1195	0.	*	6	2110	1695	0.
1	1615	196	72.	*	3	0955	696	0.	*	5	0335	1196	0.	*	6	2115	1696	0.
1	1620	197	70.	*	3	1000	697	0.	*	5	0340	1197	0.	*	6	2120	1697	0.
1	1625	198	69.	*	3	1005	698	0.	*	5	0345	1198	0.	*	6	2125	1698	0.
1	1630	199	67.	*	3	1010	699	0.	*	5	0350	1199	0.	*	6	2130	1699	0.
1	1635	200	66.	*	3	1015	700	0.	*	5	0355	1200	0.	*	6	2135	1700	0.
1	1640	201	64.	*	3	1020	701	0.	*	5	0400	1201	0.	*	6	2140	1701	0.
1	1645	202	63.	*	3	1025	702	0.	*	5	0405	1202	0.	*	6	2145	1702	0.
1	1650	203	62.	*	3	1030	703	0.	*	5	0410	1203	0.	*	6	2150	1703	0.
1	1655	204	61.	*	3	1035	704	0.	*	5	0415	1204	0.	*	6	2155	1704	0.
1	1700	205	60.	*	3	1040	705	0.	*	5	0420	1205	0.	*	6	2200	1705	0.
1	1705	206	59.	*	3	1045	706	0.	*	5	0425	1206	0.	*	6	2205	1706	0.
1	1710	207	58.	*	3	1050	707	0.	*	5	0430	1207	0.	*	6	2210	1707	0.
1	1715	208	57.	*	3	1055	708	0.	*	5	0435	1208	0.	*	6	2215	1708	0.

WATERFALL WASH @ BCW @ OLIVE AVE

1	1720	209	56.	*	3	1100	709	0.	*	5	0440	1209	0.	*	6	2220	1709	0.
1	1725	210	55.	*	3	1105	710	0.	*	5	0445	1210	0.	*	6	2225	1710	0.
1	1730	211	54.	*	3	1110	711	0.	*	5	0450	1211	0.	*	6	2230	1711	0.
1	1735	212	54.	*	3	1115	712	0.	*	5	0455	1212	0.	*	6	2235	1712	0.
1	1740	213	53.	*	3	1120	713	0.	*	5	0500	1213	0.	*	6	2240	1713	0.
1	1745	214	52.	*	3	1125	714	0.	*	5	0505	1214	0.	*	6	2245	1714	0.
1	1750	215	51.	*	3	1130	715	0.	*	5	0510	1215	0.	*	6	2250	1715	0.
1	1755	216	51.	*	3	1135	716	0.	*	5	0515	1216	0.	*	6	2255	1716	0.
1	1800	217	50.	*	3	1140	717	0.	*	5	0520	1217	0.	*	6	2300	1717	0.
1	1805	218	49.	*	3	1145	718	0.	*	5	0525	1218	0.	*	6	2305	1718	0.
1	1810	219	48.	*	3	1150	719	0.	*	5	0530	1219	0.	*	6	2310	1719	0.
1	1815	220	48.	*	3	1155	720	0.	*	5	0535	1220	0.	*	6	2315	1720	0.
1	1820	221	47.	*	3	1200	721	0.	*	5	0540	1221	0.	*	6	2320	1721	0.
1	1825	222	46.	*	3	1205	722	0.	*	5	0545	1222	0.	*	6	2325	1722	0.
1	1830	223	45.	*	3	1210	723	0.	*	5	0550	1223	0.	*	6	2330	1723	0.
1	1835	224	44.	*	3	1215	724	0.	*	5	0555	1224	0.	*	6	2335	1724	0.
1	1840	225	43.	*	3	1220	725	0.	*	5	0600	1225	0.	*	6	2340	1725	0.
1	1845	226	42.	*	3	1225	726	0.	*	5	0605	1226	0.	*	6	2345	1726	0.
1	1850	227	40.	*	3	1230	727	0.	*	5	0610	1227	0.	*	6	2350	1727	0.
1	1855	228	39.	*	3	1235	728	0.	*	5	0615	1228	0.	*	6	2355	1728	0.
1	1900	229	37.	*	3	1240	729	0.	*	5	0620	1229	0.	*	7	0000	1729	0.
1	1905	230	36.	*	3	1245	730	0.	*	5	0625	1230	0.	*	7	0005	1730	0.
1	1910	231	35.	*	3	1250	731	0.	*	5	0630	1231	0.	*	7	0010	1731	0.
1	1915	232	34.	*	3	1255	732	0.	*	5	0635	1232	0.	*	7	0015	1732	0.
1	1920	233	33.	*	3	1300	733	0.	*	5	0640	1233	0.	*	7	0020	1733	0.
1	1925	234	32.	*	3	1305	734	0.	*	5	0645	1234	0.	*	7	0025	1734	0.
1	1930	235	31.	*	3	1310	735	0.	*	5	0650	1235	0.	*	7	0030	1735	0.
1	1935	236	31.	*	3	1315	736	0.	*	5	0655	1236	0.	*	7	0035	1736	0.
1	1940	237	30.	*	3	1320	737	0.	*	5	0700	1237	0.	*	7	0040	1737	0.
1	1945	238	29.	*	3	1325	738	0.	*	5	0705	1238	0.	*	7	0045	1738	0.
1	1950	239	28.	*	3	1330	739	0.	*	5	0710	1239	0.	*	7	0050	1739	0.
1	1955	240	28.	*	3	1335	740	0.	*	5	0715	1240	0.	*	7	0055	1740	0.
1	2000	241	27.	*	3	1340	741	0.	*	5	0720	1241	0.	*	7	0100	1741	0.
1	2005	242	27.	*	3	1345	742	0.	*	5	0725	1242	0.	*	7	0105	1742	0.
1	2010	243	26.	*	3	1350	743	0.	*	5	0730	1243	0.	*	7	0110	1743	0.
1	2015	244	25.	*	3	1355	744	0.	*	5	0735	1244	0.	*	7	0115	1744	0.
1	2020	245	25.	*	3	1400	745	0.	*	5	0740	1245	0.	*	7	0120	1745	0.
1	2025	246	24.	*	3	1405	746	0.	*	5	0745	1246	0.	*	7	0125	1746	0.
1	2030	247	24.	*	3	1410	747	0.	*	5	0750	1247	0.	*	7	0130	1747	0.
1	2035	248	24.	*	3	1415	748	0.	*	5	0755	1248	0.	*	7	0135	1748	0.
1	2040	249	23.	*	3	1420	749	0.	*	5	0800	1249	0.	*	7	0140	1749	0.
1	2045	250	23.	*	3	1425	750	0.	*	5	0805	1250	0.	*	7	0145	1750	0.
1	2050	251	22.	*	3	1430	751	0.	*	5	0810	1251	0.	*	7	0150	1751	0.
1	2055	252	22.	*	3	1435	752	0.	*	5	0815	1252	0.	*	7	0155	1752	0.
1	2100	253	21.	*	3	1440	753	0.	*	5	0820	1253	0.	*	7	0200	1753	0.
1	2105	254	21.	*	3	1445	754	0.	*	5	0825	1254	0.	*	7	0205	1754	0.
1	2110	255	20.	*	3	1450	755	0.	*	5	0830	1255	0.	*	7	0210	1755	0.
1	2115	256	19.	*	3	1455	756	0.	*	5	0835	1256	0.	*	7	0215	1756	0.
1	2120	257	19.	*	3	1500	757	0.	*	5	0840	1257	0.	*	7	0220	1757	0.
1	2125	258	18.	*	3	1505	758	0.	*	5	0845	1258	0.	*	7	0225	1758	0.
1	2130	259	18.	*	3	1510	759	0.	*	5	0850	1259	0.	*	7	0230	1759	0.
1	2135	260	17.	*	3	1515	760	0.	*	5	0855	1260	0.	*	7	0235	1760	0.
1	2140	261	16.	*	3	1520	761	0.	*	5	0900	1261	0.	*	7	0240	1761	0.
1	2145	262	16.	*	3	1525	762	0.	*	5	0905	1262	0.	*	7	0245	1762	0.
1	2150	263	15.	*	3	1530	763	0.	*	5	0910	1263	0.	*	7	0250	1763	0.
1	2155	264	15.	*	3	1535	764	0.	*	5	0915	1264	0.	*	7	0255	1764	0.
1	2200	265	15.	*	3	1540	765	0.	*	5	0920	1265	0.	*	7	0300	1765	0.
1	2205	266	14.	*	3	1545	766	0.	*	5	0925	1266	0.	*	7	0305	1766	0.
1	2210	267	14.	*	3	1550	767	0.	*	5	0930	1267	0.	*	7	0310	1767	0.
1	2215	268	14.	*	3	1555	768	0.	*	5	0935	1268	0.	*	7	0315	1768	0.
1	2220	269	13.	*	3	1600	769	0.	*	5	0940	1269	0.	*	7	0320	1769	0.
1	2225	270	13.	*	3	1605	770	0.	*	5	0945	1270	0.	*	7	0325	1770	0.
1	2230	271	13.	*	3	1610	771	0.	*	5	0950	1271	0.	*	7	0330	1771	0.
1	2235	272	13.	*	3	1615	772	0.	*	5	0955	1272	0.	*	7	0335	1772	0.
1	2240	273	13.	*	3	1620	773	0.	*	5	1000	1273	0.	*	7	0340	1773	0.
1	2245	274	13.	*	3	1625	774	0.	*	5	1005	1274	0.	*	7	0345	1774	0.
1	2250	275	13.	*	3	1630	775	0.	*	5	1010	1275	0.	*	7	0350	1775	0.
1	2255	276	13.	*	3	1635	776	0.	*	5	1015	1276	0.	*	7	0355	1776	0.
1	2300	277	12.	*	3	1640	777	0.	*	5	1020	1277	0.	*	7	0400	1777	0.
1	2305	278	12.	*	3	1645	778	0.	*	5	1025	1278	0.	*	7	0405	1778	0.
1	2310	279	12.	*	3	1650	779	0.	*	5	1030	1279	0.	*	7	0410	1779	0.
1	2315	280	12.	*	3	1655	780	0.	*	5	1035	1280	0.	*	7	0415	1780	0.
1	2320	281	12.	*	3	1700	781	0.	*	5	1040	1281	0.	*	7	0420	1781	0.
1	2325	282	12.	*	3	1705	782	0.	*	5	1045	1282	0.	*	7	0425	1782	0.
1	2330	283	12.	*	3	1710	783	0.	*	5	1050	1283	0.	*	7	0430	1783	0.
1	2335	284	12.	*	3	1715	784	0.	*	5	1055	1284	0.	*	7	0435	1784	0.
1	2340	285	12.	*	3	1720	785	0.	*	5	1100	1285	0.	*	7	0440	1785	0.
1	2345	286	12.	*	3	1725	786	0.	*	5	1105	1286	0.	*	7	0445	1786	0.
1	2350	287	12.	*	3	1730	787	0.	*	5	1110	1287	0.	*	7	0450	1787	0.
1	2355	288	12.	*	3	1735	788	0.	*	5	1115	1288	0.	*	7	0455	1788	0.
2	0000	289	12.	*	3	1740	789	0.	*	5	1120	1289	0.	*	7	0500	1789	0.
2	0005	290	12.	*	3	1745	790	0.	*	5	1125	1290	0.	*	7	0505	1790	0.
2	0010	291	12.	*	3	1750	791	0.	*	5	1130	1291	0.	*	7	0510	1791	0.
2	0015	292	12.	*	3	1755	792	0.	*	5	1135	1292	0.	*	7	0515	1792	0.
2	0020	293	12.	*	3	1800	793	0.	*	5	1140	1293	0.	*	7	0520	1793	0.
2	0025	294	12.	*	3	1805	794	0.	*	5	1145	1294	0.	*	7	0525	1794	0.
2	0030	295	12.	*	3	1810	795	0.	*	5	1150	1295	0.	*	7	0530	1795	0.
2	0035	296	12.	*	3	1815	796	0.	*	5	1155	1296	0.	*	7	0535	1796	0.
2	0040	297	12.	*	3	1820	797	0.	*	5	1200	1297	0.	*	7	0540	1797	0.
2	0045	298	12.	*	3	1825	798	0.	*	5	1205	1298	0.	*	7	0545	1798	0.
2	0050	299	11.	*	3	1830	799	0.	*	5	1210	1299	0.	*	7	0550	1799	0.
2	0055	300	11.	*	3	1835	800	0.	*	5	1215	1300	0.	*	7	0555	1800	0.
2	0100	301	11.	*	3	1840	801	0.	*	5	1220	1301	0.	*	7	0600	1801	0.
2	0105	302	10.	*	3	1845	802	0.	*	5	1225	1302	0.	*	7	0605	1802	0.
2	0110	303	10.	*	3	1850	803	0.	*	5	1230	1303	0.	*	7	0610	1803	0.

2	0115	304	9.	*	3	1855	804	0.	*	5	1235	1304	0.	*	7	0615	1804	0.
2	0120	305	9.	*	3	1900	805	0.	*	5	1240	1305	0.	*	7	0620	1805	0.
2	0125	306	8.	*	3	1905	806	0.	*	5	1245	1306	0.	*	7	0625	1806	0.
2	0130	307	8.	*	3	1910	807	0.	*	5	1250	1307	0.	*	7	0630	1807	0.
2	0135	308	7.	*	3	1915	808	0.	*	5	1255	1308	0.	*	7	0635	1808	0.
2	0140	309	7.	*	3	1920	809	0.	*	5	1300	1309	0.	*	7	0640	1809	0.
2	0145	310	6.	*	3	1925	810	0.	*	5	1305	1310	0.	*	7	0645	1810	0.
2	0150	311	5.	*	3	1930	811	0.	*	5	1310	1311	0.	*	7	0650	1811	0.
2	0155	312	5.	*	3	1935	812	0.	*	5	1315	1312	0.	*	7	0655	1812	0.
2	0200	313	4.	*	3	1940	813	0.	*	5	1320	1313	0.	*	7	0700	1813	0.
2	0205	314	4.	*	3	1945	814	0.	*	5	1325	1314	0.	*	7	0705	1814	0.
2	0210	315	3.	*	3	1950	815	0.	*	5	1330	1315	0.	*	7	0710	1815	0.
2	0215	316	3.	*	3	1955	816	0.	*	5	1335	1316	0.	*	7	0715	1816	0.
2	0220	317	3.	*	3	2000	817	0.	*	5	1340	1317	0.	*	7	0720	1817	0.
2	0225	318	2.	*	3	2005	818	0.	*	5	1345	1318	0.	*	7	0725	1818	0.
2	0230	319	2.	*	3	2010	819	0.	*	5	1350	1319	0.	*	7	0730	1819	0.
2	0235	320	2.	*	3	2015	820	0.	*	5	1355	1320	0.	*	7	0735	1820	0.
2	0240	321	2.	*	3	2020	821	0.	*	5	1400	1321	0.	*	7	0740	1821	0.
2	0245	322	1.	*	3	2025	822	0.	*	5	1405	1322	0.	*	7	0745	1822	0.
2	0250	323	1.	*	3	2030	823	0.	*	5	1410	1323	0.	*	7	0750	1823	0.
2	0255	324	1.	*	3	2035	824	0.	*	5	1415	1324	0.	*	7	0755	1824	0.
2	0300	325	1.	*	3	2040	825	0.	*	5	1420	1325	0.	*	7	0800	1825	0.
2	0305	326	1.	*	3	2045	826	0.	*	5	1425	1326	0.	*	7	0805	1826	0.
2	0310	327	1.	*	3	2050	827	0.	*	5	1430	1327	0.	*	7	0810	1827	0.
2	0315	328	0.	*	3	2055	828	0.	*	5	1435	1328	0.	*	7	0815	1828	0.
2	0320	329	0.	*	3	2100	829	0.	*	5	1440	1329	0.	*	7	0820	1829	0.
2	0325	330	0.	*	3	2105	830	0.	*	5	1445	1330	0.	*	7	0825	1830	0.
2	0330	331	0.	*	3	2110	831	0.	*	5	1450	1331	0.	*	7	0830	1831	0.
2	0335	332	0.	*	3	2115	832	0.	*	5	1455	1332	0.	*	7	0835	1832	0.
2	0340	333	0.	*	3	2120	833	0.	*	5	1500	1333	0.	*	7	0840	1833	0.
2	0345	334	0.	*	3	2125	834	0.	*	5	1505	1334	0.	*	7	0845	1834	0.
2	0350	335	0.	*	3	2130	835	0.	*	5	1510	1335	0.	*	7	0850	1835	0.
2	0355	336	0.	*	3	2135	836	0.	*	5	1515	1336	0.	*	7	0855	1836	0.
2	0400	337	0.	*	3	2140	837	0.	*	5	1520	1337	0.	*	7	0900	1837	0.
2	0405	338	0.	*	3	2145	838	0.	*	5	1525	1338	0.	*	7	0905	1838	0.
2	0410	339	0.	*	3	2150	839	0.	*	5	1530	1339	0.	*	7	0910	1839	0.
2	0415	340	0.	*	3	2155	840	0.	*	5	1535	1340	0.	*	7	0915	1840	0.
2	0420	341	0.	*	3	2200	841	0.	*	5	1540	1341	0.	*	7	0920	1841	0.
2	0425	342	0.	*	3	2205	842	0.	*	5	1545	1342	0.	*	7	0925	1842	0.
2	0430	343	0.	*	3	2210	843	0.	*	5	1550	1343	0.	*	7	0930	1843	0.
2	0435	344	0.	*	3	2215	844	0.	*	5	1555	1344	0.	*	7	0935	1844	0.
2	0440	345	0.	*	3	2220	845	0.	*	5	1600	1345	0.	*	7	0940	1845	0.
2	0445	346	0.	*	3	2225	846	0.	*	5	1605	1346	0.	*	7	0945	1846	0.
2	0450	347	0.	*	3	2230	847	0.	*	5	1610	1347	0.	*	7	0950	1847	0.
2	0455	348	0.	*	3	2235	848	0.	*	5	1615	1348	0.	*	7	0955	1848	0.
2	0500	349	0.	*	3	2240	849	0.	*	5	1620	1349	0.	*	7	1000	1849	0.
2	0505	350	0.	*	3	2245	850	0.	*	5	1625	1350	0.	*	7	1005	1850	0.
2	0510	351	0.	*	3	2250	851	0.	*	5	1630	1351	0.	*	7	1010	1851	0.
2	0515	352	0.	*	3	2255	852	0.	*	5	1635	1352	0.	*	7	1015	1852	0.
2	0520	353	0.	*	3	2300	853	0.	*	5	1640	1353	0.	*	7	1020	1853	0.
2	0525	354	0.	*	3	2305	854	0.	*	5	1645	1354	0.	*	7	1025	1854	0.
2	0530	355	0.	*	3	2310	855	0.	*	5	1650	1355	0.	*	7	1030	1855	0.
2	0535	356	0.	*	3	2315	856	0.	*	5	1655	1356	0.	*	7	1035	1856	0.
2	0540	357	0.	*	3	2320	857	0.	*	5	1700	1357	0.	*	7	1040	1857	0.
2	0545	358	0.	*	3	2325	858	0.	*	5	1705	1358	0.	*	7	1045	1858	0.
2	0550	359	0.	*	3	2330	859	0.	*	5	1710	1359	0.	*	7	1050	1859	0.
2	0555	360	0.	*	3	2335	860	0.	*	5	1715	1360	0.	*	7	1055	1860	0.
2	0600	361	0.	*	3	2340	861	0.	*	5	1720	1361	0.	*	7	1100	1861	0.
2	0605	362	0.	*	3	2345	862	0.	*	5	1725	1362	0.	*	7	1105	1862	0.
2	0610	363	0.	*	3	2350	863	0.	*	5	1730	1363	0.	*	7	1110	1863	0.
2	0615	364	0.	*	3	2355	864	0.	*	5	1735	1364	0.	*	7	1115	1864	0.
2	0620	365	0.	*	4	0000	865	0.	*	5	1740	1365	0.	*	7	1120	1865	0.
2	0625	366	0.	*	4	0005	866	0.	*	5	1745	1366	0.	*	7	1125	1866	0.
2	0630	367	0.	*	4	0010	867	0.	*	5	1750	1367	0.	*	7	1130	1867	0.
2	0635	368	0.	*	4	0015	868	0.	*	5	1755	1368	0.	*	7	1135	1868	0.
2	0640	369	0.	*	4	0020	869	0.	*	5	1800	1369	0.	*	7	1140	1869	0.
2	0645	370	0.	*	4	0025	870	0.	*	5	1805	1370	0.	*	7	1145	1870	0.
2	0650	371	0.	*	4	0030	871	0.	*	5	1810	1371	0.	*	7	1150	1871	0.
2	0655	372	0.	*	4	0035	872	0.	*	5	1815	1372	0.	*	7	1155	1872	0.
2	0700	373	0.	*	4	0040	873	0.	*	5	1820	1373	0.	*	7	1200	1873	0.
2	0705	374	0.	*	4	0045	874	0.	*	5	1825	1374	0.	*	7	1205	1874	0.
2	0710	375	0.	*	4	0050	875	0.	*	5	1830	1375	0.	*	7	1210	1875	0.
2	0715	376	0.	*	4	0055	876	0.	*	5	1835	1376	0.	*	7	1215	1876	0.
2	0720	377	0.	*	4	0100	877	0.	*	5	1840	1377	0.	*	7	1220	1877	0.
2	0725	378	0.	*	4	0105	878	0.	*	5	1845	1378	0.	*	7	1225	1878	0.
2	0730	379	0.	*	4	0110	879	0.	*	5	1850	1379	0.	*	7	1230	1879	0.
2	0735	380	0.	*	4	0115	880	0.	*	5	1855	1380	0.	*	7	1235	1880	0.
2	0740	381	0.	*	4	0120	881	0.	*	5	1900	1381	0.	*	7	1240	1881	0.
2	0745	382	0.	*	4	0125	882	0.	*	5	1905	1382	0.	*	7	1245	1882	0.
2	0750	383	0.	*	4	0130	883	0.	*	5	1910	1383	0.	*	7	1250	1883	0.
2	0755	384	0.	*	4	0135	884	0.	*	5	1915	1384	0.	*	7	1255	1884	0.
2	0800	385	0.	*	4	0140	885	0.	*	5	1920	1385	0.	*	7	1300	1885	0.
2	0805	386	0.	*	4	0145	886	0.	*	5	1925	1386	0.	*	7	1305	1886	0.
2	0810	387	0.	*	4	0150	887	0.	*	5	1930	1387	0.	*	7	1310	1887	0.
2	0815	388	0.	*	4	0155	888	0.	*	5	1935	1388	0.	*	7	1315	1888	0.
2	0820	389	0.	*	4	0200	889	0.	*	5	1940	1389	0.	*	7	1320	1889	0.
2	0825	390	0.	*	4	0205	890	0.	*	5	1945	1390	0.	*	7	1325	1890	0.
2	0830	391	0.	*	4	0210	891	0.	*	5	1950	1391	0.	*	7	1330	1891	0.
2	0835	392	0.	*	4	0215	892	0.	*	5	1955	1392	0.	*	7	1335	1892	0.
2	0840	393	0.	*	4	0220	893	0.	*	5	2000	1393	0.	*	7	1340	1893	0.
2	0845	394	0.	*	4	0225	894	0.	*	5	2005	1394	0.	*	7	1345	1894	0.
2	0850	395	0.	*	4	0230	895	0.	*	5	2010	1395	0.	*	7	1350	1895	0.
2	0855	396	0.	*	4	0235	896	0.	*	5	2015	1396	0.	*	7	1355	1896	0.
2	0900	397	0.	*	4	0240	897	0.	*	5	2020	1397	0.	*	7	1400	1897	0.
2	0905	398	0.	*	4	0245	898	0.	*	5	2025	1398	0.	*	7	1405	1898	0.

2	0910	399	0.	*	4	0250	899	0.	*	5	2030	1399	0.	*	7	1410	1899	0.
2	0915	400	0.	*	4	0255	900	0.	*	5	2035	1400	0.	*	7	1415	1900	0.
2	0920	401	0.	*	4	0300	901	0.	*	5	2040	1401	0.	*	7	1420	1901	0.
2	0925	402	0.	*	4	0305	902	0.	*	5	2045	1402	0.	*	7	1425	1902	0.
2	0930	403	0.	*	4	0310	903	0.	*	5	2050	1403	0.	*	7	1430	1903	0.
2	0935	404	0.	*	4	0315	904	0.	*	5	2055	1404	0.	*	7	1435	1904	0.
2	0940	405	0.	*	4	0320	905	0.	*	5	2100	1405	0.	*	7	1440	1905	0.
2	0945	406	0.	*	4	0325	906	0.	*	5	2105	1406	0.	*	7	1445	1906	0.
2	0950	407	0.	*	4	0330	907	0.	*	5	2110	1407	0.	*	7	1450	1907	0.
2	0955	408	0.	*	4	0335	908	0.	*	5	2115	1408	0.	*	7	1455	1908	0.
2	1000	409	0.	*	4	0340	909	0.	*	5	2120	1409	0.	*	7	1500	1909	0.
2	1005	410	0.	*	4	0345	910	0.	*	5	2125	1410	0.	*	7	1505	1910	0.
2	1010	411	0.	*	4	0350	911	0.	*	5	2130	1411	0.	*	7	1510	1911	0.
2	1015	412	0.	*	4	0355	912	0.	*	5	2135	1412	0.	*	7	1515	1912	0.
2	1020	413	0.	*	4	0400	913	0.	*	5	2140	1413	0.	*	7	1520	1913	0.
2	1025	414	0.	*	4	0405	914	0.	*	5	2145	1414	0.	*	7	1525	1914	0.
2	1030	415	0.	*	4	0410	915	0.	*	5	2150	1415	0.	*	7	1530	1915	0.
2	1035	416	0.	*	4	0415	916	0.	*	5	2155	1416	0.	*	7	1535	1916	0.
2	1040	417	0.	*	4	0420	917	0.	*	5	2200	1417	0.	*	7	1540	1917	0.
2	1045	418	0.	*	4	0425	918	0.	*	5	2205	1418	0.	*	7	1545	1918	0.
2	1050	419	0.	*	4	0430	919	0.	*	5	2210	1419	0.	*	7	1550	1919	0.
2	1055	420	0.	*	4	0435	920	0.	*	5	2215	1420	0.	*	7	1555	1920	0.
2	1100	421	0.	*	4	0440	921	0.	*	5	2220	1421	0.	*	7	1600	1921	0.
2	1105	422	0.	*	4	0445	922	0.	*	5	2225	1422	0.	*	7	1605	1922	0.
2	1110	423	0.	*	4	0450	923	0.	*	5	2230	1423	0.	*	7	1610	1923	0.
2	1115	424	0.	*	4	0455	924	0.	*	5	2235	1424	0.	*	7	1615	1924	0.
2	1120	425	0.	*	4	0500	925	0.	*	5	2240	1425	0.	*	7	1620	1925	0.
2	1125	426	0.	*	4	0505	926	0.	*	5	2245	1426	0.	*	7	1625	1926	0.
2	1130	427	0.	*	4	0510	927	0.	*	5	2250	1427	0.	*	7	1630	1927	0.
2	1135	428	0.	*	4	0515	928	0.	*	5	2255	1428	0.	*	7	1635	1928	0.
2	1140	429	0.	*	4	0520	929	0.	*	5	2300	1429	0.	*	7	1640	1929	0.
2	1145	430	0.	*	4	0525	930	0.	*	5	2305	1430	0.	*	7	1645	1930	0.
2	1150	431	0.	*	4	0530	931	0.	*	5	2310	1431	0.	*	7	1650	1931	0.
2	1155	432	0.	*	4	0535	932	0.	*	5	2315	1432	0.	*	7	1655	1932	0.
2	1200	433	0.	*	4	0540	933	0.	*	5	2320	1433	0.	*	7	1700	1933	0.
2	1205	434	0.	*	4	0545	934	0.	*	5	2325	1434	0.	*	7	1705	1934	0.
2	1210	435	0.	*	4	0550	935	0.	*	5	2330	1435	0.	*	7	1710	1935	0.
2	1215	436	0.	*	4	0555	936	0.	*	5	2335	1436	0.	*	7	1715	1936	0.
2	1220	437	0.	*	4	0600	937	0.	*	5	2340	1437	0.	*	7	1720	1937	0.
2	1225	438	0.	*	4	0605	938	0.	*	5	2345	1438	0.	*	7	1725	1938	0.
2	1230	439	0.	*	4	0610	939	0.	*	5	2350	1439	0.	*	7	1730	1939	0.
2	1235	440	0.	*	4	0615	940	0.	*	5	2355	1440	0.	*	7	1735	1940	0.
2	1240	441	0.	*	4	0620	941	0.	*	6	0000	1441	0.	*	7	1740	1941	0.
2	1245	442	0.	*	4	0625	942	0.	*	6	0005	1442	0.	*	7	1745	1942	0.
2	1250	443	0.	*	4	0630	943	0.	*	6	0010	1443	0.	*	7	1750	1943	0.
2	1255	444	0.	*	4	0635	944	0.	*	6	0015	1444	0.	*	7	1755	1944	0.
2	1300	445	0.	*	4	0640	945	0.	*	6	0020	1445	0.	*	7	1800	1945	0.
2	1305	446	0.	*	4	0645	946	0.	*	6	0025	1446	0.	*	7	1805	1946	0.
2	1310	447	0.	*	4	0650	947	0.	*	6	0030	1447	0.	*	7	1810	1947	0.
2	1315	448	0.	*	4	0655	948	0.	*	6	0035	1448	0.	*	7	1815	1948	0.
2	1320	449	0.	*	4	0700	949	0.	*	6	0040	1449	0.	*	7	1820	1949	0.
2	1325	450	0.	*	4	0705	950	0.	*	6	0045	1450	0.	*	7	1825	1950	0.
2	1330	451	0.	*	4	0710	951	0.	*	6	0050	1451	0.	*	7	1830	1951	0.
2	1335	452	0.	*	4	0715	952	0.	*	6	0055	1452	0.	*	7	1835	1952	0.
2	1340	453	0.	*	4	0720	953	0.	*	6	0100	1453	0.	*	7	1840	1953	0.
2	1345	454	0.	*	4	0725	954	0.	*	6	0105	1454	0.	*	7	1845	1954	0.
2	1350	455	0.	*	4	0730	955	0.	*	6	0110	1455	0.	*	7	1850	1955	0.
2	1355	456	0.	*	4	0735	956	0.	*	6	0115	1456	0.	*	7	1855	1956	0.
2	1400	457	0.	*	4	0740	957	0.	*	6	0120	1457	0.	*	7	1900	1957	0.
2	1405	458	0.	*	4	0745	958	0.	*	6	0125	1458	0.	*	7	1905	1958	0.
2	1410	459	0.	*	4	0750	959	0.	*	6	0130	1459	0.	*	7	1910	1959	0.
2	1415	460	0.	*	4	0755	960	0.	*	6	0135	1460	0.	*	7	1915	1960	0.
2	1420	461	0.	*	4	0800	961	0.	*	6	0140	1461	0.	*	7	1920	1961	0.
2	1425	462	0.	*	4	0805	962	0.	*	6	0145	1462	0.	*	7	1925	1962	0.
2	1430	463	0.	*	4	0810	963	0.	*	6	0150	1463	0.	*	7	1930	1963	0.
2	1435	464	0.	*	4	0815	964	0.	*	6	0155	1464	0.	*	7	1935	1964	0.
2	1440	465	0.	*	4	0820	965	0.	*	6	0200	1465	0.	*	7	1940	1965	0.
2	1445	466	0.	*	4	0825	966	0.	*	6	0205	1466	0.	*	7	1945	1966	0.
2	1450	467	0.	*	4	0830	967	0.	*	6	0210	1467	0.	*	7	1950	1967	0.
2	1455	468	0.	*	4	0835	968	0.	*	6	0215	1468	0.	*	7	1955	1968	0.
2	1500	469	0.	*	4	0840	969	0.	*	6	0220	1469	0.	*	7	2000	1969	0.
2	1505	470	0.	*	4	0845	970	0.	*	6	0225	1470	0.	*	7	2005	1970	0.
2	1510	471	0.	*	4	0850	971	0.	*	6	0230	1471	0.	*	7	2010	1971	0.
2	1515	472	0.	*	4	0855	972	0.	*	6	0235	1472	0.	*	7	2015	1972	0.
2	1520	473	0.	*	4	0900	973	0.	*	6	0240	1473	0.	*	7	2020	1973	0.
2	1525	474	0.	*	4	0905	974	0.	*	6	0245	1474	0.	*	7	2025	1974	0.
2	1530	475	0.	*	4	0910	975	0.	*	6	0250	1475	0.	*	7	2030	1975	0.
2	1535	476	0.	*	4	0915	976	0.	*	6	0255	1476	0.	*	7	2035	1976	0.
2	1540	477	0.	*	4	0920	977	0.	*	6	0300	1477	0.	*	7	2040	1977	0.
2	1545	478	0.	*	4	0925	978	0.	*	6	0305	1478	0.	*	7	2045	1978	0.
2	1550	479	0.	*	4	0930	979	0.	*	6	0310	1479	0.	*	7	2050	1979	0.
2	1555	480	0.	*	4	0935	980	0.	*	6	0315	1480	0.	*	7	2055	1980	0.
2	1600	481	0.	*	4	0940	981	0.	*	6	0320	1481	0.	*	7	2100	1981	0.
2	1605	482	0.	*	4	0945	982	0.	*	6	0325	1482	0.	*	7	2105	1982	0.
2	1610	483	0.	*	4	0950	983	0.	*	6	0330	1483	0.	*	7	2110	1983	0.
2	1615	484	0.	*	4	0955	984	0.	*	6	0335	1484	0.	*	7	2115	1984	0.
2	1620	485	0.	*	4	1000	985	0.	*	6	0340	1485	0.	*	7	2120	1985	0.
2	1625	486	0.	*	4	1005	986	0.	*	6	0345	1486	0.	*	7	2125	1986	0.
2	1630	487	0.	*	4	1010	987	0.	*	6	0350	1487	0.	*	7	2130	1987	0.
2	1635	488	0.	*	4	1015	988	0.	*	6	0355	1488	0.	*	7	2135	1988	0.
2	1640	489	0.	*	4	1020	989	0.	*	6	0400	1489	0.	*	7	2140	1989	0.
2	1645	490	0.	*	4	1025	990	0.	*	6	0405	1490	0.	*	7	2145	1990	0.
2	1650	491	0.	*	4	1030	991	0.	*	6	0410	1491	0.	*	7	2150	1991	0.
2	1655	492	0.	*	4	1035	992	0.	*	6	0415	1492	0.	*	7	2155	1992	0.
2	1700	493	0.	*	4	1040	993	0.	*	6	0420	1493	0.	*	7	2200	1993	0.

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  2    1705  494      0.  *   4    1045  994      0.  *   6    0425 1494      0.  *   7    2205 1994      0.
  2    1710  495      0.  *   4    1050  995      0.  *   6    0430 1495      0.  *   7    2210 1995      0.
  2    1715  496      0.  *   4    1055  996      0.  *   6    0435 1496      0.  *   7    2215 1996      0.
  2    1720  497      0.  *   4    1100  997      0.  *   6    0440 1497      0.  *   7    2220 1997      0.
  2    1725  498      0.  *   4    1105  998      0.  *   6    0445 1498      0.  *   7    2225 1998      0.
  2    1730  499      0.  *   4    1110  999      0.  *   6    0450 1499      0.  *   7    2230 1999      0.
  2    1735  500      0.  *   4    1115 1000      0.  *   6    0455 1500      0.  *   7    2235 2000      0.
                          *                          *                          *
*****************************************************************************************************************

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+  (CFS)       (HR)
                          (CFS)
+   2722.     12.92                611.        168.         56.          24.
                        (INCHES)   1.169       1.283       1.285        1.285
                         (AC-FT)   303.        333.        333.         333.

                        CUMULATIVE AREA =    4.86 SQ MI


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


          **************
          *            *
 235 KK   *   I1CP10   *
          *            *
          **************

 236 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          2  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
                              ADD HYDROGRAPHS AT I1CP10 (CHOLLA WASH)

 238 HC          HYDROGRAPH COMBINATION
                       ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

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

                        HYDROGRAPH AT STATION   I1CP10
                       TRANSPOSITION AREA       .0 SQ MI

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+  (CFS)       (HR)
                          (CFS)
+   5339.     12.75                754.        203.         68.          29.
                        (INCHES)   1.166       1.256       1.258        1.258
                         (AC-FT)   374.        403.        403.         403.

                        CUMULATIVE AREA =    6.01 SQ MI

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

                        HYDROGRAPH AT STATION   I1CP10
                       TRANSPOSITION AREA     10.0 SQ MI

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+  (CFS)       (HR)
                          (CFS)
+   4840.     12.75                682.        184.         62.          27.
                        (INCHES)   1.055       1.140       1.142        1.142
                         (AC-FT)   338.        365.        366.         366.

                        CUMULATIVE AREA =    6.01 SQ MI

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

                        HYDROGRAPH AT STATION   I1CP10
                       TRANSPOSITION AREA     50.0 SQ MI

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                   6-HR       24-HR       72-HR    166.58-HR
+  (CFS)       (HR)
                          (CFS)
+   4239.     12.75                597.        162.         54.          23.
                        (INCHES)   .924       1.003       1.005        1.005
                         (AC-FT)   296.        321.        322.         322.

                        CUMULATIVE AREA =    6.01 SQ MI

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                                INTERPOLATED HYDROGRAPH AT   I1CP10
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DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	2		1740	501	0.	4		1120	1001	0.	6		0500	1501	0.
1		0005	2	0.	2		1745	502	0.	4		1125	1002	0.	6		0505	1502	0.
1		0010	3	0.	2		1750	503	0.	4		1130	1003	0.	6		0510	1503	0.
1		0015	4	0.	2		1755	504	0.	4		1135	1004	0.	6		0515	1504	0.
1		0020	5	0.	2		1800	505	0.	4		1140	1005	0.	6		0520	1505	0.
1		0025	6	0.	2		1805	506	0.	4		1145	1006	0.	6		0525	1506	0.
1		0030	7	0.	2		1810	507	0.	4		1150	1007	0.	6		0530	1507	0.
1		0035	8	0.	2		1815	508	0.	4		1155	1008	0.	6		0535	1508	0.
1		0040	9	0.	2		1820	509	0.	4		1200	1009	0.	6		0540	1509	0.
1		0045	10	1.	2		1825	510	0.	4		1205	1010	0.	6		0545	1510	0.
1		0050	11	1.	2		1830	511	0.	4		1210	1011	0.	6		0550	1511	0.
1		0055	12	1.	2		1835	512	0.	4		1215	1012	0.	6		0555	1512	0.
1		0100	13	1.	2		1840	513	0.	4		1220	1013	0.	6		0600	1513	0.
1		0105	14	1.	2		1845	514	0.	4		1225	1014	0.	6		0605	1514	0.
1		0110	15	2.	2		1850	515	0.	4		1230	1015	0.	6		0610	1515	0.
1		0115	16	2.	2		1855	516	0.	4		1235	1016	0.	6		0615	1516	0.
1		0120	17	2.	2		1900	517	0.	4		1240	1017	0.	6		0620	1517	0.
1		0125	18	3.	2		1905	518	0.	4		1245	1018	0.	6		0625	1518	0.
1		0130	19	3.	2		1910	519	0.	4		1250	1019	0.	6		0630	1519	0.
1		0135	20	4.	2		1915	520	0.	4		1255	1020	0.	6		0635	1520	0.
1		0140	21	4.	2		1920	521	0.	4		1300	1021	0.	6		0640	1521	0.
1		0145	22	5.	2		1925	522	0.	4		1305	1022	0.	6		0645	1522	0.
1		0150	23	5.	2		1930	523	0.	4		1310	1023	0.	6		0650	1523	0.
1		0155	24	6.	2		1935	524	0.	4		1315	1024	0.	6		0655	1524	0.
1		0200	25	7.	2		1940	525	0.	4		1320	1025	0.	6		0700	1525	0.
1		0205	26	7.	2		1945	526	0.	4		1325	1026	0.	6		0705	1526	0.
1		0210	27	8.	2		1950	527	0.	4		1330	1027	0.	6		0710	1527	0.
1		0215	28	8.	2		1955	528	0.	4		1335	1028	0.	6		0715	1528	0.
1		0220	29	9.	2		2000	529	0.	4		1340	1029	0.	6		0720	1529	0.
1		0225	30	10.	2		2005	530	0.	4		1345	1030	0.	6		0725	1530	0.
1		0230	31	10.	2		2010	531	0.	4		1350	1031	0.	6		0730	1531	0.
1		0235	32	11.	2		2015	532	0.	4		1355	1032	0.	6		0735	1532	0.
1		0240	33	11.	2		2020	533	0.	4		1400	1033	0.	6		0740	1533	0.
1		0245	34	11.	2		2025	534	0.	4		1405	1034	0.	6		0745	1534	0.
1		0250	35	12.	2		2030	535	0.	4		1410	1035	0.	6		0750	1535	0.
1		0255	36	12.	2		2035	536	0.	4		1415	1036	0.	6		0755	1536	0.
1		0300	37	12.	2		2040	537	0.	4		1420	1037	0.	6		0800	1537	0.
1		0305	38	13.	2		2045	538	0.	4		1425	1038	0.	6		0805	1538	0.
1		0310	39	13.	2		2050	539	0.	4		1430	1039	0.	6		0810	1539	0.
1		0315	40	13.	2		2055	540	0.	4		1435	1040	0.	6		0815	1540	0.
1		0320	41	13.	2		2100	541	0.	4		1440	1041	0.	6		0820	1541	0.
1		0325	42	13.	2		2105	542	0.	4		1445	1042	0.	6		0825	1542	0.
1		0330	43	13.	2		2110	543	0.	4		1450	1043	0.	6		0830	1543	0.
1		0335	44	13.	2		2115	544	0.	4		1455	1044	0.	6		0835	1544	0.
1		0340	45	14.	2		2120	545	0.	4		1500	1045	0.	6		0840	1545	0.
1		0345	46	14.	2		2125	546	0.	4		1505	1046	0.	6		0845	1546	0.
1		0350	47	14.	2		2130	547	0.	4		1510	1047	0.	6		0850	1547	0.
1		0355	48	14.	2		2135	548	0.	4		1515	1048	0.	6		0855	1548	0.
1		0400	49	14.	2		2140	549	0.	4		1520	1049	0.	6		0900	1549	0.
1		0405	50	14.	2		2145	550	0.	4		1525	1050	0.	6		0905	1550	0.
1		0410	51	14.	2		2150	551	0.	4		1530	1051	0.	6		0910	1551	0.
1		0415	52	14.	2		2155	552	0.	4		1535	1052	0.	6		0915	1552	0.
1		0420	53	14.	2		2200	553	0.	4		1540	1053	0.	6		0920	1553	0.
1		0425	54	14.	2		2205	554	0.	4		1545	1054	0.	6		0925	1554	0.
1		0430	55	14.	2		2210	555	0.	4		1550	1055	0.	6		0930	1555	0.
1		0435	56	14.	2		2215	556	0.	4		1555	1056	0.	6		0935	1556	0.
1		0440	57	14.	2		2220	557	0.	4		1600	1057	0.	6		0940	1557	0.
1		0445	58	14.	2		2225	558	0.	4		1605	1058	0.	6		0945	1558	0.
1		0450	59	14.	2		2230	559	0.	4		1610	1059	0.	6		0950	1559	0.
1		0455	60	14.	2		2235	560	0.	4		1615	1060	0.	6		0955	1560	0.
1		0500	61	15.	2		2240	561	0.	4		1620	1061	0.	6		1000	1561	0.
1		0505	62	15.	2		2245	562	0.	4		1625	1062	0.	6		1005	1562	0.
1		0510	63	15.	2		2250	563	0.	4		1630	1063	0.	6		1010	1563	0.
1		0515	64	15.	2		2255	564	0.	4		1635	1064	0.	6		1015	1564	0.
1		0520	65	15.	2		2300	565	0.	4		1640	1065	0.	6		1020	1565	0.
1		0525	66	15.	2		2305	566	0.	4		1645	1066	0.	6		1025	1566	0.
1		0530	67	16.	2		2310	567	0.	4		1650	1067	0.	6		1030	1567	0.
1		0535	68	16.	2		2315	568	0.	4		1655	1068	0.	6		1035	1568	0.
1		0540	69	16.	2		2320	569	0.	4		1700	1069	0.	6		1040	1569	0.
1		0545	70	16.	2		2325	570	0.	4		1705	1070	0.	6		1045	1570	0.
1		0550	71	16.	2		2330	571	0.	4		1710	1071	0.	6		1050	1571	0.
1		0555	72	17.	2		2335	572	0.	4		1715	1072	0.	6		1055	1572	0.
1		0600	73	17.	2		2340	573	0.	4		1720	1073	0.	6		1100	1573	0.
1		0605	74	17.	2		2345	574	0.	4		1725	1074	0.	6		1105	1574	0.
1		0610	75	17.	2		2350	575	0.	4		1730	1075	0.	6		1110	1575	0.
1		0615	76	17.	2		2355	576	0.	4		1735	1076	0.	6		1115	1576	0.
1		0620	77	18.	3		0000	577	0.	4		1740	1077	0.	6		1120	1577	0.
1		0625	78	18.	3		0005	578	0.	4		1745	1078	0.	6		1125	1578	0.
1		0630	79	18.	3		0010	579	0.	4		1750	1079	0.	6		1130	1579	0.
1		0635	80	18.	3		0015	580	0.	4		1755	1080	0.	6		1135	1580	0.
1		0640	81	18.	3		0020	581	0.	4		1800	1081	0.	6		1140	1581	0.
1		0645	82	18.	3		0025	582	0.	4		1805	1082	0.	6		1145	1582	0.
1		0650	83	18.	3		0030	583	0.	4		1810	1083	0.	6		1150	1583	0.
1		0655	84	19.	3		0035	584	0.	4		1815	1084	0.	6		1155	1584	0.
1		0700	85	19.	3		0040	585	0.	4		1820	1085	0.	6		1200	1585	0.
1		0705	86	19.	3		0045	586	0.	4		1825	1086	0.	6		1205	1586	0.
1		0710	87	19.	3		0050	587	0.	4		1830	1087	0.	6		1210	1587	0.
1		0715	88	19.	3		0055	588	0.	4		1835	1088	0.	6		1215	1588	0.
1		0720	89	19.	3		0100	589	0.	4		1840	1089	0.	6		1220	1589	0.
1		0725	90	19.	3		0105	590	0.	4		1845	1090	0.	6		1225	1590	0.
1		0730	91	20.	3		0110	591	0.	4		1850	1091	0.	6		1230	1591	0.

1	0735	92	20.	*	3	0115	592	0.	*	4	1855	1092	0.	*	6	1235	1592	0.
1	0740	93	20.	*	3	0120	593	0.	*	4	1900	1093	0.	*	6	1240	1593	0.
1	0745	94	20.	*	3	0125	594	0.	*	4	1905	1094	0.	*	6	1245	1594	0.
1	0750	95	20.	*	3	0130	595	0.	*	4	1910	1095	0.	*	6	1250	1595	0.
1	0755	96	21.	*	3	0135	596	0.	*	4	1915	1096	0.	*	6	1255	1596	0.
1	0800	97	21.	*	3	0140	597	0.	*	4	1920	1097	0.	*	6	1300	1597	0.
1	0805	98	21.	*	3	0145	598	0.	*	4	1925	1098	0.	*	6	1305	1598	0.
1	0810	99	21.	*	3	0150	599	0.	*	4	1930	1099	0.	*	6	1310	1599	0.
1	0815	100	21.	*	3	0155	600	0.	*	4	1935	1100	0.	*	6	1315	1600	0.
1	0820	101	22.	*	3	0200	601	0.	*	4	1940	1101	0.	*	6	1320	1601	0.
1	0825	102	22.	*	3	0205	602	0.	*	4	1945	1102	0.	*	6	1325	1602	0.
1	0830	103	22.	*	3	0210	603	0.	*	4	1950	1103	0.	*	6	1330	1603	0.
1	0835	104	22.	*	3	0215	604	0.	*	4	1955	1104	0.	*	6	1335	1604	0.
1	0840	105	23.	*	3	0220	605	0.	*	4	2000	1105	0.	*	6	1340	1605	0.
1	0845	106	23.	*	3	0225	606	0.	*	4	2005	1106	0.	*	6	1345	1606	0.
1	0850	107	23.	*	3	0230	607	0.	*	4	2010	1107	0.	*	6	1350	1607	0.
1	0855	108	23.	*	3	0235	608	0.	*	4	2015	1108	0.	*	6	1355	1608	0.
1	0900	109	23.	*	3	0240	609	0.	*	4	2020	1109	0.	*	6	1400	1609	0.
1	0905	110	24.	*	3	0245	610	0.	*	4	2025	1110	0.	*	6	1405	1610	0.
1	0910	111	24.	*	3	0250	611	0.	*	4	2030	1111	0.	*	6	1410	1611	0.
1	0915	112	24.	*	3	0255	612	0.	*	4	2035	1112	0.	*	6	1415	1612	0.
1	0920	113	24.	*	3	0300	613	0.	*	4	2040	1113	0.	*	6	1420	1613	0.
1	0925	114	25.	*	3	0305	614	0.	*	4	2045	1114	0.	*	6	1425	1614	0.
1	0930	115	25.	*	3	0310	615	0.	*	4	2050	1115	0.	*	6	1430	1615	0.
1	0935	116	25.	*	3	0315	616	0.	*	4	2055	1116	0.	*	6	1435	1616	0.
1	0940	117	26.	*	3	0320	617	0.	*	4	2100	1117	0.	*	6	1440	1617	0.
1	0945	118	26.	*	3	0325	618	0.	*	4	2105	1118	0.	*	6	1445	1618	0.
1	0950	119	27.	*	3	0330	619	0.	*	4	2110	1119	0.	*	6	1450	1619	0.
1	0955	120	27.	*	3	0335	620	0.	*	4	2115	1120	0.	*	6	1455	1620	0.
1	1000	121	28.	*	3	0340	621	0.	*	4	2120	1121	0.	*	6	1500	1621	0.
1	1005	122	28.	*	3	0345	622	0.	*	4	2125	1122	0.	*	6	1505	1622	0.
1	1010	123	29.	*	3	0350	623	0.	*	4	2130	1123	0.	*	6	1510	1623	0.
1	1015	124	29.	*	3	0355	624	0.	*	4	2135	1124	0.	*	6	1515	1624	0.
1	1020	125	30.	*	3	0400	625	0.	*	4	2140	1125	0.	*	6	1520	1625	0.
1	1025	126	31.	*	3	0405	626	0.	*	4	2145	1126	0.	*	6	1525	1626	0.
1	1030	127	31.	*	3	0410	627	0.	*	4	2150	1127	0.	*	6	1530	1627	0.
1	1035	128	32.	*	3	0415	628	0.	*	4	2155	1128	0.	*	6	1535	1628	0.
1	1040	129	33.	*	3	0420	629	0.	*	4	2200	1129	0.	*	6	1540	1629	0.
1	1045	130	34.	*	3	0425	630	0.	*	4	2205	1130	0.	*	6	1545	1630	0.
1	1050	131	34.	*	3	0430	631	0.	*	4	2210	1131	0.	*	6	1550	1631	0.
1	1055	132	35.	*	3	0435	632	0.	*	4	2215	1132	0.	*	6	1555	1632	0.
1	1100	133	36.	*	3	0440	633	0.	*	4	2220	1133	0.	*	6	1600	1633	0.
1	1105	134	37.	*	3	0445	634	0.	*	4	2225	1134	0.	*	6	1605	1634	0.
1	1110	135	38.	*	3	0450	635	0.	*	4	2230	1135	0.	*	6	1610	1635	0.
1	1115	136	39.	*	3	0455	636	0.	*	4	2235	1136	0.	*	6	1615	1636	0.
1	1120	137	40.	*	3	0500	637	0.	*	4	2240	1137	0.	*	6	1620	1637	0.
1	1125	138	42.	*	3	0505	638	0.	*	4	2245	1138	0.	*	6	1625	1638	0.
1	1130	139	43.	*	3	0510	639	0.	*	4	2250	1139	0.	*	6	1630	1639	0.
1	1135	140	51.	*	3	0515	640	0.	*	4	2255	1140	0.	*	6	1635	1640	0.
1	1140	141	60.	*	3	0520	641	0.	*	4	2300	1141	0.	*	6	1640	1641	0.
1	1145	142	75.	*	3	0525	642	0.	*	4	2305	1142	0.	*	6	1645	1642	0.
1	1150	143	128.	*	3	0530	643	0.	*	4	2310	1143	0.	*	6	1650	1643	0.
1	1155	144	190.	*	3	0535	644	0.	*	4	2315	1144	0.	*	6	1655	1644	0.
1	1200	145	283.	*	3	0540	645	0.	*	4	2320	1145	0.	*	6	1700	1645	0.
1	1205	146	399.	*	3	0545	646	0.	*	4	2325	1146	0.	*	6	1705	1646	0.
1	1210	147	559.	*	3	0550	647	0.	*	4	2330	1147	0.	*	6	1710	1647	0.
1	1215	148	757.	*	3	0555	648	0.	*	4	2335	1148	0.	*	6	1715	1648	0.
1	1220	149	1069.	*	3	0600	649	0.	*	4	2340	1149	0.	*	6	1720	1649	0.
1	1225	150	1713.	*	3	0605	650	0.	*	4	2345	1150	0.	*	6	1725	1650	0.
1	1230	151	2744.	*	3	0610	651	0.	*	4	2350	1151	0.	*	6	1730	1651	0.
1	1235	152	3891.	*	3	0615	652	0.	*	4	2355	1152	0.	*	6	1735	1652	0.
1	1240	153	4629.	*	3	0620	653	0.	*	5	0000	1153	0.	*	6	1740	1653	0.
1	1245	154	4877.	*	3	0625	654	0.	*	5	0005	1154	0.	*	6	1745	1654	0.
1	1250	155	4638.	*	3	0630	655	0.	*	5	0010	1155	0.	*	6	1750	1655	0.
1	1255	156	4011.	*	3	0635	656	0.	*	5	0015	1156	0.	*	6	1755	1656	0.
1	1300	157	3296.	*	3	0640	657	0.	*	5	0020	1157	0.	*	6	1800	1657	0.
1	1305	158	2680.	*	3	0645	658	0.	*	5	0025	1158	0.	*	6	1805	1658	0.
1	1310	159	2223.	*	3	0650	659	0.	*	5	0030	1159	0.	*	6	1810	1659	0.
1	1315	160	1819.	*	3	0655	660	0.	*	5	0035	1160	0.	*	6	1815	1660	0.
1	1320	161	1491.	*	3	0700	661	0.	*	5	0040	1161	0.	*	6	1820	1661	0.
1	1325	162	1192.	*	3	0705	662	0.	*	5	0045	1162	0.	*	6	1825	1662	0.
1	1330	163	941.	*	3	0710	663	0.	*	5	0050	1163	0.	*	6	1830	1663	0.
1	1335	164	742.	*	3	0715	664	0.	*	5	0055	1164	0.	*	6	1835	1664	0.
1	1340	165	606.	*	3	0720	665	0.	*	5	0100	1165	0.	*	6	1840	1665	0.
1	1345	166	511.	*	3	0725	666	0.	*	5	0105	1166	0.	*	6	1845	1666	0.
1	1350	167	427.	*	3	0730	667	0.	*	5	0110	1167	0.	*	6	1850	1667	0.
1	1355	168	346.	*	3	0735	668	0.	*	5	0115	1168	0.	*	6	1855	1668	0.
1	1400	169	285.	*	3	0740	669	0.	*	5	0120	1169	0.	*	6	1900	1669	0.
1	1405	170	233.	*	3	0745	670	0.	*	5	0125	1170	0.	*	6	1905	1670	0.
1	1410	171	200.	*	3	0750	671	0.	*	5	0130	1171	0.	*	6	1910	1671	0.
1	1415	172	183.	*	3	0755	672	0.	*	5	0135	1172	0.	*	6	1915	1672	0.
1	1420	173	166.	*	3	0800	673	0.	*	5	0140	1173	0.	*	6	1920	1673	0.
1	1425	174	149.	*	3	0805	674	0.	*	5	0145	1174	0.	*	6	1925	1674	0.
1	1430	175	134.	*	3	0810	675	0.	*	5	0150	1175	0.	*	6	1930	1675	0.
1	1435	176	121.	*	3	0815	676	0.	*	5	0155	1176	0.	*	6	1935	1676	0.
1	1440	177	102.	*	3	0820	677	0.	*	5	0200	1177	0.	*	6	1940	1677	0.
1	1445	178	84.	*	3	0825	678	0.	*	5	0205	1178	0.	*	6	1945	1678	0.
1	1450	179	68.	*	3	0830	679	0.	*	5	0210	1179	0.	*	6	1950	1679	0.
1	1455	180	63.	*	3	0835	680	0.	*	5	0215	1180	0.	*	6	1955	1680	0.
1	1500	181	59.	*	3	0840	681	0.	*	5	0220	1181	0.	*	6	2000	1681	0.
1	1505	182	56.	*	3	0845	682	0.	*	5	0225	1182	0.	*	6	2005	1682	0.
1	1510	183	54.	*	3	0850	683	0.	*	5	0230	1183	0.	*	6	2010	1683	0.
1	1515	184	52.	*	3	0855	684	0.	*	5	0235	1184	0.	*	6	2015	1684	0.
1	1520	185	51.	*	3	0900	685	0.	*	5	0240	1185	0.	*	6	2020	1685	0.
1	1525	186	50.	*	3	0905	686	0.	*	5	0245	1186	0.	*	6	2025	1686	0.

CHOLLA WASH

1	1530	187	50.	*	3	0910	687	0.	*	5	0250	1187	0.	*	6	2030	1687	0.
1	1535	188	49.	*	3	0915	688	0.	*	5	0255	1188	0.	*	6	2035	1688	0.
1	1540	189	48.	*	3	0920	689	0.	*	5	0300	1189	0.	*	6	2040	1689	0.
1	1545	190	47.	*	3	0925	690	0.	*	5	0305	1190	0.	*	6	2045	1690	0.
1	1550	191	46.	*	3	0930	691	0.	*	5	0310	1191	0.	*	6	2050	1691	0.
1	1555	192	45.	*	3	0935	692	0.	*	5	0315	1192	0.	*	6	2055	1692	0.
1	1600	193	44.	*	3	0940	693	0.	*	5	0320	1193	0.	*	6	2100	1693	0.
1	1605	194	43.	*	3	0945	694	0.	*	5	0325	1194	0.	*	6	2105	1694	0.
1	1610	195	42.	*	3	0950	695	0.	*	5	0330	1195	0.	*	6	2110	1695	0.
1	1615	196	40.	*	3	0955	696	0.	*	5	0335	1196	0.	*	6	2115	1696	0.
1	1620	197	39.	*	3	1000	697	0.	*	5	0340	1197	0.	*	6	2120	1697	0.
1	1625	198	38.	*	3	1005	698	0.	*	5	0345	1198	0.	*	6	2125	1698	0.
1	1630	199	38.	*	3	1010	699	0.	*	5	0350	1199	0.	*	6	2130	1699	0.
1	1635	200	37.	*	3	1015	700	0.	*	5	0355	1200	0.	*	6	2135	1700	0.
1	1640	201	36.	*	3	1020	701	0.	*	5	0400	1201	0.	*	6	2140	1701	0.
1	1645	202	35.	*	3	1025	702	0.	*	5	0405	1202	0.	*	6	2145	1702	0.
1	1650	203	34.	*	3	1030	703	0.	*	5	0410	1203	0.	*	6	2150	1703	0.
1	1655	204	33.	*	3	1035	704	0.	*	5	0415	1204	0.	*	6	2155	1704	0.
1	1700	205	33.	*	3	1040	705	0.	*	5	0420	1205	0.	*	6	2200	1705	0.
1	1705	206	32.	*	3	1045	706	0.	*	5	0425	1206	0.	*	6	2205	1706	0.
1	1710	207	32.	*	3	1050	707	0.	*	5	0430	1207	0.	*	6	2210	1707	0.
1	1715	208	31.	*	3	1055	708	0.	*	5	0435	1208	0.	*	6	2215	1708	0.
1	1720	209	30.	*	3	1100	709	0.	*	5	0440	1209	0.	*	6	2220	1709	0.
1	1725	210	30.	*	3	1105	710	0.	*	5	0445	1210	0.	*	6	2225	1710	0.
1	1730	211	29.	*	3	1110	711	0.	*	5	0450	1211	0.	*	6	2230	1711	0.
1	1735	212	29.	*	3	1115	712	0.	*	5	0455	1212	0.	*	6	2235	1712	0.
1	1740	213	29.	*	3	1120	713	0.	*	5	0500	1213	0.	*	6	2240	1713	0.
1	1745	214	28.	*	3	1125	714	0.	*	5	0505	1214	0.	*	6	2245	1714	0.
1	1750	215	28.	*	3	1130	715	0.	*	5	0510	1215	0.	*	6	2250	1715	0.
1	1755	216	28.	*	3	1135	716	0.	*	5	0515	1216	0.	*	6	2255	1716	0.
1	1800	217	27.	*	3	1140	717	0.	*	5	0520	1217	0.	*	6	2300	1717	0.
1	1805	218	27.	*	3	1145	718	0.	*	5	0525	1218	0.	*	6	2305	1718	0.
1	1810	219	27.	*	3	1150	719	0.	*	5	0530	1219	0.	*	6	2310	1719	0.
1	1815	220	26.	*	3	1155	720	0.	*	5	0535	1220	0.	*	6	2315	1720	0.
1	1820	221	26.	*	3	1200	721	0.	*	5	0540	1221	0.	*	6	2320	1721	0.
1	1825	222	26.	*	3	1205	722	0.	*	5	0545	1222	0.	*	6	2325	1722	0.
1	1830	223	25.	*	3	1210	723	0.	*	5	0550	1223	0.	*	6	2330	1723	0.
1	1835	224	25.	*	3	1215	724	0.	*	5	0555	1224	0.	*	6	2335	1724	0.
1	1840	225	25.	*	3	1220	725	0.	*	5	0600	1225	0.	*	6	2340	1725	0.
1	1845	226	24.	*	3	1225	726	0.	*	5	0605	1226	0.	*	6	2345	1726	0.
1	1850	227	24.	*	3	1230	727	0.	*	5	0610	1227	0.	*	6	2350	1727	0.
1	1855	228	24.	*	3	1235	728	0.	*	5	0615	1228	0.	*	6	2355	1728	0.
1	1900	229	23.	*	3	1240	729	0.	*	5	0620	1229	0.	*	7	0000	1729	0.
1	1905	230	23.	*	3	1245	730	0.	*	5	0625	1230	0.	*	7	0005	1730	0.
1	1910	231	23.	*	3	1250	731	0.	*	5	0630	1231	0.	*	7	0010	1731	0.
1	1915	232	22.	*	3	1255	732	0.	*	5	0635	1232	0.	*	7	0015	1732	0.
1	1920	233	22.	*	3	1300	733	0.	*	5	0640	1233	0.	*	7	0020	1733	0.
1	1925	234	22.	*	3	1305	734	0.	*	5	0645	1234	0.	*	7	0025	1734	0.
1	1930	235	22.	*	3	1310	735	0.	*	5	0650	1235	0.	*	7	0030	1735	0.
1	1935	236	21.	*	3	1315	736	0.	*	5	0655	1236	0.	*	7	0035	1736	0.
1	1940	237	21.	*	3	1320	737	0.	*	5	0700	1237	0.	*	7	0040	1737	0.
1	1945	238	21.	*	3	1325	738	0.	*	5	0705	1238	0.	*	7	0045	1738	0.
1	1950	239	21.	*	3	1330	739	0.	*	5	0710	1239	0.	*	7	0050	1739	0.
1	1955	240	20.	*	3	1335	740	0.	*	5	0715	1240	0.	*	7	0055	1740	0.
1	2000	241	20.	*	3	1340	741	0.	*	5	0720	1241	0.	*	7	0100	1741	0.
1	2005	242	20.	*	3	1345	742	0.	*	5	0725	1242	0.	*	7	0105	1742	0.
1	2010	243	20.	*	3	1350	743	0.	*	5	0730	1243	0.	*	7	0110	1743	0.
1	2015	244	19.	*	3	1355	744	0.	*	5	0735	1244	0.	*	7	0115	1744	0.
1	2020	245	19.	*	3	1400	745	0.	*	5	0740	1245	0.	*	7	0120	1745	0.
1	2025	246	19.	*	3	1405	746	0.	*	5	0745	1246	0.	*	7	0125	1746	0.
1	2030	247	19.	*	3	1410	747	0.	*	5	0750	1247	0.	*	7	0130	1747	0.
1	2035	248	19.	*	3	1415	748	0.	*	5	0755	1248	0.	*	7	0135	1748	0.
1	2040	249	18.	*	3	1420	749	0.	*	5	0800	1249	0.	*	7	0140	1749	0.
1	2045	250	18.	*	3	1425	750	0.	*	5	0805	1250	0.	*	7	0145	1750	0.
1	2050	251	18.	*	3	1430	751	0.	*	5	0810	1251	0.	*	7	0150	1751	0.
1	2055	252	18.	*	3	1435	752	0.	*	5	0815	1252	0.	*	7	0155	1752	0.
1	2100	253	18.	*	3	1440	753	0.	*	5	0820	1253	0.	*	7	0200	1753	0.
1	2105	254	18.	*	3	1445	754	0.	*	5	0825	1254	0.	*	7	0205	1754	0.
1	2110	255	18.	*	3	1450	755	0.	*	5	0830	1255	0.	*	7	0210	1755	0.
1	2115	256	17.	*	3	1455	756	0.	*	5	0835	1256	0.	*	7	0215	1756	0.
1	2120	257	17.	*	3	1500	757	0.	*	5	0840	1257	0.	*	7	0220	1757	0.
1	2125	258	17.	*	3	1505	758	0.	*	5	0845	1258	0.	*	7	0225	1758	0.
1	2130	259	17.	*	3	1510	759	0.	*	5	0850	1259	0.	*	7	0230	1759	0.
1	2135	260	16.	*	3	1515	760	0.	*	5	0855	1260	0.	*	7	0235	1760	0.
1	2140	261	16.	*	3	1520	761	0.	*	5	0900	1261	0.	*	7	0240	1761	0.
1	2145	262	16.	*	3	1525	762	0.	*	5	0905	1262	0.	*	7	0245	1762	0.
1	2150	263	16.	*	3	1530	763	0.	*	5	0910	1263	0.	*	7	0250	1763	0.
1	2155	264	16.	*	3	1535	764	0.	*	5	0915	1264	0.	*	7	0255	1764	0.
1	2200	265	15.	*	3	1540	765	0.	*	5	0920	1265	0.	*	7	0300	1765	0.
1	2205	266	15.	*	3	1545	766	0.	*	5	0925	1266	0.	*	7	0305	1766	0.
1	2210	267	15.	*	3	1550	767	0.	*	5	0930	1267	0.	*	7	0310	1767	0.
1	2215	268	15.	*	3	1555	768	0.	*	5	0935	1268	0.	*	7	0315	1768	0.
1	2220	269	15.	*	3	1600	769	0.	*	5	0940	1269	0.	*	7	0320	1769	0.
1	2225	270	15.	*	3	1605	770	0.	*	5	0945	1270	0.	*	7	0325	1770	0.
1	2230	271	14.	*	3	1610	771	0.	*	5	0950	1271	0.	*	7	0330	1771	0.
1	2235	272	14.	*	3	1615	772	0.	*	5	0955	1272	0.	*	7	0335	1772	0.
1	2240	273	14.	*	3	1620	773	0.	*	5	1000	1273	0.	*	7	0340	1773	0.
1	2245	274	14.	*	3	1625	774	0.	*	5	1005	1274	0.	*	7	0345	1774	0.
1	2250	275	14.	*	3	1630	775	0.	*	5	1010	1275	0.	*	7	0350	1775	0.
1	2255	276	14.	*	3	1635	776	0.	*	5	1015	1276	0.	*	7	0355	1776	0.
1	2300	277	14.	*	3	1640	777	0.	*	5	1020	1277	0.	*	7	0400	1777	0.
1	2305	278	14.	*	3	1645	778	0.	*	5	1025	1278	0.	*	7	0405	1778	0.
1	2310	279	14.	*	3	1650	779	0.	*	5	1030	1279	0.	*	7	0410	1779	0.
1	2315	280	14.	*	3	1655	780	0.	*	5	1035	1280	0.	*	7	0415	1780	0.
1	2320	281	14.	*	3	1700	781	0.	*	5	1040	1281	0.	*	7	0420	1781	0.

1	2325	282	14.	*	3	1705	782	0.	*	5	1045	1282	0.	*	7	0425	1782	0.
1	2330	283	14.	*	3	1710	783	0.	*	5	1050	1283	0.	*	7	0430	1783	0.
1	2335	284	14.	*	3	1715	784	0.	*	5	1055	1284	0.	*	7	0435	1784	0.
1	2340	285	14.	*	3	1720	785	0.	*	5	1100	1285	0.	*	7	0440	1785	0.
1	2345	286	14.	*	3	1725	786	0.	*	5	1105	1286	0.	*	7	0445	1786	0.
1	2350	287	14.	*	3	1730	787	0.	*	5	1110	1287	0.	*	7	0450	1787	0.
1	2355	288	14.	*	3	1735	788	0.	*	5	1115	1288	0.	*	7	0455	1788	0.
2	0000	289	14.	*	3	1740	789	0.	*	5	1120	1289	0.	*	7	0500	1789	0.
2	0005	290	14.	*	3	1745	790	0.	*	5	1125	1290	0.	*	7	0505	1790	0.
2	0010	291	14.	*	3	1750	791	0.	*	5	1130	1291	0.	*	7	0510	1791	0.
2	0015	292	14.	*	3	1755	792	0.	*	5	1135	1292	0.	*	7	0515	1792	0.
2	0020	293	14.	*	3	1800	793	0.	*	5	1140	1293	0.	*	7	0520	1793	0.
2	0025	294	13.	*	3	1805	794	0.	*	5	1145	1294	0.	*	7	0525	1794	0.
2	0030	295	13.	*	3	1810	795	0.	*	5	1150	1295	0.	*	7	0530	1795	0.
2	0035	296	13.	*	3	1815	796	0.	*	5	1155	1296	0.	*	7	0535	1796	0.
2	0040	297	13.	*	3	1820	797	0.	*	5	1200	1297	0.	*	7	0540	1797	0.
2	0045	298	13.	*	3	1825	798	0.	*	5	1205	1298	0.	*	7	0545	1798	0.
2	0050	299	13.	*	3	1830	799	0.	*	5	1210	1299	0.	*	7	0550	1799	0.
2	0055	300	12.	*	3	1835	800	0.	*	5	1215	1300	0.	*	7	0555	1800	0.
2	0100	301	12.	*	3	1840	801	0.	*	5	1220	1301	0.	*	7	0600	1801	0.
2	0105	302	12.	*	3	1845	802	0.	*	5	1225	1302	0.	*	7	0605	1802	0.
2	0110	303	11.	*	3	1850	803	0.	*	5	1230	1303	0.	*	7	0610	1803	0.
2	0115	304	11.	*	3	1855	804	0.	*	5	1235	1304	0.	*	7	0615	1804	0.
2	0120	305	11.	*	3	1900	805	0.	*	5	1240	1305	0.	*	7	0620	1805	0.
2	0125	306	10.	*	3	1905	806	0.	*	5	1245	1306	0.	*	7	0625	1806	0.
2	0130	307	10.	*	3	1910	807	0.	*	5	1250	1307	0.	*	7	0630	1807	0.
2	0135	308	9.	*	3	1915	808	0.	*	5	1255	1308	0.	*	7	0635	1808	0.
2	0140	309	9.	*	3	1920	809	0.	*	5	1300	1309	0.	*	7	0640	1809	0.
2	0145	310	8.	*	3	1925	810	0.	*	5	1305	1310	0.	*	7	0645	1810	0.
2	0150	311	7.	*	3	1930	811	0.	*	5	1310	1311	0.	*	7	0650	1811	0.
2	0155	312	7.	*	3	1935	812	0.	*	5	1315	1312	0.	*	7	0655	1812	0.
2	0200	313	6.	*	3	1940	813	0.	*	5	1320	1313	0.	*	7	0700	1813	0.
2	0205	314	5.	*	3	1945	814	0.	*	5	1325	1314	0.	*	7	0705	1814	0.
2	0210	315	5.	*	3	1950	815	0.	*	5	1330	1315	0.	*	7	0710	1815	0.
2	0215	316	4.	*	3	1955	816	0.	*	5	1335	1316	0.	*	7	0715	1816	0.
2	0220	317	4.	*	3	2000	817	0.	*	5	1340	1317	0.	*	7	0720	1817	0.
2	0225	318	3.	*	3	2005	818	0.	*	5	1345	1318	0.	*	7	0725	1818	0.
2	0230	319	3.	*	3	2010	819	0.	*	5	1350	1319	0.	*	7	0730	1819	0.
2	0235	320	2.	*	3	2015	820	0.	*	5	1355	1320	0.	*	7	0735	1820	0.
2	0240	321	2.	*	3	2020	821	0.	*	5	1400	1321	0.	*	7	0740	1821	0.
2	0245	322	2.	*	3	2025	822	0.	*	5	1405	1322	0.	*	7	0745	1822	0.
2	0250	323	1.	*	3	2030	823	0.	*	5	1410	1323	0.	*	7	0750	1823	0.
2	0255	324	1.	*	3	2035	824	0.	*	5	1415	1324	0.	*	7	0755	1824	0.
2	0300	325	1.	*	3	2040	825	0.	*	5	1420	1325	0.	*	7	0800	1825	0.
2	0305	326	1.	*	3	2045	826	0.	*	5	1425	1326	0.	*	7	0805	1826	0.
2	0310	327	1.	*	3	2050	827	0.	*	5	1430	1327	0.	*	7	0810	1827	0.
2	0315	328	1.	*	3	2055	828	0.	*	5	1435	1328	0.	*	7	0815	1828	0.
2	0320	329	0.	*	3	2100	829	0.	*	5	1440	1329	0.	*	7	0820	1829	0.
2	0325	330	0.	*	3	2105	830	0.	*	5	1445	1330	0.	*	7	0825	1830	0.
2	0330	331	0.	*	3	2110	831	0.	*	5	1450	1331	0.	*	7	0830	1831	0.
2	0335	332	0.	*	3	2115	832	0.	*	5	1455	1332	0.	*	7	0835	1832	0.
2	0340	333	0.	*	3	2120	833	0.	*	5	1500	1333	0.	*	7	0840	1833	0.
2	0345	334	0.	*	3	2125	834	0.	*	5	1505	1334	0.	*	7	0845	1834	0.
2	0350	335	0.	*	3	2130	835	0.	*	5	1510	1335	0.	*	7	0850	1835	0.
2	0355	336	0.	*	3	2135	836	0.	*	5	1515	1336	0.	*	7	0855	1836	0.
2	0400	337	0.	*	3	2140	837	0.	*	5	1520	1337	0.	*	7	0900	1837	0.
2	0405	338	0.	*	3	2145	838	0.	*	5	1525	1338	0.	*	7	0905	1838	0.
2	0410	339	0.	*	3	2150	839	0.	*	5	1530	1339	0.	*	7	0910	1839	0.
2	0415	340	0.	*	3	2155	840	0.	*	5	1535	1340	0.	*	7	0915	1840	0.
2	0420	341	0.	*	3	2200	841	0.	*	5	1540	1341	0.	*	7	0920	1841	0.
2	0425	342	0.	*	3	2205	842	0.	*	5	1545	1342	0.	*	7	0925	1842	0.
2	0430	343	0.	*	3	2210	843	0.	*	5	1550	1343	0.	*	7	0930	1843	0.
2	0435	344	0.	*	3	2215	844	0.	*	5	1555	1344	0.	*	7	0935	1844	0.
2	0440	345	0.	*	3	2220	845	0.	*	5	1600	1345	0.	*	7	0940	1845	0.
2	0445	346	0.	*	3	2225	846	0.	*	5	1605	1346	0.	*	7	0945	1846	0.
2	0450	347	0.	*	3	2230	847	0.	*	5	1610	1347	0.	*	7	0950	1847	0.
2	0455	348	0.	*	3	2235	848	0.	*	5	1615	1348	0.	*	7	0955	1848	0.
2	0500	349	0.	*	3	2240	849	0.	*	5	1620	1349	0.	*	7	1000	1849	0.
2	0505	350	0.	*	3	2245	850	0.	*	5	1625	1350	0.	*	7	1005	1850	0.
2	0510	351	0.	*	3	2250	851	0.	*	5	1630	1351	0.	*	7	1010	1851	0.
2	0515	352	0.	*	3	2255	852	0.	*	5	1635	1352	0.	*	7	1015	1852	0.
2	0520	353	0.	*	3	2300	853	0.	*	5	1640	1353	0.	*	7	1020	1853	0.
2	0525	354	0.	*	3	2305	854	0.	*	5	1645	1354	0.	*	7	1025	1854	0.
2	0530	355	0.	*	3	2310	855	0.	*	5	1650	1355	0.	*	7	1030	1855	0.
2	0535	356	0.	*	3	2315	856	0.	*	5	1655	1356	0.	*	7	1035	1856	0.
2	0540	357	0.	*	3	2320	857	0.	*	5	1700	1357	0.	*	7	1040	1857	0.
2	0545	358	0.	*	3	2325	858	0.	*	5	1705	1358	0.	*	7	1045	1858	0.
2	0550	359	0.	*	3	2330	859	0.	*	5	1710	1359	0.	*	7	1050	1859	0.
2	0555	360	0.	*	3	2335	860	0.	*	5	1715	1360	0.	*	7	1055	1860	0.
2	0600	361	0.	*	3	2340	861	0.	*	5	1720	1361	0.	*	7	1100	1861	0.
2	0605	362	0.	*	3	2345	862	0.	*	5	1725	1362	0.	*	7	1105	1862	0.
2	0610	363	0.	*	3	2350	863	0.	*	5	1730	1363	0.	*	7	1110	1863	0.
2	0615	364	0.	*	3	2355	864	0.	*	5	1735	1364	0.	*	7	1115	1864	0.
2	0620	365	0.	*	4	0000	865	0.	*	5	1740	1365	0.	*	7	1120	1865	0.
2	0625	366	0.	*	4	0005	866	0.	*	5	1745	1366	0.	*	7	1125	1866	0.
2	0630	367	0.	*	4	0010	867	0.	*	5	1750	1367	0.	*	7	1130	1867	0.
2	0635	368	0.	*	4	0015	868	0.	*	5	1755	1368	0.	*	7	1135	1868	0.
2	0640	369	0.	*	4	0020	869	0.	*	5	1800	1369	0.	*	7	1140	1869	0.
2	0645	370	0.	*	4	0025	870	0.	*	5	1805	1370	0.	*	7	1145	1870	0.
2	0650	371	0.	*	4	0030	871	0.	*	5	1810	1371	0.	*	7	1150	1871	0.
2	0655	372	0.	*	4	0035	872	0.	*	5	1815	1372	0.	*	7	1155	1872	0.
2	0700	373	0.	*	4	0040	873	0.	*	5	1820	1373	0.	*	7	1200	1873	0.
2	0705	374	0.	*	4	0045	874	0.	*	5	1825	1374	0.	*	7	1205	1874	0.
2	0710	375	0.	*	4	0050	875	0.	*	5	1830	1375	0.	*	7	1210	1875	0.
2	0715	376	0.	*	4	0055	876	0.	*	5	1835	1376	0.	*	7	1215	1876	0.

2	0720	377	0.	*	4	0100	877	0.	*	5	1840	1377	0.	*	7	1220	1877	0.
2	0725	378	0.	*	4	0105	878	0.	*	5	1845	1378	0.	*	7	1225	1878	0.
2	0730	379	0.	*	4	0110	879	0.	*	5	1850	1379	0.	*	7	1230	1879	0.
2	0735	380	0.	*	4	0115	880	0.	*	5	1855	1380	0.	*	7	1235	1880	0.
2	0740	381	0.	*	4	0120	881	0.	*	5	1900	1381	0.	*	7	1240	1881	0.
2	0745	382	0.	*	4	0125	882	0.	*	5	1905	1382	0.	*	7	1245	1882	0.
2	0750	383	0.	*	4	0130	883	0.	*	5	1910	1383	0.	*	7	1250	1883	0.
2	0755	384	0.	*	4	0135	884	0.	*	5	1915	1384	0.	*	7	1255	1884	0.
2	0800	385	0.	*	4	0140	885	0.	*	5	1920	1385	0.	*	7	1300	1885	0.
2	0805	386	0.	*	4	0145	886	0.	*	5	1925	1386	0.	*	7	1305	1886	0.
2	0810	387	0.	*	4	0150	887	0.	*	5	1930	1387	0.	*	7	1310	1887	0.
2	0815	388	0.	*	4	0155	888	0.	*	5	1935	1388	0.	*	7	1315	1888	0.
2	0820	389	0.	*	4	0200	889	0.	*	5	1940	1389	0.	*	7	1320	1889	0.
2	0825	390	0.	*	4	0205	890	0.	*	5	1945	1390	0.	*	7	1325	1890	0.
2	0830	391	0.	*	4	0210	891	0.	*	5	1950	1391	0.	*	7	1330	1891	0.
2	0835	392	0.	*	4	0215	892	0.	*	5	1955	1392	0.	*	7	1335	1892	0.
2	0840	393	0.	*	4	0220	893	0.	*	5	2000	1393	0.	*	7	1340	1893	0.
2	0845	394	0.	*	4	0225	894	0.	*	5	2005	1394	0.	*	7	1345	1894	0.
2	0850	395	0.	*	4	0230	895	0.	*	5	2010	1395	0.	*	7	1350	1895	0.
2	0855	396	0.	*	4	0235	896	0.	*	5	2015	1396	0.	*	7	1355	1896	0.
2	0900	397	0.	*	4	0240	897	0.	*	5	2020	1397	0.	*	7	1400	1897	0.
2	0905	398	0.	*	4	0245	898	0.	*	5	2025	1398	0.	*	7	1405	1898	0.
2	0910	399	0.	*	4	0250	899	0.	*	5	2030	1399	0.	*	7	1410	1899	0.
2	0915	400	0.	*	4	0255	900	0.	*	5	2035	1400	0.	*	7	1415	1900	0.
2	0920	401	0.	*	4	0300	901	0.	*	5	2040	1401	0.	*	7	1420	1901	0.
2	0925	402	0.	*	4	0305	902	0.	*	5	2045	1402	0.	*	7	1425	1902	0.
2	0930	403	0.	*	4	0310	903	0.	*	5	2050	1403	0.	*	7	1430	1903	0.
2	0935	404	0.	*	4	0315	904	0.	*	5	2055	1404	0.	*	7	1435	1904	0.
2	0940	405	0.	*	4	0320	905	0.	*	5	2100	1405	0.	*	7	1440	1905	0.
2	0945	406	0.	*	4	0325	906	0.	*	5	2105	1406	0.	*	7	1445	1906	0.
2	0950	407	0.	*	4	0330	907	0.	*	5	2110	1407	0.	*	7	1450	1907	0.
2	0955	408	0.	*	4	0335	908	0.	*	5	2115	1408	0.	*	7	1455	1908	0.
2	1000	409	0.	*	4	0340	909	0.	*	5	2120	1409	0.	*	7	1500	1909	0.
2	1005	410	0.	*	4	0345	910	0.	*	5	2125	1410	0.	*	7	1505	1910	0.
2	1010	411	0.	*	4	0350	911	0.	*	5	2130	1411	0.	*	7	1510	1911	0.
2	1015	412	0.	*	4	0355	912	0.	*	5	2135	1412	0.	*	7	1515	1912	0.
2	1020	413	0.	*	4	0400	913	0.	*	5	2140	1413	0.	*	7	1520	1913	0.
2	1025	414	0.	*	4	0405	914	0.	*	5	2145	1414	0.	*	7	1525	1914	0.
2	1030	415	0.	*	4	0410	915	0.	*	5	2150	1415	0.	*	7	1530	1915	0.
2	1035	416	0.	*	4	0415	916	0.	*	5	2155	1416	0.	*	7	1535	1916	0.
2	1040	417	0.	*	4	0420	917	0.	*	5	2200	1417	0.	*	7	1540	1917	0.
2	1045	418	0.	*	4	0425	918	0.	*	5	2205	1418	0.	*	7	1545	1918	0.
2	1050	419	0.	*	4	0430	919	0.	*	5	2210	1419	0.	*	7	1550	1919	0.
2	1055	420	0.	*	4	0435	920	0.	*	5	2215	1420	0.	*	7	1555	1920	0.
2	1100	421	0.	*	4	0440	921	0.	*	5	2220	1421	0.	*	7	1600	1921	0.
2	1105	422	0.	*	4	0445	922	0.	*	5	2225	1422	0.	*	7	1605	1922	0.
2	1110	423	0.	*	4	0450	923	0.	*	5	2230	1423	0.	*	7	1610	1923	0.
2	1115	424	0.	*	4	0455	924	0.	*	5	2235	1424	0.	*	7	1615	1924	0.
2	1120	425	0.	*	4	0500	925	0.	*	5	2240	1425	0.	*	7	1620	1925	0.
2	1125	426	0.	*	4	0505	926	0.	*	5	2245	1426	0.	*	7	1625	1926	0.
2	1130	427	0.	*	4	0510	927	0.	*	5	2250	1427	0.	*	7	1630	1927	0.
2	1135	428	0.	*	4	0515	928	0.	*	5	2255	1428	0.	*	7	1635	1928	0.
2	1140	429	0.	*	4	0520	929	0.	*	5	2300	1429	0.	*	7	1640	1929	0.
2	1145	430	0.	*	4	0525	930	0.	*	5	2305	1430	0.	*	7	1645	1930	0.
2	1150	431	0.	*	4	0530	931	0.	*	5	2310	1431	0.	*	7	1650	1931	0.
2	1155	432	0.	*	4	0535	932	0.	*	5	2315	1432	0.	*	7	1655	1932	0.
2	1200	433	0.	*	4	0540	933	0.	*	5	2320	1433	0.	*	7	1700	1933	0.
2	1205	434	0.	*	4	0545	934	0.	*	5	2325	1434	0.	*	7	1705	1934	0.
2	1210	435	0.	*	4	0550	935	0.	*	5	2330	1435	0.	*	7	1710	1935	0.
2	1215	436	0.	*	4	0555	936	0.	*	5	2335	1436	0.	*	7	1715	1936	0.
2	1220	437	0.	*	4	0600	937	0.	*	5	2340	1437	0.	*	7	1720	1937	0.
2	1225	438	0.	*	4	0605	938	0.	*	5	2345	1438	0.	*	7	1725	1938	0.
2	1230	439	0.	*	4	0610	939	0.	*	5	2350	1439	0.	*	7	1730	1939	0.
2	1235	440	0.	*	4	0615	940	0.	*	5	2355	1440	0.	*	7	1735	1940	0.
2	1240	441	0.	*	4	0620	941	0.	*	6	0000	1441	0.	*	7	1740	1941	0.
2	1245	442	0.	*	4	0625	942	0.	*	6	0005	1442	0.	*	7	1745	1942	0.
2	1250	443	0.	*	4	0630	943	0.	*	6	0010	1443	0.	*	7	1750	1943	0.
2	1255	444	0.	*	4	0635	944	0.	*	6	0015	1444	0.	*	7	1755	1944	0.
2	1300	445	0.	*	4	0640	945	0.	*	6	0020	1445	0.	*	7	1800	1945	0.
2	1305	446	0.	*	4	0645	946	0.	*	6	0025	1446	0.	*	7	1805	1946	0.
2	1310	447	0.	*	4	0650	947	0.	*	6	0030	1447	0.	*	7	1810	1947	0.
2	1315	448	0.	*	4	0655	948	0.	*	6	0035	1448	0.	*	7	1815	1948	0.
2	1320	449	0.	*	4	0700	949	0.	*	6	0040	1449	0.	*	7	1820	1949	0.
2	1325	450	0.	*	4	0705	950	0.	*	6	0045	1450	0.	*	7	1825	1950	0.
2	1330	451	0.	*	4	0710	951	0.	*	6	0050	1451	0.	*	7	1830	1951	0.
2	1335	452	0.	*	4	0715	952	0.	*	6	0055	1452	0.	*	7	1835	1952	0.
2	1340	453	0.	*	4	0720	953	0.	*	6	0100	1453	0.	*	7	1840	1953	0.
2	1345	454	0.	*	4	0725	954	0.	*	6	0105	1454	0.	*	7	1845	1954	0.
2	1350	455	0.	*	4	0730	955	0.	*	6	0110	1455	0.	*	7	1850	1955	0.
2	1355	456	0.	*	4	0735	956	0.	*	6	0115	1456	0.	*	7	1855	1956	0.
2	1400	457	0.	*	4	0740	957	0.	*	6	0120	1457	0.	*	7	1900	1957	0.
2	1405	458	0.	*	4	0745	958	0.	*	6	0125	1458	0.	*	7	1905	1958	0.
2	1410	459	0.	*	4	0750	959	0.	*	6	0130	1459	0.	*	7	1910	1959	0.
2	1415	460	0.	*	4	0755	960	0.	*	6	0135	1460	0.	*	7	1915	1960	0.
2	1420	461	0.	*	4	0800	961	0.	*	6	0140	1461	0.	*	7	1920	1961	0.
2	1425	462	0.	*	4	0805	962	0.	*	6	0145	1462	0.	*	7	1925	1962	0.
2	1430	463	0.	*	4	0810	963	0.	*	6	0150	1463	0.	*	7	1930	1963	0.
2	1435	464	0.	*	4	0815	964	0.	*	6	0155	1464	0.	*	7	1935	1964	0.
2	1440	465	0.	*	4	0820	965	0.	*	6	0200	1465	0.	*	7	1940	1965	0.
2	1445	466	0.	*	4	0825	966	0.	*	6	0205	1466	0.	*	7	1945	1966	0.
2	1450	467	0.	*	4	0830	967	0.	*	6	0210	1467	0.	*	7	1950	1967	0.
2	1455	468	0.	*	4	0835	968	0.	*	6	0215	1468	0.	*	7	1955	1968	0.
2	1500	469	0.	*	4	0840	969	0.	*	6	0220	1469	0.	*	7	2000	1969	0.
2	1505	470	0.	*	4	0845	970	0.	*	6	0225	1470	0.	*	7	2005	1970	0.
2	1510	471	0.	*	4	0850	971	0.	*	6	0230	1471	0.	*	7	2010	1971	0.

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  2   1515  472    0.  *  4   0855  972    0.  *  6   0235 1472    0.  *  7   2015 1972    0.
  2   1520  473    0.  *  4   0900  973    0.  *  6   0240 1473    0.  *  7   2020 1973    0.
  2   1525  474    0.  *  4   0905  974    0.  *  6   0245 1474    0.  *  7   2025 1974    0.
  2   1530  475    0.  *  4   0910  975    0.  *  6   0250 1475    0.  *  7   2030 1975    0.
  2   1535  476    0.  *  4   0915  976    0.  *  6   0255 1476    0.  *  7   2035 1976    0.
  2   1540  477    0.  *  4   0920  977    0.  *  6   0300 1477    0.  *  7   2040 1977    0.
  2   1545  478    0.  *  4   0925  978    0.  *  6   0305 1478    0.  *  7   2045 1978    0.
  2   1550  479    0.  *  4   0930  979    0.  *  6   0310 1479    0.  *  7   2050 1979    0.
  2   1555  480    0.  *  4   0935  980    0.  *  6   0315 1480    0.  *  7   2055 1980    0.
  2   1600  481    0.  *  4   0940  981    0.  *  6   0320 1481    0.  *  7   2100 1981    0.
  2   1605  482    0.  *  4   0945  982    0.  *  6   0325 1482    0.  *  7   2105 1982    0.
  2   1610  483    0.  *  4   0950  983    0.  *  6   0330 1483    0.  *  7   2110 1983    0.
  2   1615  484    0.  *  4   0955  984    0.  *  6   0335 1484    0.  *  7   2115 1984    0.
  2   1620  485    0.  *  4   1000  985    0.  *  6   0340 1485    0.  *  7   2120 1985    0.
  2   1625  486    0.  *  4   1005  986    0.  *  6   0345 1486    0.  *  7   2125 1986    0.
  2   1630  487    0.  *  4   1010  987    0.  *  6   0350 1487    0.  *  7   2130 1987    0.
  2   1635  488    0.  *  4   1015  988    0.  *  6   0355 1488    0.  *  7   2135 1988    0.
  2   1640  489    0.  *  4   1020  989    0.  *  6   0400 1489    0.  *  7   2140 1989    0.
  2   1645  490    0.  *  4   1025  990    0.  *  6   0405 1490    0.  *  7   2145 1990    0.
  2   1650  491    0.  *  4   1030  991    0.  *  6   0410 1491    0.  *  7   2150 1991    0.
  2   1655  492    0.  *  4   1035  992    0.  *  6   0415 1492    0.  *  7   2155 1992    0.
  2   1700  493    0.  *  4   1040  993    0.  *  6   0420 1493    0.  *  7   2200 1993    0.
  2   1705  494    0.  *  4   1045  994    0.  *  6   0425 1494    0.  *  7   2205 1994    0.
  2   1710  495    0.  *  4   1050  995    0.  *  6   0430 1495    0.  *  7   2210 1995    0.
  2   1715  496    0.  *  4   1055  996    0.  *  6   0435 1496    0.  *  7   2215 1996    0.
  2   1720  497    0.  *  4   1100  997    0.  *  6   0440 1497    0.  *  7   2220 1997    0.
  2   1725  498    0.  *  4   1105  998    0.  *  6   0445 1498    0.  *  7   2225 1998    0.
  2   1730  499    0.  *  4   1110  999    0.  *  6   0450 1499    0.  *  7   2230 1999    0.
  2   1735  500    0.  *  4   1115 1000    0.  *  6   0455 1500    0.  *  7   2235 2000    0.
                       *                       *                       *
*****************************************************************************************************

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+  (CFS)       (HR)
                        (CFS)
+   4877.     12.75                687.         186.          62.          27.
                       (INCHES)    1.063        1.149        1.151        1.151
                       (AC-FT)      341.         368.         369.         369.

                       CUMULATIVE AREA =    6.01 SQ MI


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


            **************
            *            *
 254 KK     *        12  *
            *            *
            **************

 255 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          2  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                              RUNOFF HYDROGRAPH FROM SUB-BASIN 12.

              SUBBASIN RUNOFF DATA

 257 BA          SUBBASIN CHARACTERISTICS
                      TAREA       1.38  SUBBASIN AREA

 258 LG          GREEN AND AMPT LOSS RATE
                      STRTL        .16  STARTING LOSS
                        DTH        .35  MOISTURE DEFICIT
                       PSIF       4.80  WETTING FRONT SUCTION
                      XKSAT        .31  HYDRAULIC CONDUCTIVITY
                      RTIMP       3.00  PERCENT IMPERVIOUS AREA

 256 UI          INPUT UNITGRAPH,  25 ORDINATES,  VOLUME = 1.00
                     111.0     129.0     394.0     536.0     636.0     759.0     932.0    1314.0    1276.0    1007.0
                     850.0     696.0     573.0     444.0     263.0     191.0     169.0     111.0      91.0      34.0
                      34.0      34.0      34.0      34.0      34.0
                                                                          ***

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

                        HYDROGRAPH AT STATION       12
                      TRANSPOSITION AREA       .0 SQ MI

   TOTAL RAINFALL =    4.03, TOTAL LOSS =    2.78, TOTAL EXCESS =    1.25

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR     166.58-HR
+  (CFS)       (HR)
                        (CFS)
+   1306.     12.50                180.          46.          15.           7.
                       (INCHES)    1.213        1.248        1.248        1.248
                       (AC-FT)      89.          92.          92.          92.

                       CUMULATIVE AREA =    1.38 SQ MI
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***            ***            ***            ***            ***

                    HYDROGRAPH AT STATION      12
                  TRANSPOSITION AREA     10.0 SQ MI

    TOTAL RAINFALL =    3.79, TOTAL LOSS =    2.66, TOTAL EXCESS =    1.13

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                                   (CFS)
+   1189.     12.50                 163.         42.         14.          6.
                            (INCHES)     1.098       1.131       1.131       1.131
                             (AC-FT)      81.         83.         83.         83.

                         CUMULATIVE AREA =    1.38 SQ MI


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

                    HYDROGRAPH AT STATION      12
                  TRANSPOSITION AREA     50.0 SQ MI

    TOTAL RAINFALL =    3.51, TOTAL LOSS =    2.51, TOTAL EXCESS =    1.00

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                                   (CFS)
+   1057.     12.50                 144.         37.         12.          5.
                            (INCHES)      .973       1.004       1.004       1.004
                             (AC-FT)      72.         74.         74.         74.

                         CUMULATIVE AREA =    1.38 SQ MI
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INTERPOLATED HYDROGRAPH AT 12

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DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	2		1740	501	0.	4		1120	1001	0.	6		0500	1501	0.
1		0005	2	0.	2		1745	502	0.	4		1125	1002	0.	6		0505	1502	0.
1		0010	3	0.	2		1750	503	0.	4		1130	1003	0.	6		0510	1503	0.
1		0015	4	0.	2		1755	504	0.	4		1135	1004	0.	6		0515	1504	0.
1		0020	5	0.	2		1800	505	0.	4		1140	1005	0.	6		0520	1505	0.
1		0025	6	0.	2		1805	506	0.	4		1145	1006	0.	6		0525	1506	0.
1		0030	7	0.	2		1810	507	0.	4		1150	1007	0.	6		0530	1507	0.
1		0035	8	0.	2		1815	508	0.	4		1155	1008	0.	6		0535	1508	0.
1		0040	9	0.	2		1820	509	0.	4		1200	1009	0.	6		0540	1509	0.
1		0045	10	1.	2		1825	510	0.	4		1205	1010	0.	6		0545	1510	0.
1		0050	11	1.	2		1830	511	0.	4		1210	1011	0.	6		0550	1511	0.
1		0055	12	1.	2		1835	512	0.	4		1215	1012	0.	6		0555	1512	0.
1		0100	13	1.	2		1840	513	0.	4		1220	1013	0.	6		0600	1513	0.
1		0105	14	1.	2		1845	514	0.	4		1225	1014	0.	6		0605	1514	0.
1		0110	15	1.	2		1850	515	0.	4		1230	1015	0.	6		0610	1515	0.
1		0115	16	1.	2		1855	516	0.	4		1235	1016	0.	6		0615	1516	0.
1		0120	17	1.	2		1900	517	0.	4		1240	1017	0.	6		0620	1517	0.
1		0125	18	1.	2		1905	518	0.	4		1245	1018	0.	6		0625	1518	0.
1		0130	19	1.	2		1910	519	0.	4		1250	1019	0.	6		0630	1519	0.
1		0135	20	1.	2		1915	520	0.	4		1255	1020	0.	6		0635	1520	0.
1		0140	21	1.	2		1920	521	0.	4		1300	1021	0.	6		0640	1521	0.
1		0145	22	1.	2		1925	522	0.	4		1305	1022	0.	6		0645	1522	0.
1		0150	23	1.	2		1930	523	0.	4		1310	1023	0.	6		0650	1523	0.
1		0155	24	1.	2		1935	524	0.	4		1315	1024	0.	6		0655	1524	0.
1		0200	25	1.	2		1940	525	0.	4		1320	1025	0.	6		0700	1525	0.
1		0205	26	1.	2		1945	526	0.	4		1325	1026	0.	6		0705	1526	0.
1		0210	27	1.	2		1950	527	0.	4		1330	1027	0.	6		0710	1527	0.
1		0215	28	1.	2		1955	528	0.	4		1335	1028	0.	6		0715	1528	0.
1		0220	29	1.	2		2000	529	0.	4		1340	1029	0.	6		0720	1529	0.
1		0225	30	1.	2		2005	530	0.	4		1345	1030	0.	6		0725	1530	0.
1		0230	31	1.	2		2010	531	0.	4		1350	1031	0.	6		0730	1531	0.
1		0235	32	1.	2		2015	532	0.	4		1355	1032	0.	6		0735	1532	0.
1		0240	33	1.	2		2020	533	0.	4		1400	1033	0.	6		0740	1533	0.
1		0245	34	1.	2		2025	534	0.	4		1405	1034	0.	6		0745	1534	0.
1		0250	35	1.	2		2030	535	0.	4		1410	1035	0.	6		0750	1535	0.
1		0255	36	1.	2		2035	536	0.	4		1415	1036	0.	6		0755	1536	0.
1		0300	37	1.	2		2040	537	0.	4		1420	1037	0.	6		0800	1537	0.
1		0305	38	1.	2		2045	538	0.	4		1425	1038	0.	6		0805	1538	0.
1		0310	39	1.	2		2050	539	0.	4		1430	1039	0.	6		0810	1539	0.
1		0315	40	1.	2		2055	540	0.	4		1435	1040	0.	6		0815	1540	0.
1		0320	41	1.	2		2100	541	0.	4		1440	1041	0.	6		0820	1541	0.
1		0325	42	1.	2		2105	542	0.	4		1445	1042	0.	6		0825	1542	0.
1		0330	43	1.	2		2110	543	0.	4		1450	1043	0.	6		0830	1543	0.
1		0335	44	1.	2		2115	544	0.	4		1455	1044	0.	6		0835	1544	0.
1		0340	45	1.	2		2120	545	0.	4		1500	1045	0.	6		0840	1545	0.
1		0345	46	1.	2		2125	546	0.	4		1505	1046	0.	6		0845	1546	0.
1		0350	47	1.	2		2130	547	0.	4		1510	1047	0.	6		0850	1547	0.
1		0355	48	1.	2		2135	548	0.	4		1515	1048	0.	6		0855	1548	0.
1		0400	49	1.	2		2140	549	0.	4		1520	1049	0.	6		0900	1549	0.

1	0405	50	1.	*	2	2145	550	0.	*	4	1525	1050	0.	*	6	0905	1550	0.
1	0410	51	1.	*	2	2150	551	0.	*	4	1530	1051	0.	*	6	0910	1551	0.
1	0415	52	1.	*	2	2155	552	0.	*	4	1535	1052	0.	*	6	0915	1552	0.
1	0420	53	1.	*	2	2200	553	0.	*	4	1540	1053	0.	*	6	0920	1553	0.
1	0425	54	1.	*	2	2205	554	0.	*	4	1545	1054	0.	*	6	0925	1554	0.
1	0430	55	1.	*	2	2210	555	0.	*	4	1550	1055	0.	*	6	0930	1555	0.
1	0435	56	2.	*	2	2215	556	0.	*	4	1555	1056	0.	*	6	0935	1556	0.
1	0440	57	2.	*	2	2220	557	0.	*	4	1600	1057	0.	*	6	0940	1557	0.
1	0445	58	2.	*	2	2225	558	0.	*	4	1605	1058	0.	*	6	0945	1558	0.
1	0450	59	2.	*	2	2230	559	0.	*	4	1610	1059	0.	*	6	0950	1559	0.
1	0455	60	2.	*	2	2235	560	0.	*	4	1615	1060	0.	*	6	0955	1560	0.
1	0500	61	2.	*	2	2240	561	0.	*	4	1620	1061	0.	*	6	1000	1561	0.
1	0505	62	2.	*	2	2245	562	0.	*	4	1625	1062	0.	*	6	1005	1562	0.
1	0510	63	2.	*	2	2250	563	0.	*	4	1630	1063	0.	*	6	1010	1563	0.
1	0515	64	2.	*	2	2255	564	0.	*	4	1635	1064	0.	*	6	1015	1564	0.
1	0520	65	2.	*	2	2300	565	0.	*	4	1640	1065	0.	*	6	1020	1565	0.
1	0525	66	2.	*	2	2305	566	0.	*	4	1645	1066	0.	*	6	1025	1566	0.
1	0530	67	2.	*	2	2310	567	0.	*	4	1650	1067	0.	*	6	1030	1567	0.
1	0535	68	2.	*	2	2315	568	0.	*	4	1655	1068	0.	*	6	1035	1568	0.
1	0540	69	2.	*	2	2320	569	0.	*	4	1700	1069	0.	*	6	1040	1569	0.
1	0545	70	2.	*	2	2325	570	0.	*	4	1705	1070	0.	*	6	1045	1570	0.
1	0550	71	2.	*	2	2330	571	0.	*	4	1710	1071	0.	*	6	1050	1571	0.
1	0555	72	2.	*	2	2335	572	0.	*	4	1715	1072	0.	*	6	1055	1572	0.
1	0600	73	2.	*	2	2340	573	0.	*	4	1720	1073	0.	*	6	1100	1573	0.
1	0605	74	2.	*	2	2345	574	0.	*	4	1725	1074	0.	*	6	1105	1574	0.
1	0610	75	2.	*	2	2350	575	0.	*	4	1730	1075	0.	*	6	1110	1575	0.
1	0615	76	2.	*	2	2355	576	0.	*	4	1735	1076	0.	*	6	1115	1576	0.
1	0620	77	2.	*	3	0000	577	0.	*	4	1740	1077	0.	*	6	1120	1577	0.
1	0625	78	2.	*	3	0005	578	0.	*	4	1745	1078	0.	*	6	1125	1578	0.
1	0630	79	2.	*	3	0010	579	0.	*	4	1750	1079	0.	*	6	1130	1579	0.
1	0635	80	2.	*	3	0015	580	0.	*	4	1755	1080	0.	*	6	1135	1580	0.
1	0640	81	2.	*	3	0020	581	0.	*	4	1800	1081	0.	*	6	1140	1581	0.
1	0645	82	2.	*	3	0025	582	0.	*	4	1805	1082	0.	*	6	1145	1582	0.
1	0650	83	2.	*	3	0030	583	0.	*	4	1810	1083	0.	*	6	1150	1583	0.
1	0655	84	2.	*	3	0035	584	0.	*	4	1815	1084	0.	*	6	1155	1584	0.
1	0700	85	2.	*	3	0040	585	0.	*	4	1820	1085	0.	*	6	1200	1585	0.
1	0705	86	2.	*	3	0045	586	0.	*	4	1825	1086	0.	*	6	1205	1586	0.
1	0710	87	2.	*	3	0050	587	0.	*	4	1830	1087	0.	*	6	1210	1587	0.
1	0715	88	2.	*	3	0055	588	0.	*	4	1835	1088	0.	*	6	1215	1588	0.
1	0720	89	2.	*	3	0100	589	0.	*	4	1840	1089	0.	*	6	1220	1589	0.
1	0725	90	2.	*	3	0105	590	0.	*	4	1845	1090	0.	*	6	1225	1590	0.
1	0730	91	2.	*	3	0110	591	0.	*	4	1850	1091	0.	*	6	1230	1591	0.
1	0735	92	2.	*	3	0115	592	0.	*	4	1855	1092	0.	*	6	1235	1592	0.
1	0740	93	2.	*	3	0120	593	0.	*	4	1900	1093	0.	*	6	1240	1593	0.
1	0745	94	2.	*	3	0125	594	0.	*	4	1905	1094	0.	*	6	1245	1594	0.
1	0750	95	2.	*	3	0130	595	0.	*	4	1910	1095	0.	*	6	1250	1595	0.
1	0755	96	2.	*	3	0135	596	0.	*	4	1915	1096	0.	*	6	1255	1596	0.
1	0800	97	2.	*	3	0140	597	0.	*	4	1920	1097	0.	*	6	1300	1597	0.
1	0805	98	2.	*	3	0145	598	0.	*	4	1925	1098	0.	*	6	1305	1598	0.
1	0810	99	2.	*	3	0150	599	0.	*	4	1930	1099	0.	*	6	1310	1599	0.
1	0815	100	2.	*	3	0155	600	0.	*	4	1935	1100	0.	*	6	1315	1600	0.
1	0820	101	2.	*	3	0200	601	0.	*	4	1940	1101	0.	*	6	1320	1601	0.
1	0825	102	2.	*	3	0205	602	0.	*	4	1945	1102	0.	*	6	1325	1602	0.
1	0830	103	2.	*	3	0210	603	0.	*	4	1950	1103	0.	*	6	1330	1603	0.
1	0835	104	2.	*	3	0215	604	0.	*	4	1955	1104	0.	*	6	1335	1604	0.
1	0840	105	2.	*	3	0220	605	0.	*	4	2000	1105	0.	*	6	1340	1605	0.
1	0845	106	2.	*	3	0225	606	0.	*	4	2005	1106	0.	*	6	1345	1606	0.
1	0850	107	2.	*	3	0230	607	0.	*	4	2010	1107	0.	*	6	1350	1607	0.
1	0855	108	3.	*	3	0235	608	0.	*	4	2015	1108	0.	*	6	1355	1608	0.
1	0900	109	3.	*	3	0240	609	0.	*	4	2020	1109	0.	*	6	1400	1609	0.
1	0905	110	3.	*	3	0245	610	0.	*	4	2025	1110	0.	*	6	1405	1610	0.
1	0910	111	3.	*	3	0250	611	0.	*	4	2030	1111	0.	*	6	1410	1611	0.
1	0915	112	3.	*	3	0255	612	0.	*	4	2035	1112	0.	*	6	1415	1612	0.
1	0920	113	3.	*	3	0300	613	0.	*	4	2040	1113	0.	*	6	1420	1613	0.
1	0925	114	3.	*	3	0305	614	0.	*	4	2045	1114	0.	*	6	1425	1614	0.
1	0930	115	3.	*	3	0310	615	0.	*	4	2050	1115	0.	*	6	1430	1615	0.
1	0935	116	3.	*	3	0315	616	0.	*	4	2055	1116	0.	*	6	1435	1616	0.
1	0940	117	3.	*	3	0320	617	0.	*	4	2100	1117	0.	*	6	1440	1617	0.
1	0945	118	3.	*	3	0325	618	0.	*	4	2105	1118	0.	*	6	1445	1618	0.
1	0950	119	3.	*	3	0330	619	0.	*	4	2110	1119	0.	*	6	1450	1619	0.
1	0955	120	3.	*	3	0335	620	0.	*	4	2115	1120	0.	*	6	1455	1620	0.
1	1000	121	3.	*	3	0340	621	0.	*	4	2120	1121	0.	*	6	1500	1621	0.
1	1005	122	3.	*	3	0345	622	0.	*	4	2125	1122	0.	*	6	1505	1622	0.
1	1010	123	3.	*	3	0350	623	0.	*	4	2130	1123	0.	*	6	1510	1623	0.
1	1015	124	4.	*	3	0355	624	0.	*	4	2135	1124	0.	*	6	1515	1624	0.
1	1020	125	4.	*	3	0400	625	0.	*	4	2140	1125	0.	*	6	1520	1625	0.
1	1025	126	4.	*	3	0405	626	0.	*	4	2145	1126	0.	*	6	1525	1626	0.
1	1030	127	4.	*	3	0410	627	0.	*	4	2150	1127	0.	*	6	1530	1627	0.
1	1035	128	4.	*	3	0415	628	0.	*	4	2155	1128	0.	*	6	1535	1628	0.
1	1040	129	4.	*	3	0420	629	0.	*	4	2200	1129	0.	*	6	1540	1629	0.
1	1045	130	4.	*	3	0425	630	0.	*	4	2205	1130	0.	*	6	1545	1630	0.
1	1050	131	4.	*	3	0430	631	0.	*	4	2210	1131	0.	*	6	1550	1631	0.
1	1055	132	5.	*	3	0435	632	0.	*	4	2215	1132	0.	*	6	1555	1632	0.
1	1100	133	5.	*	3	0440	633	0.	*	4	2220	1133	0.	*	6	1600	1633	0.
1	1105	134	5.	*	3	0445	634	0.	*	4	2225	1134	0.	*	6	1605	1634	0.
1	1110	135	5.	*	3	0450	635	0.	*	4	2230	1135	0.	*	6	1610	1635	0.
1	1115	136	6.	*	3	0455	636	0.	*	4	2235	1136	0.	*	6	1615	1636	0.
1	1120	137	6.	*	3	0500	637	0.	*	4	2240	1137	0.	*	6	1620	1637	0.
1	1125	138	7.	*	3	0505	638	0.	*	4	2245	1138	0.	*	6	1625	1638	0.
1	1130	139	7.	*	3	0510	639	0.	*	4	2250	1139	0.	*	6	1630	1639	0.
1	1135	140	15.	*	3	0515	640	0.	*	4	2255	1140	0.	*	6	1635	1640	0.
1	1140	141	24.	*	3	0520	641	0.	*	4	2300	1141	0.	*	6	1640	1641	0.
1	1145	142	50.	*	3	0525	642	0.	*	4	2305	1142	0.	*	6	1645	1642	0.
1	1150	143	111.	*	3	0530	643	0.	*	4	2310	1143	0.	*	6	1650	1643	0.
1	1155	144	184.	*	3	0535	644	0.	*	4	2315	1144	0.	*	6	1655	1644	0.

1	1200	145	324.	*	3	0540	645	0.	*	4	2320	1145	0.	*	6	1700	1645	0.
1	1205	146	476.	*	3	0545	646	0.	*	4	2325	1146	0.	*	6	1705	1646	0.
1	1210	147	671.	*	3	0550	647	0.	*	4	2330	1147	0.	*	6	1710	1647	0.
1	1215	148	814.	*	3	0555	648	0.	*	4	2335	1148	0.	*	6	1715	1648	0.
1	1220	149	938.	*	3	0600	649	0.	*	4	2340	1149	0.	*	6	1720	1649	0.
1	1225	150	1108.	*	3	0605	650	0.	*	4	2345	1150	0.	*	6	1725	1650	0.
1	1230	151	1222.	*	3	0610	651	0.	*	4	2350	1151	0.	*	6	1730	1651	0.
1	1235	152	1217.	*	3	0615	652	0.	*	4	2355	1152	0.	*	6	1735	1652	0.
1	1240	153	1054.	*	3	0620	653	0.	*	5	0000	1153	0.	*	6	1740	1653	0.
1	1245	154	855.	*	3	0625	654	0.	*	5	0005	1154	0.	*	6	1745	1654	0.
1	1250	155	702.	*	3	0630	655	0.	*	5	0010	1155	0.	*	6	1750	1655	0.
1	1255	156	563.	*	3	0635	656	0.	*	5	0015	1156	0.	*	6	1755	1656	0.
1	1300	157	424.	*	3	0640	657	0.	*	5	0020	1157	0.	*	6	1800	1657	0.
1	1305	158	304.	*	3	0645	658	0.	*	5	0025	1158	0.	*	6	1805	1658	0.
1	1310	159	213.	*	3	0650	659	0.	*	5	0030	1159	0.	*	6	1810	1659	0.
1	1315	160	161.	*	3	0655	660	0.	*	5	0035	1160	0.	*	6	1815	1660	0.
1	1320	161	127.	*	3	0700	661	0.	*	5	0040	1161	0.	*	6	1820	1661	0.
1	1325	162	86.	*	3	0705	662	0.	*	5	0045	1162	0.	*	6	1825	1662	0.
1	1330	163	63.	*	3	0710	663	0.	*	5	0050	1163	0.	*	6	1830	1663	0.
1	1335	164	45.	*	3	0715	664	0.	*	5	0055	1164	0.	*	6	1835	1664	0.
1	1340	165	42.	*	3	0720	665	0.	*	5	0100	1165	0.	*	6	1840	1665	0.
1	1345	166	40.	*	3	0725	666	0.	*	5	0105	1166	0.	*	6	1845	1666	0.
1	1350	167	37.	*	3	0730	667	0.	*	5	0110	1167	0.	*	6	1850	1667	0.
1	1355	168	27.	*	3	0735	668	0.	*	5	0115	1168	0.	*	6	1855	1668	0.
1	1400	169	16.	*	3	0740	669	0.	*	5	0120	1169	0.	*	6	1900	1669	0.
1	1405	170	6.	*	3	0745	670	0.	*	5	0125	1170	0.	*	6	1905	1670	0.
1	1410	171	5.	*	3	0750	671	0.	*	5	0130	1171	0.	*	6	1910	1671	0.
1	1415	172	5.	*	3	0755	672	0.	*	5	0135	1172	0.	*	6	1915	1672	0.
1	1420	173	5.	*	3	0800	673	0.	*	5	0140	1173	0.	*	6	1920	1673	0.
1	1425	174	5.	*	3	0805	674	0.	*	5	0145	1174	0.	*	6	1925	1674	0.
1	1430	175	4.	*	3	0810	675	0.	*	5	0150	1175	0.	*	6	1930	1675	0.
1	1435	176	4.	*	3	0815	676	0.	*	5	0155	1176	0.	*	6	1935	1676	0.
1	1440	177	4.	*	3	0820	677	0.	*	5	0200	1177	0.	*	6	1940	1677	0.
1	1445	178	4.	*	3	0825	678	0.	*	5	0205	1178	0.	*	6	1945	1678	0.
1	1450	179	4.	*	3	0830	679	0.	*	5	0210	1179	0.	*	6	1950	1679	0.
1	1455	180	4.	*	3	0835	680	0.	*	5	0215	1180	0.	*	6	1955	1680	0.
1	1500	181	4.	*	3	0840	681	0.	*	5	0220	1181	0.	*	6	2000	1681	0.
1	1505	182	3.	*	3	0845	682	0.	*	5	0225	1182	0.	*	6	2005	1682	0.
1	1510	183	3.	*	3	0850	683	0.	*	5	0230	1183	0.	*	6	2010	1683	0.
1	1515	184	3.	*	3	0855	684	0.	*	5	0235	1184	0.	*	6	2015	1684	0.
1	1520	185	3.	*	3	0900	685	0.	*	5	0240	1185	0.	*	6	2020	1685	0.
1	1525	186	3.	*	3	0905	686	0.	*	5	0245	1186	0.	*	6	2025	1686	0.
1	1530	187	3.	*	3	0910	687	0.	*	5	0250	1187	0.	*	6	2030	1687	0.
1	1535	188	3.	*	3	0915	688	0.	*	5	0255	1188	0.	*	6	2035	1688	0.
1	1540	189	3.	*	3	0920	689	0.	*	5	0300	1189	0.	*	6	2040	1689	0.
1	1545	190	3.	*	3	0925	690	0.	*	5	0305	1190	0.	*	6	2045	1690	0.
1	1550	191	3.	*	3	0930	691	0.	*	5	0310	1191	0.	*	6	2050	1691	0.
1	1555	192	3.	*	3	0935	692	0.	*	5	0315	1192	0.	*	6	2055	1692	0.
1	1600	193	3.	*	3	0940	693	0.	*	5	0320	1193	0.	*	6	2100	1693	0.
1	1605	194	3.	*	3	0945	694	0.	*	5	0325	1194	0.	*	6	2105	1694	0.
1	1610	195	3.	*	3	0950	695	0.	*	5	0330	1195	0.	*	6	2110	1695	0.
1	1615	196	3.	*	3	0955	696	0.	*	5	0335	1196	0.	*	6	2115	1696	0.
1	1620	197	3.	*	3	1000	697	0.	*	5	0340	1197	0.	*	6	2120	1697	0.
1	1625	198	3.	*	3	1005	698	0.	*	5	0345	1198	0.	*	6	2125	1698	0.
1	1630	199	3.	*	3	1010	699	0.	*	5	0350	1199	0.	*	6	2130	1699	0.
1	1635	200	2.	*	3	1015	700	0.	*	5	0355	1200	0.	*	6	2135	1700	0.
1	1640	201	2.	*	3	1020	701	0.	*	5	0400	1201	0.	*	6	2140	1701	0.
1	1645	202	2.	*	3	1025	702	0.	*	5	0405	1202	0.	*	6	2145	1702	0.
1	1650	203	2.	*	3	1030	703	0.	*	5	0410	1203	0.	*	6	2150	1703	0.
1	1655	204	2.	*	3	1035	704	0.	*	5	0415	1204	0.	*	6	2155	1704	0.
1	1700	205	2.	*	3	1040	705	0.	*	5	0420	1205	0.	*	6	2200	1705	0.
1	1705	206	2.	*	3	1045	706	0.	*	5	0425	1206	0.	*	6	2205	1706	0.
1	1710	207	2.	*	3	1050	707	0.	*	5	0430	1207	0.	*	6	2210	1707	0.
1	1715	208	2.	*	3	1055	708	0.	*	5	0435	1208	0.	*	6	2215	1708	0.
1	1720	209	2.	*	3	1100	709	0.	*	5	0440	1209	0.	*	6	2220	1709	0.
1	1725	210	2.	*	3	1105	710	0.	*	5	0445	1210	0.	*	6	2225	1710	0.
1	1730	211	2.	*	3	1110	711	0.	*	5	0450	1211	0.	*	6	2230	1711	0.
1	1735	212	2.	*	3	1115	712	0.	*	5	0455	1212	0.	*	6	2235	1712	0.
1	1740	213	2.	*	3	1120	713	0.	*	5	0500	1213	0.	*	6	2240	1713	0.
1	1745	214	2.	*	3	1125	714	0.	*	5	0505	1214	0.	*	6	2245	1714	0.
1	1750	215	2.	*	3	1130	715	0.	*	5	0510	1215	0.	*	6	2250	1715	0.
1	1755	216	2.	*	3	1135	716	0.	*	5	0515	1216	0.	*	6	2255	1716	0.
1	1800	217	2.	*	3	1140	717	0.	*	5	0520	1217	0.	*	6	2300	1717	0.
1	1805	218	2.	*	3	1145	718	0.	*	5	0525	1218	0.	*	6	2305	1718	0.
1	1810	219	2.	*	3	1150	719	0.	*	5	0530	1219	0.	*	6	2310	1719	0.
1	1815	220	2.	*	3	1155	720	0.	*	5	0535	1220	0.	*	6	2315	1720	0.
1	1820	221	2.	*	3	1200	721	0.	*	5	0540	1221	0.	*	6	2320	1721	0.
1	1825	222	2.	*	3	1205	722	0.	*	5	0545	1222	0.	*	6	2325	1722	0.
1	1830	223	2.	*	3	1210	723	0.	*	5	0550	1223	0.	*	6	2330	1723	0.
1	1835	224	2.	*	3	1215	724	0.	*	5	0555	1224	0.	*	6	2335	1724	0.
1	1840	225	2.	*	3	1220	725	0.	*	5	0600	1225	0.	*	6	2340	1725	0.
1	1845	226	2.	*	3	1225	726	0.	*	5	0605	1226	0.	*	6	2345	1726	0.
1	1850	227	2.	*	3	1230	727	0.	*	5	0610	1227	0.	*	6	2350	1727	0.
1	1855	228	2.	*	3	1235	728	0.	*	5	0615	1228	0.	*	6	2355	1728	0.
1	1900	229	2.	*	3	1240	729	0.	*	5	0620	1229	0.	*	7	0000	1729	0.
1	1905	230	2.	*	3	1245	730	0.	*	5	0625	1230	0.	*	7	0005	1730	0.
1	1910	231	2.	*	3	1250	731	0.	*	5	0630	1231	0.	*	7	0010	1731	0.
1	1915	232	2.	*	3	1255	732	0.	*	5	0635	1232	0.	*	7	0015	1732	0.
1	1920	233	2.	*	3	1300	733	0.	*	5	0640	1233	0.	*	7	0020	1733	0.
1	1925	234	2.	*	3	1305	734	0.	*	5	0645	1234	0.	*	7	0025	1734	0.
1	1930	235	2.	*	3	1310	735	0.	*	5	0650	1235	0.	*	7	0030	1735	0.
1	1935	236	2.	*	3	1315	736	0.	*	5	0655	1236	0.	*	7	0035	1736	0.
1	1940	237	2.	*	3	1320	737	0.	*	5	0700	1237	0.	*	7	0040	1737	0.
1	1945	238	2.	*	3	1325	738	0.	*	5	0705	1238	0.	*	7	0045	1738	0.
1	1950	239	2.	*	3	1330	739	0.	*	5	0710	1239	0.	*	7	0050	1739	0.

1	1955	240	2.	*	3	1335	740	0.	*	5	0715	1240	0.	*	7	0055	1740	0.
1	2000	241	2.	*	3	1340	741	0.	*	5	0720	1241	0.	*	7	0100	1741	0.
1	2005	242	2.	*	3	1345	742	0.	*	5	0725	1242	0.	*	7	0105	1742	0.
1	2010	243	2.	*	3	1350	743	0.	*	5	0730	1243	0.	*	7	0110	1743	0.
1	2015	244	2.	*	3	1355	744	0.	*	5	0735	1244	0.	*	7	0115	1744	0.
1	2020	245	2.	*	3	1400	745	0.	*	5	0740	1245	0.	*	7	0120	1745	0.
1	2025	246	1.	*	3	1405	746	0.	*	5	0745	1246	0.	*	7	0125	1746	0.
1	2030	247	1.	*	3	1410	747	0.	*	5	0750	1247	0.	*	7	0130	1747	0.
1	2035	248	1.	*	3	1415	748	0.	*	5	0755	1248	0.	*	7	0135	1748	0.
1	2040	249	1.	*	3	1420	749	0.	*	5	0800	1249	0.	*	7	0140	1749	0.
1	2045	250	1.	*	3	1425	750	0.	*	5	0805	1250	0.	*	7	0145	1750	0.
1	2050	251	1.	*	3	1430	751	0.	*	5	0810	1251	0.	*	7	0150	1751	0.
1	2055	252	1.	*	3	1435	752	0.	*	5	0815	1252	0.	*	7	0155	1752	0.
1	2100	253	1.	*	3	1440	753	0.	*	5	0820	1253	0.	*	7	0200	1753	0.
1	2105	254	1.	*	3	1445	754	0.	*	5	0825	1254	0.	*	7	0205	1754	0.
1	2110	255	1.	*	3	1450	755	0.	*	5	0830	1255	0.	*	7	0210	1755	0.
1	2115	256	1.	*	3	1455	756	0.	*	5	0835	1256	0.	*	7	0215	1756	0.
1	2120	257	1.	*	3	1500	757	0.	*	5	0840	1257	0.	*	7	0220	1757	0.
1	2125	258	1.	*	3	1505	758	0.	*	5	0845	1258	0.	*	7	0225	1758	0.
1	2130	259	1.	*	3	1510	759	0.	*	5	0850	1259	0.	*	7	0230	1759	0.
1	2135	260	1.	*	3	1515	760	0.	*	5	0855	1260	0.	*	7	0235	1760	0.
1	2140	261	1.	*	3	1520	761	0.	*	5	0900	1261	0.	*	7	0240	1761	0.
1	2145	262	1.	*	3	1525	762	0.	*	5	0905	1262	0.	*	7	0245	1762	0.
1	2150	263	1.	*	3	1530	763	0.	*	5	0910	1263	0.	*	7	0250	1763	0.
1	2155	264	1.	*	3	1535	764	0.	*	5	0915	1264	0.	*	7	0255	1764	0.
1	2200	265	1.	*	3	1540	765	0.	*	5	0920	1265	0.	*	7	0300	1765	0.
1	2205	266	1.	*	3	1545	766	0.	*	5	0925	1266	0.	*	7	0305	1766	0.
1	2210	267	1.	*	3	1550	767	0.	*	5	0930	1267	0.	*	7	0310	1767	0.
1	2215	268	1.	*	3	1555	768	0.	*	5	0935	1268	0.	*	7	0315	1768	0.
1	2220	269	1.	*	3	1600	769	0.	*	5	0940	1269	0.	*	7	0320	1769	0.
1	2225	270	1.	*	3	1605	770	0.	*	5	0945	1270	0.	*	7	0325	1770	0.
1	2230	271	1.	*	3	1610	771	0.	*	5	0950	1271	0.	*	7	0330	1771	0.
1	2235	272	1.	*	3	1615	772	0.	*	5	0955	1272	0.	*	7	0335	1772	0.
1	2240	273	1.	*	3	1620	773	0.	*	5	1000	1273	0.	*	7	0340	1773	0.
1	2245	274	1.	*	3	1625	774	0.	*	5	1005	1274	0.	*	7	0345	1774	0.
1	2250	275	1.	*	3	1630	775	0.	*	5	1010	1275	0.	*	7	0350	1775	0.
1	2255	276	1.	*	3	1635	776	0.	*	5	1015	1276	0.	*	7	0355	1776	0.
1	2300	277	1.	*	3	1640	777	0.	*	5	1020	1277	0.	*	7	0400	1777	0.
1	2305	278	1.	*	3	1645	778	0.	*	5	1025	1278	0.	*	7	0405	1778	0.
1	2310	279	1.	*	3	1650	779	0.	*	5	1030	1279	0.	*	7	0410	1779	0.
1	2315	280	1.	*	3	1655	780	0.	*	5	1035	1280	0.	*	7	0415	1780	0.
1	2320	281	1.	*	3	1700	781	0.	*	5	1040	1281	0.	*	7	0420	1781	0.
1	2325	282	1.	*	3	1705	782	0.	*	5	1045	1282	0.	*	7	0425	1782	0.
1	2330	283	1.	*	3	1710	783	0.	*	5	1050	1283	0.	*	7	0430	1783	0.
1	2335	284	1.	*	3	1715	784	0.	*	5	1055	1284	0.	*	7	0435	1784	0.
1	2340	285	1.	*	3	1720	785	0.	*	5	1100	1285	0.	*	7	0440	1785	0.
1	2345	286	1.	*	3	1725	786	0.	*	5	1105	1286	0.	*	7	0445	1786	0.
1	2350	287	1.	*	3	1730	787	0.	*	5	1110	1287	0.	*	7	0450	1787	0.
1	2355	288	1.	*	3	1735	788	0.	*	5	1115	1288	0.	*	7	0455	1788	0.
2	0000	289	1.	*	3	1740	789	0.	*	5	1120	1289	0.	*	7	0500	1789	0.
2	0005	290	1.	*	3	1745	790	0.	*	5	1125	1290	0.	*	7	0505	1790	0.
2	0010	291	1.	*	3	1750	791	0.	*	5	1130	1291	0.	*	7	0510	1791	0.
2	0015	292	1.	*	3	1755	792	0.	*	5	1135	1292	0.	*	7	0515	1792	0.
2	0020	293	1.	*	3	1800	793	0.	*	5	1140	1293	0.	*	7	0520	1793	0.
2	0025	294	1.	*	3	1805	794	0.	*	5	1145	1294	0.	*	7	0525	1794	0.
2	0030	295	1.	*	3	1810	795	0.	*	5	1150	1295	0.	*	7	0530	1795	0.
2	0035	296	1.	*	3	1815	796	0.	*	5	1155	1296	0.	*	7	0535	1796	0.
2	0040	297	1.	*	3	1820	797	0.	*	5	1200	1297	0.	*	7	0540	1797	0.
2	0045	298	0.	*	3	1825	798	0.	*	5	1205	1298	0.	*	7	0545	1798	0.
2	0050	299	0.	*	3	1830	799	0.	*	5	1210	1299	0.	*	7	0550	1799	0.
2	0055	300	0.	*	3	1835	800	0.	*	5	1215	1300	0.	*	7	0555	1800	0.
2	0100	301	0.	*	3	1840	801	0.	*	5	1220	1301	0.	*	7	0600	1801	0.
2	0105	302	0.	*	3	1845	802	0.	*	5	1225	1302	0.	*	7	0605	1802	0.
2	0110	303	0.	*	3	1850	803	0.	*	5	1230	1303	0.	*	7	0610	1803	0.
2	0115	304	0.	*	3	1855	804	0.	*	5	1235	1304	0.	*	7	0615	1804	0.
2	0120	305	0.	*	3	1900	805	0.	*	5	1240	1305	0.	*	7	0620	1805	0.
2	0125	306	0.	*	3	1905	806	0.	*	5	1245	1306	0.	*	7	0625	1806	0.
2	0130	307	0.	*	3	1910	807	0.	*	5	1250	1307	0.	*	7	0630	1807	0.
2	0135	308	0.	*	3	1915	808	0.	*	5	1255	1308	0.	*	7	0635	1808	0.
2	0140	309	0.	*	3	1920	809	0.	*	5	1300	1309	0.	*	7	0640	1809	0.
2	0145	310	0.	*	3	1925	810	0.	*	5	1305	1310	0.	*	7	0645	1810	0.
2	0150	311	0.	*	3	1930	811	0.	*	5	1310	1311	0.	*	7	0650	1811	0.
2	0155	312	0.	*	3	1935	812	0.	*	5	1315	1312	0.	*	7	0655	1812	0.
2	0200	313	0.	*	3	1940	813	0.	*	5	1320	1313	0.	*	7	0700	1813	0.
2	0205	314	0.	*	3	1945	814	0.	*	5	1325	1314	0.	*	7	0705	1814	0.
2	0210	315	0.	*	3	1950	815	0.	*	5	1330	1315	0.	*	7	0710	1815	0.
2	0215	316	0.	*	3	1955	816	0.	*	5	1335	1316	0.	*	7	0715	1816	0.
2	0220	317	0.	*	3	2000	817	0.	*	5	1340	1317	0.	*	7	0720	1817	0.
2	0225	318	0.	*	3	2005	818	0.	*	5	1345	1318	0.	*	7	0725	1818	0.
2	0230	319	0.	*	3	2010	819	0.	*	5	1350	1319	0.	*	7	0730	1819	0.
2	0235	320	0.	*	3	2015	820	0.	*	5	1355	1320	0.	*	7	0735	1820	0.
2	0240	321	0.	*	3	2020	821	0.	*	5	1400	1321	0.	*	7	0740	1821	0.
2	0245	322	0.	*	3	2025	822	0.	*	5	1405	1322	0.	*	7	0745	1822	0.
2	0250	323	0.	*	3	2030	823	0.	*	5	1410	1323	0.	*	7	0750	1823	0.
2	0255	324	0.	*	3	2035	824	0.	*	5	1415	1324	0.	*	7	0755	1824	0.
2	0300	325	0.	*	3	2040	825	0.	*	5	1420	1325	0.	*	7	0800	1825	0.
2	0305	326	0.	*	3	2045	826	0.	*	5	1425	1326	0.	*	7	0805	1826	0.
2	0310	327	0.	*	3	2050	827	0.	*	5	1430	1327	0.	*	7	0810	1827	0.
2	0315	328	0.	*	3	2055	828	0.	*	5	1435	1328	0.	*	7	0815	1828	0.
2	0320	329	0.	*	3	2100	829	0.	*	5	1440	1329	0.	*	7	0820	1829	0.
2	0325	330	0.	*	3	2105	830	0.	*	5	1445	1330	0.	*	7	0825	1830	0.
2	0330	331	0.	*	3	2110	831	0.	*	5	1450	1331	0.	*	7	0830	1831	0.
2	0335	332	0.	*	3	2115	832	0.	*	5	1455	1332	0.	*	7	0835	1832	0.
2	0340	333	0.	*	3	2120	833	0.	*	5	1500	1333	0.	*	7	0840	1833	0.
2	0345	334	0.	*	3	2125	834	0.	*	5	1505	1334	0.	*	7	0845	1834	0.

2	0350	335	0.	*	3	2130	835	0.	*	5	1510	1335	0.	*	7	0850	1835	0.
2	0355	336	0.	*	3	2135	836	0.	*	5	1515	1336	0.	*	7	0855	1836	0.
2	0400	337	0.	*	3	2140	837	0.	*	5	1520	1337	0.	*	7	0900	1837	0.
2	0405	338	0.	*	3	2145	838	0.	*	5	1525	1338	0.	*	7	0905	1838	0.
2	0410	339	0.	*	3	2150	839	0.	*	5	1530	1339	0.	*	7	0910	1839	0.
2	0415	340	0.	*	3	2155	840	0.	*	5	1535	1340	0.	*	7	0915	1840	0.
2	0420	341	0.	*	3	2200	841	0.	*	5	1540	1341	0.	*	7	0920	1841	0.
2	0425	342	0.	*	3	2205	842	0.	*	5	1545	1342	0.	*	7	0925	1842	0.
2	0430	343	0.	*	3	2210	843	0.	*	5	1550	1343	0.	*	7	0930	1843	0.
2	0435	344	0.	*	3	2215	844	0.	*	5	1555	1344	0.	*	7	0935	1844	0.
2	0440	345	0.	*	3	2220	845	0.	*	5	1600	1345	0.	*	7	0940	1845	0.
2	0445	346	0.	*	3	2225	846	0.	*	5	1605	1346	0.	*	7	0945	1846	0.
2	0450	347	0.	*	3	2230	847	0.	*	5	1610	1347	0.	*	7	0950	1847	0.
2	0455	348	0.	*	3	2235	848	0.	*	5	1615	1348	0.	*	7	0955	1848	0.
2	0500	349	0.	*	3	2240	849	0.	*	5	1620	1349	0.	*	7	1000	1849	0.
2	0505	350	0.	*	3	2245	850	0.	*	5	1625	1350	0.	*	7	1005	1850	0.
2	0510	351	0.	*	3	2250	851	0.	*	5	1630	1351	0.	*	7	1010	1851	0.
2	0515	352	0.	*	3	2255	852	0.	*	5	1635	1352	0.	*	7	1015	1852	0.
2	0520	353	0.	*	3	2300	853	0.	*	5	1640	1353	0.	*	7	1020	1853	0.
2	0525	354	0.	*	3	2305	854	0.	*	5	1645	1354	0.	*	7	1025	1854	0.
2	0530	355	0.	*	3	2310	855	0.	*	5	1650	1355	0.	*	7	1030	1855	0.
2	0535	356	0.	*	3	2315	856	0.	*	5	1655	1356	0.	*	7	1035	1856	0.
2	0540	357	0.	*	3	2320	857	0.	*	5	1700	1357	0.	*	7	1040	1857	0.
2	0545	358	0.	*	3	2325	858	0.	*	5	1705	1358	0.	*	7	1045	1858	0.
2	0550	359	0.	*	3	2330	859	0.	*	5	1710	1359	0.	*	7	1050	1859	0.
2	0555	360	0.	*	3	2335	860	0.	*	5	1715	1360	0.	*	7	1055	1860	0.
2	0600	361	0.	*	3	2340	861	0.	*	5	1720	1361	0.	*	7	1100	1861	0.
2	0605	362	0.	*	3	2345	862	0.	*	5	1725	1362	0.	*	7	1105	1862	0.
2	0610	363	0.	*	3	2350	863	0.	*	5	1730	1363	0.	*	7	1110	1863	0.
2	0615	364	0.	*	3	2355	864	0.	*	5	1735	1364	0.	*	7	1115	1864	0.
2	0620	365	0.	*	4	0000	865	0.	*	5	1740	1365	0.	*	7	1120	1865	0.
2	0625	366	0.	*	4	0005	866	0.	*	5	1745	1366	0.	*	7	1125	1866	0.
2	0630	367	0.	*	4	0010	867	0.	*	5	1750	1367	0.	*	7	1130	1867	0.
2	0635	368	0.	*	4	0015	868	0.	*	5	1755	1368	0.	*	7	1135	1868	0.
2	0640	369	0.	*	4	0020	869	0.	*	5	1800	1369	0.	*	7	1140	1869	0.
2	0645	370	0.	*	4	0025	870	0.	*	5	1805	1370	0.	*	7	1145	1870	0.
2	0650	371	0.	*	4	0030	871	0.	*	5	1810	1371	0.	*	7	1150	1871	0.
2	0655	372	0.	*	4	0035	872	0.	*	5	1815	1372	0.	*	7	1155	1872	0.
2	0700	373	0.	*	4	0040	873	0.	*	5	1820	1373	0.	*	7	1200	1873	0.
2	0705	374	0.	*	4	0045	874	0.	*	5	1825	1374	0.	*	7	1205	1874	0.
2	0710	375	0.	*	4	0050	875	0.	*	5	1830	1375	0.	*	7	1210	1875	0.
2	0715	376	0.	*	4	0055	876	0.	*	5	1835	1376	0.	*	7	1215	1876	0.
2	0720	377	0.	*	4	0100	877	0.	*	5	1840	1377	0.	*	7	1220	1877	0.
2	0725	378	0.	*	4	0105	878	0.	*	5	1845	1378	0.	*	7	1225	1878	0.
2	0730	379	0.	*	4	0110	879	0.	*	5	1850	1379	0.	*	7	1230	1879	0.
2	0735	380	0.	*	4	0115	880	0.	*	5	1855	1380	0.	*	7	1235	1880	0.
2	0740	381	0.	*	4	0120	881	0.	*	5	1900	1381	0.	*	7	1240	1881	0.
2	0745	382	0.	*	4	0125	882	0.	*	5	1905	1382	0.	*	7	1245	1882	0.
2	0750	383	0.	*	4	0130	883	0.	*	5	1910	1383	0.	*	7	1250	1883	0.
2	0755	384	0.	*	4	0135	884	0.	*	5	1915	1384	0.	*	7	1255	1884	0.
2	0800	385	0.	*	4	0140	885	0.	*	5	1920	1385	0.	*	7	1300	1885	0.
2	0805	386	0.	*	4	0145	886	0.	*	5	1925	1386	0.	*	7	1305	1886	0.
2	0810	387	0.	*	4	0150	887	0.	*	5	1930	1387	0.	*	7	1310	1887	0.
2	0815	388	0.	*	4	0155	888	0.	*	5	1935	1388	0.	*	7	1315	1888	0.
2	0820	389	0.	*	4	0200	889	0.	*	5	1940	1389	0.	*	7	1320	1889	0.
2	0825	390	0.	*	4	0205	890	0.	*	5	1945	1390	0.	*	7	1325	1890	0.
2	0830	391	0.	*	4	0210	891	0.	*	5	1950	1391	0.	*	7	1330	1891	0.
2	0835	392	0.	*	4	0215	892	0.	*	5	1955	1392	0.	*	7	1335	1892	0.
2	0840	393	0.	*	4	0220	893	0.	*	5	2000	1393	0.	*	7	1340	1893	0.
2	0845	394	0.	*	4	0225	894	0.	*	5	2005	1394	0.	*	7	1345	1894	0.
2	0850	395	0.	*	4	0230	895	0.	*	5	2010	1395	0.	*	7	1350	1895	0.
2	0855	396	0.	*	4	0235	896	0.	*	5	2015	1396	0.	*	7	1355	1896	0.
2	0900	397	0.	*	4	0240	897	0.	*	5	2020	1397	0.	*	7	1400	1897	0.
2	0905	398	0.	*	4	0245	898	0.	*	5	2025	1398	0.	*	7	1405	1898	0.
2	0910	399	0.	*	4	0250	899	0.	*	5	2030	1399	0.	*	7	1410	1899	0.
2	0915	400	0.	*	4	0255	900	0.	*	5	2035	1400	0.	*	7	1415	1900	0.
2	0920	401	0.	*	4	0300	901	0.	*	5	2040	1401	0.	*	7	1420	1901	0.
2	0925	402	0.	*	4	0305	902	0.	*	5	2045	1402	0.	*	7	1425	1902	0.
2	0930	403	0.	*	4	0310	903	0.	*	5	2050	1403	0.	*	7	1430	1903	0.
2	0935	404	0.	*	4	0315	904	0.	*	5	2055	1404	0.	*	7	1435	1904	0.
2	0940	405	0.	*	4	0320	905	0.	*	5	2100	1405	0.	*	7	1440	1905	0.
2	0945	406	0.	*	4	0325	906	0.	*	5	2105	1406	0.	*	7	1445	1906	0.
2	0950	407	0.	*	4	0330	907	0.	*	5	2110	1407	0.	*	7	1450	1907	0.
2	0955	408	0.	*	4	0335	908	0.	*	5	2115	1408	0.	*	7	1455	1908	0.
2	1000	409	0.	*	4	0340	909	0.	*	5	2120	1409	0.	*	7	1500	1909	0.
2	1005	410	0.	*	4	0345	910	0.	*	5	2125	1410	0.	*	7	1505	1910	0.
2	1010	411	0.	*	4	0350	911	0.	*	5	2130	1411	0.	*	7	1510	1911	0.
2	1015	412	0.	*	4	0355	912	0.	*	5	2135	1412	0.	*	7	1515	1912	0.
2	1020	413	0.	*	4	0400	913	0.	*	5	2140	1413	0.	*	7	1520	1913	0.
2	1025	414	0.	*	4	0405	914	0.	*	5	2145	1414	0.	*	7	1525	1914	0.
2	1030	415	0.	*	4	0410	915	0.	*	5	2150	1415	0.	*	7	1530	1915	0.
2	1035	416	0.	*	4	0415	916	0.	*	5	2155	1416	0.	*	7	1535	1916	0.
2	1040	417	0.	*	4	0420	917	0.	*	5	2200	1417	0.	*	7	1540	1917	0.
2	1045	418	0.	*	4	0425	918	0.	*	5	2205	1418	0.	*	7	1545	1918	0.
2	1050	419	0.	*	4	0430	919	0.	*	5	2210	1419	0.	*	7	1550	1919	0.
2	1055	420	0.	*	4	0435	920	0.	*	5	2215	1420	0.	*	7	1555	1920	0.
2	1100	421	0.	*	4	0440	921	0.	*	5	2220	1421	0.	*	7	1600	1921	0.
2	1105	422	0.	*	4	0445	922	0.	*	5	2225	1422	0.	*	7	1605	1922	0.
2	1110	423	0.	*	4	0450	923	0.	*	5	2230	1423	0.	*	7	1610	1923	0.
2	1115	424	0.	*	4	0455	924	0.	*	5	2235	1424	0.	*	7	1615	1924	0.
2	1120	425	0.	*	4	0500	925	0.	*	5	2240	1425	0.	*	7	1620	1925	0.
2	1125	426	0.	*	4	0505	926	0.	*	5	2245	1426	0.	*	7	1625	1926	0.
2	1130	427	0.	*	4	0510	927	0.	*	5	2250	1427	0.	*	7	1630	1927	0.
2	1135	428	0.	*	4	0515	928	0.	*	5	2255	1428	0.	*	7	1635	1928	0.
2	1140	429	0.	*	4	0520	929	0.	*	5	2300	1429	0.	*	7	1640	1929	0.

2	1145	430	0.	*	4	0525	930	0.	*	5	2305	1430	0.	*	7	1645	1930	0.
2	1150	431	0.	*	4	0530	931	0.	*	5	2310	1431	0.	*	7	1650	1931	0.
2	1155	432	0.	*	4	0535	932	0.	*	5	2315	1432	0.	*	7	1655	1932	0.
2	1200	433	0.	*	4	0540	933	0.	*	5	2320	1433	0.	*	7	1700	1933	0.
2	1205	434	0.	*	4	0545	934	0.	*	5	2325	1434	0.	*	7	1705	1934	0.
2	1210	435	0.	*	4	0550	935	0.	*	5	2330	1435	0.	*	7	1710	1935	0.
2	1215	436	0.	*	4	0555	936	0.	*	5	2335	1436	0.	*	7	1715	1936	0.
2	1220	437	0.	*	4	0600	937	0.	*	5	2340	1437	0.	*	7	1720	1937	0.
2	1225	438	0.	*	4	0605	938	0.	*	5	2345	1438	0.	*	7	1725	1938	0.
2	1230	439	0.	*	4	0610	939	0.	*	5	2350	1439	0.	*	7	1730	1939	0.
2	1235	440	0.	*	4	0615	940	0.	*	5	2355	1440	0.	*	7	1735	1940	0.
2	1240	441	0.	*	4	0620	941	0.	*	6	0000	1441	0.	*	7	1740	1941	0.
2	1245	442	0.	*	4	0625	942	0.	*	6	0005	1442	0.	*	7	1745	1942	0.
2	1250	443	0.	*	4	0630	943	0.	*	6	0010	1443	0.	*	7	1750	1943	0.
2	1255	444	0.	*	4	0635	944	0.	*	6	0015	1444	0.	*	7	1755	1944	0.
2	1300	445	0.	*	4	0640	945	0.	*	6	0020	1445	0.	*	7	1800	1945	0.
2	1305	446	0.	*	4	0645	946	0.	*	6	0025	1446	0.	*	7	1805	1946	0.
2	1310	447	0.	*	4	0650	947	0.	*	6	0030	1447	0.	*	7	1810	1947	0.
2	1315	448	0.	*	4	0655	948	0.	*	6	0035	1448	0.	*	7	1815	1948	0.
2	1320	449	0.	*	4	0700	949	0.	*	6	0040	1449	0.	*	7	1820	1949	0.
2	1325	450	0.	*	4	0705	950	0.	*	6	0045	1450	0.	*	7	1825	1950	0.
2	1330	451	0.	*	4	0710	951	0.	*	6	0050	1451	0.	*	7	1830	1951	0.
2	1335	452	0.	*	4	0715	952	0.	*	6	0055	1452	0.	*	7	1835	1952	0.
2	1340	453	0.	*	4	0720	953	0.	*	6	0100	1453	0.	*	7	1840	1953	0.
2	1345	454	0.	*	4	0725	954	0.	*	6	0105	1454	0.	*	7	1845	1954	0.
2	1350	455	0.	*	4	0730	955	0.	*	6	0110	1455	0.	*	7	1850	1955	0.
2	1355	456	0.	*	4	0735	956	0.	*	6	0115	1456	0.	*	7	1855	1956	0.
2	1400	457	0.	*	4	0740	957	0.	*	6	0120	1457	0.	*	7	1900	1957	0.
2	1405	458	0.	*	4	0745	958	0.	*	6	0125	1458	0.	*	7	1905	1958	0.
2	1410	459	0.	*	4	0750	959	0.	*	6	0130	1459	0.	*	7	1910	1959	0.
2	1415	460	0.	*	4	0755	960	0.	*	6	0135	1460	0.	*	7	1915	1960	0.
2	1420	461	0.	*	4	0800	961	0.	*	6	0140	1461	0.	*	7	1920	1961	0.
2	1425	462	0.	*	4	0805	962	0.	*	6	0145	1462	0.	*	7	1925	1962	0.
2	1430	463	0.	*	4	0810	963	0.	*	6	0150	1463	0.	*	7	1930	1963	0.
2	1435	464	0.	*	4	0815	964	0.	*	6	0155	1464	0.	*	7	1935	1964	0.
2	1440	465	0.	*	4	0820	965	0.	*	6	0200	1465	0.	*	7	1940	1965	0.
2	1445	466	0.	*	4	0825	966	0.	*	6	0205	1466	0.	*	7	1945	1966	0.
2	1450	467	0.	*	4	0830	967	0.	*	6	0210	1467	0.	*	7	1950	1967	0.
2	1455	468	0.	*	4	0835	968	0.	*	6	0215	1468	0.	*	7	1955	1968	0.
2	1500	469	0.	*	4	0840	969	0.	*	6	0220	1469	0.	*	7	2000	1969	0.
2	1505	470	0.	*	4	0845	970	0.	*	6	0225	1470	0.	*	7	2005	1970	0.
2	1510	471	0.	*	4	0850	971	0.	*	6	0230	1471	0.	*	7	2010	1971	0.
2	1515	472	0.	*	4	0855	972	0.	*	6	0235	1472	0.	*	7	2015	1972	0.
2	1520	473	0.	*	4	0900	973	0.	*	6	0240	1473	0.	*	7	2020	1973	0.
2	1525	474	0.	*	4	0905	974	0.	*	6	0245	1474	0.	*	7	2025	1974	0.
2	1530	475	0.	*	4	0910	975	0.	*	6	0250	1475	0.	*	7	2030	1975	0.
2	1535	476	0.	*	4	0915	976	0.	*	6	0255	1476	0.	*	7	2035	1976	0.
2	1540	477	0.	*	4	0920	977	0.	*	6	0300	1477	0.	*	7	2040	1977	0.
2	1545	478	0.	*	4	0925	978	0.	*	6	0305	1478	0.	*	7	2045	1978	0.
2	1550	479	0.	*	4	0930	979	0.	*	6	0310	1479	0.	*	7	2050	1979	0.
2	1555	480	0.	*	4	0935	980	0.	*	6	0315	1480	0.	*	7	2055	1980	0.
2	1600	481	0.	*	4	0940	981	0.	*	6	0320	1481	0.	*	7	2100	1981	0.
2	1605	482	0.	*	4	0945	982	0.	*	6	0325	1482	0.	*	7	2105	1982	0.
2	1610	483	0.	*	4	0950	983	0.	*	6	0330	1483	0.	*	7	2110	1983	0.
2	1615	484	0.	*	4	0955	984	0.	*	6	0335	1484	0.	*	7	2115	1984	0.
2	1620	485	0.	*	4	1000	985	0.	*	6	0340	1485	0.	*	7	2120	1985	0.
2	1625	486	0.	*	4	1005	986	0.	*	6	0345	1486	0.	*	7	2125	1986	0.
2	1630	487	0.	*	4	1010	987	0.	*	6	0350	1487	0.	*	7	2130	1987	0.
2	1635	488	0.	*	4	1015	988	0.	*	6	0355	1488	0.	*	7	2135	1988	0.
2	1640	489	0.	*	4	1020	989	0.	*	6	0400	1489	0.	*	7	2140	1989	0.
2	1645	490	0.	*	4	1025	990	0.	*	6	0405	1490	0.	*	7	2145	1990	0.
2	1650	491	0.	*	4	1030	991	0.	*	6	0410	1491	0.	*	7	2150	1991	0.
2	1655	492	0.	*	4	1035	992	0.	*	6	0415	1492	0.	*	7	2155	1992	0.
2	1700	493	0.	*	4	1040	993	0.	*	6	0420	1493	0.	*	7	2200	1993	0.
2	1705	494	0.	*	4	1045	994	0.	*	6	0425	1494	0.	*	7	2205	1994	0.
2	1710	495	0.	*	4	1050	995	0.	*	6	0430	1495	0.	*	7	2210	1995	0.
2	1715	496	0.	*	4	1055	996	0.	*	6	0435	1496	0.	*	7	2215	1996	0.
2	1720	497	0.	*	4	1100	997	0.	*	6	0440	1497	0.	*	7	2220	1997	0.
2	1725	498	0.	*	4	1105	998	0.	*	6	0445	1498	0.	*	7	2225	1998	0.
2	1730	499	0.	*	4	1110	999	0.	*	6	0450	1499	0.	*	7	2230	1999	0.
2	1735	500	0.	*	4	1115	1000	0.	*	6	0455	1500	0.	*	7	2235	2000	0.
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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1222.	12.50		168.	43.	14.	6.
		(INCHES)	1.131	1.165	1.165	1.165
		(AC-FT)	83.	86.	86.	86.

CUMULATIVE AREA = 1.38 SQ MI

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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1582.	12.50	224.	62.	21.	1.94		

+	ROUTED TO	RCP1	1395.	12.83	223.	62.	21.	1.94
+	HYDROGRAPH AT	2	1347.	12.75	239.	66.	22.	1.82
+	HYDROGRAPH AT	MD-1	731.	12.08	51.	13.	4.	.38
+	ROUTED TO	MD-10	58.	12.50	44.	13.	4.	.38
+	ROUTED TO	RMD1	57.	12.67	44.	13.	4.	.38
+	3 COMBINED AT	CP2	2720.	12.75	496.	139.	46.	4.14
+	ROUTED TO	RCP2	2523.	12.92	495.	139.	46.	4.14
+	HYDROGRAPH AT	3A	317.	12.33	31.	8.	3.	.29
+	ROUTED TO	RCP3A	253.	12.50	31.	8.	3.	.29
+	HYDROGRAPH AT	3	870.	12.33	90.	22.	7.	.81
+	2 COMBINED AT	I1CP3	1056.	12.42	120.	30.	10.	1.10
+	2 COMBINED AT	CP3	2722.	12.92	611.	168.	56.	4.86 BEARDSLEY/WATERFALL AT OLIVE
+	DIVERSION TO	SIDEWR	1626.	12.92	322.	95.	32.	4.86
+	HYDROGRAPH AT	D3	1096.	12.92	289.	72.	24.	4.86
+	ROUTED TO	RCP3	1043.	13.08	289.	72.	24.	4.86 BEARDSLEY CANAL WASH (OLIVE TO CHOLLA)
+	HYDROGRAPH AT	4	400.	12.25	36.	10.	3.	.30
+	HYDROGRAPH AT	5	935.	12.25	86.	24.	8.	.72
+	2 COMBINED AT	CP5	1325.	12.25	122.	33.	11.	1.02
+	ROUTED TO	RCP5	1322.	12.25	122.	33.	11.	1.02
+	HYDROGRAPH AT	6	754.	12.08	53.	15.	5.	.45
+	2 COMBINED AT	CP6	1866.	12.17	173.	47.	16.	1.47
+	ROUTED TO	RCP6	1797.	12.17	173.	47.	16.	1.47
+	HYDROGRAPH AT	7	500.	12.08	36.	10.	3.	.31
+	2 COMBINED AT	CP7	2259.	12.17	208.	57.	19.	1.78
+	ROUTED TO	RCP7	1960.	12.33	208.	57.	19.	1.78
+	HYDROGRAPH AT	9	1412.	12.33	162.	45.	15.	1.40
+	2 COMBINED AT	I1CP9	3338.	12.33	366.	101.	34.	3.18
+	HYDROGRAPH AT	8	897.	12.33	94.	26.	9.	.81
+	2 COMBINED AT	CP9	4204.	12.33	456.	126.	42.	3.99
+	ROUTED TO	RCP9	3555.	12.75	456.	125.	42.	3.99
+	HYDROGRAPH AT	10	1364.	12.75	238.	62.	21.	2.02
	2 COMBINED AT							

```
+                    I1CP10     4877.   12.75     687.     186.     62.     6.01 CHOLLA WASH
  2 COMBINED AT
+                    CP10       5678.   12.75     964.     255.     85.    10.87 BEARDSLEY+CHOLLA @ NORTHERN
  HYDROGRAPH AT
+                    NIC        1626.   12.92     322.      95.     32.     4.86
  2 COMBINED AT
+                    CP10B      7132.   12.75    1278.     348.    116.    10.87 IN CHANNEL SOUTH OF NORTHERN
  ROUTED TO
+                    RCP10B     6970.   12.83    1277.     348.    116.    10.87
  HYDROGRAPH AT
+                    12         1222.   12.50     168.      43.     14.     1.38
  2 COMBINED AT
+                    CP12       7572.   12.83    1426.     386.    129.    12.25 IN CHANNEL 1200' SOUTH OF NORTHERN
                                                                                  TO FRS#3

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

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number 0406915

Sheet 1 of 4

Project NORTH INLET CHANNEL Date 12/10/04

Subject LOOP 303 / WHITETANKS ADMP UPDATE Designed JKK Checked
HEC-1 FILE OUTPUT COMPARISON & SELECTION FOR NIC PROJECT CORRIDOR

	L303F8B	L303M1L	L33PE4H	L33PF6D
CP3	2689	2655	2665 (!BC2)	2699 (!BC2)
DI189	564	548	0	0
RCP3	2057	2038	2468	2494
I1CP10	4701	4868	4868	4698
CP10	6348	6522	6322 (!BC3)	6047 (!BC3)
1DI188	931	958	0	0
2DI188	1557	1596	0	0
RCP10	3698	3822	6426	5786 (!BC4)
CP12	4347	4459	6593 (!BC4)	6218

RBC3

HEC-1 SUBBASIN OR ROUTING I.D.

PER FCDMC (JOE RUMANN / BILL HURST) SELECTED MODEL (9/04)

PEAK DISCHARGES

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number 0406915

Sheet 2 of 4

Project NORTH INLET CHANNEL Date 8/25/04 - UPDATED 12/10/04

Subject PEAK DISCHARGES FROM LOOP 303/UNITE TANKS AMP HEC-1 MODEL ALONG PROJECT CORRIDOR Designed JKK Checked

L303M1L

AT OLIVE AVE (CP3): 2655 cfs ← USE THIS NUMBER AT OLIVE AVE.

DIVERSION (BREAKOUT) AT OLIVE AVE (DI189): 548 cfs ← OUR NUMBER NEEDS TO BE HERE

BEARDSLEY CANAL WASH (RCP3): 2038 cfs ← THIS NUMBER WILL CHANGE

CHOLLA WASH (I1CP10): 4868 cfs ← PEAK Q BEFORE COMBINE WITH RCP3

AT NORTHERN AVE (CP10): 6522 cfs ← PEAK Q AT NORTHERN AVE BEFORE BREAKOUT

DIVERSION 1 AT NORTHERN AVE (1DI188): 958 cfs ← FROM URS FLOODPLAIN STUDY BY MIKE R. & BOB D. ON 2-14-02

DIVERSION 2 AT NORTHERN AVE (2DI88): 1596 cfs ←

FLOW IN CHANNEL FROM NORTHERN TO FRS#3 (RCP10): 3822 cfs ← ROUTING AFTER DIVERSIONS AT NORTHERN

FLOW AT FRS#3 (CP12): 4459 cfs ← COMBINED FLOW AT NORTHERN END OF FRS#3

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number 0406915

Sheet 3 of 4

Project NORTH INLET CHANNEL Date 9/13/04 UPDATED 12/10/04

Subject MODELING* DISCHARGES BASED ON LOOP 303/ WHITE TANKS ADMP HEC-1 (L303M1L.DAT) Designed JGR Checked

UPDATED: 7/8/05

PROPOSED PEAK Q INPUTS FOR MODELING PURPOSES BASED ON URS ADMP HEC-1 (L303M1L)

AT OLIVE ~~2655~~ 2722 (FRZR, STANTEC, JAN 10, 2005) cfs

DIVERSION 1600 cfs

OLIVE TO CHOLLA ~~1055~~ 1122 cfs

CHOLLA + ~~4868~~ 4877 (FRZR) cfs

5999 ~~5923~~ - (384)

CHOLLA TO NORTHERN ~~5539~~ 5615

NORTHERN TO 1600' SOUTH NORTHERN ~~5539~~ 5615 + 1600 = ~~7139~~ 7215

SUBBASIN 12 + ~~1214~~ 1222 (FRZR)

8437 ~~8353~~ - (577)

~~4000~~ 1600' S. OF NORTHERN TO FRS#3 ~~7776~~ 7860

CORRECT ☒

THIS IS AN ACTUAL DISTANCE BASED ON AERIAL PHOTO (NOT A ROUTING DISTANCE) TO NEXT WASH SOUTH OF NORTHERN (Q IS FOR TOTAL AT SUB-BASIN 12, BUT SHOULD BE APPLIED TO CHANNEL 1600' S. OF NORTHERN) WHICH ENDS AT THE N. END OF FRS#3

IN HEC-1 MODEL CHOLLA/BEARDSLEY SUM AS FOLLOWS:

2038 + 4868 = 6906 (DIRECT SUMMATION)
(BEARDSLEY) (CHOLLA)

6522 (HEC-1 SUMMATION)

384 LESS

IN HEC-1 MODEL BASIN 12/BEARDSLEY SUM AS FOLLOWS:

1214 + 3822 = 5036 (DIRECT SUM)
(SUBBASIN 12) (FLOW FROM NORTHERN)

4459 (HEC-1 SUM)

577 LESS

* MODELING = FOR MODELING PROPOSED DESIGN OF NIC PROJECT IN HEC-RAS.

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number 0406915

Sheet 4 of 4

Project NORTH INLET CHANNEL Date 9/04 UPDATED 12/10/04

Subject HEC-1 "CHECK" USING LOOP 303/WHITE TANKS ADMP HEC-1 MODEL (L303M1L.DAT) Designed TKK Checked

1) DIVERSION, ACCOUNTING FOR NATURAL BREAKOUT OF BEARDSLEY CANAL WASH AT OLIVE AVENUE, WAS INCREASED TO REPRESENT THE CONTROLLED DIVERSION OF ≈ 1600 cfs INTO NIC AT OLIVE AVENUE.

2) MODEL WAS RUN TO SEE IF HYDROGRAPH COMBINE AT CHOLLA WASH & BEARDSLEY CANAL WASH WAS CLOSE TO ESTIMATED VALUE (SEE MODELING DISCHARGES, P.3) USING A STRAIGHT SUBTRACTION METHOD OF THE DIFFERENCE IN PEAK FLOWS VS. COMBINED FLOWS.

RESULTS WERE:

HEC-1 I.D.	PEAK Q ESTIMATED	PEAK Q HEC-1 CHECK	
AT OLIVE (CP3) :	n/a	2655	
DIVERSION AT OLIVE (DI189) :	1600	1587	← BY TWEAKING DIVERSION RATING (RESULT OF BREAKOUT IS APPROX. EQUAL TO DESIRED DIVERSION OF 1600 cfs)
BEARDSLEY CANAL WASH (RCP3) :	1055	✓ 1001	
CHOLLA WASH (I1CP10) :	n/a	4868	
AT NORTHERN AVE (CP10) :	5539	✓ 5540	

ASSUMPTION WAS MADE THAT SUBTRACTION METHOD TO ACCOUNT FOR HYDROGRAPH COMBINES IS SUFFICIENT FOR REACH SOUTH OF NORTHERN AVE TO APPROXIMATE MODELING* DISCHARGES.

"n/a" UNDER PEAK Q ESTIMATED INDICATES VALUE IS SAME AS HEC-1 RESULT AND WAS USED DIRECTLY.

HEC-1 MODELS ARE ON THE CD AT END OF THIS REPORT.

* SEE P. 3

URS ADMP File Names (HEC-1 Files)

```
ID      WHITE TANKS AREA DRAINAGE MASTER STUDY *UPDATE*
ID      Original MODEL BY THE WLB Group for FCDMC AS PART OF THE WHITE
ID      TANKS/AGUA FRIA ADMS, Date: October 1991
ID
ID      PER DIRECTION AND BY PROVISION OF THE FCDMC, URS HAS ADDED THE
ID      PROVIDED DIVERT DATA FOR THE EXISTING DIVERSION (PREVIOUSLY
ID      TURNED OFF) AT DI189.
ID
ID      ***REMOVED RETENTION AT SUPER BASIN #5 SUB BASINS 297, 315, ***
ID      ***334, 335A, 335, 316 TO REFLECT RELAXED RETENTION REQUIRE-***
ID      ***MENTS ADJACENT TO THE BULLARD CHANNEL S. OF I-10.        ***
ID
ID     * URS REVISED RTIMP PERCENT IMPERVIOUS VALUES *
ID     * AS PER FCDMC GIS DATA - 6-27-01 *
ID
ID      REVISED HYDROLOGY HEC-1 RUN FOR WHITE TANKS ADMS
ID      100-YEAR, 24-HOUR STORM                  original file: WTADMS.24
ID
ID      FUTURE CASE WITH RETENTION VOLUME DIVERTS
ID
ID                                   REVISED BY URS     DATE: 01-14-04
ID                                                      FILE: L303F8B.DAT
```

```
ID      DRAFT PREFERRED ALTERNATIVE LEVEL III
ID
ID      INCORPORATE ALTERNATIVE #3 FROM CHANGE ORDER #14 INTO
ID      SR 303L OFFSITE FLOOD CONTROL FACILITY - NORTHERN AND CACTUS
ID      BASINS ARE NOW OFFLINE WITH MULTIPLE BASINS LOCATED WITHIN
ID      LUKE AIR FORCE BASE CRASH ZONE AREA
ID
ID      **ADOT BASIN GEOMETRY REPRESENTS MOST RECENT 2' CONTOURS**
ID      WHITE TANKS AREA DRAINAGE MASTER STUDY *UPDATE*
ID      Original MODEL BY THE WLB Group for FCDMC AS PART OF THE WHITE
ID      TANKS/AGUA FRIA ADMS, Date: October 1991
ID
ID      REVISED HYDROLOGY HEC-1 RUN FOR WHITE TANKS ADMS
ID      100-YEAR, 24-HOUR STORM                  original file: WTADMS.24
ID
ID                                   REVISED BY URS     DATE: 01-14-04
ID                                                      FILE: L33PE4H.DAT
```

```
ID      FUTURE CONDITION HDYROLOGY MODEL WITH PROJECTS - LEVEL III
ID
ID      WHITE TANKS AREA DRAINAGE MASTER STUDY *UPDATE*
ID      Original MODEL BY THE WLB Group for FCDMC AS PART OF THE WHITE
ID      TANKS/AGUA FRIA ADMS, Date: October 1991
ID
ID      ***REMOVED RETENTION AT SUPER BASIN #5 SUB BASINS 297, 315, ***
ID      ***334, 335A, 335, 316 TO REFLECT RELAXED RETENTION REQUIRE-***
ID      ***MENTS ADJACENT TO THE BULLARD CHANNEL S. OF I-10.        ***
ID
ID     * URS REVISED RTIMP PERCENT IMPERVIOUS VALUES *
ID     * AS PER FCDMC GIS DATA - 6-27-01 *
ID
ID      REVISED HYDROLOGY HEC-1 RUN FOR WHITE TANKS ADMS
ID      100-YEAR, 24-HOUR STORM                  original file: WTADMS.24
ID
ID      FUTURE CASE WITH RETENTION VOLUME DIVERTS
ID
ID                                      REVISED BY URS     DATE: 01-14-04
ID                                                         FILE: L33PF6D.DAT
```

```
ID   LOOP 303 CORRIDOR-WHITE TANKS AREA DRAINAGE MASTER PLAN UPDATE
ID   EXISTING CONDITION HYDROLOGY MODEL 'WITHOUT PROJECTS IN PLACE'
ID
ID   PER DIRECTION AND BY PROVISION OF THE FCDMC, URS HAS ADDED THE
ID   PROVIDED DIVERT DATA FOR THE EXISTING DIVERSION (PREVIOUSLY
ID   TURNED OFF) AT DI189.
ID
ID   THE RESULTS OF THE FLOODPLAIN FLOW SPLIT ANALYSIS
ID   AT PERRYVILLE & 83RD AVE BETWEEN GLENDALE AND BETHANY
ID   HOME ROAD HAVE BEEN INCORPORATED INTO THIS MODEL
ID
ID
ID                                      REVISED BY URS     DATE: 01-14-04
ID                                                         FILE: L303M1L.DAT
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
* RUN DATE   25AUG04  TIME  13:57:53    *
*                                       *
*****************************************
```

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

TITLE PAGE AND PERTINENT OUTPUT OF ORIGINAL MODEL (LOOP303/WHITE TANKS ADMP) FOR NIC PROJECT CORRIDOR

```
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     LOOP 303 CORRIDOR-WHITE TANKS AREA DRAINAGE MASTER PLAN UPDATE
  2           ID     EXISTING CONDITION HYDROLOGY MODEL 'WITHOUT PROJECTS IN PLACE'
  3           ID
  4           ID     PER DIRECTION AND BY PROVISION OF THE FCDMC, URS HAS ADDED THE
  5           ID     PROVIDED DIVERT DATA FOR THE EXISTING DIVERSION (PREVIOUSLY
  6           ID     TURNED OFF) AT DI189.
  7           ID
  8           ID     THE RESULTS OF THE FLOODPLAIN FLOW SPLIT ANALYSIS
  9           ID     AT PERRYVILLE & 83RD AVE BETWEEN GLENDALE AND BETHANY
 10           ID     HOME ROAD HAVE BEEN INCORPORATED INTO THIS MODEL
 11           ID
 12           ID
 13           ID                                    REVISED BY URS      DATE: 01-14-04
 14           ID                                                        FILE: L303M1L.DAT
 15           ID       NOTES:
 16           ID       1. THIS HEC-1 MODEL CONTAINS THE FOLLOWING SUPER BASINS: WHITE TANKS 3,
 17           ID          2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 2 & 3, 4 THRU 26.
 18           ID       2. REVISED TO REFLECT UPDATED SOILS MAPS AND NEW DEVELOPMENT.
 19           ID       3. AVERAGE XKSAT VALUES FOR EACH SUBBASIN WAS RECEIVED FROM FCDMC
 20           ID          GIS DATA AND THEN ADJUSTED FOR VEGETATION, OR LEFT AS ORIGINALLY IN
 21           ID          THE WLB MODEL.
 22           ID       4. FOR NEW DEVELOPMENTS ONLY 80% OF REPORTED PROVIDED RETENTION
 23           ID          WAS INCLUDED IN THIS MODEL (AS A CONSERVATIVE ESTIMATE). RETENTION
 24           ID          CAPACITIES WERE ESTIMATED BY EEC FOR DEVELOPMENTS WITH NO
 25           ID          DRAINAGE REPORTS.
 26           ID       5. REVISED DRAINAGE BOUNDARIES BASED UPON FIELD INSPECTION OF SUN CITY.
 27           ID          GRAND.  COMBINED SEVERAL BASINS TOGETHER TO MAKE NEW BASINS 114 &115.
 28           ID          ALSO REROUTED SUBBASINS 100A, 101, 102A AND 106 TO THE SOUTH TO 113A.
 29           ID       6. CHANNEL ROUTE ALONG REEMS ROAD UPDATED TO REFLECT NEW CONSTRUCTION.
 30           ID       7. REVISED SCS TYPE II RAINFALL DISTRIBUTION FOR THE 24-HOUR GENERAL
 31           ID          STORM.
 32           ID       8. REVISED RAINFALL DEPTH-AREA REDUCTION FACTORS.
 33           ID       9. PSIF WERE ADJUSTED BASED ON THE VALUES OF XKSAT AND WERE EDITED INTO
 34           ID          THE DATA FILE BY THE FCDMC.
 35           ID      10. AVERAGE XKSAT VALUES FOR SUBBASINS WITH BORROW PITS (WHITE TANKS
 36           ID          AREAS #3 & #4) WERE ESTIMATED BY EEC.
              *DIAGRAM
 37           IT       5                    600
 38           IO       5
 39           IN      15
 40           JD    4.03    .001
 41           PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
 42           PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
 43           PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
 44           PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
 45           PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
 46           PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
 47           PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
 48           PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
 49           PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
 50           PC    .983    .986    .989    .992    .995    .998    1.00   1.000   1.000   1.000
 51           JD    3.79      10
 52           JD    3.51      50
 53           JD    3.39     100
 54           JD    3.29     200
              * ***********************************************************************
              * **************THE FOLLOWING SECTION IS WHITE TANKS 3*********************
```

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WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    862.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    880.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    881.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    878.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    870.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    869.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    869.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    864.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    868.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    866.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE	
+	HYDROGRAPH AT	1	1573.	12.50	222.	61.	30.	1.94			
+	ROUTED TO	RCP1	1386.	12.83	222.	61.	30.	1.94			
+	HYDROGRAPH AT	2	1339.	12.75	237.	66.	32.	1.82			
+	2 COMBINED AT	CP2	2657.	12.75	456.	126.	61.	3.76			
+	ROUTED TO	RCP2	2458.	12.92	455.	126.	61.	3.76			
+	HYDROGRAPH AT	3A	313.	12.33	31.	8.	4.	.29			
+	ROUTED TO	RCP3A	250.	12.50	31.	8.	4.	.29			
+	HYDROGRAPH AT	3	863.	12.33	89.	22.	11.	.81			
+	2 COMBINED AT	I1CP3	1048.	12.42	119.	30.	14.	1.10			
+	2 COMBINED AT	CP3	2655.	12.92	571.	155.	75.	4.86	OLIVE AVE (WATERFALL/BEARDSLEY)		
+	DIVERSION TO	DI189	548.	12.92	54.	14.	7.	4.86	BREAKOUT		
+	HYDROGRAPH AT	D3	2107.	12.92	517.	141.	68.	4.86			
+	ROUTED TO	RCP3	2038.	13.08	517.	141.	68.	4.86	BEARDSLEY CANAL WASH (OLIVE TO CHOLLA WASH)		
+	HYDROGRAPH AT	4	396.	12.25	36.	10.	5.	.30			
+	HYDROGRAPH AT	5	927.	12.25	86.	23.	11.	.72			
+	2 COMBINED AT	CP5	1315.	12.25	121.	33.	16.	1.02			
+	ROUTED TO	RCP5	1312.	12.25	121.	33.	16.	1.02			
+	HYDROGRAPH AT	6	746.	12.08	52.	14.	7.	.45			
+	2 COMBINED AT	CP6	1854.	12.17	172.	47.	23.	1.47			
	ROUTED TO										

+		RCP6	1784.	12.17	172.	47.	23.	1.47	
+	HYDROGRAPH AT	7	494.	12.08	36.	10.	5.	.31	
+	2 COMBINED AT	CP7	2245.	12.17	206.	57.	27.	1.78	
+	ROUTED TO	RCP7	1947.	12.33	206.	57.	27.	1.78	
+	HYDROGRAPH AT	9	1402.	12.33	161.	44.	21.	1.40	
+	2 COMBINED AT	I1CP9	3324.	12.33	364.	100.	48.	3.18	
+	HYDROGRAPH AT	8	890.	12.33	93.	26.	12.	.81	
+	2 COMBINED AT	CP9	4190.	12.33	455.	125.	60.	3.99	
+	ROUTED TO	RCP9	3543.	12.75	454.	125.	60.	3.99	
+	HYDROGRAPH AT	10	1357.	12.75	237.	62.	30.	2.02	
+	2 COMBINED AT	I1CP10	4868.	12.75	686.	185.	89.	6.01	CHOLLA WASH
+	2 COMBINED AT	CP10	6522.	12.75	1189.	323.	156.	10.87	NORTHERN AVE
+	DIVERSION TO	1DI188	958.	12.75	174.	47.	23.	10.87	BREAKOUT
+	HYDROGRAPH AT	1D10	5564.	12.75	1014.	276.	133.	10.87	
+	DIVERSION TO	2DI188	1596.	12.75	215.	54.	26.	10.87	BREAKOUT
+	HYDROGRAPH AT	2D10	3968.	12.75	799.	222.	107.	10.87	
+	ROUTED TO	RCP10	3822.	12.83	799.	222.	107.	10.87	FRS#3 CHANNEL
+	HYDROGRAPH AT	12	1214.	12.50	167.	43.	21.	1.38	
+	2 COMBINED AT	CP12	4459.	12.83	953.	261.	126.	12.25	FRS#3 CHANNEL AT FRS#3
+	ROUTED TO	RCP12	4085.	13.00	952.	261.	126.	12.25	
+	HYDROGRAPH AT	11	1559.	12.42	202.	54.	26.	1.56	
+	ROUTED TO	RCP11	1268.	12.75	201.	54.	26.	1.56	
+	HYDROGRAPH AT	13	1223.	12.42	145.	36.	17.	1.30	
+	2 COMBINED AT	CP13	2062.	12.58	344.	89.	43.	2.86	
+	ROUTED TO	RCP13	2035.	12.67	344.	89.	43.	2.86	
+	HYDROGRAPH AT	14	1548.	12.33	173.	47.	23.	1.47	
+	ROUTED TO	RCP14	1392.	12.58	173.	47.	23.	1.47	
+	HYDROGRAPH AT	15	1272.	12.42	149.	40.	19.	1.26	
+	2 COMBINED AT	I1CP15	2485.	12.50	319.	86.	42.	2.73	
+	HYDROGRAPH AT	16	1206.	12.42	149.	41.	20.	1.13	
+	ROUTED TO	SR16	0.	.00	0.	0.	0.	1.13	
+	2 COMBINED AT	CP15	2485.	12.50	319.	86.	42.	3.90	

MODIFIED TO CHECK DIVERSION AT OLIVE AVE AND ROUTING/COMBINE OF CHOLLA WASH & BEARDSLEY CANAL WASH

```
1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*          JUN  1998                *
*        VERSION 4.1                *
*                                   *
*  RUN DATE   14DEC04  TIME  10:51:27*
*                                   *
*************************************
```

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

(SEE 3RD PAGE)

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     LOOP 303 CORRIDOR-WHITE TANKS AREA DRAINAGE MASTER PLAN UPDATE
  2           ID     EXISTING CONDITION HYDROLOGY MODEL 'WITHOUT PROJECTS IN PLACE'
  3           ID
  4           ID     PER DIRECTION AND BY PROVISION OF THE FCDMC, URS HAS ADDED THE
  5           ID     PROVIDED DIVERT DATA FOR THE EXISTING DIVERSION (PREVIOUSLY
  6           ID     TURNED OFF) AT DI189.
  7           ID
  8           ID     THE RESULTS OF THE FLOODPLAIN FLOW SPLIT ANALYSIS
  9           ID     AT PERRYVILLE & 83RD AVE BETWEEN GLENDALE AND BETHANY
 10           ID     HOME ROAD HAVE BEEN INCORPORATED INTO THIS MODEL
 11           ID
 12           ID
 13           ID                                        REVISED BY URS     DATE: 01-14-04
 14           ID                                                           FILE: L303M1L.DAT
 15           ID        NOTES:
 16           ID        1. THIS HEC-1 MODEL CONTAINS THE FOLLOWING SUPER BASINS: WHITE TANKS 3,
 17           ID           2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 2 & 3, 4 THRU 26.
 18           ID        2. REVISED TO REFLECT UPDATED SOILS MAPS AND NEW DEVELOPMENT.
 19           ID        3. AVERAGE XKSAT VALUES FOR EACH SUBBASIN WAS RECEIVED FROM FCDMC
 20           ID           GIS DATA AND THEN ADJUSTED FOR VEGETATION, OR LEFT AS ORIGINALLY IN
 21           ID           THE WLB MODEL.
 22           ID        4. FOR NEW DEVELOPMENTS ONLY 80% OF REPORTED PROVIDED RETENTION
 23           ID           WAS INCLUDED IN THIS MODEL (AS A CONSERVATIVE ESTIMATE). RETENTION
 24           ID           CAPACITIES WERE ESTIMATED BY EEC FOR DEVELOPMENTS WITH NO
 25           ID           DRAINAGE REPORTS.
 26           ID        5. REVISED DRAINAGE BOUNDARIES BASED UPON FIELD INSPECTION OF SUN CITY.
 27           ID           GRAND.  COMBINED SEVERAL BASINS TOGETHER TO MAKE NEW BASINS 114 &115.
 28           ID           ALSO REROUTED SUBBASINS 100A, 101, 102A AND 106 TO THE SOUTH TO 113A.
 29           ID        6. CHANNEL ROUTE ALONG REEMS ROAD UPDATED TO REFLECT NEW CONSTRUCTION.
 30           ID        7. REVISED SCS TYPE II RAINFALL DISTRIBUTION FOR THE 24-HOUR GENERAL
 31           ID           STORM.
 32           ID        8. REVISED RAINFALL DEPTH-AREA REDUCTION FACTORS.
 33           ID        9. PSIF WERE ADJUSTED BASED ON THE VALUES OF XKSAT AND WERE EDITED INTO
 34           ID           THE DATA FILE BY THE FCDMC.
 35           ID       10. AVERAGE XKSAT VALUES FOR SUBBASINS WITH BORROW PITS (WHITE TANKS
 36           ID           AREAS #3 & #4) WERE ESTIMATED BY EEC.
              *DIAGRAM
 37           IT       5                    600
 38           IO       5
 39           IN      15
 40           JD    4.03    .001
 41           PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
 42           PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
 43           PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
 44           PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
 45           PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
 46           PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
 47           PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
 48           PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
 49           PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
 50           PC    .983    .986    .989    .992    .995    .998    1.00   1.000   1.000   1.000
 51           JD    3.79      10
 52           JD    3.51      50
 53           JD    3.39     100
 54           JD    3.29     200
              * ***********************************************************************
              * **************THE FOLLOWING SECTION IS WHITE TANKS 3**********************
```

```
                 * ************************************************************************
                 * ******TRANSMISSION LOSSES REMOVED - 4/25/00 - ERE*************************
                 * ************************************************************************
                 *
                 * SUB BASIN LG AND UI RECORDS UPDATED PER SLOPE CHANGE TO SUB BASIN 1
                 * AT REQUEST OF FCDMC ON 11-17-03
                 *
1                                          HEC-1 INPUT                                          PAGE  2

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

  55             KK       1
  56             KM    SUB BASIN 1
  57             KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  58             KM     L=       3.5  Lca=       1.5    S=  527.2  Kn= .050  LAG=  40.7
  59             KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  60             BA     1.94
  61             LG      .20      .35     4.00      .52    10.00
  62             UI     160.     207.     585.     790.     939.    1135.    1427.    1996.    1720.    1386.
  63             UI    1159.     946.     776.     535.     307.     267.     194.     160.      72.      49.
  64             UI      49.      49.      49.      49.      0.       0.       0.       0.       0.       0.
  65             UI       0.       0.       0.       0.      0.       0.       0.       0.       0.       0.

  66             KK     RCP1
  67             KM         ROUTE FLOW FROM CP1 TO CP2.
  68             RS       5                -1       0
  69             RC     .06      .04      .06    17800    .0469
  70             RX    1000     1125     1300     1390     1405     1490     1590     1750
  71             RY    1440     1439     1437     1428     1428     1439     1442     1444
                 *

  72             KK       2
  73             KM         RUNOFF HYDROGRAPH FROM SUB-BASIN 2.
  74             BA     1.82
  75             LG      .18      .35     4.55      .37    12.00
  76             UI     115.     115.     259.     443.     557.     643.     728.     849.    1014.    1348.
  77             UI    1418.    1145.     985.     864.     735.     634.     545.     404.     268.     202.
  78             UI     189.     143.     115.     102.      35.      35.      35.      35.      35.      35.
  79             UI      35.       0.       0.       0.      0.       0.       0.       0.       0.       0.
  80             UI       0.       0.       0.       0.      0.       0.       0.       0.       0.       0.

  81             KK      CP2
  82             KM         ADD HYDROGRAPHS AT CP2.
  83             HC       2     3.76

  84             KK     RCP2
  85             KM         ROUTE COMBINED HYDROGRAPHS AT CP2 TO CP3.
  86             RS       2                -1       0
  87             RC     .06     .035      .06     4500    .0111
  88             RX    1000     1100     1350     1705     1735     1780     1850     2000
  89             RY    1304     1302     1302     1298     1298     1303     1302     1305
                 *

  90             KK      3A
  91             KM         RUNOFF HYDROGRAPH FROM SUB-BASIN 3A
  92             BA     .29
  93             LG     .15      .35     4.30      .42      .00
  94             UI      34.      90.     165.     213.     289.     411.     312.     240.     181.     121.
  95             UI      60.      47.      32.      10.      10.      10.      10.       0.       0.       0.
  96             UI       0.       0.       0.       0.      0.       0.       0.       0.       0.       0.
1                                          HEC-1 INPUT                                          PAGE  3

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

  97             KK    RCP3A
  98             KM         ROUTE FLOW FROM CP3A TO CP3
  99             RS       2                -1       0
 100             RC     .03      .03      .05     5300    .0060
 101             RX    1000     1023     1032     1046     1058     1067     1250     1540
 102             RY    1289     1288     1286     1284     1284     1286     1288     1291
                 *

 103             KK       3
 104             KM         RUNOFF HYDROGRAPH FROM SUB-BASIN 3.
 105             BA     .81
 106             LG     .15      .35     4.45      .38      .00
 107             UI      90.     226.     427.     550.     718.    1081.     912.     702.     537.     401.
 108             UI     208.     151.      97.      59.      28.      28.      28.      28.       0.       0.
 109             UI       0.       0.       0.       0.      0.       0.       0.       0.       0.       0.

 110             KK    I1CP3
 111             KM         ADD HYDROGRAPHS AT I1CP3
 112             HC       2      1.1

 113             KK      CP3
 114             KM         ADD HYDROGRAPHS AT CP3.
 115             HC       2     4.86
                 * PER URS FLOODPLAIN ANALYSIS BY MIKE R.
                 * TURN OFF DIVERT PER CULVERT IMPROVEMENT BY 'SONORAN RIDGE REALESTATE'
                 * ALSO BY DIRECTION OF MIKE DUNCAN AT FCDMC PER HIS PHONE CONVERSATION
                 * WITH SONORAN RIDGE ON 2-14-02.
                 *
                 * PER PHONE CONVERSATION WITH FCDMC - PROPOSED 2-10'X6' BOX CULVERTS WERE
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                 * BACKFILLED ON 11-01-02.  THERE IS ALSO AN EXISTING 7' CMP AND AN 8' CMP
                 * AT THIS LOCATION
                 *

 116             KK      D3
 117             KM        NORTH INLET CHANNEL DIVERSION BY KM ON 12/14/04 AT OLIVE ANENUE
 118             DT   DI189
 119             DI       0    2655    4000
 120             DQ       0    1600    1600   <-- NIC DIVERSION
                 * ORIGINAL DIVERT DATA COMMENTED-OUT FOR CHECK OF NIC DIVERSION CONDITION
                 * KM DIVERT FLOWS THAT WILL OVERTOP THE BEARDSLEY CANAL AT OLIVE AVENUE.  THE
                 * KM HEC-2 DIVERSION RATING CURVE MODELED BY THE FLOOD CONTROL DISTRICT IS
                 * KM INCORPORATED HERE.
                 * FOLLOWING DIVERT DATA PROVIDED BY FCDMC ON 5-14-03
                 * THIS INFORMATION IS BASED ON THE CULVERT STRUCTURE CONSTRUCTED PER THE
                 * SONORAN RIDGE DEVELOPMENT, SEE 'S02001035' AND 'S02002033'
                 * DT DI189
                 * DI     0    1432    2823    3000    4000
                 * DQ     0       0     622     728    1728
```

NATURAL BREAKOUT MODIFIED TO SIMULATE NIC DIVERSION


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

 121             KK    RCP3
 122             KM        ROUTE FLOW FROM CP3 TO CP10.
 123             RS       2              -1       0
 124             RC     .05     .03     .05    5280    .0083
 125             RX    1010    1015    1020    1050    1100    1275    1580    1750
 126             RY    1251    1249    1249    1245    1245    1250    1250    1254
                 *

 127             KK       4
 128             KM        RUNOFF HYDROGRAPH FORM SUB-BASIN 4.
 129             BA     .30
 130             LG     .20     .35    4.35     .44    9.00
 131             UI     47.    191.    286.    443.    513.    346.    237.    115.     67.     36.
 132             UI     14.     14.      0.      0.      0.      0.      0.      0.      0.      0.
 133             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                 *

 134             KK       5
 135             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 5.
 136             BA     .72
 137             LG     .20     .35    4.30     .45    9.00
 138             UI    109.    433.    653.    981.   1241.    852.    594.    323.    177.    104.
 139             UI     33.     33.     33.      0.      0.      0.      0.      0.      0.      0.
 140             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 141             KK     CP5
 142             KM        ADD HYDROGRAPHS AT CP5.
 143             HC       2    1.02

 144             KK    RCP5
 145             KM        ROUTE COMBINED HYDROGRAPHS AT CP5 TO CP6.
 146             RS       1              -1       0
 147             RC     .08     .05     .08    2400    .0833
 148             RX     955     970     985    1000    1020    1035    1050    1065
 149             RY    2815    2810    2805    2800    2800    2805    2810    2815
                 *

 150             KK       6
 151             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 6.
 152             BA     .45
 153             LG     .20     .35    3.95     .53   10.00
 154             UI    206.    627.   1145.    834.    421.    154.     53.     33.      0.      0.
 155             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 156             KK     CP6
 157             KM        ADD HYDROGRAPHS AT CP6.
 158             HC       2    1.47

 159             KK    RCP6
 160             KM        ROUTE COMBINED HYDROGRAPHS AT CP6 TO CP7.
 161             RS       1              -1       0
 162             RC     .08     .05     .08    2400    .0833
 163             RX     955     970     985    1000    1020    1035    1050    1065
 164             RY    2815    2810    2805    2800    2800    2805    2810    2815
                 *
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LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 165             KK       7
 166             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 7.
 167             BA     .31
                 *    LG    0.35    0.15   7.976   0.082      20
 168             LG     .20     .35    3.95     .53   10.00
 169             UI    124.    383.    708.    610.    347.    132.     54.     21.      0.      0.
 170             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 171             KK     CP7
 172             KM        ADD HYDROGRAPHS AT CP7.
 173             HC       2    1.78
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WARNING --- ROUTED OUTFLOW (    932.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    916.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    896.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    862.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    880.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    881.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    878.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    870.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    869.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    874.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    869.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    864.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    868.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
WARNING --- ROUTED OUTFLOW (    866.) IS GREATER THAN MAXIMUM OUTFLOW (    860.) IN STORAGE-OUTFLOW TABLE
1
```
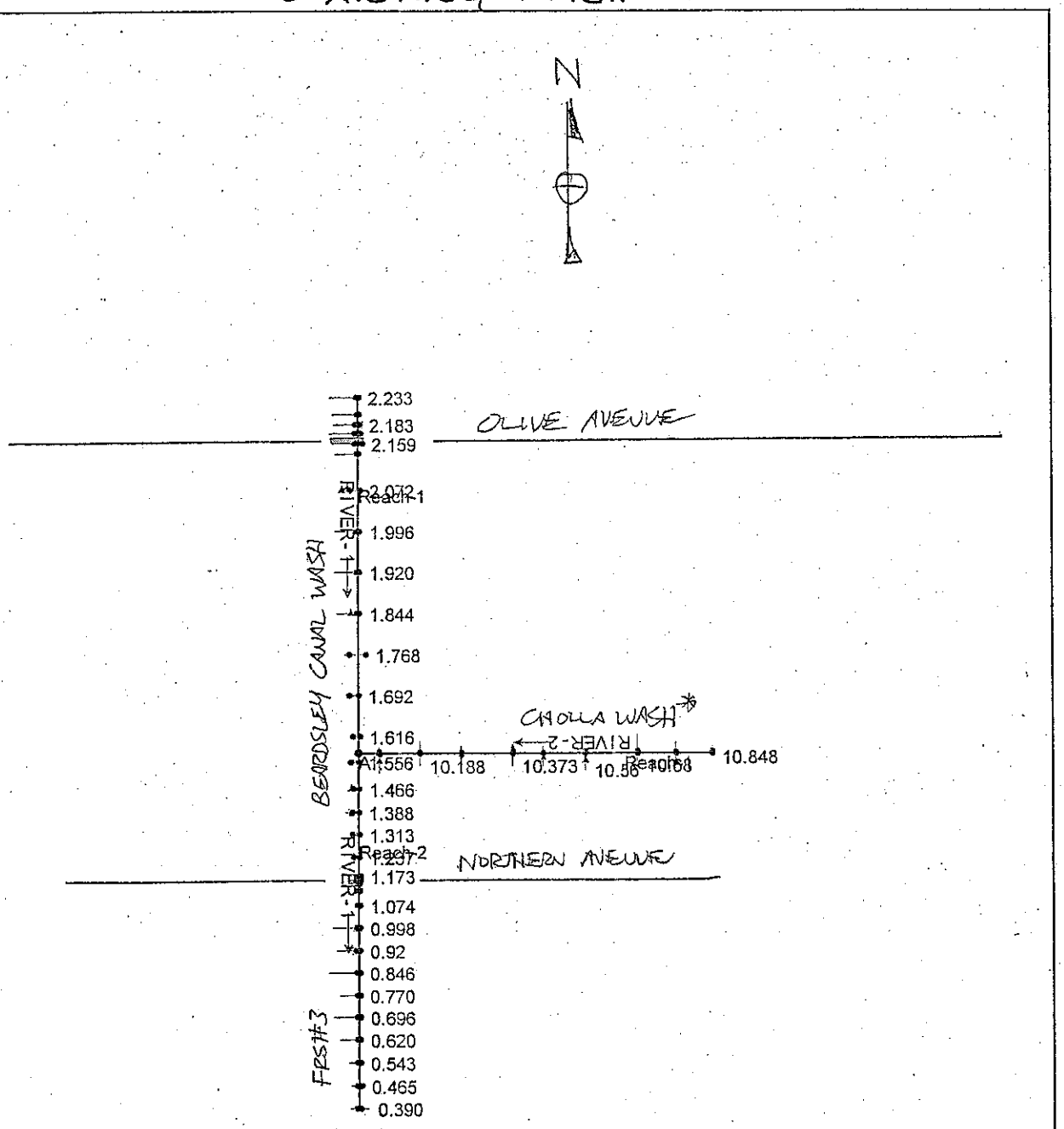

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

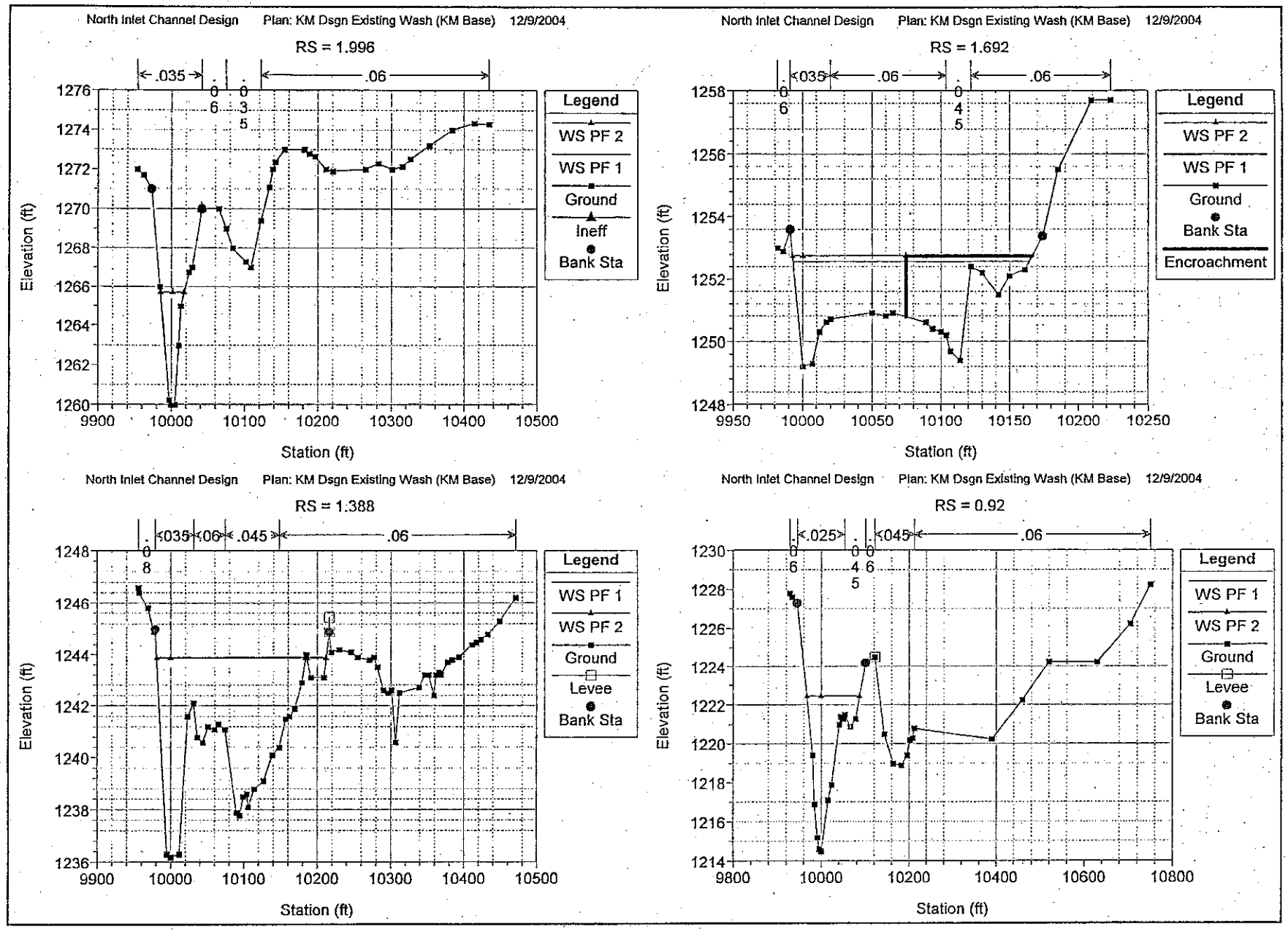
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	1	1573.	12.50	222.	61.	30.	1.94		
+	ROUTED TO	RCP1	1386.	12.83	222.	61.	30.	1.94		
+	HYDROGRAPH AT	2	1339.	12.75	237.	66.	32.	1.82		
+	2 COMBINED AT	CP2	2657.	12.75	456.	126.	61.	3.76		
+	ROUTED TO	RCP2	2458.	12.92	455.	126.	61.	3.76		
+	HYDROGRAPH AT	3A	313.	12.33	31.	8.	4.	.29		
+	ROUTED TO	RCP3A	250.	12.50	31.	8.	4.	.29		
+	HYDROGRAPH AT	3	863.	12.33	89.	22.	11.	.81		
+	2 COMBINED AT	ILCP3	1048.	12.42	119.	30.	14.	1.10		
+	2 COMBINED AT	CP3	2655.	12.92	571.	155.	75.	4.86		
+	DIVERSION TO	DI189	1587.	12.92	344.	93.	45.	4.86	← NIC DIVERSION AT OLIVE AVE.	
+	HYDROGRAPH AT	D3	1068.	12.92	227.	62.	30.	4.86		
+	ROUTED TO	RCP3	1001.	13.08	227.	62.	30.	4.86	← OLIVE TO CHOLLA WASH	
+	HYDROGRAPH AT	4	396.	12.25	36.	10.	5.	.30		
+	HYDROGRAPH AT	5	927.	12.25	86.	23.	11.	.72		
+	2 COMBINED AT	CP5	1315.	12.25	121.	33.	16.	1.02		
+	ROUTED TO	RCP5	1312.	12.25	121.	33.	16.	1.02		
+	HYDROGRAPH AT	6	746.	12.08	52.	14.	7.	.45		

+	2 COMBINED AT	CP6	1854.	12.17	172.	47.	23.	1.47
+	ROUTED TO	RCP6	1784.	12.17	172.	47.	23.	1.47
+	HYDROGRAPH AT	7	494.	12.08	36.	10.	5.	.31
+	2 COMBINED AT	CP7	2245.	12.17	206.	57.	27.	1.78
+	ROUTED TO	RCP7	1947.	12.33	206.	57.	27.	1.78
+	HYDROGRAPH AT	9	1402.	12.33	161.	44.	21.	1.40
+	2 COMBINED AT	I1CP9	3324.	12.33	364.	100.	48.	3.18
+	HYDROGRAPH AT	8	890.	12.33	93.	26.	12.	.81
+	2 COMBINED AT	CP9	4190.	12.33	455.	125.	60.	3.99
+	ROUTED TO	RCP9	3543.	12.75	454.	125.	60.	3.99
+	HYDROGRAPH AT	10	1357.	12.75	237.	62.	30.	2.02
+	2 COMBINED AT	I1CP10	4868.	12.75	686.	185.	89.	6.01 ← CHOLLA WASH
+	2 COMBINED AT	CP10	5540.	12.75	901.	244.	117.	10.87 ← BEARDSLEY CANAL WASH COMBINE W/ CHOLLA WASH (✓)
+	DIVERSION TO	1DI188	813.	12.75	132.	36.	17.	10.87
+	HYDROGRAPH AT	1D10	4727.	12.75	769.	208.	100.	10.87
+	DIVERSION TO	2DI188	1356.	12.75	150.	38.	18.	10.87
+	HYDROGRAPH AT	2D10	3371.	12.75	619.	170.	82.	10.87
+	ROUTED TO	RCP10	3225.	12.83	618.	170.	82.	10.87
+	HYDROGRAPH AT	12	1214.	12.50	167.	43.	21.	1.38
+	2 COMBINED AT	CP12	3867.	12.83	774.	210.	101.	12.25
+	ROUTED TO	RCP12	3491.	13.00	773.	210.	101.	12.25
+	HYDROGRAPH AT	11	1559.	12.42	202.	54.	26.	1.56
+	ROUTED TO	RCP11	1268.	12.75	201.	54.	26.	1.56
+	HYDROGRAPH AT	13	1223.	12.42	145.	36.	17.	1.30
+	2 COMBINED AT	CP13	2062.	12.58	344.	89.	43.	2.86
+	ROUTED TO	RCP13	2035.	12.67	344.	89.	43.	2.86
+	HYDROGRAPH AT	14	1548.	12.33	173.	47.	23.	1.47
+	ROUTED TO	RCP14	1392.	12.58	173.	47.	23.	1.47
+	HYDROGRAPH AT	15	1272.	12.42	149.	40.	19.	1.26
+	2 COMBINED AT	I1CP15	2485.	12.50	319.	86.	42.	2.73
+	HYDROGRAPH AT	16	1206.	12.42	149.	41.	20.	1.13
	ROUTED TO							

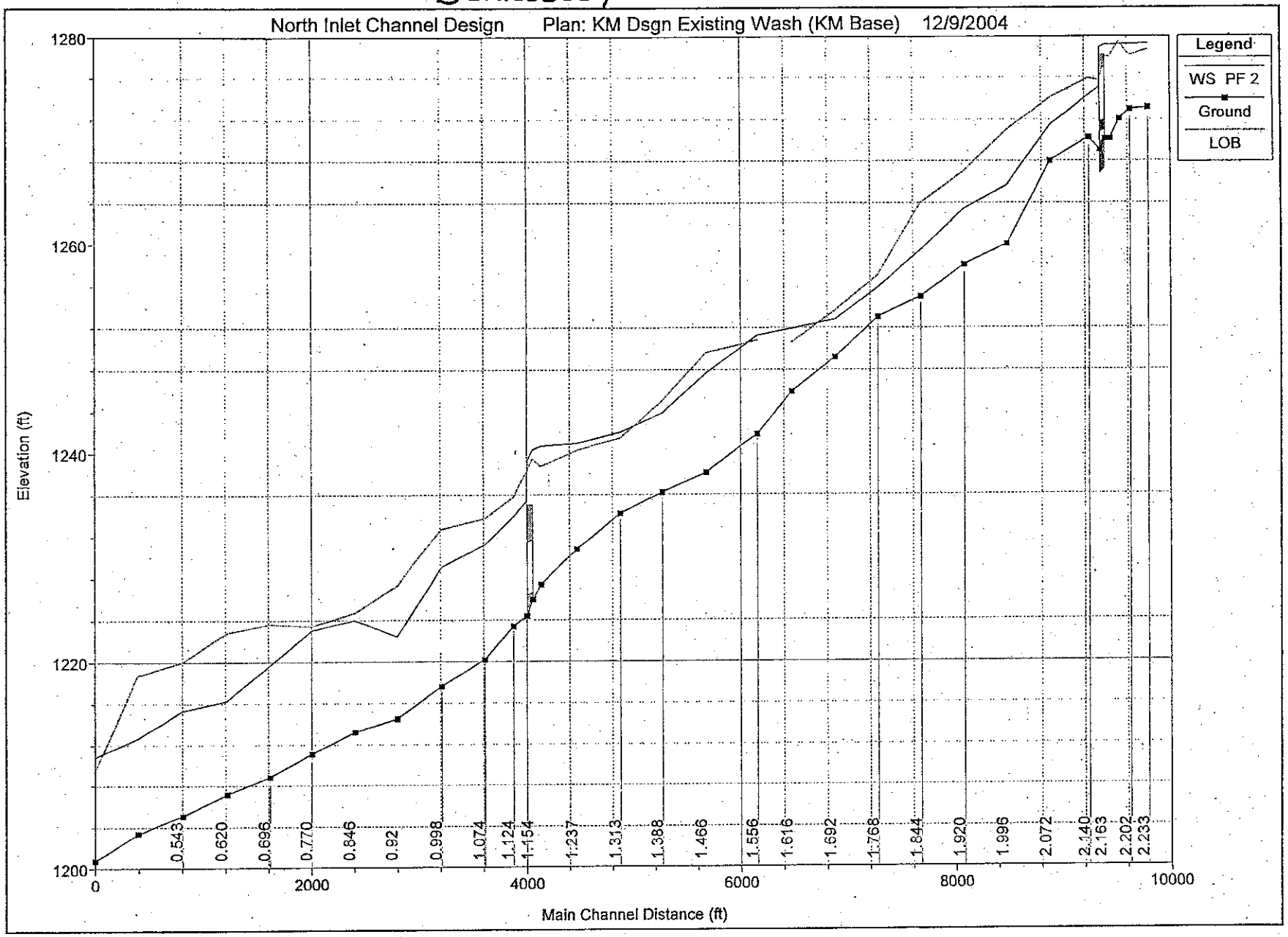
EXISTING WASH



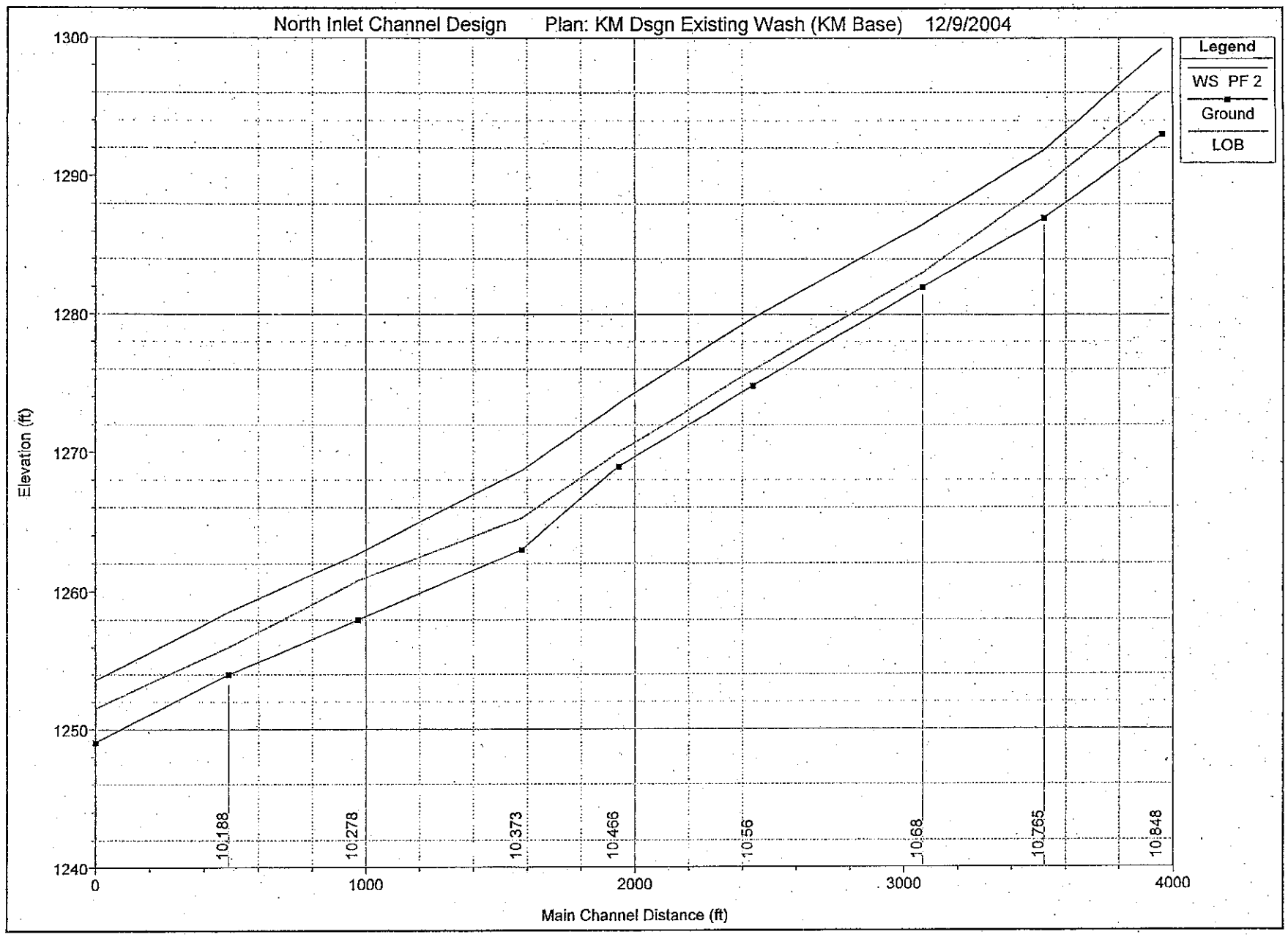
* SCHEMATIC INCORRECT — CHOLLA WASH COMES FROM THE WEST.


North Inlet Channel Design Plan: KM Dsgn Existing Wash (KM Base) 12/9/2004
RS = 1.996
.035
.06
.06
.035
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
North Inlet Channel Design Plan: KM Dsgn Existing Wash (KM Base) 12/9/2004
RS = 1.692
.035
.06
.06
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
North Inlet Channel Design Plan: KM Dsgn Existing Wash (KM Base) 12/9/2004
RS = 1.388
.035
.06
.045
.06
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
North Inlet Channel Design Plan: KM Dsgn Existing Wash (KM Base) 12/9/2004
RS = 0.92
.025
.045
.06
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

BEARDSLEY WASH



CHOLLA WASH


North Inlet Channel Design Plan: KM Dsgn Existing Wash (KM Base) 12/9/2004
Legend
WS PF 2
Ground
LOB
Elevation (ft)
1300
1290
1280
1270
1260
1250
1240
0
1000
2000
3000
4000
Main Channel Distance (ft)
10.188
10.278
10.373
10.466
10.56
10.68
10.765
10.848

HEC-RAS Plan: KM Dsgn Exst Profile: PF 2

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
RIVER-2	Reach-1	10.848	PF 2	4868.00	1293.00	1299.19	1299.19	1300.64	0.010712	11.85	642.88	200.10	0.99
RIVER-2	Reach-1	10.765	PF 2	4868.00	1287.00	1291.85	1292.56	1294.28	0.020294	15.80	551.30	230.00	1.35
RIVER-2	Reach-1	10.68	PF 2	4868.00	1282.00	1286.52	1286.52	1287.90	0.013047	12.10	649.46	220.00	1.07
RIVER-2	Reach-1	10.56	PF 2	4868.00	1274.79	1279.73	1278.38	1280.36	0.005897	8.47	856.47	206.00	0.70
RIVER-2	Reach-1	10.466	PF 2	4868.00	1269.00	1273.53	1273.53	1275.48	0.021800	15.76	486.21	124.41	1.38
RIVER-2	Reach-1	10.373	PF 2	4868.00	1263.00	1268.70	1268.03	1269.81	0.009340	11.76	686.57	165.83	0.93
RIVER-2	Reach-1	10.278	PF 2	4868.00	1258.00	1262.69	1262.53	1263.75	0.012121	9.59	617.36	238.86	0.98
RIVER-2	Reach-1	10.188	PF 2	4868.00	1254.00	1258.57		1259.31	0.007267	8.75	764.36	253.21	0.79
RIVER-2	Reach-1	10.095	PF 2	4868.00	1249.07	1253.58	1253.58	1254.78	0.013180	10.25	585.89	240.00	1.03
RIVER-1	Reach-1	2.233	PF 2	2655.00	1273.15	1279.30	1277.77	1279.47	0.001814	4.41	907.58	360.33	0.40
RIVER-1	Reach-1	2.202	PF 2	2655.00	1273.00	1279.26		1279.36	0.000738	2.99	1084.02	452.46	0.26
RIVER-1	Reach-1	2.183	PF 2	2655.00	1272.10	1279.22	1275.80	1279.31	0.000746	2.70	1209.70	415.08	0.20
RIVER-1	Reach-1	2.167	PF 2	2655.00	1270.20	1279.17	1274.25	1279.27	0.000289	2.65	1379.65	521.34	0.17
RIVER-1	Reach-1	2.163		Culvert									
RIVER-1	Reach-1	2.159	PF 2	1055.00	1269.10	1275.10	1271.33	1275.25	0.000568	3.12	337.70	111.83	0.22
RIVER-1	Reach-1	2.140	PF 2	1055.00	1270.30	1274.28		1274.96	0.006931	6.77	160.01	50.83	0.66
RIVER-1	Reach-1	2.072	PF 2	1055.00	1268.00	1271.47	1270.83	1271.96	0.009808	5.66	186.56	79.37	0.65
RIVER-1	Reach-1	1.996	PF 2	1055.00	1260.00	1265.72	1265.72	1267.32	0.013277	10.15	103.96	32.13	0.99
RIVER-1	Reach-1	1.920	PF 2	1055.00	1258.00	1263.43	1261.80	1264.05	0.003573	6.35	166.23	39.02	0.54
RIVER-1	Reach-1	1.844	PF 2	1055.00	1255.00	1259.40	1259.40	1261.01	0.021964	10.18	103.60	32.56	1.01
RIVER-1	Reach-1	1.768	PF 2	1055.00	1253.00	1255.83	1254.94	1255.96	0.003990	2.91	363.01	199.65	0.38
RIVER-1	Reach-1	1.692	PF 2	1055.00	1249.20	1252.75		1253.31	0.012536	6.00	175.83	82.01	0.72
RIVER-1	Reach-1	1.616	PF 2	1055.00	1245.90	1251.92		1251.99	0.001281	2.21	477.94	118.52	0.19
RIVER-1	Reach-2	1.556	PF 2	5539.00	1241.80	1251.27	1247.49	1251.45	0.001766	3.37	1644.79	294.61	0.25
RIVER-1	Reach-2	1.466	PF 2	5539.00	1238.10	1247.67	1247.53	1249.23	0.024184	10.01	553.33	157.81	0.94
RIVER-1	Reach-2	1.388	PF 2	5539.00	1236.20	1243.87	1242.75	1244.59	0.006004	6.83	810.75	229.32	0.64
RIVER-1	Reach-2	1.313	PF 2	5539.00	1234.20	1242.00		1242.37	0.004812	4.88	1160.81	253.97	0.39
RIVER-1	Reach-2	1.237	PF 2	5539.00	1230.70	1240.87		1241.12	0.002037	4.03	1407.45	242.00	0.28
RIVER-1	Reach-2	1.173	PF 2	5539.00	1227.40	1240.64		1240.78	0.000523	3.31	1909.43	268.67	0.18
RIVER-1	Reach-2	1.159	PF 2	5539.00	1226.00	1240.28	1237.26	1240.69	0.001548	5.25	1157.13	265.00	0.39
RIVER-1	Reach-2	1.154		Culvert									
RIVER-1	Reach-2	1.148	PF 2	7139.00	1224.40	1235.36	1235.36	1238.66	0.005715	14.58	492.01	83.29	1.00
RIVER-1	Reach-2	1.124	PF 2	7139.00	1223.40	1233.89	1230.85	1234.93	0.001385	8.17	873.82	120.18	0.53
RIVER-1	Reach-2	1.074	PF 2	7139.00	1220.20	1231.16	1231.09	1234.10	0.005117	13.77	518.42	85.90	0.99
RIVER-1	Reach-2	0.998	PF 2	7139.00	1217.60	1229.00	1229.00	1231.85	0.006052	13.54	527.36	92.05	1.00
RIVER-1	Reach-2	0.92	PF 2	7139.00	1214.50	1222.46	1224.11	1227.67	0.017447	18.33	389.43	119.70	1.79
RIVER-1	Reach-2	0.846	PF 2	7776.00	1213.20	1224.01	1221.77	1224.23	0.000558	4.94	2967.86	781.45	0.34
RIVER-1	Reach-2	0.770	PF 2	7776.00	1211.10	1223.02		1223.84	0.001422	8.11	1677.95	538.06	0.54
RIVER-1	Reach-2	0.696	PF 2	7776.00	1208.80	1219.68	1219.68	1222.66	0.005272	13.86	561.08	94.91	1.00
RIVER-1	Reach-2	0.620	PF 2	7776.00	1207.20	1216.27	1217.52	1220.02	0.007946	15.88	629.12	314.58	1.22

HEC-RAS Plan: KM Dsgn Exst Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
RIVER-1	Reach-2	0.543	PF 2	7776.00	1205.10	1215.31	1214.64	1216.95	0.003217	10.95	894.43	225.99	0.79
RIVER-1	Reach-2	0.465	PF 2	7776.00	1203.40	1212.64	1212.64	1215.18	0.005453	12.77	608.71	120.80	1.00
RIVER-1	Reach-2	0.390	PF 2	7776.00	1200.80	1210.80	1209.82	1211.54	0.001640	7.83	1759.18	587.72	0.57

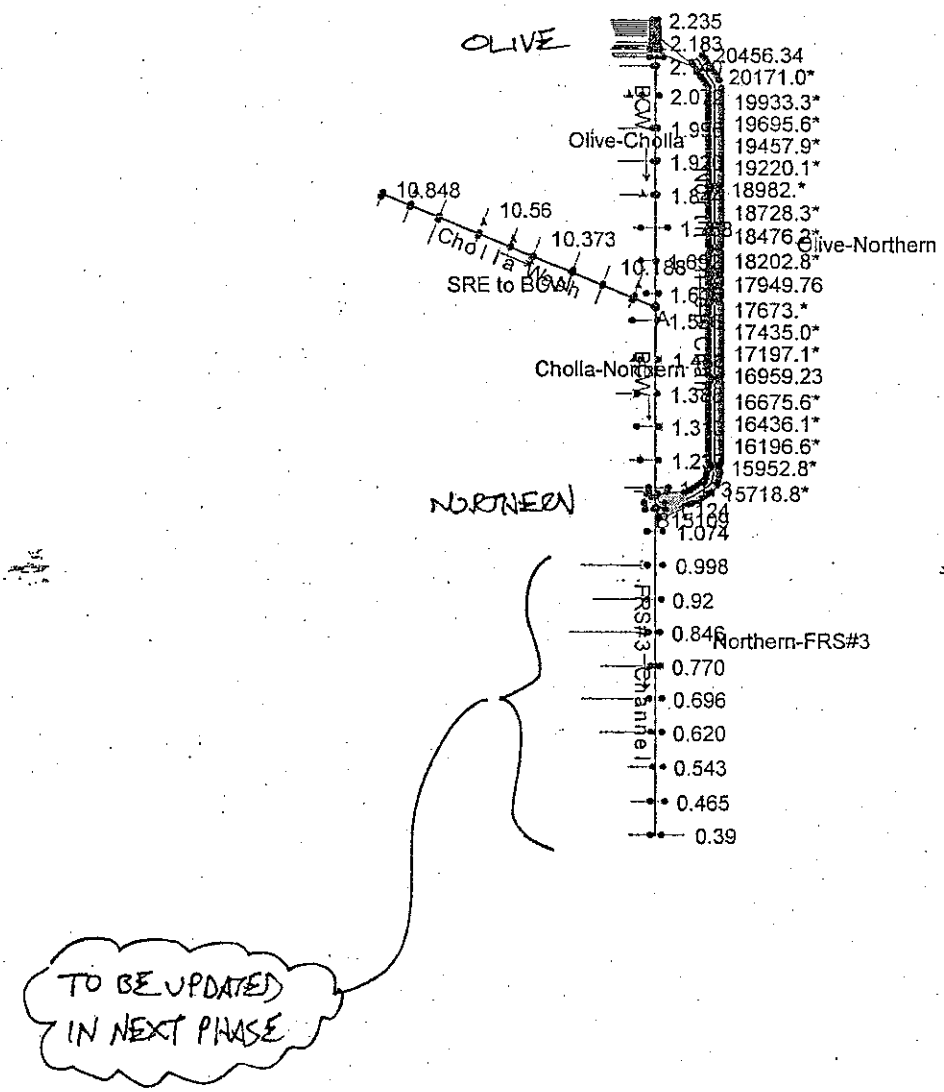
APPENDIX A – HYDROLOGY

- HEC-1 peak discharges from Loop 303/White Tanks ADMP
- Estimation of peak discharges from modeling design
- HEC-1 Check of peak discharge estimates
- HEC-RAS output for existing conditions with proposed flow rates (1600 cfs diversion)

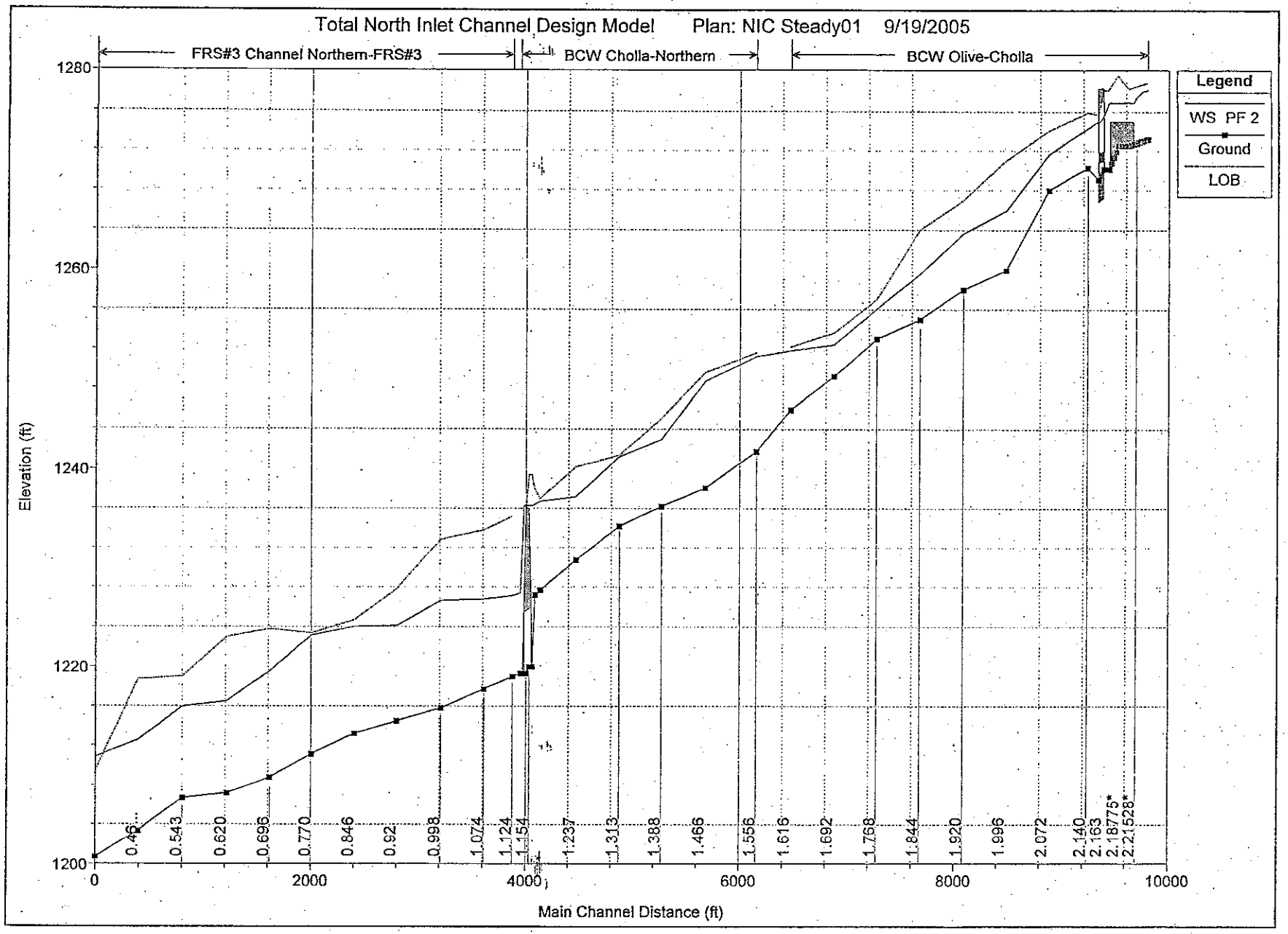
HEC-RAS Model

The channel was analyzed using a HEC-RAS. At the 90% stage of the design, it was decided to revise the section of the channel from Northern to FRS#3(NIC South). A drop structure will be installed at the outlet of the Northern Ave culverts, greatly improving the efficiency of the channel and the culverts at Northern. An interim channel was provided on the NIC North project.

Since the exact geometry of the downstream channel at Northern is unknown, the HEC-RAS model will be revised and resubmitted during the NIC South design.



TO BE UPDATED IN NEXT PHASE


Total North Inlet Channel Design Model Plan: NIC Steady01 9/19/2005
FRS#3 Channel Northern-FRS#3
BCW Cholla-Northern
BCW Olive-Cholla
Legend
WS PF 2
Ground
LOB
Elevation (ft)
1280
1260
1240
1220
1200
0
2000
4000
6000
8000
10000
Main Channel Distance (ft)
0.46
0.543
0.620
0.696
0.770
0.846
0.92
0.998
1.074
1.124
1.154
1.237
1.313
1.388
1.466
1.556
1.616
1.692
1.768
1.844
1.920
1.996
2.072
2.140
2.163
2.18775*
2.21528*

HEC-RAS Plan: Steady01 Profile: PF 2

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Manin Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	20456.34	PF 2	10.00	47.54	1256.43	5.97	1262.40	1256.72	0.000000	0.0008	0.030	0.02	494.59	120.69	0.00
North Inlet Chan	Olive-Northern	20408.7*	PF 2	1590.05	47.54	1256.39	5.81	1262.21		0.000724	0.0006	0.030	3.34	475.54	118.78	0.29
North Inlet Chan	Olive-Northern	20361.2*	PF 2	1590.05	47.54	1256.36	5.81	1262.17		0.000727	0.0008	0.030	3.35	474.96	118.72	0.29
North Inlet Chan	Olive-Northern	20313.7*	PF 2	1590.05	47.54	1256.32	5.82	1262.14		0.000724	0.0006	0.030	3.34	475.62	118.79	0.29
North Inlet Chan	Olive-Northern	20266.1*	PF 2	1590.05	47.54	1256.29	5.81	1262.10		0.000726	0.0008	0.030	3.35	475.03	118.72	0.29
North Inlet Chan	Olive-Northern	20218.6*	PF 2	1590.05	47.54	1256.25	5.82	1262.07		0.000723	0.0006	0.030	3.34	475.70	118.79	0.29
North Inlet Chan	Olive-Northern	20171.0*	PF 2	1590.05	47.54	1256.22	5.81	1262.03		0.000726	0.0008	0.030	3.35	475.12	118.73	0.29
North Inlet Chan	Olive-Northern	20123.5*	PF 2	1590.05	47.54	1256.18	5.82	1262.00		0.000723	0.0008	0.030	3.34	475.77	118.80	0.29
North Inlet Chan	Olive-Northern	20075.9*	PF 2	1590.05	47.54	1256.14	5.82	1261.96		0.000720	0.0006	0.030	3.34	476.46	118.87	0.29
North Inlet Chan	Olive-Northern	20028.4*	PF 2	1590.05	47.54	1256.11	5.82	1261.93		0.000722	0.0008	0.030	3.34	475.91	118.81	0.29
North Inlet Chan	Olive-Northern	19980.8*	PF 2	1590.05	47.54	1256.07	5.82	1261.89		0.000719	0.0006	0.030	3.34	476.61	118.88	0.29
North Inlet Chan	Olive-Northern	19933.3*	PF 2	1590.05	47.54	1256.04	5.82	1261.86		0.000722	0.0008	0.030	3.34	476.04	118.83	0.29
North Inlet Chan	Olive-Northern	19885.8*	PF 2	1590.05	47.54	1256.00	5.82	1261.83		0.000719	0.0006	0.030	3.34	476.74	118.90	0.29
North Inlet Chan	Olive-Northern	19838.2*	PF 2	1590.05	47.54	1255.97	5.82	1261.79		0.000721	0.0008	0.030	3.34	476.19	118.84	0.29
North Inlet Chan	Olive-Northern	19790.7*	PF 2	1590.05	47.54	1255.93	5.83	1261.76		0.000718	0.0006	0.030	3.33	476.87	118.91	0.29
North Inlet Chan	Olive-Northern	19743.1*	PF 2	1590.05	47.54	1255.90	5.82	1261.72		0.000721	0.0008	0.030	3.34	476.32	118.86	0.29
North Inlet Chan	Olive-Northern	19695.6*	PF 2	1590.05	47.54	1255.86	5.83	1261.69		0.000718	0.0008	0.030	3.33	477.01	118.93	0.29
North Inlet Chan	Olive-Northern	19648.0*	PF 2	1590.05	47.54	1255.82	5.83	1261.65		0.000715	0.0006	0.030	3.33	477.74	119.00	0.29
North Inlet Chan	Olive-Northern	19600.5*	PF 2	1590.05	47.54	1255.79	5.83	1261.62		0.000717	0.0008	0.030	3.33	477.20	118.95	0.29
North Inlet Chan	Olive-Northern	19552.9*	PF 2	1590.05	47.54	1255.75	5.83	1261.59		0.000714	0.0006	0.030	3.33	477.93	119.02	0.29
North Inlet Chan	Olive-Northern	19505.4*	PF 2	1590.05	47.54	1255.72	5.83	1261.55		0.000716	0.0008	0.030	3.33	477.41	118.96	0.29
North Inlet Chan	Olive-Northern	19457.9*	PF 2	1590.05	47.54	1255.68	5.84	1261.52		0.000713	0.0006	0.030	3.33	478.12	119.04	0.29
North Inlet Chan	Olive-Northern	19410.3*	PF 2	1590.05	47.54	1255.65	5.83	1261.48		0.000715	0.0008	0.030	3.33	477.61	118.99	0.29
North Inlet Chan	Olive-Northern	19362.8*	PF 2	1590.05	47.54	1255.61	5.84	1261.45		0.000712	0.0008	0.030	3.32	478.35	119.06	0.29
North Inlet Chan	Olive-Northern	19315.2*	PF 2	1590.05	47.54	1255.57	5.84	1261.42		0.000709	0.0006	0.030	3.32	479.11	119.14	0.29
North Inlet Chan	Olive-Northern	19267.7*	PF 2	1590.05	47.54	1255.54	5.84	1261.38		0.000711	0.0008	0.030	3.32	478.61	119.09	0.29
North Inlet Chan	Olive-Northern	19220.1*	PF 2	1590.05	47.54	1255.50	5.85	1261.35		0.000708	0.0006	0.030	3.32	479.37	119.16	0.29
North Inlet Chan	Olive-Northern	19172.6*	PF 2	1590.05	47.54	1255.47	5.84	1261.31		0.000710	0.0008	0.030	3.32	478.89	119.12	0.29
North Inlet Chan	Olive-Northern	19125.0*	PF 2	1590.05	47.54	1255.43	5.85	1261.28		0.000707	0.0006	0.030	3.32	479.65	119.19	0.29
North Inlet Chan	Olive-Northern	19077.5*	PF 2	1590.05	47.54	1255.40	5.85	1261.25		0.000709	0.0008	0.030	3.32	479.18	119.14	0.29
North Inlet Chan	Olive-Northern	19030.00	PF 2	1590.05	1.67	1255.36	5.85	1261.21		0.000706	0.0000	0.030	3.31	479.95	119.22	0.29
North Inlet Chan	Olive-Northern	19028.3*	PF 2	1590.05	1.67	1255.36	5.85	1261.21		0.000766	0.0000	0.031	3.35	473.98	116.94	0.29
North Inlet Chan	Olive-Northern	19026.6*	PF 2	1590.05	1.67	1255.36	5.84	1261.20		0.000779	0.0000	0.031	3.40	467.85	114.61	0.30
North Inlet Chan	Olive-Northern	19025.*	PF 2	1590.05	1.67	1255.36	5.83	1261.19		0.000846	0.0000	0.032	3.45	461.45	112.25	0.30
North Inlet Chan	Olive-Northern	19023.3*	PF 2	1590.05	1.67	1255.36	5.83	1261.19		0.000920	0.0000	0.033	3.50	454.41	109.82	0.30
North Inlet Chan	Olive-Northern	19021.6*	PF 2	1590.05	1.67	1255.35	5.83	1261.18		0.000941	0.0000	0.033	3.55	447.48	107.43	0.31
North Inlet Chan	Olive-Northern	19020.*	PF 2	1590.05	1.67	1255.35	5.82	1261.17		0.001021	0.0000	0.034	3.61	440.56	104.96	0.31
North Inlet Chan	Olive-Northern	19018.3*	PF 2	1590.05	1.67	1255.35	5.81	1261.16		0.001115	0.0000	0.035	3.68	432.57	102.42	0.32
North Inlet Chan	Olive-Northern	19016.6*	PF 2	1590.05	1.67	1255.35	5.80	1261.15		0.001147	0.0000	0.035	3.74	424.80	99.90	0.32
North Inlet Chan	Olive-Northern	19015.00	PF 2	1590.05	1.67	1255.35	5.79	1261.14		0.001255	0.0000	0.036	3.82	416.33	97.29	0.33
North Inlet Chan	Olive-Northern	19013.3*	PF 2	1590.05	1.67	1255.35	5.75	1261.10		0.001453	0.0000	0.036	4.05	392.39	93.68	0.35
North Inlet Chan	Olive-Northern	19011.6*	PF 2	1590.05	1.67	1255.35	5.71	1261.06		0.001688	0.0000	0.036	4.31	369.27	90.07	0.37
North Inlet Chan	Olive-Northern	19010.*	PF 2	1590.05	1.67	1255.35	5.67	1261.02		0.001986	0.0000	0.036	4.60	345.76	86.34	0.40
North Inlet Chan	Olive-Northern	19008.3*	PF 2	1590.05	1.67	1255.35	5.61	1260.96		0.002368	0.0000	0.036	4.93	322.25	82.53	0.44
North Inlet Chan	Olive-Northern	19006.6*	PF 2	1590.05	1.67	1255.34	5.55	1260.89		0.002844	0.0000	0.036	5.31	299.32	78.71	0.48
North Inlet Chan	Olive-Northern	19005.*	PF 2	1590.05	1.67	1255.34	5.45	1260.79		0.003509	0.0000	0.036	5.78	275.18	74.62	0.53
North Inlet Chan	Olive-Northern	19003.3*	PF 2	1590.05	1.67	1255.34	5.33	1260.67		0.004455	0.0000	0.036	6.36	250.20	70.29	0.59
North Inlet Chan	Olive-Northern	19001.6*	PF 2	1590.05	1.67	1255.34	5.13	1260.47		0.005053	0.0000	0.036	7.17	221.77	65.37	0.69
North Inlet Chan	Olive-Northern	19000.00	PF 2	1590.05	2.00	1255.34	4.41	1259.75	1259.75	0.013236	0.2500	0.036	9.62	165.23	56.29	0.99
North Inlet Chan	Olive-Northern	18998.*	PF 2	1590.05	2.00	1254.84	3.63	1258.47	1259.24	0.029728	0.2500	0.036	12.87	123.55	50.02	1.44
North Inlet Chan	Olive-Northern	18996.*	PF 2	1590.05	2.00	1254.34	3.37	1257.71	1258.74	0.040412	0.2500	0.036	14.36	110.74	47.93	1.68
North Inlet Chan	Olive-Northern	18994.*	PF 2	1590.05	2.00	1253.84	3.19	1257.03	1258.24	0.050106	0.2500	0.036	15.50	102.60	46.55	1.84
North Inlet Chan	Olive-Northern	18992.*	PF 2	1590.05	2.00	1253.34	3.06	1256.40	1257.74	0.059344	0.2500	0.036	16.45	96.63	45.51	1.99
North Inlet Chan	Olive-Northern	18990.*	PF 2	1590.05	2.00	1252.84	2.96	1255.80	1257.24	0.068157	0.2500	0.036	17.28	92.02	44.69	2.12
North Inlet Chan	Olive-Northern	18988.*	PF 2	1590.05	2.00	1252.34	2.88	1255.22	1256.74	0.076607	0.2500	0.036	18.01	88.31	44.02	2.24
North Inlet Chan	Olive-Northern	18986.00	PF 2	1590.05	2.00	1251.84	2.81	1254.65	1256.25	0.084785	0.0000	0.036	18.66	85.21	43.46	2.35
North Inlet Chan	Olive-Northern	18984.*	PF 2	1590.05	2.00	1251.84	2.74	1254.59	1256.13	0.084449	0.0000	0.036	18.38	86.52	45.08	2.34
North Inlet Chan	Olive-Northern	18982.*	PF 2	1590.05	2.00	1251.84	2.69	1254.53	1256.02	0.084044	0.0000	0.036	18.08	87.92	46.83	2.33
North Inlet Chan	Olive-Northern	18980.*	PF 2	1590.05	2.00	1251.84	2.63	1254.47	1255.92	0.083277	0.0050	0.036	17.79	89.36	48.49	2.31

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	18978.*	PF 2	1590.05	2.00	1251.83	2.58	1254.41	1255.82	0.082464	0.0000	0.036	17.50	90.84	50.20	2.29
North Inlet Chan	Olive-Northern	18976.*	PF 2	1590.05	2.00	1251.83	5.68	1257.51	1255.71	0.002871	0.0000	0.036	5.37	296.19	77.15	0.48
North Inlet Chan	Olive-Northern	18974.*	PF 2	1590.05	2.00	1251.83	5.70	1257.53		0.002596	0.0000	0.036	5.15	308.84	79.44	0.46
North Inlet Chan	Olive-Northern	18972.*	PF 2	1590.05	2.00	1251.83	5.72	1257.55		0.002346	0.0000	0.036	4.94	321.91	81.72	0.44
North Inlet Chan	Olive-Northern	18970.*	PF 2	1590.05	2.00	1251.83	5.73	1257.56		0.002131	0.0000	0.036	4.75	334.94	83.98	0.42
North Inlet Chan	Olive-Northern	18968.*	PF 2	1590.05	2.00	1251.83	5.74	1257.57		0.001936	0.0000	0.036	4.56	348.36	86.23	0.40
North Inlet Chan	Olive-Northern	18966.*	PF 2	1590.05	2.00	1251.83	5.76	1257.59		0.001762	0.0050	0.036	4.39	362.03	88.50	0.38
North Inlet Chan	Olive-Northern	18964.*	PF 2	1590.05	2.00	1251.82	5.78	1257.60		0.001605	0.0000	0.036	4.23	376.13	90.80	0.37
North Inlet Chan	Olive-Northern	18962.*	PF 2	1590.05	2.00	1251.82	5.79	1257.61		0.001471	0.0000	0.036	4.08	389.88	93.02	0.35
North Inlet Chan	Olive-Northern	18960.*	PF 2	1590.05	2.00	1251.82	5.80	1257.62		0.001348	0.0000	0.036	3.94	404.02	95.24	0.34
North Inlet Chan	Olive-Northern	18958.00	PF 2	1590.05	1.67	1251.82	5.81	1257.63		0.001239	0.0000	0.036	3.80	418.14	97.44	0.32
North Inlet Chan	Olive-Northern	18956.3*	PF 2	1590.05	1.67	1251.82	5.81	1257.63		0.001139	0.0000	0.035	3.73	425.84	99.98	0.32
North Inlet Chan	Olive-Northern	18954.6*	PF 2	1590.05	1.67	1251.82	5.81	1257.63		0.001110	0.0000	0.035	3.67	433.26	102.48	0.31
North Inlet Chan	Olive-Northern	18953.*	PF 2	1590.05	1.67	1251.82	5.81	1257.64		0.001024	0.0000	0.034	3.61	440.14	104.93	0.31
North Inlet Chan	Olive-Northern	18951.3*	PF 2	1590.05	1.67	1251.82	5.82	1257.64		0.000943	0.0059	0.033	3.56	447.13	107.37	0.31
North Inlet Chan	Olive-Northern	18949.6*	PF 2	1590.05	1.67	1251.81	5.83	1257.64		0.000921	0.0000	0.033	3.50	454.26	109.84	0.30
North Inlet Chan	Olive-Northern	18948.*	PF 2	1590.05	1.67	1251.81	5.83	1257.64		0.000850	0.0000	0.032	3.45	460.65	112.21	0.30
North Inlet Chan	Olive-Northern	18946.3*	PF 2	1590.05	1.67	1251.81	5.83	1257.64		0.000784	0.0000	0.031	3.41	466.87	114.54	0.30
North Inlet Chan	Olive-Northern	18944.6*	PF 2	1590.05	1.67	1251.81	5.84	1257.65		0.000771	0.0000	0.031	3.36	472.81	116.83	0.29
North Inlet Chan	Olive-Northern	18943.00	PF 2	1590.05	42.92	1251.81	5.84	1257.65		0.000713	0.0007	0.030	3.32	478.23	119.05	0.29
North Inlet Chan	Olive-Northern	18900.0*	PF 2	1590.05	42.92	1251.78	5.84	1257.62		0.000713	0.0007	0.030	3.33	478.16	119.04	0.29
North Inlet Chan	Olive-Northern	18857.1*	PF 2	1590.05	42.92	1251.75	5.84	1257.59		0.000713	0.0009	0.030	3.33	478.09	119.04	0.29
North Inlet Chan	Olive-Northern	18814.2*	PF 2	1590.05	42.92	1251.71	5.85	1257.56		0.000709	0.0007	0.030	3.32	479.24	119.15	0.29
North Inlet Chan	Olive-Northern	18771.2*	PF 2	1590.05	42.92	1251.68	5.85	1257.53		0.000709	0.0007	0.030	3.32	479.16	119.14	0.29
North Inlet Chan	Olive-Northern	18728.3*	PF 2	1590.05	42.92	1251.65	5.84	1257.50		0.000709	0.0007	0.030	3.32	479.11	119.14	0.29
North Inlet Chan	Olive-Northern	18685.4*	PF 2	1590.05	42.92	1251.62	5.84	1257.46		0.000709	0.0009	0.030	3.32	479.05	119.13	0.29
North Inlet Chan	Olive-Northern	18642.5*	PF 2	1590.05	42.93	1251.58	5.85	1257.43		0.000705	0.0007	0.030	3.31	480.21	119.25	0.29
North Inlet Chan	Olive-Northern	18599.58	PF 2	1590.05	1.67	1251.55	5.85	1257.40		0.000705	0.0000	0.030	3.31	480.15	119.24	0.29
North Inlet Chan	Olive-Northern	18597.9*	PF 2	1590.05	1.67	1251.55	5.85	1257.40		0.000765	0.0000	0.031	3.35	474.18	116.98	0.29
North Inlet Chan	Olive-Northern	18596.2*	PF 2	1590.05	1.67	1251.55	5.84	1257.39		0.000778	0.0000	0.031	3.40	468.04	114.63	0.30
North Inlet Chan	Olive-Northern	18594.5*	PF 2	1590.05	1.67	1251.55	5.83	1257.39		0.000845	0.0000	0.032	3.44	461.64	112.27	0.30
North Inlet Chan	Olive-Northern	18592.9*	PF 2	1590.05	1.67	1251.55	5.83	1257.38		0.000919	0.0060	0.033	3.50	454.61	109.84	0.30
North Inlet Chan	Olive-Northern	18591.2*	PF 2	1590.05	1.67	1251.54	5.83	1257.37		0.000940	0.0000	0.033	3.55	447.67	107.45	0.31
North Inlet Chan	Olive-Northern	18589.5*	PF 2	1590.05	1.67	1251.54	5.82	1257.36		0.001020	0.0000	0.034	3.61	440.75	104.98	0.31
North Inlet Chan	Olive-Northern	18587.9*	PF 2	1590.05	1.67	1251.54	5.81	1257.35		0.001113	0.0000	0.035	3.67	432.75	102.44	0.32
North Inlet Chan	Olive-Northern	18586.2*	PF 2	1590.05	1.67	1251.54	5.80	1257.34		0.001146	0.0000	0.035	3.74	424.97	99.91	0.32
North Inlet Chan	Olive-Northern	18584.58	PF 2	1590.05	1.67	1251.54	5.79	1257.33		0.001253	0.0000	0.036	3.82	416.50	97.31	0.33
North Inlet Chan	Olive-Northern	18582.9*	PF 2	1590.05	1.67	1251.54	5.76	1257.30		0.001451	0.0000	0.036	4.05	392.55	93.69	0.35
North Inlet Chan	Olive-Northern	18581.2*	PF 2	1590.05	1.67	1251.54	5.72	1257.26		0.001688	0.0000	0.036	4.30	369.43	90.08	0.37
North Inlet Chan	Olive-Northern	18579.5*	PF 2	1590.05	1.67	1251.54	5.67	1257.21		0.001985	0.0000	0.036	4.60	345.92	86.36	0.40
North Inlet Chan	Olive-Northern	18577.9*	PF 2	1590.05	1.67	1251.54	5.61	1257.15		0.002365	0.0060	0.036	4.93	322.40	82.54	0.44
North Inlet Chan	Olive-Northern	18576.2*	PF 2	1590.05	1.67	1251.53	5.55	1257.08		0.002840	0.0000	0.036	5.31	299.49	78.73	0.48
North Inlet Chan	Olive-Northern	18574.5*	PF 2	1590.05	1.67	1251.53	5.46	1256.99		0.003502	0.0000	0.036	5.77	275.36	74.64	0.53
North Inlet Chan	Olive-Northern	18572.9*	PF 2	1590.05	1.67	1251.53	5.33	1256.86		0.004445	0.0000	0.036	6.35	250.39	70.31	0.59
North Inlet Chan	Olive-Northern	18571.2*	PF 2	1590.05	1.67	1251.53	5.13	1256.66		0.006037	0.0000	0.036	7.16	221.99	65.40	0.69
North Inlet Chan	Olive-Northern	18569.58	PF 2	1590.05	2.00	1251.53	4.40	1255.93	1255.93	0.013433	0.2500	0.036	9.67	164.35	56.17	1.00
North Inlet Chan	Olive-Northern	18567.5*	PF 2	1590.05	2.00	1251.03	3.63	1254.66	1255.43	0.029712	0.2500	0.036	12.87	123.58	50.02	1.44
North Inlet Chan	Olive-Northern	18565.5*	PF 2	1590.05	2.00	1250.53	3.37	1253.90	1254.93	0.040400	0.2500	0.036	14.36	110.75	47.93	1.66
North Inlet Chan	Olive-Northern	18563.5*	PF 2	1590.05	2.00	1250.03	3.19	1253.22	1254.43	0.050097	0.2500	0.036	15.50	102.61	46.55	1.84
North Inlet Chan	Olive-Northern	18561.5*	PF 2	1590.05	2.00	1249.53	3.06	1252.59	1253.93	0.059334	0.2500	0.036	16.45	96.64	45.51	1.99
North Inlet Chan	Olive-Northern	18559.5*	PF 2	1590.05	2.00	1249.03	2.96	1251.99	1253.43	0.068144	0.2500	0.036	17.28	92.03	44.69	2.12
North Inlet Chan	Olive-Northern	18557.5*	PF 2	1590.05	2.00	1248.53	2.88	1251.41	1252.93	0.076594	0.2500	0.036	18.00	88.31	44.02	2.24
North Inlet Chan	Olive-Northern	18555.58	PF 2	1590.05	2.00	1248.03	2.81	1250.84	1252.43	0.084771	0.0000	0.036	18.66	85.21	43.46	2.35
North Inlet Chan	Olive-Northern	18553.5*	PF 2	1590.05	2.00	1248.03	2.74	1250.78	1252.32	0.084431	0.0000	0.036	18.38	86.53	45.08	2.34
North Inlet Chan	Olive-Northern	18551.5*	PF 2	1590.05	2.00	1248.03	2.69	1250.72	1252.21	0.084036	0.0000	0.036	18.08	87.93	46.83	2.33
North Inlet Chan	Olive-Northern	18549.5*	PF 2	1590.05	2.00	1248.03	2.63	1250.66	1252.11	0.083268	0.0050	0.036	17.79	89.37	48.49	2.31
North Inlet Chan	Olive-Northern	18547.5*	PF 2	1590.05	2.00	1248.02	2.58	1250.60	1252.01	0.082455	0.0000	0.036	17.50	90.84	50.20	2.29
North Inlet Chan	Olive-Northern	18545.5*	PF 2	1590.05	2.00	1248.02	5.68	1253.70	1251.91	0.002874	0.0000	0.036	5.37	296.11	77.15	0.48
North Inlet Chan	Olive-Northern	18543.5*	PF 2	1590.05	2.00	1248.02	5.70	1253.72		0.002598	0.0000	0.036	5.15	308.75	79.43	0.46

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Ch Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	18541.5*	PF 2	1590.05	2.00	1248.02	5.71	1253.73		0.002348	0.0000	0.036	4.94	321.83	81.71	0.44
North Inlet Chan	Olive-Northern	18539.5*	PF 2	1590.05	2.00	1248.02	5.73	1253.75		0.002133	0.0000	0.036	4.75	334.66	83.97	0.42
North Inlet Chan	Olive-Northern	18537.5*	PF 2	1590.05	2.00	1248.02	5.74	1253.76		0.001937	0.0000	0.036	4.57	348.27	86.22	0.40
North Inlet Chan	Olive-Northern	18535.5*	PF 2	1590.05	2.00	1248.02	5.76	1253.78		0.001764	0.0050	0.036	4.39	361.94	88.49	0.38
North Inlet Chan	Olive-Northern	18533.5*	PF 2	1590.05	2.00	1248.01	5.78	1253.79		0.001606	0.0000	0.036	4.23	376.03	90.79	0.37
North Inlet Chan	Olive-Northern	18531.5*	PF 2	1590.05	2.00	1248.01	5.79	1253.80		0.001472	0.0000	0.036	4.08	389.78	93.02	0.35
North Inlet Chan	Olive-Northern	18529.5*	PF 2	1590.05	2.00	1248.01	5.80	1253.81		0.001349	0.0000	0.036	3.94	403.92	95.23	0.34
North Inlet Chan	Olive-Northern	18527.59	PF 2	1590.05	1.67	1248.01	5.80	1253.81		0.001240	0.0000	0.036	3.80	418.03	97.43	0.32
North Inlet Chan	Olive-Northern	18525.9*	PF 2	1590.05	1.67	1248.01	5.81	1253.82		0.001140	0.0000	0.035	3.73	425.73	99.98	0.32
North Inlet Chan	Olive-Northern	18524.2*	PF 2	1590.05	1.67	1248.01	5.81	1253.82		0.001110	0.0000	0.035	3.67	433.15	102.47	0.31
North Inlet Chan	Olive-Northern	18522.5*	PF 2	1590.05	1.67	1248.01	5.81	1253.82		0.001025	0.0000	0.034	3.61	440.02	104.92	0.31
North Inlet Chan	Olive-Northern	18520.9*	PF 2	1590.05	1.67	1248.01	5.82	1253.83		0.000944	0.0060	0.033	3.56	447.02	107.36	0.31
North Inlet Chan	Olive-Northern	18519.2*	PF 2	1590.05	1.67	1248.00	5.83	1253.83		0.000922	0.0000	0.033	3.50	454.14	109.83	0.30
North Inlet Chan	Olive-Northern	18517.5*	PF 2	1590.05	1.67	1248.00	5.83	1253.83		0.000851	0.0000	0.032	3.45	460.53	112.20	0.30
North Inlet Chan	Olive-Northern	18515.9*	PF 2	1590.05	1.67	1248.00	5.83	1253.83		0.000784	0.0000	0.031	3.41	466.76	114.53	0.30
North Inlet Chan	Olive-Northern	18514.2*	PF 2	1590.05	1.67	1248.00	5.83	1253.84		0.000772	0.0000	0.031	3.36	472.69	116.82	0.29
North Inlet Chan	Olive-Northern	18512.58	PF 2	1590.05	36.36	1248.00	5.84	1253.84		0.000713	0.0008	0.030	3.33	478.12	119.04	0.29
North Inlet Chan	Olive-Northern	18476.2*	PF 2	1590.05	36.36	1247.97	5.84	1253.81		0.000711	0.0008	0.030	3.32	478.61	119.09	0.29
North Inlet Chan	Olive-Northern	18439.8*	PF 2	1590.05	36.36	1247.94	5.84	1253.79		0.000709	0.0008	0.030	3.32	479.12	119.14	0.29
North Inlet Chan	Olive-Northern	18403.5*	PF 2	1590.05	36.36	1247.91	5.85	1253.76		0.000707	0.0008	0.030	3.32	479.61	119.19	0.29
North Inlet Chan	Olive-Northern	18367.14	PF 2	1590.05	1.67	1247.88	5.85	1253.73		0.000705	0.0000	0.030	3.31	480.14	119.24	0.29
North Inlet Chan	Olive-Northern	18365.4*	PF 2	1590.05	1.67	1247.88	5.85	1253.73		0.000765	0.0000	0.031	3.35	474.17	116.96	0.29
North Inlet Chan	Olive-Northern	18363.8*	PF 2	1590.05	1.67	1247.88	5.84	1253.72		0.000778	0.0000	0.031	3.40	468.03	114.62	0.30
North Inlet Chan	Olive-Northern	18362.1*	PF 2	1590.05	1.67	1247.88	5.83	1253.72		0.000845	0.0000	0.032	3.44	461.82	112.27	0.30
North Inlet Chan	Olive-Northern	18360.4*	PF 2	1590.05	1.67	1247.88	5.83	1253.71		0.000919	0.0060	0.033	3.50	454.59	109.84	0.30
North Inlet Chan	Olive-Northern	18358.8*	PF 2	1590.05	1.67	1247.87	5.83	1253.70		0.000940	0.0000	0.033	3.55	447.65	107.45	0.31
North Inlet Chan	Olive-Northern	18357.1*	PF 2	1590.05	1.67	1247.87	5.82	1253.69		0.001020	0.0000	0.034	3.61	440.72	104.98	0.31
North Inlet Chan	Olive-Northern	18355.4*	PF 2	1590.05	1.67	1247.87	5.81	1253.68		0.001113	0.0000	0.035	3.67	432.74	102.44	0.32
North Inlet Chan	Olive-Northern	18353.8*	PF 2	1590.05	1.67	1247.87	5.80	1253.67		0.001146	0.0000	0.035	3.74	424.96	99.91	0.32
North Inlet Chan	Olive-Northern	18352.14	PF 2	1590.05	1.67	1247.87	5.79	1253.66		0.001253	0.0000	0.036	3.82	416.49	97.31	0.33
North Inlet Chan	Olive-Northern	18350.4*	PF 2	1590.05	1.67	1247.87	5.75	1253.63		0.001452	0.0000	0.036	4.05	392.54	93.69	0.35
North Inlet Chan	Olive-Northern	18348.8*	PF 2	1590.05	1.67	1247.87	5.72	1253.59		0.001687	0.0000	0.036	4.30	369.42	90.08	0.37
North Inlet Chan	Olive-Northern	18347.1*	PF 2	1590.05	1.67	1247.87	5.67	1253.54		0.001985	0.0000	0.036	4.60	345.91	86.36	0.40
North Inlet Chan	Olive-Northern	18345.4*	PF 2	1590.05	1.67	1247.87	5.61	1253.48		0.002365	0.0060	0.036	4.93	322.39	82.54	0.44
North Inlet Chan	Olive-Northern	18343.8*	PF 2	1590.05	1.67	1247.86	5.55	1253.41		0.002840	0.0000	0.036	5.31	299.47	78.72	0.48
North Inlet Chan	Olive-Northern	18342.1*	PF 2	1590.05	1.67	1247.86	5.46	1253.32		0.003503	0.0000	0.036	5.77	275.35	74.64	0.53
North Inlet Chan	Olive-Northern	18340.4*	PF 2	1590.05	1.67	1247.86	5.33	1253.19		0.004445	0.0000	0.036	6.35	250.39	70.31	0.59
North Inlet Chan	Olive-Northern	18338.8*	PF 2	1590.05	1.67	1247.86	5.13	1252.99		0.006037	0.0000	0.036	7.16	221.99	65.40	0.69
North Inlet Chan	Olive-Northern	18337.14	PF 2	1590.05	2.00	1247.86	4.40	1252.26	1252.26	0.013436	0.2500	0.036	9.68	164.34	56.16	1.00
North Inlet Chan	Olive-Northern	18335.1*	PF 2	1590.05	2.00	1247.36	3.63	1250.99	1251.76	0.029712	0.2500	0.036	12.87	123.58	50.02	1.44
North Inlet Chan	Olive-Northern	18333.1*	PF 2	1590.05	2.00	1246.86	3.36	1250.22	1251.23	0.040569	0.2500	0.036	14.38	110.59	47.90	1.67
North Inlet Chan	Olive-Northern	18331.1*	PF 2	1590.05	2.00	1246.36	3.19	1249.55	1250.73	0.050254	0.2500	0.036	15.51	102.49	46.53	1.84
North Inlet Chan	Olive-Northern	18329.1*	PF 2	1590.05	2.00	1245.86	3.06	1248.92	1250.27	0.059479	0.2500	0.036	16.47	96.56	45.50	1.99
North Inlet Chan	Olive-Northern	18327.1*	PF 2	1590.05	2.00	1245.36	2.96	1248.32	1249.77	0.068053	0.2500	0.036	17.27	92.07	44.70	2.12
North Inlet Chan	Olive-Northern	18325.1*	PF 2	1590.05	2.00	1244.86	2.88	1247.74	1249.27	0.076512	0.2500	0.036	18.00	88.34	44.03	2.24
North Inlet Chan	Olive-Northern	18323.14	PF 2	1590.05	2.00	1244.36	2.81	1247.17	1248.76	0.084695	0.0000	0.036	18.65	85.24	43.46	2.35
North Inlet Chan	Olive-Northern	18321.1*	PF 2	1590.05	2.00	1244.36	2.75	1247.11	1248.65	0.084356	0.0000	0.036	18.37	86.55	45.09	2.34
North Inlet Chan	Olive-Northern	18319.1*	PF 2	1590.05	2.00	1244.36	2.69	1247.05	1248.54	0.083959	0.0000	0.036	18.08	87.95	46.83	2.32
North Inlet Chan	Olive-Northern	18317.1*	PF 2	1590.05	2.00	1244.36	2.63	1246.99	1248.44	0.083194	0.0050	0.036	17.79	89.39	48.49	2.31
North Inlet Chan	Olive-Northern	18315.1*	PF 2	1590.05	2.00	1244.35	2.58	1246.93	1248.34	0.082384	0.0000	0.036	17.50	90.87	50.20	2.29
North Inlet Chan	Olive-Northern	18313.1*	PF 2	1590.05	2.00	1244.35	2.52	1246.87	1248.24	0.081238	0.0000	0.036	17.20	92.44	51.88	2.27
North Inlet Chan	Olive-Northern	18311.1*	PF 2	1590.05	2.00	1244.35	5.53	1249.88	1248.14	0.002927	0.0000	0.036	5.37	295.89	78.13	0.49
North Inlet Chan	Olive-Northern	18309.1*	PF 2	1590.05	2.00	1244.35	5.55	1249.90		0.002639	0.0000	0.036	5.15	308.74	80.42	0.46
North Inlet Chan	Olive-Northern	18307.1*	PF 2	1590.05	2.00	1244.35	5.57	1249.92		0.002392	0.0000	0.036	4.95	321.52	82.69	0.44
North Inlet Chan	Olive-Northern	18305.1*	PF 2	1590.05	2.00	1244.35	5.58	1249.93		0.002168	0.0000	0.036	4.75	334.68	84.85	0.42
North Inlet Chan	Olive-Northern	18303.1*	PF 2	1590.05	2.00	1244.35	5.60	1249.95		0.001970	0.0050	0.036	4.57	348.10	87.23	0.40
North Inlet Chan	Olive-Northern	18301.1*	PF 2	1590.05	2.00	1244.34	5.62	1249.96		0.001791	0.0000	0.036	4.39	361.93	89.54	0.39
North Inlet Chan	Olive-Northern	18299.1*	PF 2	1590.05	2.00	1244.34	5.63	1249.97		0.001638	0.0000	0.036	4.24	375.40	91.77	0.37
North Inlet Chan	Olive-Northern	18297.1*	PF 2	1590.05	2.00	1244.34	5.64	1249.98		0.001499	0.0000	0.036	4.08	389.28	93.99	0.35

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	18295.14	PF 2	1590.05	1.67	1244.34	5.65	1249.99		0.001376	0.0000	0.036	3.94	403.12	98.20	0.34
North Inlet Chan	Olive-Northern	18293.4*	PF 2	1590.05	1.67	1244.34	5.65	1249.99		0.001265	0.0000	0.035	3.87	410.44	98.69	0.33
North Inlet Chan	Olive-Northern	18291.6*	PF 2	1590.05	1.67	1244.34	5.66	1250.00		0.001233	0.0000	0.035	3.81	417.49	101.12	0.33
North Inlet Chan	Olive-Northern	18290.1*	PF 2	1590.05	1.67	1244.34	5.66	1250.00		0.001139	0.0000	0.034	3.75	423.99	103.50	0.33
North Inlet Chan	Olive-Northern	18288.4*	PF 2	1590.05	1.67	1244.34	5.66	1250.00		0.001049	0.0060	0.033	3.69	430.61	105.88	0.32
North Inlet Chan	Olive-Northern	18286.6*	PF 2	1590.05	1.67	1244.33	5.68	1250.01		0.001026	0.0000	0.033	3.64	437.37	108.28	0.32
North Inlet Chan	Olive-Northern	18285.1*	PF 2	1590.05	1.67	1244.33	5.68	1250.01		0.000947	0.0000	0.032	3.59	443.41	110.58	0.32
North Inlet Chan	Olive-Northern	18283.4*	PF 2	1590.05	1.67	1244.33	5.68	1250.01		0.000873	0.0000	0.031	3.54	449.30	112.85	0.31
North Inlet Chan	Olive-Northern	18281.8*	PF 2	1590.05	1.67	1244.33	5.68	1250.01		0.000859	0.0000	0.031	3.50	454.89	115.05	0.31
North Inlet Chan	Olive-Northern	18280.14	PF 2	1590.05	38.64	1244.33	5.68	1250.01		0.000794	0.0008	0.030	3.46	459.98	117.20	0.31
North Inlet Chan	Olive-Northern	18241.5*	PF 2	1590.05	38.64	1244.30	5.68	1249.98		0.000777	0.0008	0.030	3.43	463.77	117.69	0.30
North Inlet Chan	Olive-Northern	18202.8*	PF 2	1590.05	38.64	1244.27	5.69	1249.96		0.000760	0.0008	0.030	3.40	467.66	118.20	0.30
North Inlet Chan	Olive-Northern	18164.2*	PF 2	1590.05	38.64	1244.24	5.69	1249.93		0.000744	0.0008	0.030	3.37	471.64	118.72	0.30
North Inlet Chan	Olive-Northern	18125.5*	PF 2	1590.05	38.64	1244.21	5.69	1249.90		0.000727	0.0008	0.030	3.34	475.71	119.24	0.29
North Inlet Chan	Olive-Northern	18086.94	PF 2	1590.05	1.67	1244.18	5.70	1249.88		0.000710	0.0000	0.030	3.31	479.89	119.77	0.29
North Inlet Chan	Olive-Northern	18085.2*	PF 2	1590.05	1.67	1244.18	5.69	1249.87		0.000771	0.0000	0.031	3.35	473.94	117.46	0.29
North Inlet Chan	Olive-Northern	18083.6*	PF 2	1590.05	1.67	1244.18	5.68	1249.87		0.000785	0.0000	0.031	3.40	467.46	115.10	0.30
North Inlet Chan	Olive-Northern	18081.9*	PF 2	1590.05	1.67	1244.18	5.68	1249.86		0.000855	0.0000	0.032	3.45	460.73	112.72	0.30
North Inlet Chan	Olive-Northern	18080.2*	PF 2	1590.05	1.67	1244.18	5.67	1249.85		0.000930	0.0060	0.033	3.50	453.74	110.28	0.30
North Inlet Chan	Olive-Northern	18078.6*	PF 2	1590.05	1.67	1244.17	5.67	1249.84		0.000951	0.0000	0.033	3.56	446.84	107.87	0.31
North Inlet Chan	Olive-Northern	18076.9*	PF 2	1590.05	1.67	1244.17	5.66	1249.83		0.001034	0.0000	0.034	3.62	439.58	105.37	0.31
North Inlet Chan	Olive-Northern	18075.2*	PF 2	1590.05	1.67	1244.17	5.65	1249.82		0.001128	0.0000	0.035	3.68	431.63	102.81	0.32
North Inlet Chan	Olive-Northern	18073.6*	PF 2	1590.05	1.67	1244.17	5.64	1249.81		0.001164	0.0000	0.035	3.75	423.56	100.27	0.32
North Inlet Chan	Olive-Northern	18071.94	PF 2	1590.05	1.67	1244.17	5.63	1249.80		0.001273	0.0000	0.036	3.83	415.09	97.64	0.33
North Inlet Chan	Olive-Northern	18070.2*	PF 2	1590.05	1.67	1244.17	5.60	1249.77		0.001474	0.0000	0.036	4.06	391.32	94.03	0.35
North Inlet Chan	Olive-Northern	18068.6*	PF 2	1590.05	1.67	1244.17	5.56	1249.73		0.001709	0.0000	0.036	4.32	368.47	90.42	0.38
North Inlet Chan	Olive-Northern	18066.9*	PF 2	1590.05	1.67	1244.17	5.51	1249.68		0.002009	0.0000	0.036	4.61	345.22	86.69	0.41
North Inlet Chan	Olive-Northern	18065.2*	PF 2	1590.05	1.67	1244.17	5.45	1249.62		0.002388	0.0060	0.036	4.94	321.95	82.88	0.44
North Inlet Chan	Olive-Northern	18063.6*	PF 2	1590.05	1.67	1244.16	5.39	1249.55		0.002863	0.0000	0.036	5.31	299.26	79.07	0.48
North Inlet Chan	Olive-Northern	18061.9*	PF 2	1590.05	1.67	1244.16	5.30	1249.46		0.003523	0.0000	0.036	5.77	275.37	74.99	0.53
North Inlet Chan	Olive-Northern	18060.2*	PF 2	1590.05	1.67	1244.16	5.17	1249.33		0.004480	0.0000	0.036	6.35	250.28	70.66	0.59
North Inlet Chan	Olive-Northern	18058.6*	PF 2	1590.05	1.67	1244.16	4.98	1249.14		0.006072	0.0000	0.036	7.16	222.06	65.75	0.69
North Inlet Chan	Olive-Northern	18056.94	PF 2	1590.05	2.00	1244.16	4.25	1248.41	1248.41	0.013406	0.2500	0.036	9.64	164.95	58.61	1.00
North Inlet Chan	Olive-Northern	18054.9*	PF 2	1590.05	2.00	1243.66	3.51	1247.17	1247.93	0.029491	0.2500	0.036	12.79	124.30	50.48	1.44
North Inlet Chan	Olive-Northern	18052.9*	PF 2	1590.05	2.00	1243.16	3.28	1246.44	1247.46	0.039708	0.2500	0.036	14.23	111.75	48.38	1.65
North Inlet Chan	Olive-Northern	18050.9*	PF 2	1590.05	2.00	1242.66	3.14	1245.80	1246.98	0.049016	0.2500	0.036	15.34	103.65	46.95	1.82
North Inlet Chan	Olive-Northern	18048.9*	PF 2	1590.05	2.00	1242.16	3.02	1245.18	1246.47	0.057948	0.2500	0.036	16.28	97.64	45.88	1.97
North Inlet Chan	Olive-Northern	18046.9*	PF 2	1590.05	2.00	1241.66	2.94	1244.60	1246.02	0.066247	0.2500	0.036	17.08	93.08	45.01	2.09
North Inlet Chan	Olive-Northern	18044.9*	PF 2	1590.05	2.00	1241.16	2.88	1244.04	1245.53	0.074194	0.2500	0.036	17.79	89.37	44.28	2.21
North Inlet Chan	Olive-Northern	18042.94	PF 2	1590.05	2.00	1240.66	2.83	1243.49	1245.06	0.081777	0.0000	0.036	18.42	86.30	43.66	2.31
North Inlet Chan	Olive-Northern	18040.9*	PF 2	1590.05	2.00	1240.66	2.77	1243.43	1244.95	0.081577	0.0000	0.036	18.16	87.57	45.27	2.30
North Inlet Chan	Olive-Northern	18038.9*	PF 2	1590.05	2.00	1240.66	2.71	1243.37	1244.84	0.081321	0.0000	0.036	17.88	88.93	47.00	2.29
North Inlet Chan	Olive-Northern	18036.9*	PF 2	1590.05	2.00	1240.66	2.65	1243.31	1244.74	0.080706	0.0050	0.036	17.60	90.33	48.65	2.28
North Inlet Chan	Olive-Northern	18034.9*	PF 2	1590.05	2.00	1240.65	2.60	1243.25	1244.64	0.080034	0.0000	0.036	17.33	91.77	50.34	2.26
North Inlet Chan	Olive-Northern	18032.9*	PF 2	1590.05	2.00	1240.65	5.69	1246.34	1244.54	0.002846	0.0000	0.036	5.35	297.14	77.25	0.48
North Inlet Chan	Olive-Northern	18030.9*	PF 2	1590.05	2.00	1240.65	5.71	1246.36		0.002573	0.0000	0.036	5.13	309.80	79.54	0.46
North Inlet Chan	Olive-Northern	18028.9*	PF 2	1590.05	2.00	1240.65	5.73	1246.38		0.002326	0.0000	0.036	4.92	322.90	81.81	0.44
North Inlet Chan	Olive-Northern	18026.9*	PF 2	1590.05	2.00	1240.65	5.74	1246.39		0.002113	0.0000	0.036	4.73	335.94	84.08	0.42
North Inlet Chan	Olive-Northern	18024.9*	PF 2	1590.05	2.00	1240.65	5.76	1246.41		0.001920	0.0000	0.036	4.55	349.38	86.33	0.40
North Inlet Chan	Olive-Northern	18022.9*	PF 2	1590.05	2.00	1240.65	5.77	1246.42		0.001748	0.0050	0.036	4.38	363.08	88.59	0.38
North Inlet Chan	Olive-Northern	18020.9*	PF 2	1590.05	2.00	1240.64	5.79	1246.43		0.001592	0.0000	0.036	4.22	377.20	90.89	0.36
North Inlet Chan	Olive-Northern	18018.9*	PF 2	1590.05	2.00	1240.64	5.80	1246.44		0.001459	0.0000	0.036	4.07	390.96	93.12	0.35
North Inlet Chan	Olive-Northern	18016.9*	PF 2	1590.05	2.00	1240.64	5.81	1246.45		0.001337	0.0000	0.036	3.92	405.13	95.33	0.34
North Inlet Chan	Olive-Northern	18014.94	PF 2	1590.05	1.67	1240.64	5.82	1246.46		0.001230	0.0000	0.036	3.79	419.27	97.54	0.32
North Inlet Chan	Olive-Northern	18013.2*	PF 2	1590.05	1.67	1240.64	5.82	1246.46		0.001130	0.0000	0.035	3.72	426.99	100.08	0.32
North Inlet Chan	Olive-Northern	18011.6*	PF 2	1590.05	1.67	1240.64	5.82	1246.46		0.001101	0.0000	0.035	3.66	434.45	102.58	0.31
North Inlet Chan	Olive-Northern	18009.9*	PF 2	1590.05	1.67	1240.64	5.83	1246.47		0.001016	0.0000	0.034	3.60	441.36	105.03	0.31
North Inlet Chan	Olive-Northern	18008.2*	PF 2	1590.05	1.67	1240.64	5.83	1246.47		0.000936	0.0060	0.033	3.55	448.38	107.48	0.31
North Inlet Chan	Olive-Northern	18006.6*	PF 2	1590.05	1.67	1240.63	5.84	1246.47		0.000914	0.0000	0.033	3.49	455.53	109.96	0.30

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	18004.9*	PF 2	1590.05	1.67	1240.63	5.84	1246.47		0.000844	0.0000	0.032	3.44	461.95	112.93	0.30
North Inlet Chan	Olive-Northern	18003.2*	PF 2	1590.05	1.67	1240.63	5.85	1246.48		0.000778	0.0000	0.031	3.40	468.20	114.67	0.30
North Inlet Chan	Olive-Northern	18001.6*	PF 2	1590.05	1.67	1240.63	5.85	1246.48		0.000765	0.0000	0.031	3.35	474.17	116.96	0.29
North Inlet Chan	Olive-Northern	17999.94	PF 2	1590.05	25.09	1240.63	5.85	1246.48		0.000707	0.0008	0.030	3.32	479.61	119.19	0.29
North Inlet Chan	Olive-Northern	17974.8*	PF 2	1590.05	25.09	1240.61	5.85	1246.46		0.000706	0.0008	0.030	3.31	479.89	119.21	0.29
North Inlet Chan	Olive-Northern	17949.76	PF 2	1590.05	1.67	1240.59	5.85	1246.44		0.000705	0.0000	0.030	3.31	480.17	119.24	0.29
North Inlet Chan	Olive-Northern	17948.0*	PF 2	1590.05	1.67	1240.59	5.85	1246.44		0.000765	0.0000	0.031	3.35	474.19	116.96	0.29
North Inlet Chan	Olive-Northern	17946.4*	PF 2	1590.05	1.67	1240.59	5.84	1246.43		0.000778	0.0000	0.031	3.40	468.05	114.63	0.30
North Inlet Chan	Olive-Northern	17944.7*	PF 2	1590.05	1.67	1240.59	5.83	1246.43		0.000845	0.0000	0.032	3.44	461.65	112.27	0.30
North Inlet Chan	Olive-Northern	17943.0*	PF 2	1590.05	1.67	1240.59	5.83	1246.42		0.000919	0.0060	0.033	3.50	454.62	109.84	0.30
North Inlet Chan	Olive-Northern	17941.4*	PF 2	1590.05	1.67	1240.58	5.83	1246.41		0.000940	0.0000	0.033	3.55	447.68	107.45	0.31
North Inlet Chan	Olive-Northern	17939.7*	PF 2	1590.05	1.67	1240.58	5.82	1246.40		0.001020	0.0000	0.034	3.61	440.75	104.98	0.31
North Inlet Chan	Olive-Northern	17938.0*	PF 2	1590.05	1.67	1240.58	5.81	1246.39		0.001113	0.0000	0.035	3.67	432.77	102.44	0.32
North Inlet Chan	Olive-Northern	17936.4*	PF 2	1590.05	1.67	1240.58	5.80	1246.38		0.001145	0.0000	0.035	3.74	424.99	99.91	0.32
North Inlet Chan	Olive-Northern	17934.76	PF 2	1590.05	1.67	1240.58	5.79	1246.37		0.001253	0.0000	0.036	3.82	416.52	97.31	0.33
North Inlet Chan	Olive-Northern	17933.0*	PF 2	1590.05	1.67	1240.58	5.76	1246.34		0.001451	0.0000	0.036	4.05	392.56	93.70	0.35
North Inlet Chan	Olive-Northern	17931.4*	PF 2	1590.05	1.67	1240.58	5.72	1246.30		0.001686	0.0000	0.036	4.30	369.45	90.08	0.37
North Inlet Chan	Olive-Northern	17929.7*	PF 2	1590.05	1.67	1240.58	5.67	1246.25		0.001985	0.0000	0.036	4.60	345.93	86.36	0.40
North Inlet Chan	Olive-Northern	17928.0*	PF 2	1590.05	1.67	1240.58	5.61	1246.19		0.002364	0.0060	0.036	4.93	322.41	82.54	0.44
North Inlet Chan	Olive-Northern	17926.4*	PF 2	1590.05	1.67	1240.57	5.55	1246.12		0.002840	0.0000	0.036	5.31	299.48	78.72	0.48
North Inlet Chan	Olive-Northern	17924.7*	PF 2	1590.05	1.67	1240.57	5.46	1246.03		0.003503	0.0000	0.036	5.77	275.36	74.64	0.53
North Inlet Chan	Olive-Northern	17923.0*	PF 2	1590.05	1.67	1240.57	5.33	1245.90		0.004445	0.0000	0.036	6.35	250.40	70.31	0.59
North Inlet Chan	Olive-Northern	17921.4*	PF 2	1590.05	1.67	1240.57	5.13	1245.70		0.006038	0.0000	0.036	7.16	221.97	65.39	0.69
North Inlet Chan	Olive-Northern	17919.76	PF 2	1590.05	2.00	1240.57	4.40	1244.97	1244.97	0.013431	0.2500	0.036	9.67	164.36	58.17	1.00
North Inlet Chan	Olive-Northern	17917.7*	PF 2	1590.05	2.00	1240.07	3.63	1243.70	1244.47	0.029712	0.2500	0.036	12.87	123.58	50.02	1.44
North Inlet Chan	Olive-Northern	17915.7*	PF 2	1590.05	2.00	1239.57	3.37	1242.94	1243.97	0.040395	0.2500	0.036	14.36	110.76	47.93	1.66
North Inlet Chan	Olive-Northern	17913.7*	PF 2	1590.05	2.00	1239.07	3.19	1242.26	1243.47	0.050091	0.2500	0.036	15.50	102.61	46.55	1.84
North Inlet Chan	Olive-Northern	17911.7*	PF 2	1590.05	2.00	1238.57	3.06	1241.63	1242.97	0.059324	0.2500	0.036	16.45	96.64	45.51	1.99
North Inlet Chan	Olive-Northern	17909.7*	PF 2	1590.05	2.00	1238.07	2.96	1241.03	1242.47	0.068144	0.2500	0.036	17.28	92.03	44.69	2.12
North Inlet Chan	Olive-Northern	17907.7*	PF 2	1590.05	2.00	1237.57	2.88	1240.45	1241.97	0.076594	0.2500	0.036	18.00	88.31	44.02	2.24
North Inlet Chan	Olive-Northern	17905.76	PF 2	1590.05	2.00	1237.07	2.81	1239.88	1241.47	0.084771	0.0000	0.036	18.66	85.21	43.46	2.35
North Inlet Chan	Olive-Northern	17903.7*	PF 2	1590.05	2.00	1237.07	2.75	1239.82	1241.36	0.084426	0.0000	0.036	18.38	86.53	45.08	2.34
North Inlet Chan	Olive-Northern	17901.7*	PF 2	1590.05	2.00	1237.07	2.69	1239.76	1241.25	0.084031	0.0000	0.036	18.08	87.93	46.83	2.33
North Inlet Chan	Olive-Northern	17899.7*	PF 2	1590.05	2.00	1237.07	2.63	1239.70	1241.15	0.083258	0.0049	0.036	17.79	89.37	48.49	2.31
North Inlet Chan	Olive-Northern	17897.7*	PF 2	1590.05	2.00	1237.06	2.58	1239.64	1241.05	0.082436	0.0000	0.036	17.50	90.85	50.20	2.29
North Inlet Chan	Olive-Northern	17895.7*	PF 2	1590.05	2.00	1237.06	5.69	1242.75	1240.95	0.002846	0.0000	0.036	5.35	297.13	77.25	0.48
North Inlet Chan	Olive-Northern	17893.7*	PF 2	1590.05	2.00	1237.06	5.71	1242.77		0.002573	0.0000	0.036	5.13	309.79	79.54	0.46
North Inlet Chan	Olive-Northern	17891.7*	PF 2	1590.05	2.00	1237.06	5.73	1242.79		0.002326	0.0000	0.036	4.92	322.89	81.81	0.44
North Inlet Chan	Olive-Northern	17889.7*	PF 2	1590.05	2.00	1237.06	5.74	1242.80		0.002113	0.0000	0.036	4.73	335.94	84.08	0.42
North Inlet Chan	Olive-Northern	17887.7*	PF 2	1590.05	2.00	1237.06	5.76	1242.82		0.001920	0.0000	0.036	4.55	349.36	86.32	0.40
North Inlet Chan	Olive-Northern	17885.7*	PF 2	1590.05	2.00	1237.06	5.77	1242.83		0.001748	0.0050	0.036	4.38	363.06	88.59	0.38
North Inlet Chan	Olive-Northern	17883.7*	PF 2	1590.05	2.00	1237.05	5.79	1242.84		0.001593	0.0000	0.036	4.22	377.18	90.89	0.36
North Inlet Chan	Olive-Northern	17881.7*	PF 2	1590.05	2.00	1237.05	5.80	1242.85		0.001460	0.0000	0.036	4.07	390.94	93.12	0.35
North Inlet Chan	Olive-Northern	17879.7*	PF 2	1590.05	2.00	1237.05	5.81	1242.86		0.001337	0.0000	0.036	3.92	405.11	95.33	0.34
North Inlet Chan	Olive-Northern	17877.76	PF 2	1590.05	1.67	1237.05	5.82	1242.87		0.001230	0.0000	0.036	3.79	419.25	97.54	0.32
North Inlet Chan	Olive-Northern	17876.0*	PF 2	1590.05	1.67	1237.05	5.82	1242.87		0.001130	0.0000	0.035	3.72	426.97	100.08	0.32
North Inlet Chan	Olive-Northern	17874.4*	PF 2	1590.05	1.67	1237.05	5.82	1242.87		0.001101	0.0000	0.035	3.66	434.43	102.58	0.31
North Inlet Chan	Olive-Northern	17872.7*	PF 2	1590.05	1.67	1237.05	5.83	1242.88		0.001016	0.0000	0.034	3.60	441.33	105.03	0.31
North Inlet Chan	Olive-Northern	17871.0*	PF 2	1590.05	1.67	1237.05	5.83	1242.88		0.000936	0.0060	0.033	3.55	448.36	107.48	0.31
North Inlet Chan	Olive-Northern	17869.4*	PF 2	1590.05	1.67	1237.04	5.84	1242.88		0.000914	0.0000	0.033	3.49	455.50	109.96	0.30
North Inlet Chan	Olive-Northern	17867.7*	PF 2	1590.05	1.67	1237.04	5.84	1242.88		0.000844	0.0000	0.032	3.44	461.92	112.33	0.30
North Inlet Chan	Olive-Northern	17866.0*	PF 2	1590.05	1.67	1237.04	5.85	1242.89		0.000778	0.0000	0.031	3.40	468.18	114.67	0.30
North Inlet Chan	Olive-Northern	17864.4*	PF 2	1590.05	1.67	1237.04	5.85	1242.89		0.000765	0.0000	0.031	3.35	474.14	116.96	0.29
North Inlet Chan	Olive-Northern	17862.76	PF 2	1590.05	25.08	1237.04	5.85	1242.89		0.000707	0.0008	0.030	3.32	479.59	119.19	0.29
North Inlet Chan	Olive-Northern	17837.6*	PF 2	1590.05	25.08	1237.02	5.85	1242.87		0.000706	0.0008	0.030	3.31	479.86	119.21	0.29
North Inlet Chan	Olive-Northern	17812.59	PF 2	1590.05	1.67	1237.00	5.85	1242.85		0.000705	0.0000	0.030	3.31	480.14	119.24	0.29
North Inlet Chan	Olive-Northern	17810.9*	PF 2	1590.05	1.67	1237.00	5.85	1242.85		0.000765	0.0000	0.031	3.35	474.16	116.96	0.29
North Inlet Chan	Olive-Northern	17809.2*	PF 2	1590.05	1.67	1237.00	5.84	1242.84		0.000778	0.0000	0.031	3.40	468.03	114.62	0.30
North Inlet Chan	Olive-Northern	17807.5*	PF 2	1590.05	1.67	1237.00	5.83	1242.84		0.000845	0.0000	0.032	3.44	461.62	112.27	0.30

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	17805.9*	PF 2	1590.05	1.67	1237.00	5.83	1242.83		0.000919	0.0060	0.033	3.50	454.59	109.84	0.30
North Inlet Chan	Olive-Northern	17804.2*	PF 2	1590.05	1.67	1236.99	5.83	1242.82		0.000940	0.0000	0.033	3.55	447.65	107.45	0.31
North Inlet Chan	Olive-Northern	17802.5*	PF 2	1590.05	1.67	1236.99	5.82	1242.81		0.001020	0.0000	0.034	3.61	440.72	104.98	0.31
North Inlet Chan	Olive-Northern	17800.9*	PF 2	1590.05	1.67	1236.99	5.81	1242.80		0.001113	0.0000	0.035	3.67	432.74	102.44	0.32
North Inlet Chan	Olive-Northern	17799.2*	PF 2	1590.05	1.67	1236.99	5.80	1242.79		0.001146	0.0000	0.035	3.74	424.96	99.91	0.32
North Inlet Chan	Olive-Northern	17797.59	PF 2	1590.05	1.67	1236.99	5.79	1242.78		0.001253	0.0000	0.036	3.82	416.49	97.31	0.33
North Inlet Chan	Olive-Northern	17795.9*	PF 2	1590.05	1.67	1236.99	5.75	1242.75		0.001452	0.0000	0.036	4.05	392.54	93.69	0.35
North Inlet Chan	Olive-Northern	17794.2*	PF 2	1590.05	1.67	1236.99	5.72	1242.71		0.001687	0.0000	0.036	4.30	369.42	90.08	0.37
North Inlet Chan	Olive-Northern	17792.5*	PF 2	1590.05	1.67	1236.99	5.67	1242.66		0.001985	0.0000	0.036	4.60	345.91	86.36	0.40
North Inlet Chan	Olive-Northern	17790.9*	PF 2	1590.05	1.67	1236.99	5.61	1242.60		0.002365	0.0060	0.036	4.93	322.39	82.54	0.44
North Inlet Chan	Olive-Northern	17789.2*	PF 2	1590.05	1.67	1236.98	5.55	1242.53		0.002840	0.0000	0.036	5.31	299.47	78.72	0.48
North Inlet Chan	Olive-Northern	17787.5*	PF 2	1590.05	1.67	1236.98	5.46	1242.44		0.003503	0.0000	0.036	5.77	275.35	74.84	0.53
North Inlet Chan	Olive-Northern	17785.9*	PF 2	1590.05	1.67	1236.98	5.33	1242.31		0.004445	0.0000	0.036	6.35	250.39	70.31	0.59
North Inlet Chan	Olive-Northern	17784.2*	PF 2	1590.05	1.67	1236.98	5.13	1242.11		0.006037	0.0000	0.036	7.16	221.99	65.40	0.69
North Inlet Chan	Olive-Northern	17782.59	PF 2	1590.05	2.00	1236.98	4.40	1241.38	1241.38	0.013433	0.2500	0.036	9.67	164.35	56.17	1.00
North Inlet Chan	Olive-Northern	17780.5*	PF 2	1590.05	2.00	1236.48	3.63	1240.11	1240.88	0.029712	0.2500	0.036	12.87	123.58	50.02	1.44
North Inlet Chan	Olive-Northern	17778.5*	PF 2	1590.05	2.00	1235.98	3.37	1239.35	1240.38	0.040400	0.2500	0.036	14.36	110.75	47.93	1.66
North Inlet Chan	Olive-Northern	17776.5*	PF 2	1590.05	2.00	1235.48	3.19	1238.67	1239.88	0.050097	0.2500	0.036	15.50	102.61	46.55	1.84
North Inlet Chan	Olive-Northern	17774.5*	PF 2	1590.05	2.00	1234.98	3.06	1238.04	1239.38	0.059334	0.2500	0.036	16.45	96.64	45.51	1.99
North Inlet Chan	Olive-Northern	17772.5*	PF 2	1590.05	2.00	1234.48	2.96	1237.44	1238.88	0.068144	0.2500	0.036	17.28	92.03	44.69	2.12
North Inlet Chan	Olive-Northern	17770.5*	PF 2	1590.05	2.00	1233.98	2.88	1236.86	1238.38	0.076594	0.2500	0.036	18.00	88.31	44.02	2.24
North Inlet Chan	Olive-Northern	17768.5*	PF 2	1590.05	2.00	1233.48	2.81	1236.29	1237.88	0.084771	0.2500	0.036	18.66	85.21	43.46	2.35
North Inlet Chan	Olive-Northern	17766.5*	PF 2	1590.05	2.00	1232.98	2.75	1235.73	1237.38	0.092588	0.2500	0.036	19.25	82.61	42.97	2.45
North Inlet Chan	Olive-Northern	17764.59	PF 2	1590.05	1.93	1232.48	2.69	1235.17	1236.98	0.100201	0.0000	0.036	19.79	80.35	42.55	2.54
North Inlet Chan	Olive-Northern	17762.6*	PF 2	1590.05	1.93	1232.48	2.65	1235.13	1236.78	0.099125	0.0000	0.036	19.43	81.81	44.22	2.52
North Inlet Chan	Olive-Northern	17760.7*	PF 2	1590.05	1.93	1232.48	2.60	1235.08	1236.68	0.097730	0.0000	0.036	19.09	83.30	45.82	2.49
North Inlet Chan	Olive-Northern	17758.7*	PF 2	1590.05	1.93	1232.48	2.55	1235.04	1236.58	0.096057	0.0052	0.036	18.73	84.89	47.47	2.47
North Inlet Chan	Olive-Northern	17756.6*	PF 2	1590.05	1.93	1232.47	2.51	1234.98	1236.48	0.094430	0.0000	0.036	18.40	86.42	49.06	2.44
North Inlet Chan	Olive-Northern	17754.9*	PF 2	1590.05	1.93	1232.47	2.47	1234.94	1236.39	0.092410	0.0000	0.036	18.04	88.13	50.72	2.41
North Inlet Chan	Olive-Northern	17752.9*	PF 2	1590.05	1.93	1232.47	2.43	1234.90	1236.30	0.090256	0.0000	0.036	17.69	89.89	52.39	2.38
North Inlet Chan	Olive-Northern	17751.0*	PF 2	1590.05	1.93	1232.47	5.69	1238.16	1236.21	0.002491	0.0000	0.036	5.06	314.32	80.51	0.45
North Inlet Chan	Olive-Northern	17749.1*	PF 2	1590.05	1.93	1232.47	5.70	1238.17		0.002275	0.0000	0.036	4.87	326.32	82.63	0.43
North Inlet Chan	Olive-Northern	17747.1*	PF 2	1590.05	1.93	1232.47	5.72	1238.19		0.002076	0.0000	0.036	4.69	338.76	84.73	0.41
North Inlet Chan	Olive-Northern	17745.2*	PF 2	1590.05	1.93	1232.47	5.73	1238.20		0.001904	0.0000	0.036	4.53	351.06	86.83	0.40
North Inlet Chan	Olive-Northern	17743.3*	PF 2	1590.05	1.93	1232.47	5.74	1238.21		0.001745	0.0052	0.036	4.37	363.78	88.92	0.38
North Inlet Chan	Olive-Northern	17741.3*	PF 2	1590.05	1.93	1232.46	5.76	1238.22		0.001603	0.0000	0.036	4.22	376.68	91.05	0.37
North Inlet Chan	Olive-Northern	17739.4*	PF 2	1590.05	1.93	1232.46	5.77	1238.23		0.001475	0.0000	0.036	4.08	389.76	93.15	0.35
North Inlet Chan	Olive-Northern	17737.5*	PF 2	1590.05	1.93	1232.46	5.78	1238.24		0.001359	0.0000	0.036	3.95	402.99	95.22	0.34
North Inlet Chan	Olive-Northern	17735.59	PF 2	1590.05	1.67	1232.46	5.79	1238.25		0.001256	0.0000	0.036	3.82	416.17	97.28	0.33
North Inlet Chan	Olive-Northern	17733.9*	PF 2	1590.05	1.67	1232.46	5.79	1238.25		0.001155	0.0000	0.035	3.75	423.81	99.81	0.32
North Inlet Chan	Olive-Northern	17732.2*	PF 2	1590.05	1.67	1232.46	5.79	1238.25		0.001125	0.0000	0.035	3.69	431.18	102.30	0.32
North Inlet Chan	Olive-Northern	17730.5*	PF 2	1590.05	1.67	1232.46	5.79	1238.26		0.001036	0.0000	0.034	3.63	438.01	104.74	0.31
North Inlet Chan	Olive-Northern	17728.9*	PF 2	1590.05	1.67	1232.46	5.80	1238.26		0.000958	0.0060	0.033	3.57	444.96	107.18	0.31
North Inlet Chan	Olive-Northern	17727.2*	PF 2	1590.05	1.67	1232.45	5.81	1238.26		0.000934	0.0000	0.033	3.52	452.04	109.64	0.31
North Inlet Chan	Olive-Northern	17725.5*	PF 2	1590.05	1.67	1232.45	5.81	1238.26		0.000862	0.0000	0.032	3.47	458.38	112.00	0.30
North Inlet Chan	Olive-Northern	17723.9*	PF 2	1590.05	1.67	1232.45	5.81	1238.26		0.000795	0.0000	0.031	3.42	464.56	114.32	0.30
North Inlet Chan	Olive-Northern	17722.2*	PF 2	1590.05	1.67	1232.45	5.82	1238.27		0.000782	0.0000	0.031	3.38	470.46	116.60	0.30
North Inlet Chan	Olive-Northern	17720.59	PF 2	1590.05	47.58	1232.45	5.82	1238.27		0.000723	0.0008	0.030	3.34	475.84	118.81	0.29
North Inlet Chan	Olive-Northern	17673.*	PF 2	1590.05	47.58	1232.41	5.82	1238.23		0.000720	0.0006	0.030	3.34	476.51	118.88	0.29
North Inlet Chan	Olive-Northern	17625.4*	PF 2	1590.05	47.58	1232.38	5.82	1238.20		0.000722	0.0008	0.030	3.34	475.95	118.82	0.29
North Inlet Chan	Olive-Northern	17577.8*	PF 2	1590.05	47.58	1232.34	5.82	1238.16		0.000719	0.0008	0.030	3.34	476.65	118.89	0.29
North Inlet Chan	Olive-Northern	17530.2*	PF 2	1590.05	47.58	1232.30	5.83	1238.13		0.000716	0.0006	0.030	3.33	477.35	118.96	0.29
North Inlet Chan	Olive-Northern	17482.6*	PF 2	1590.05	47.58	1232.27	5.83	1238.10		0.000719	0.0008	0.030	3.33	476.81	118.91	0.29
North Inlet Chan	Olive-Northern	17435.0*	PF 2	1590.05	47.58	1232.23	5.83	1238.06		0.000716	0.0006	0.030	3.33	477.52	118.98	0.29
North Inlet Chan	Olive-Northern	17387.5*	PF 2	1590.05	47.58	1232.20	5.83	1238.03		0.000718	0.0008	0.030	3.33	476.99	118.92	0.29
North Inlet Chan	Olive-Northern	17339.9*	PF 2	1590.05	47.58	1232.16	5.83	1237.99		0.000715	0.0008	0.030	3.33	477.68	118.99	0.29
North Inlet Chan	Olive-Northern	17292.3*	PF 2	1590.05	47.58	1232.12	5.84	1237.96		0.000712	0.0006	0.030	3.32	478.41	119.07	0.29
North Inlet Chan	Olive-Northern	17244.7*	PF 2	1590.05	47.58	1232.09	5.83	1237.93		0.000714	0.0008	0.030	3.33	477.90	119.02	0.29
North Inlet Chan	Olive-Northern	17197.1*	PF 2	1590.05	47.58	1232.05	5.84	1237.89		0.000711	0.0006	0.030	3.32	478.63	119.09	0.29

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	17149.5*	PF 2	1590.05	47.58	1232.02	5.84	1237.86		0.000713	0.0008	0.030	3.33	478.13	119.04	0.29
North Inlet Chan	Olive-Northern	17101.9*	PF 2	1590.05	47.58	1231.98	5.84	1237.82		0.000710	0.0008	0.030	3.32	478.87	119.11	0.29
North Inlet Chan	Olive-Northern	17054.4*	PF 2	1590.05	47.58	1231.94	5.85	1237.79		0.000707	0.0006	0.030	3.32	479.63	119.19	0.29
North Inlet Chan	Olive-Northern	17006.8*	PF 2	1590.05	47.58	1231.91	5.84	1237.76		0.000709	0.0008	0.030	3.32	479.14	119.14	0.29
North Inlet Chan	Olive-Northern	16959.23	PF 2	1590.05	1.67	1231.87	5.85	1237.72		0.000706	0.0000	0.030	3.31	479.91	119.22	0.29
North Inlet Chan	Olive-Northern	16957.5*	PF 2	1590.05	1.67	1231.87	5.84	1237.71		0.000780	0.0000	0.031	3.39	469.71	115.84	0.30
North Inlet Chan	Olive-Northern	16955.9*	PF 2	1590.05	1.67	1231.87	5.83	1237.70		0.000801	0.0000	0.031	3.45	460.81	112.85	0.30
North Inlet Chan	Olive-Northern	16954.2*	PF 2	1590.05	1.67	1231.87	5.82	1237.69		0.000878	0.0000	0.032	3.51	452.45	109.79	0.31
North Inlet Chan	Olive-Northern	16952.5*	PF 2	1590.05	1.67	1231.87	5.82	1237.69		0.000958	0.0060	0.033	3.57	444.84	107.20	0.31
North Inlet Chan	Olive-Northern	16950.9*	PF 2	1590.05	1.67	1231.86	5.82	1237.68		0.000974	0.0000	0.033	3.62	439.01	104.93	0.31
North Inlet Chan	Olive-Northern	16949.2*	PF 2	1590.05	1.67	1231.86	5.81	1237.67		0.001057	0.0000	0.034	3.68	432.60	102.76	0.32
North Inlet Chan	Olive-Northern	16947.5*	PF 2	1590.05	1.67	1231.86	5.80	1237.66		0.001143	0.0000	0.035	3.73	426.68	100.77	0.32
North Inlet Chan	Olive-Northern	16945.9*	PF 2	1590.05	1.67	1231.86	5.79	1237.65		0.001165	0.0000	0.035	3.77	421.38	99.00	0.32
North Inlet Chan	Olive-Northern	16944.23	PF 2	1590.05	1.67	1231.86	5.79	1237.65		0.001255	0.0000	0.036	3.82	416.27	97.29	0.33
North Inlet Chan	Olive-Northern	16942.5*	PF 2	1590.05	1.67	1231.86	5.76	1237.62		0.001430	0.0000	0.036	4.03	394.42	93.75	0.35
North Inlet Chan	Olive-Northern	16940.9*	PF 2	1590.05	1.67	1231.86	5.72	1237.58		0.001646	0.0000	0.036	4.27	372.19	90.09	0.37
North Inlet Chan	Olive-Northern	16939.2*	PF 2	1590.05	1.67	1231.86	5.68	1237.54		0.001913	0.0000	0.036	4.54	350.04	86.45	0.40
North Inlet Chan	Olive-Northern	16937.5*	PF 2	1590.05	1.67	1231.86	5.62	1237.48		0.002256	0.0060	0.036	4.88	327.27	82.66	0.43
North Inlet Chan	Olive-Northern	16935.9*	PF 2	1590.05	1.67	1231.85	5.56	1237.41		0.002698	0.0000	0.036	5.22	304.36	78.82	0.47
North Inlet Chan	Olive-Northern	16934.2*	PF 2	1590.05	1.67	1231.85	5.47	1237.32		0.003329	0.0000	0.036	5.68	279.82	74.74	0.52
North Inlet Chan	Olive-Northern	16932.5*	PF 2	1590.05	1.67	1231.85	5.35	1237.20		0.004244	0.0000	0.036	6.26	254.15	70.45	0.58
North Inlet Chan	Olive-Northern	16930.9*	PF 2	1590.05	1.67	1231.85	5.15	1237.00		0.005816	0.0000	0.036	7.08	224.70	65.53	0.67
North Inlet Chan	Olive-Northern	16929.23	PF 2	1590.05	2.00	1231.85	4.40	1236.25	1236.25	0.013433	0.2500	0.036	9.67	164.35	56.17	1.00
North Inlet Chan	Olive-Northern	16927.2*	PF 2	1590.05	2.00	1231.35	3.63	1234.98	1235.75	0.029712	0.2500	0.036	12.87	123.58	50.02	1.44
North Inlet Chan	Olive-Northern	16925.2*	PF 2	1590.05	2.00	1230.85	3.37	1234.22	1235.25	0.040400	0.2500	0.036	14.36	110.75	47.93	1.66
North Inlet Chan	Olive-Northern	16923.2*	PF 2	1590.05	2.00	1230.35	3.19	1233.54	1234.75	0.050097	0.2500	0.036	15.50	102.61	46.55	1.84
North Inlet Chan	Olive-Northern	16921.2*	PF 2	1590.05	2.00	1229.85	3.06	1232.91	1234.25	0.059334	0.2500	0.036	16.45	96.64	45.51	1.99
North Inlet Chan	Olive-Northern	16919.2*	PF 2	1590.05	2.00	1229.35	2.96	1232.31	1233.75	0.068144	0.2500	0.036	17.28	92.03	44.69	2.12
North Inlet Chan	Olive-Northern	16917.2*	PF 2	1590.05	2.00	1228.85	2.88	1231.73	1233.25	0.076594	0.2500	0.036	18.00	88.31	44.02	2.24
North Inlet Chan	Olive-Northern	16915.2*	PF 2	1590.05	2.00	1228.35	2.81	1231.16	1232.75	0.084771	0.2500	0.036	18.66	85.21	43.46	2.35
North Inlet Chan	Olive-Northern	16913.2*	PF 2	1590.05	2.00	1227.85	2.75	1230.60	1232.25	0.092588	0.2500	0.036	19.25	82.61	42.97	2.45
North Inlet Chan	Olive-Northern	16911.23	PF 2	1590.05	1.93	1227.35	2.69	1230.04	1231.76	0.100201	0.0000	0.036	19.79	80.35	42.55	2.54
North Inlet Chan	Olive-Northern	16909.3*	PF 2	1590.05	1.93	1227.35	2.65	1230.00	1231.65	0.099125	0.0000	0.036	19.43	81.81	44.22	2.52
North Inlet Chan	Olive-Northern	16907.3*	PF 2	1590.05	1.93	1227.35	2.60	1229.95	1231.55	0.097730	0.0000	0.036	19.09	83.30	45.82	2.49
North Inlet Chan	Olive-Northern	16905.4*	PF 2	1590.05	1.93	1227.35	2.55	1229.91	1231.45	0.096045	0.0052	0.036	18.73	84.89	47.47	2.47
North Inlet Chan	Olive-Northern	16903.5*	PF 2	1590.05	1.93	1227.34	2.51	1229.85	1231.35	0.094430	0.0000	0.036	18.40	86.42	49.06	2.44
North Inlet Chan	Olive-Northern	16901.5*	PF 2	1590.05	1.93	1227.34	2.47	1229.81	1231.26	0.092410	0.0000	0.036	18.04	88.13	50.72	2.41
North Inlet Chan	Olive-Northern	16899.6*	PF 2	1590.05	1.93	1227.34	2.43	1229.77	1231.17	0.090258	0.0000	0.036	17.69	89.89	52.39	2.38
North Inlet Chan	Olive-Northern	16897.7*	PF 2	1590.05	1.93	1227.34	5.69	1233.03	1231.08	0.002485	0.0000	0.036	5.05	314.60	80.54	0.45
North Inlet Chan	Olive-Northern	16895.7*	PF 2	1590.05	1.93	1227.34	5.71	1233.05		0.002269	0.0000	0.036	4.87	326.62	82.65	0.43
North Inlet Chan	Olive-Northern	16893.8*	PF 2	1590.05	1.93	1227.34	5.72	1233.06		0.002071	0.0000	0.036	4.69	339.05	84.76	0.41
North Inlet Chan	Olive-Northern	16891.9*	PF 2	1590.05	1.93	1227.34	5.73	1233.07		0.001900	0.0000	0.036	4.53	351.35	86.86	0.40
North Inlet Chan	Olive-Northern	16889.9*	PF 2	1590.05	1.93	1227.34	5.74	1233.08		0.001741	0.0052	0.036	4.37	364.09	88.95	0.38
North Inlet Chan	Olive-Northern	16888.0*	PF 2	1590.05	1.93	1227.33	5.76	1233.09		0.001600	0.0000	0.036	4.22	376.99	91.08	0.37
North Inlet Chan	Olive-Northern	16886.1*	PF 2	1590.05	1.93	1227.33	5.77	1233.10		0.001472	0.0000	0.036	4.08	390.07	93.18	0.35
North Inlet Chan	Olive-Northern	16884.1*	PF 2	1590.05	1.93	1227.33	5.78	1233.11		0.001356	0.0000	0.036	3.94	403.30	95.24	0.34
North Inlet Chan	Olive-Northern	16882.23	PF 2	1590.05	1.67	1227.33	5.79	1233.12		0.001253	0.0000	0.036	3.82	416.47	97.31	0.33
North Inlet Chan	Olive-Northern	16880.5*	PF 2	1590.05	1.67	1227.33	5.79	1233.12		0.001152	0.0000	0.035	3.75	424.13	99.84	0.32
North Inlet Chan	Olive-Northern	16878.9*	PF 2	1590.05	1.67	1227.33	5.80	1233.13		0.001122	0.0060	0.035	3.68	431.51	102.33	0.32
North Inlet Chan	Olive-Northern	16877.2*	PF 2	1590.05	1.67	1227.32	5.81	1233.13		0.001029	0.0000	0.034	3.62	439.47	104.87	0.31
North Inlet Chan	Olive-Northern	16875.5*	PF 2	1590.05	1.67	1227.32	5.81	1233.13		0.000947	0.0000	0.033	3.56	446.45	107.31	0.31
North Inlet Chan	Olive-Northern	16873.9*	PF 2	1590.05	1.67	1227.32	5.81	1233.13		0.000928	0.0000	0.033	3.51	453.11	109.71	0.30
North Inlet Chan	Olive-Northern	16872.2*	PF 2	1590.05	1.67	1227.32	5.82	1233.14		0.000856	0.0059	0.032	3.46	459.48	112.07	0.30
North Inlet Chan	Olive-Northern	16870.5*	PF 2	1590.05	1.67	1227.31	5.83	1233.14		0.000787	0.0000	0.031	3.41	466.14	114.47	0.30
North Inlet Chan	Olive-Northern	16868.9*	PF 2	1590.05	1.67	1227.31	5.83	1233.14		0.000777	0.0000	0.031	3.37	471.63	116.71	0.30
North Inlet Chan	Olive-Northern	16867.23	PF 2	1590.05	47.90	1227.31	5.83	1233.14		0.000716	0.0008	0.030	3.33	477.46	118.97	0.29
North Inlet Chan	Olive-Northern	16819.3*	PF 2	1590.05	47.90	1227.27	5.84	1233.11		0.000713	0.0006	0.030	3.33	478.16	119.04	0.29
North Inlet Chan	Olive-Northern	16771.4*	PF 2	1590.05	47.90	1227.24	5.83	1233.07		0.000715	0.0008	0.030	3.33	477.62	118.99	0.29
North Inlet Chan	Olive-Northern	16723.5*	PF 2	1590.05	47.90	1227.20	5.84	1233.04		0.000712	0.0006	0.030	3.32	478.33	119.06	0.29

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Ch Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Manr Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	16675.6*	PF 2	1590.05	47.90	1227.17	5.83	1233.00		0.000715	0.0008	0.030	3.33	477.79	119.00	0.29
North Inlet Chan	Olive-Northern	16627.7*	PF 2	1590.05	47.90	1227.13	5.84	1232.97		0.000712	0.0006	0.030	3.32	478.50	119.07	0.29
North Inlet Chan	Olive-Northern	16579.8*	PF 2	1590.05	47.90	1227.10	5.84	1232.94		0.000714	0.0008	0.030	3.33	477.96	119.02	0.29
North Inlet Chan	Olive-Northern	16531.9*	PF 2	1590.05	47.90	1227.06	5.84	1232.90		0.000711	0.0006	0.030	3.32	478.66	119.09	0.29
North Inlet Chan	Olive-Northern	16484.0*	PF 2	1590.05	47.90	1227.03	5.84	1232.87		0.000713	0.0008	0.030	3.33	478.12	119.04	0.29
North Inlet Chan	Olive-Northern	16436.1*	PF 2	1590.05	47.90	1226.99	5.84	1232.83		0.000710	0.0008	0.030	3.32	478.83	119.11	0.29
North Inlet Chan	Olive-Northern	16388.2*	PF 2	1590.05	47.90	1226.95	5.85	1232.80		0.000707	0.0006	0.030	3.32	479.56	119.18	0.29
North Inlet Chan	Olive-Northern	16340.3*	PF 2	1590.05	47.90	1226.92	5.84	1232.76		0.000709	0.0008	0.030	3.32	479.03	119.13	0.29
North Inlet Chan	Olive-Northern	16292.4*	PF 2	1590.05	47.90	1226.88	5.85	1232.73		0.000706	0.0006	0.030	3.31	479.78	119.20	0.29
North Inlet Chan	Olive-Northern	16244.5*	PF 2	1590.05	47.90	1226.85	5.85	1232.70		0.000708	0.0008	0.030	3.32	479.28	119.15	0.29
North Inlet Chan	Olive-Northern	16196.6*	PF 2	1590.05	47.90	1226.81	5.85	1232.66		0.000705	0.0006	0.030	3.31	480.01	119.23	0.29
North Inlet Chan	Olive-Northern	16148.7*	PF 2	1590.05	47.90	1226.78	5.85	1232.63		0.000707	0.0008	0.030	3.32	479.51	119.18	0.29
North Inlet Chan	Olive-Northern	16100.8*	PF 2	1590.05	47.90	1226.74	5.85	1232.59		0.000704	0.0006	0.030	3.31	480.27	119.25	0.29
North Inlet Chan	Olive-Northern	16052.9*	PF 2	1590.05	47.90	1226.71	5.85	1232.56		0.000706	0.0008	0.030	3.31	479.78	119.20	0.29
North Inlet Chan	Olive-Northern	16005.09	PF 2	1590.05	1.67	1226.67	5.86	1232.53		0.000703	0.0000	0.030	3.31	480.52	119.28	0.29
North Inlet Chan	Olive-Northern	16003.4*	PF 2	1590.05	1.67	1226.67	5.85	1232.52		0.000763	0.0000	0.031	3.35	474.54	117.00	0.29
North Inlet Chan	Olive-Northern	16001.7*	PF 2	1590.05	1.67	1226.67	5.84	1232.52		0.000776	0.0000	0.031	3.39	468.40	114.66	0.30
North Inlet Chan	Olive-Northern	16000.0*	PF 2	1590.05	1.67	1226.67	5.84	1232.51		0.000843	0.0000	0.032	3.44	461.99	112.30	0.30
North Inlet Chan	Olive-Northern	15998.4*	PF 2	1590.05	1.67	1226.67	5.83	1232.50		0.000917	0.0000	0.033	3.50	454.95	109.87	0.30
North Inlet Chan	Olive-Northern	15996.7*	PF 2	1590.05	1.67	1226.66	5.83	1232.49		0.000938	0.0000	0.033	3.55	448.01	107.48	0.31
North Inlet Chan	Olive-Northern	15995.0*	PF 2	1590.05	1.67	1226.66	5.82	1232.48		0.001018	0.0000	0.034	3.60	441.07	105.01	0.31
North Inlet Chan	Olive-Northern	15993.4*	PF 2	1590.05	1.67	1226.65	5.81	1232.47		0.001111	0.0000	0.035	3.67	433.09	102.46	0.31
North Inlet Chan	Olive-Northern	15991.7*	PF 2	1590.05	1.67	1226.66	5.80	1232.46		0.001143	0.0000	0.035	3.74	425.30	99.94	0.32
North Inlet Chan	Olive-Northern	15990.09	PF 2	1590.05	1.67	1226.66	5.79	1232.45		0.001250	0.0000	0.036	3.81	418.82	97.34	0.32
North Inlet Chan	Olive-Northern	15988.4*	PF 2	1590.05	1.67	1226.66	5.76	1232.42		0.001448	0.0000	0.036	4.05	392.87	93.72	0.35
North Inlet Chan	Olive-Northern	15986.7*	PF 2	1590.05	1.67	1226.66	5.72	1232.38		0.001682	0.0000	0.036	4.30	369.75	90.11	0.37
North Inlet Chan	Olive-Northern	15985.0*	PF 2	1590.05	1.67	1226.66	5.67	1232.33		0.001980	0.0000	0.036	4.59	346.22	86.38	0.40
North Inlet Chan	Olive-Northern	15983.4*	PF 2	1590.05	1.67	1226.65	5.61	1232.27		0.002358	0.0000	0.036	4.93	322.71	82.57	0.44
North Inlet Chan	Olive-Northern	15981.7*	PF 2	1590.05	1.67	1226.65	5.55	1232.20		0.002831	0.0000	0.036	5.30	299.80	78.76	0.48
North Inlet Chan	Olive-Northern	15980.0*	PF 2	1590.05	1.67	1226.65	5.46	1232.11		0.003491	0.0000	0.036	5.77	275.69	74.67	0.53
North Inlet Chan	Olive-Northern	15978.4*	PF 2	1590.05	1.67	1226.65	5.34	1231.99		0.004428	0.0000	0.036	6.34	250.74	70.35	0.59
North Inlet Chan	Olive-Northern	15976.7*	PF 2	1590.05	1.67	1226.65	5.14	1231.79		0.006006	0.0000	0.036	7.15	222.40	65.45	0.68
North Inlet Chan	Olive-Northern	15975.09	PF 2	1590.05	2.00	1226.65	4.37	1231.02	1231.02	0.013740	0.3500	0.036	9.75	163.02	55.98	1.01
North Inlet Chan	Olive-Northern	15972.3*	PF 2	1590.05	2.00	1225.95	3.52	1229.47	1230.37	0.033915	0.3450	0.036	13.55	117.37	48.54	1.54
North Inlet Chan	Olive-Northern	15969.5*	PF 2	1590.05	2.00	1225.26	3.25	1228.51	1229.69	0.047577	0.3500	0.036	15.34	103.68	45.90	1.80
North Inlet Chan	Olive-Northern	15966.7*	PF 2	1590.05	2.00	1224.56	3.07	1227.63	1228.99	0.060342	0.3500	0.036	16.74	94.99	44.08	2.01
North Inlet Chan	Olive-Northern	15963.9*	PF 2	1590.05	2.00	1223.86	2.94	1226.80	1228.33	0.072546	0.3450	0.036	17.92	88.72	42.66	2.19
North Inlet Chan	Olive-Northern	15961.2*	PF 2	1590.05	2.00	1223.17	2.84	1226.01	1227.64	0.084011	0.3500	0.036	18.93	84.01	41.55	2.35
North Inlet Chan	Olive-Northern	15958.4*	PF 2	1590.05	2.00	1222.47	7.33	1229.80	1226.93	0.001711	0.3500	0.036	4.70	338.60	72.28	0.38
North Inlet Chan	Olive-Northern	15955.6*	PF 2	1590.05	2.00	1221.77	8.09	1229.86		0.001143	0.3450	0.036	4.07	391.01	76.39	0.32
North Inlet Chan	Olive-Northern	15952.8*	PF 2	1590.05	2.00	1221.08	8.82	1229.90		0.000803	0.3500	0.036	3.59	443.51	80.14	0.27
North Inlet Chan	Olive-Northern	15950.09	PF 2	1590.05	2.00	1220.38	9.54	1229.93		0.000580	0.0000	0.036	3.19	497.68	83.67	0.23
North Inlet Chan	Olive-Northern	15948.0*	PF 2	1590.05	2.00	1220.38	9.55	1229.93		0.000539	0.0000	0.036	3.10	513.06	85.46	0.22
North Inlet Chan	Olive-Northern	15946.0*	PF 2	1590.05	2.00	1220.38	9.56	1229.94		0.000500	0.0000	0.036	3.01	528.70	87.26	0.22
North Inlet Chan	Olive-Northern	15944.0*	PF 2	1590.05	2.00	1220.38	9.56	1229.94		0.000465	0.0000	0.036	2.92	544.68	89.07	0.21
North Inlet Chan	Olive-Northern	15942.0*	PF 2	1590.05	2.00	1220.38	9.56	1229.94		0.000434	0.0050	0.036	2.84	560.44	90.85	0.20
North Inlet Chan	Olive-Northern	15940.0*	PF 2	1590.05	2.00	1220.37	9.58	1229.95		0.000404	0.0000	0.036	2.76	576.85	92.70	0.19
North Inlet Chan	Olive-Northern	15938.0*	PF 2	1590.05	2.00	1220.37	9.58	1229.95		0.000377	0.0000	0.036	2.68	593.29	94.49	0.19
North Inlet Chan	Olive-Northern	15936.0*	PF 2	1590.05	2.00	1220.37	9.58	1229.96		0.000353	0.0000	0.036	2.61	609.88	96.29	0.18
North Inlet Chan	Olive-Northern	15934.0*	PF 2	1590.05	2.00	1220.37	9.59	1229.96		0.000330	0.0000	0.036	2.54	626.34	98.07	0.18
North Inlet Chan	Olive-Northern	15932.0*	PF 2	1590.05	2.00	1220.37	9.59	1229.96		0.000310	0.0000	0.036	2.47	642.98	99.85	0.17
North Inlet Chan	Olive-Northern	15930.0*	PF 2	1590.05	2.00	1220.37	9.59	1229.96		0.000290	0.0000	0.036	2.41	660.25	101.63	0.17
North Inlet Chan	Olive-Northern	15928.0*	PF 2	1590.05	2.00	1220.37	9.60	1229.97		0.000273	0.0000	0.036	2.35	677.54	103.42	0.16
North Inlet Chan	Olive-Northern	15926.0*	PF 2	1590.05	2.00	1220.37	9.60	1229.97		0.000256	0.0050	0.036	2.29	694.70	105.20	0.16
North Inlet Chan	Olive-Northern	15924.0*	PF 2	1590.05	2.00	1220.36	9.61	1229.97		0.000241	0.0000	0.036	2.23	712.86	107.04	0.15
North Inlet Chan	Olive-Northern	15922.0*	PF 2	1590.05	2.00	1220.36	9.61	1229.97		0.000227	0.0000	0.036	2.18	730.65	108.81	0.15
North Inlet Chan	Olive-Northern	15920.0*	PF 2	1590.05	2.00	1220.36	9.62	1229.98		0.000214	0.0000	0.036	2.12	748.54	110.61	0.14
North Inlet Chan	Olive-Northern	15918.0*	PF 2	1590.05	2.00	1220.36	9.62	1229.98		0.000201	0.0000	0.036	2.07	766.82	112.38	0.14
North Inlet Chan	Olive-Northern	15916.09	PF 2	1590.05	1.67	1220.36	9.62	1229.98		0.000190	0.0000	0.036	2.03	784.95	114.15	0.14

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Mann Wtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
North Inlet Chan	Olive-Northern	15914.4*	PF 2	1590.05	1.67	1220.36	9.62	1229.98		0.000174	0.0000	0.035	1.98	801.68	117.46	0.13
North Inlet Chan	Olive-Northern	15912.7*	PF 2	1590.05	1.67	1220.36	9.62	1229.98		0.000168	0.0000	0.035	1.94	817.60	120.75	0.13
North Inlet Chan	Olive-Northern	15911.0*	PF 2	1590.05	1.67	1220.36	9.62	1229.98		0.000154	0.0000	0.034	1.91	833.72	124.05	0.13
North Inlet Chan	Olive-Northern	15909.4*	PF 2	1590.05	1.67	1220.36	9.62	1229.98		0.000141	0.0060	0.033	1.87	849.49	127.36	0.13
North Inlet Chan	Olive-Northern	15907.7*	PF 2	1590.05	1.67	1220.35	9.64	1229.99		0.000137	0.0000	0.033	1.84	865.39	130.72	0.13
North Inlet Chan	Olive-Northern	15906.0*	PF 2	1590.05	1.67	1220.35	9.64	1229.99		0.000126	0.0000	0.032	1.81	879.95	134.03	0.12
North Inlet Chan	Olive-Northern	15904.4*	PF 2	1590.05	1.67	1220.35	9.64	1229.99		0.000115	0.0000	0.031	1.78	894.68	137.33	0.12
North Inlet Chan	Olive-Northern	15902.7*	PF 2	1590.05	1.67	1220.35	9.64	1229.99		0.000113	0.0000	0.031	1.75	908.95	140.62	0.12
North Inlet Chan	Olive-Northern	15901.09	PF 2	1590.05	45.57	1220.35	9.64	1229.99		0.000103	0.0009	0.030	1.72	922.70	143.92	0.12
North Inlet Chan	Olive-Northern	15855.5*	PF 2	1590.05	45.57	1220.31	9.67	1229.99		0.000102	0.0007	0.030	1.71	927.84	144.27	0.12
North Inlet Chan	Olive-Northern	15809.9*	PF 2	1590.05	45.57	1220.28	9.70	1229.98		0.000101	0.0009	0.030	1.71	931.54	144.52	0.12
North Inlet Chan	Olive-Northern	15764.3*	PF 2	1590.05	45.57	1220.24	9.74	1229.98		0.000099	0.0007	0.030	1.70	936.73	144.87	0.12
North Inlet Chan	Olive-Northern	15718.8*	PF 2	1590.05	45.57	1220.21	9.76	1229.97		0.000098	0.0009	0.030	1.69	940.82	175.00	0.12
North Inlet Chan	Olive-Northern	15673.2*	PF 2	1590.05	45.57	1220.17	9.80	1229.97		0.000096	0.0007	0.030	1.68	947.10	175.00	0.12
North Inlet Chan	Olive-Northern	15627.6*	PF 2	1590.05	45.57	1220.14	9.82	1229.96		0.000095	0.0009	0.030	1.67	951.63	175.00	0.12
North Inlet Chan	Olive-Northern	15582.1*	PF 2	1590.05	45.57	1220.10	9.86	1229.96		0.000093	0.0007	0.030	1.67	957.95	175.00	0.11
North Inlet Chan	Olive-Northern	15536.5*	PF 2	1590.05	45.57	1220.07	9.89	1229.96		0.000092	0.0007	0.030	1.66	962.50	175.00	0.11
North Inlet Chan	Olive-Northern	15491.*	PF 2	1590.05	45.57	1220.04	9.91	1229.95		0.000091	0.0009	0.030	1.65	967.06	175.00	0.11
North Inlet Chan	Olive-Northern	15445.49	PF 2	1590.05	347.00	1220.00	9.95	1229.95	1223.02	0.000089	0.0019	0.030	1.64	973.40	175.00	0.11
North Inlet Chan	Olive-Northern	15445		Culvert												
North Inlet Chan	Olive-Northern	15109	PF 2	1590.05	10.00	1219.34	8.36	1227.70		0.000037	0.0360	0.032	1.07	1484.92	197.45	0.07
FRS#3 Channel	Northern-FRS#3	1.124	PF 2	7132.00	265.00	1218.98	8.18	1227.16		0.000305	0.0048	0.018	5.26	1355.51	190.51	0.35
FRS#3 Channel	Northern-FRS#3	1.074	PF 2	7132.00	400.00	1217.71	9.10	1226.81		0.001047	0.0048	0.029	6.32	1128.75	152.02	0.41
FRS#3 Channel	Northern-FRS#3	0.998	PF 2	7132.00	410.00	1215.80	10.87	1226.67	1221.03	0.000571	0.0032	0.029	5.05	1411.25	183.75	0.30
FRS#3 Channel	Northern-FRS#3	0.92	PF 2	7132.00	395.00	1214.50	9.62	1224.13	1224.13	0.010455	0.0033	0.034	11.76	606.46	140.34	1.00
FRS#3 Channel	Northern-FRS#3	0.845	PF 2	7572.00	400.00	1213.20	10.83	1224.03	1221.66	0.000583	0.0052	0.028	4.53	2989.61	781.81	0.31
FRS#3 Channel	Northern-FRS#3	0.770	PF 2	7572.00	390.00	1211.10	12.08	1223.18	1221.72	0.001506	0.0059	0.029	7.37	1760.58	540.66	0.49
FRS#3 Channel	Northern-FRS#3	0.696	PF 2	7572.00	400.00	1208.80	10.75	1219.55	1219.55	0.006812	0.0040	0.028	13.79	549.28	93.70	1.00
FRS#3 Channel	Northern-FRS#3	0.620	PF 2	7572.00	410.00	1207.20	9.29	1216.49	1217.43	0.008067	0.0012	0.028	14.48	699.76	324.84	1.09
FRS#3 Channel	Northern-FRS#3	0.543	PF 2	7572.00	410.00	1206.70	9.28	1215.98	1214.48	0.002355	0.0080	0.029	8.42	1280.87	314.32	0.61
FRS#3 Channel	Northern-FRS#3	0.465	PF 2	7572.00	395.00	1203.40	9.14	1212.54	1212.54	0.007697	0.0066	0.030	12.70	596.19	119.87	1.00
FRS#3 Channel	Northern-FRS#3	0.39	PF 2	7572.00		1200.80	10.00	1210.80	1209.74	0.001868		0.028	7.40	1759.18	587.72	0.54
BCW	Olive-Cholla	2.235	PF 2	2722.00	10.00	1273.15	4.91	1278.06	1277.80	0.009042	0.0000	0.035	7.98	498.57	303.67	0.82
BCW	Olive-Cholla	2.233	PF 2	2722.00	23.57	1273.15	4.80	1277.95		0.009301	0.0038	0.035	7.96	490.05	291.92	0.83
BCW	Olive-Cholla	2.22857*	PF 2	2722.00	23.57	1273.06	4.88	1277.94		0.010166	0.0034	0.054	5.78	513.65	264.92	0.58
BCW	Olive-Cholla	2.22414*	PF 2	2722.00	23.57	1272.98	4.77	1277.75		0.010571	0.0038	0.052	6.27	502.28	237.43	0.62
BCW	Olive-Cholla	2.21971*	PF 2	2722.00	23.57	1272.89	4.63	1277.52		0.010946	0.0038	0.049	6.60	481.56	233.33	0.67
BCW	Olive-Cholla	2.21528*	PF 2	2722.00	23.57	1272.80	4.49	1277.29		0.010766	0.0038	0.047	7.09	464.27	228.42	0.70
BCW	Olive-Cholla	2.21085*	PF 2	2722.00	23.57	1272.71	4.12	1276.83		0.011545	0.0034	0.042	8.47	404.94	202.99	0.86
BCW	Olive-Cholla	2.21		Lat Struct												
BCW	Olive-Cholla	2.20642*	PF 2	2595.14	23.57	1272.63	4.21	1276.84		0.007059	0.0038	0.040	7.16	452.94	194.59	0.66
BCW	Olive-Cholla	2.202	PF 2	2419.27	25.00	1272.54	4.34	1276.88		0.003892	0.0000	0.038	5.98	508.61	190.34	0.53
BCW	Olive-Cholla	2.19725*	PF 2	2232.72	25.00	1272.54	4.29	1276.83		0.003097	0.0000	0.035	5.70	493.61	174.24	0.51
BCW	Olive-Cholla	2.19925*	PF 2	2050.32	25.00	1272.54	4.29	1276.83		0.002640	0.0000	0.035	5.10	491.28	166.75	0.47
BCW	Olive-Cholla	2.19775*	PF 2	1868.83	25.00	1272.54	4.28	1276.82		0.002079	0.0000	0.035	4.58	494.97	156.86	0.41
BCW	Olive-Cholla	2.183	PF 2	1687.27	21.00	1272.54	4.29	1276.83	1275.22	0.001741	0.0276	0.038	3.98	501.40	154.07	0.36
BCW	Olive-Cholla	2.179*	PF 2	1535.64	21.00	1271.96	4.85	1276.81		0.001181	0.0281	0.035	3.72	510.68	168.76	0.32
BCW	Olive-Cholla	2.175*	PF 2	1384.13	21.00	1271.37	5.46	1276.83		0.000704	0.0281	0.035	3.04	532.29	182.65	0.25
BCW	Olive-Cholla	2.171*	PF 2	1229.74	21.00	1270.78	6.07	1276.85		0.000364	0.0276	0.035	2.31	564.08	193.94	0.18
BCW	Olive-Cholla	2.167	PF 2	1141.95	102.00	1270.20	6.58	1276.78	1272.50	0.000405	0.0108	0.035	3.00	380.60	115.37	0.21
BCW	Olive-Cholla	2.163		Culvert												
BCW	Olive-Cholla	2.159	PF 2	1141.95	100.00	1269.10	5.89	1274.99	1271.43	0.000708	-0.0120	0.035	3.45	331.31	109.23	0.25
BCW	Olive-Cholla	2.140*	PF 2	1141.95	360.00	1270.30	3.97	1274.27		0.006202	0.0064	0.040	6.40	181.82	57.83	0.63
BCW	Olive-Cholla	2.072	PF 2	1141.95	400.00	1268.00	3.62	1271.63	1270.95	0.009455	0.0200	0.046	5.73	199.26	80.22	0.64
BCW	Olive-Cholla	1.996	PF 2	1141.95	400.00	1260.00	5.94	1265.94	1265.94	0.013289	0.0050	0.035	10.25	111.45	34.08	1.00
BCW	Olive-Cholla	1.920	PF 2	1141.95	405.00	1258.00	5.68	1263.68	1261.99	0.003592	0.0074	0.035	6.51	175.31	39.63	0.55
BCW	Olive-Cholla	1.844	PF 2	1141.95	400.00	1255.00	4.59	1259.59	1259.59	0.021762	0.0050	0.045	10.39	109.87	33.18	1.01
BCW	Olive-Cholla	1.768	PF 2	1141.95	400.00	1253.00	3.07	1256.07	1255.00	0.003231	0.0095	0.049	2.78	410.20	200.67	0.34
BCW	Olive-Cholla	1.692	PF 2	1141.95	400.00	1249.20	3.22	1252.42	1252.42	0.024275	0.0082	0.045	7.68	148.67	81.33	1.00

HEC-RAS Plan: Steady01 Profile: PF 2 (Continued)

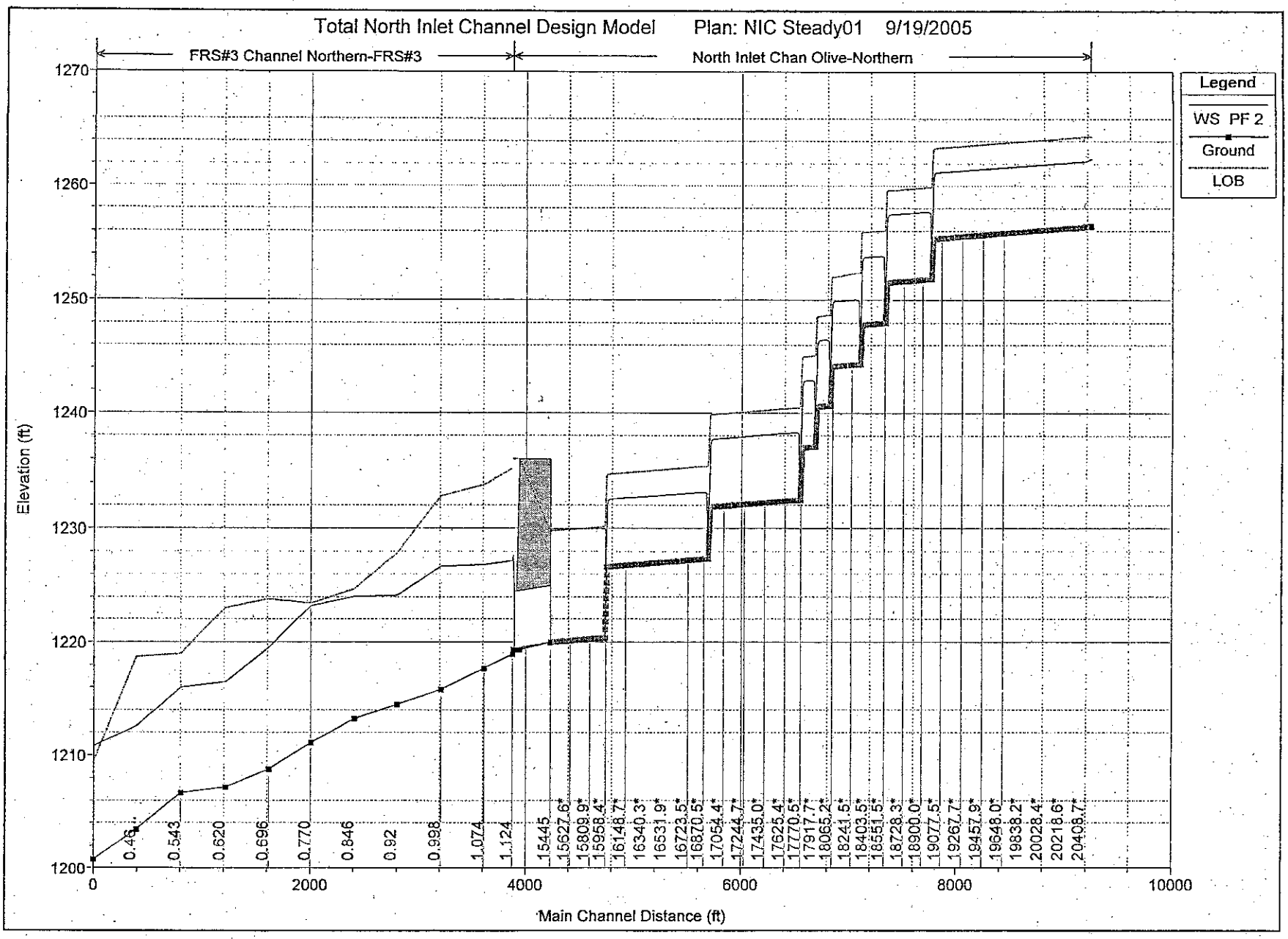
River	Reach	River Sta	Profile	Q Total	Length Chnl	Min Ch El	Max Chl Dpth	W.S. Elev	Crit W.S.	E.G. Slope	Invert Slope	Manin Vtd Chnl	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)			(ft/s)	(sq ft)	(ft)	
BCW	Ollye-Cholla	1.610	PF 2	1141.95	320.00	1245.90	5.92	1251.82	1249.17	0.001056	0.0128	0.047	2.47	462.12	117.25	0.22
BCW	Cholla-Northern	1.556	PF 2	5678.00	475.00	1241.80	9.43	1251.23	1247.51	0.001638	0.0078	0.054	3.50	1622.61	288.76	0.26
BCW	Cholla-Northern	1.466	PF 2	5678.00	410.00	1238.10	10.63	1248.73	1247.58	0.013032	0.0046	0.053	7.73	735.27	190.34	0.69
BCW	Cholla-Northern	1.388	PF 2	5678.00	395.00	1236.20	6.78	1242.98	1242.80	0.012919	0.0051	0.042	9.22	615.90	196.72	0.92
BCW	Cholla-Northern	1.313	PF 2	5678.00	405.00	1234.20	7.04	1241.25	1239.48	0.003234	0.0086	0.039	5.98	950.18	228.65	0.52
BCW	Cholla-Northern	1.237	PF 2	5678.00	335.00	1230.70	6.51	1237.21	1237.21	0.032296	0.0090	0.055	9.72	584.17	202.60	1.01
BCW	Cholla-Northern	1.173	PF 2	5678.00	49.00	1227.70	9.02	1236.72	1231.84	0.000738	0.0092	0.035	4.32	1314.46	204.51	0.30
BCW	Cholla-Northern	1.167	PF 2	5678.00	26.00	1227.25	9.15	1236.40		0.001464	0.2788	0.035	5.86	969.19	166.08	0.43
BCW	Cholla-Northern	1.159	PF 2	5678.00	110.00	1220.00	16.26	1236.26	1227.07	0.000144	0.0060	0.013	6.48	876.29	54.78	0.29
BCW	Cholla-Northern	1.154		Culvert												
BCW	Cholla-Northern	1.149	PF 2	5678.00	75.00	1219.34	8.09	1227.43		0.000527	0.0048	0.032	3.96	1432.35	196.19	0.26

HEC-RAS Plan: Steady01 Profile: PF 2

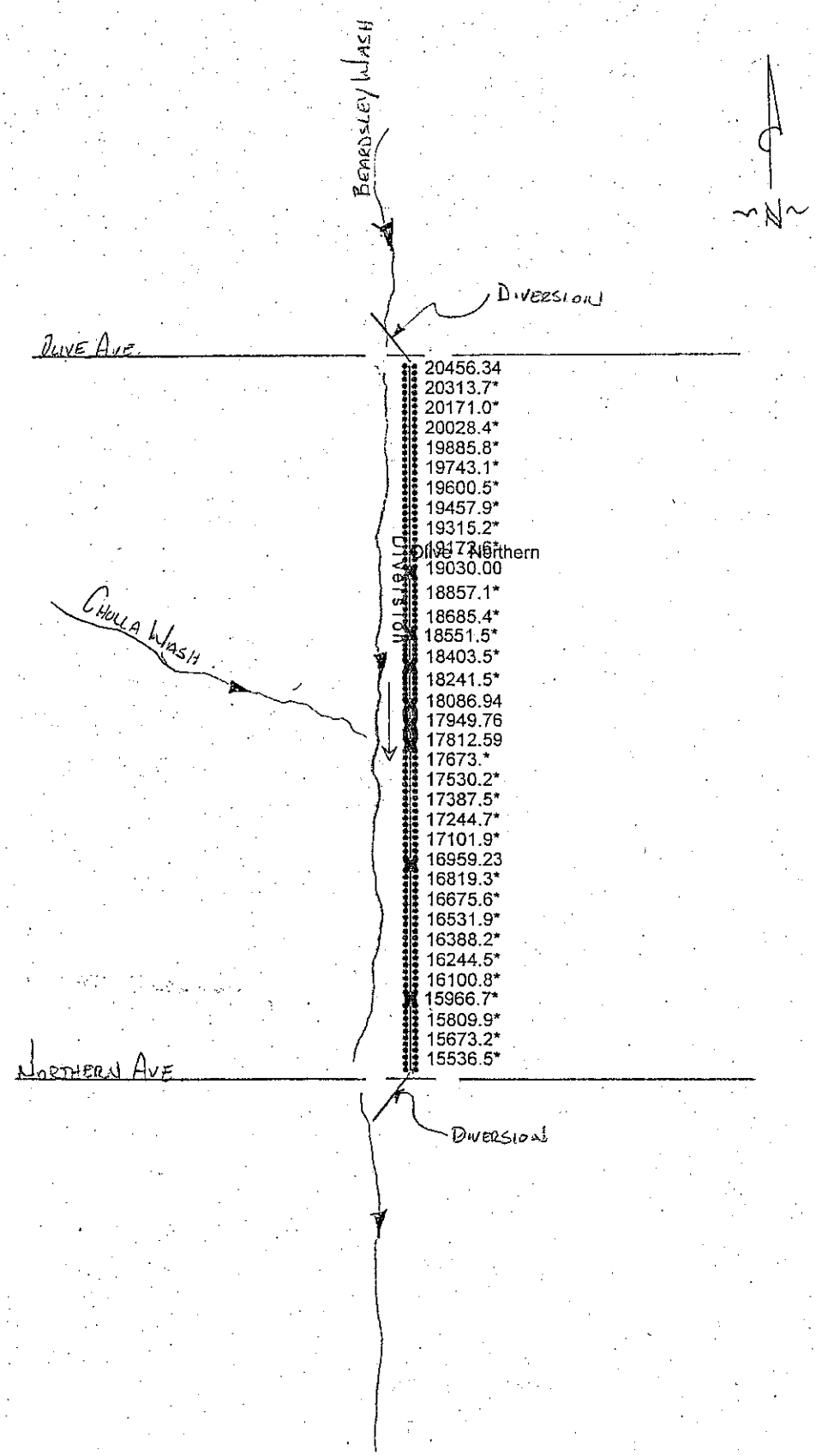
River	Reach	River Sta	Profile	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US.	W.S. US.	E.G. DS	W.S. DS
				(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
BCW	Olive-Cholla	2.21	PF 2	2722.00	1609.22	1141.95	1609.22		216.00	1.88	1.83	1275.00	1277.61	1276.83	1276.93	1276.81

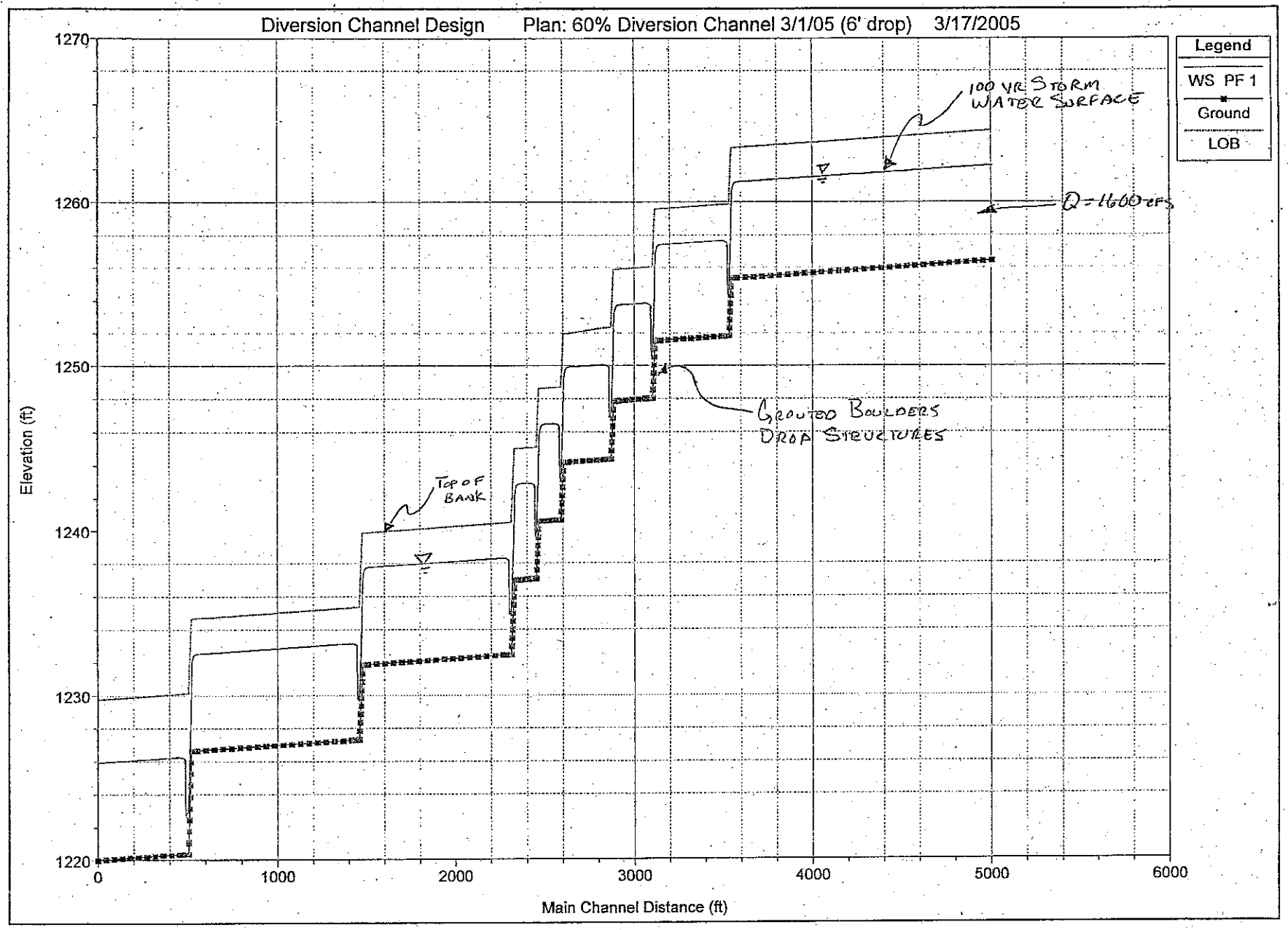
HEC-RAS Plan: Steady01 Profile: PF 2

River	Reach	River Sta	Profile	E.G. US.	W.S. US.	E.G. IC	E.G. OC	Min El Weir Flow	Q Culv Group	Q Weir	Delta WS	Culv Vel US	Culv Vel DS
				(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(ft)	(ft/s)	(ft/s)
North Inlet Chan	Olive-Northern	15445 Culvert #1	PF 2	1229.99	1229.95	1226.01	1229.99	1236.01	1590.05		2.25	7.95	7.95
BCW	Olive-Cholla	2.163 Culvert #1	PF 2	1276.92	1276.78	1276.24	1276.90	1278.49	278.30		1.79	8.42	8.42
BCW	Olive-Cholla	2.163 Culvert #2	PF 2	1276.92	1276.78	1276.47	1276.93	1278.49	262.92		1.79	8.49	8.49
BCW	Olive-Cholla	2.163 Culvert #3	PF 2	1276.92	1276.78	1276.93	1276.85	1278.49	600.73		1.79	9.62	9.54
BCW	Cholla-Northern	1.154 Culvert #1	PF 2	1236.91	1236.26	1237.31	1236.91	1236.01	5575.00	103.00	8.83	19.36	19.36

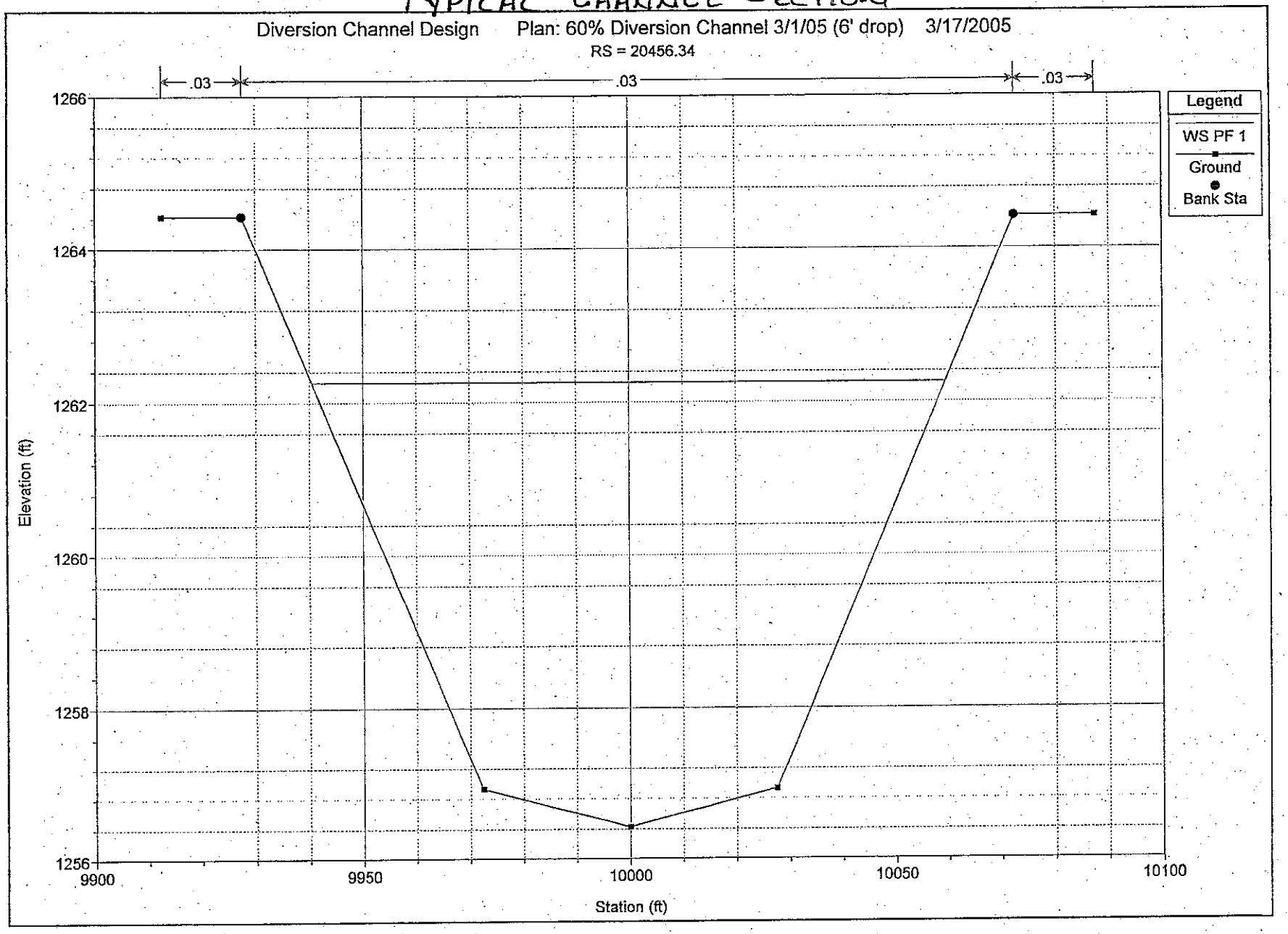

Total North Inlet Channel Design Model
Plan: NIC Steady01 9/19/2005
FRS#3 Channel Northern-FRS#3
North Inlet Chan Olive-Northern
Legend
WS PF 2
Ground
LOB
Elevation (ft)
Main Channel Distance (ft)
1270
1260
1250
1240
1230
1220
1210
1200
0
2000
4000
6000
8000
10000
0.46
0.543
0.620
0.696
0.770
0.846
0.92
0.998
1.074
1.124
15445
15627.6*
15809.9*
15958.4*
16148.7*
16340.3*
16531.9*
16723.5*
16870.5*
17054.4*
17244.7*
17435.0*
17625.4*
17770.5*
17917.7*
18065.2*
18241.5*
18403.5*
18551.5*
18728.3*
18900.0*
19077.5*
19267.7*
19457.9*
19648.0*
19838.2*
20028.4*
20218.6*
20408.7*

DIVERSION CHANNEL DESIGN




Diversion Channel Design
Plan: 60% Diversion Channel 3/1/05 (6' drop)
3/17/2005
Legend
WS PF 1
Ground
LOB
100 YR STORM WATER SURFACE
Q=1600 cfs
GROUTED BOULDERS DROP STRUCTURES
TOP OF BANK
Elevation (ft)
1270
1260
1250
1240
1230
1220
0
1000
2000
3000
4000
5000
6000
Main Channel Distance (ft)

TYPICAL CHANNEL SECTION



HEC-RAS Plan:

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	20456.34	PF 1	1600.00	1256.43	1262.26	1259.43	1262.43	0.000726	3.35	477.13	118.94	0.30
Olive - Northern	20408.7*	PF 1	1600.00	1256.39	1262.22		1262.40	0.000723	3.35	477.80	119.00	0.29
Olive - Northern	20361.2*	PF 1	1600.00	1256.36	1262.19		1262.36	0.000726	3.35	477.22	118.95	0.29
Olive - Northern	20313.7*	PF 1	1600.00	1256.32	1262.15		1262.33	0.000723	3.35	477.89	119.01	0.29
Olive - Northern	20266.1*	PF 1	1600.00	1256.29	1262.12		1262.29	0.000726	3.35	477.29	118.95	0.29
Olive - Northern	20218.6*	PF 1	1600.00	1256.25	1262.09		1262.26	0.000723	3.35	477.97	119.02	0.29
Olive - Northern	20171.0*	PF 1	1600.00	1256.22	1262.05		1262.23	0.000725	3.35	477.41	118.96	0.29
Olive - Northern	20123.5*	PF 1	1600.00	1256.18	1262.02		1262.19	0.000722	3.35	478.08	119.03	0.29
Olive - Northern	20075.9*	PF 1	1600.00	1256.14	1261.98		1262.16	0.000719	3.34	478.77	119.10	0.29
Olive - Northern	20028.4*	PF 1	1600.00	1256.11	1261.95		1262.12	0.000722	3.35	478.22	119.05	0.29
Olive - Northern	19980.8*	PF 1	1600.00	1256.07	1261.91		1262.09	0.000719	3.34	478.92	119.12	0.29
Olive - Northern	19933.3*	PF 1	1600.00	1256.04	1261.88		1262.05	0.000721	3.34	478.35	119.06	0.29
Olive - Northern	19885.8*	PF 1	1600.00	1256.00	1261.84		1262.02	0.000718	3.34	479.05	119.13	0.29
Olive - Northern	19838.2*	PF 1	1600.00	1255.97	1261.81		1261.98	0.000720	3.34	478.51	119.08	0.29
Olive - Northern	19790.7*	PF 1	1600.00	1255.93	1261.78		1261.95	0.000718	3.34	479.21	119.15	0.29
Olive - Northern	19743.1*	PF 1	1600.00	1255.90	1261.74		1261.92	0.000720	3.34	478.67	119.09	0.29
Olive - Northern	19695.6*	PF 1	1600.00	1255.86	1261.71		1261.88	0.000717	3.34	479.38	119.16	0.29
Olive - Northern	19648.0*	PF 1	1600.00	1255.82	1261.67		1261.85	0.000714	3.33	480.11	119.24	0.29
Olive - Northern	19600.5*	PF 1	1600.00	1255.79	1261.64		1261.81	0.000716	3.34	479.57	119.18	0.29
Olive - Northern	19552.9*	PF 1	1600.00	1255.75	1261.61		1261.78	0.000713	3.33	480.30	119.26	0.29
Olive - Northern	19505.4*	PF 1	1600.00	1255.72	1261.57		1261.74	0.000715	3.33	479.79	119.21	0.29
Olive - Northern	19457.9*	PF 1	1600.00	1255.68	1261.54		1261.71	0.000712	3.33	480.52	119.28	0.29
Olive - Northern	19410.3*	PF 1	1600.00	1255.65	1261.50		1261.68	0.000714	3.33	480.01	119.23	0.29
Olive - Northern	19362.8*	PF 1	1600.00	1255.61	1261.47		1261.64	0.000711	3.33	480.75	119.30	0.29
Olive - Northern	19315.2*	PF 1	1600.00	1255.57	1261.44		1261.61	0.000708	3.32	481.51	119.38	0.29
Olive - Northern	19267.7*	PF 1	1600.00	1255.54	1261.40		1261.57	0.000710	3.33	481.01	119.33	0.29
Olive - Northern	19220.1*	PF 1	1600.00	1255.50	1261.37		1261.54	0.000707	3.32	481.79	119.41	0.29
Olive - Northern	19172.6*	PF 1	1600.00	1255.47	1261.33		1261.51	0.000709	3.32	481.32	119.36	0.29
Olive - Northern	19125.0*	PF 1	1600.00	1255.43	1261.30		1261.47	0.000706	3.32	482.08	119.44	0.29
Olive - Northern	19077.5*	PF 1	1600.00	1255.40	1261.27		1261.44	0.000708	3.32	481.61	119.39	0.29
Olive - Northern	19030.00	PF 1	1600.00	1255.36	1261.23		1261.40	0.000704	3.32	482.40	119.47	0.29
Olive - Northern	19028.3*	PF 1	1600.00	1255.36	1261.23		1261.40	0.000765	3.36	476.38	117.18	0.29
Olive - Northern	19026.6*	PF 1	1600.00	1255.36	1261.22		1261.40	0.000778	3.40	470.20	114.83	0.30
Olive - Northern	19025.*	PF 1	1600.00	1255.36	1261.21		1261.40	0.000845	3.45	463.75	112.47	0.30
Olive - Northern	19023.3*	PF 1	1600.00	1255.36	1261.21		1261.40	0.000919	3.50	456.66	110.03	0.30
Olive - Northern	19021.6*	PF 1	1600.00	1255.35	1261.20		1261.39	0.000940	3.56	449.67	107.63	0.31
Olive - Northern	19020.*	PF 1	1600.00	1255.35	1261.19		1261.39	0.001020	3.61	442.67	105.15	0.31
Olive - Northern	19018.3*	PF 1	1600.00	1255.35	1261.18		1261.39	0.001113	3.68	434.64	102.60	0.32
Olive - Northern	19016.6*	PF 1	1600.00	1255.35	1261.17		1261.39	0.001146	3.75	426.80	100.07	0.32

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	19015.00	PF 1	1600.00	1255.35	1261.16		1261.38	0.001254	3.83	418.28	97.46	0.33
Olive - Northern	19013.3*	PF 1	1600.00	1255.35	1261.12		1261.38	0.001452	4.06	394.26	93.84	0.35
Olive - Northern	19011.6*	PF 1	1600.00	1255.35	1261.08		1261.37	0.001686	4.31	371.08	90.23	0.37
Olive - Northern	19010.*	PF 1	1600.00	1255.35	1261.04		1261.37	0.001985	4.60	347.49	86.50	0.40
Olive - Northern	19008.3*	PF 1	1600.00	1255.35	1260.98		1261.36	0.002363	4.94	323.90	82.69	0.44
Olive - Northern	19006.6*	PF 1	1600.00	1255.34	1260.91		1261.35	0.002838	5.32	300.89	78.87	0.48
Olive - Northern	19005.*	PF 1	1600.00	1255.34	1260.82		1261.33	0.003499	5.78	276.69	74.78	0.53
Olive - Northern	19003.3*	PF 1	1600.00	1255.34	1260.69		1261.32	0.004440	6.36	251.63	70.46	0.59
Olive - Northern	19001.6*	PF 1	1600.00	1255.34	1260.49		1261.29	0.006027	7.17	223.13	65.54	0.68
Olive - Northern	19000.00	PF 1	1600.00	1255.34	1259.74	1259.74	1261.21	0.013492	9.71	164.83	56.23	1.00
Olive - Northern	18998.*	PF 1	1600.00	1254.84	1258.47	1259.24	1261.07	0.029898	12.92	123.85	50.07	1.45
Olive - Northern	18996.*	PF 1	1600.00	1254.34	1257.71	1258.74	1260.94	0.040714	14.42	110.94	47.96	1.67
Olive - Northern	18994.*	PF 1	1600.00	1253.84	1257.04	1258.24	1260.80	0.050428	15.56	102.82	46.59	1.85
Olive - Northern	18992.*	PF 1	1600.00	1253.34	1256.41	1257.74	1260.64	0.059591	16.51	96.92	45.56	1.99
Olive - Northern	18990.*	PF 1	1600.00	1252.84	1255.81	1257.24	1260.47	0.068368	17.33	92.33	44.75	2.13
Olive - Northern	18988.*	PF 1	1600.00	1252.34	1255.22	1256.74	1260.29	0.076993	18.07	88.54	44.06	2.25
Olive - Northern	18986.00	PF 1	1600.00	1251.84	1254.65	1256.22	1260.10	0.085124	18.72	85.46	43.50	2.35
Olive - Northern	18984.*	PF 1	1600.00	1251.84	1254.59	1256.12	1259.87	0.084777	18.44	86.78	45.13	2.34
Olive - Northern	18982.*	PF 1	1600.00	1251.84	1254.53	1256.01	1259.65	0.084384	18.14	88.18	46.87	2.33
Olive - Northern	18980.*	PF 1	1600.00	1251.84	1254.47	1255.91	1259.42	0.083608	17.85	89.62	48.53	2.32
Olive - Northern	18978.*	PF 1	1600.00	1251.83	1254.41	1255.81	1259.20	0.082792	17.56	91.10	50.24	2.30
Olive - Northern	18976.*	PF 1	1600.00	1251.83	1257.53	1255.71	1257.98	0.002870	5.38	297.57	77.30	0.48
Olive - Northern	18974.*	PF 1	1600.00	1251.83	1257.55		1257.96	0.002595	5.16	310.25	79.58	0.46
Olive - Northern	18972.*	PF 1	1600.00	1251.83	1257.56		1257.94	0.002346	4.95	323.37	81.86	0.44
Olive - Northern	18970.*	PF 1	1600.00	1251.83	1257.58		1257.93	0.002131	4.76	336.44	84.13	0.42
Olive - Northern	18968.*	PF 1	1600.00	1251.83	1257.59		1257.92	0.001936	4.57	349.90	86.38	0.40
Olive - Northern	18966.*	PF 1	1600.00	1251.83	1257.60		1257.91	0.001762	4.40	363.63	88.64	0.38
Olive - Northern	18964.*	PF 1	1600.00	1251.82	1257.62		1257.89	0.001606	4.24	377.77	90.94	0.37
Olive - Northern	18962.*	PF 1	1600.00	1251.82	1257.63		1257.89	0.001471	4.09	391.56	93.17	0.35
Olive - Northern	18960.*	PF 1	1600.00	1251.82	1257.64		1257.88	0.001348	3.94	405.74	95.38	0.34
Olive - Northern	18958.00	PF 1	1600.00	1251.82	1257.64		1257.87	0.001240	3.81	419.90	97.59	0.32
Olive - Northern	18956.3*	PF 1	1600.00	1251.82	1257.65		1257.86	0.001139	3.74	427.64	100.14	0.32
Olive - Northern	18954.6*	PF 1	1600.00	1251.82	1257.65		1257.86	0.001110	3.68	435.11	102.63	0.31
Olive - Northern	18953.*	PF 1	1600.00	1251.82	1257.65		1257.86	0.001025	3.62	442.03	105.09	0.31
Olive - Northern	18951.3*	PF 1	1600.00	1251.82	1257.66		1257.85	0.000943	3.56	449.07	107.55	0.31
Olive - Northern	18949.6*	PF 1	1600.00	1251.81	1257.66		1257.85	0.000922	3.51	456.24	110.02	0.30
Olive - Northern	18948.*	PF 1	1600.00	1251.81	1257.66		1257.85	0.000850	3.46	462.69	112.40	0.30
Olive - Northern	18946.3*	PF 1	1600.00	1251.81	1257.66		1257.84	0.000784	3.41	468.97	114.75	0.30
Olive - Northern	18944.6*	PF 1	1600.00	1251.81	1257.66		1257.84	0.000771	3.37	474.95	117.04	0.29

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	18943.00	PF 1	1600.00	1251.81	1257.67		1257.84	0.000713	3.33	480.42	119.27	0.29
Olive - Northern	18900.0*	PF 1	1600.00	1251.78	1257.64		1257.81	0.000713	3.33	480.34	119.26	0.29
Olive - Northern	18857.1*	PF 1	1600.00	1251.75	1257.60		1257.78	0.000713	3.33	480.27	119.25	0.29
Olive - Northern	18814.2*	PF 1	1600.00	1251.71	1257.57		1257.75	0.000708	3.32	481.42	119.37	0.29
Olive - Northern	18771.2*	PF 1	1600.00	1251.68	1257.54		1257.72	0.000709	3.32	481.36	119.36	0.29
Olive - Northern	18728.3*	PF 1	1600.00	1251.65	1257.51		1257.69	0.000709	3.32	481.32	119.36	0.29
Olive - Northern	18685.4*	PF 1	1600.00	1251.62	1257.48		1257.66	0.000709	3.32	481.28	119.36	0.29
Olive - Northern	18642.5*	PF 1	1600.00	1251.58	1257.45		1257.62	0.000704	3.32	482.44	119.47	0.29
Olive - Northern	18599.58	PF 1	1600.00	1251.55	1257.42		1257.59	0.000704	3.32	482.38	119.47	0.29
Olive - Northern	18597.9*	PF 1	1600.00	1251.55	1257.42		1257.59	0.000765	3.36	476.37	117.18	0.29
Olive - Northern	18596.2*	PF 1	1600.00	1251.55	1257.41		1257.59	0.000778	3.40	470.19	114.83	0.30
Olive - Northern	18594.5*	PF 1	1600.00	1251.55	1257.40		1257.59	0.000845	3.45	463.74	112.47	0.30
Olive - Northern	18592.9*	PF 1	1600.00	1251.55	1257.40		1257.59	0.000919	3.50	456.66	110.03	0.30
Olive - Northern	18591.2*	PF 1	1600.00	1251.54	1257.39		1257.58	0.000940	3.56	449.68	107.63	0.31
Olive - Northern	18589.5*	PF 1	1600.00	1251.54	1257.38		1257.58	0.001020	3.61	442.68	105.15	0.31
Olive - Northern	18587.9*	PF 1	1600.00	1251.54	1257.37		1257.58	0.001113	3.68	434.64	102.60	0.32
Olive - Northern	18586.2*	PF 1	1600.00	1251.54	1257.36		1257.58	0.001146	3.75	426.80	100.07	0.32
Olive - Northern	18584.58	PF 1	1600.00	1251.54	1257.35		1257.57	0.001254	3.83	418.28	97.46	0.33
Olive - Northern	18582.9*	PF 1	1600.00	1251.54	1257.31		1257.57	0.001452	4.06	394.27	93.84	0.35
Olive - Northern	18581.2*	PF 1	1600.00	1251.54	1257.28		1257.56	0.001686	4.31	371.08	90.23	0.37
Olive - Northern	18579.5*	PF 1	1600.00	1251.54	1257.23		1257.56	0.001984	4.60	347.49	86.50	0.40
Olive - Northern	18577.9*	PF 1	1600.00	1251.54	1257.17		1257.55	0.002363	4.94	323.90	82.69	0.44
Olive - Northern	18576.2*	PF 1	1600.00	1251.53	1257.10		1257.54	0.002838	5.32	300.90	78.87	0.48
Olive - Northern	18574.5*	PF 1	1600.00	1251.53	1257.01		1257.52	0.003499	5.78	276.69	74.78	0.53
Olive - Northern	18572.9*	PF 1	1600.00	1251.53	1256.88		1257.51	0.004440	6.36	251.63	70.46	0.59
Olive - Northern	18571.2*	PF 1	1600.00	1251.53	1256.68		1257.48	0.006027	7.17	223.13	65.54	0.68
Olive - Northern	18569.58	PF 1	1600.00	1251.53	1255.93	1255.93	1257.40	0.013492	9.71	164.83	56.23	1.00
Olive - Northern	18567.5*	PF 1	1600.00	1251.03	1254.66	1255.43	1257.26	0.029898	12.92	123.85	50.07	1.45
Olive - Northern	18565.5*	PF 1	1600.00	1250.53	1253.90	1254.93	1257.13	0.040708	14.42	110.95	47.96	1.67
Olive - Northern	18563.5*	PF 1	1600.00	1250.03	1253.23	1254.43	1256.99	0.050347	15.55	102.88	46.59	1.84
Olive - Northern	18561.5*	PF 1	1600.00	1249.53	1252.60	1253.93	1256.83	0.059514	16.50	96.96	45.57	1.99
Olive - Northern	18559.5*	PF 1	1600.00	1249.03	1252.00	1253.43	1256.66	0.068299	17.32	92.36	44.75	2.13
Olive - Northern	18557.5*	PF 1	1600.00	1248.53	1251.41	1252.93	1256.48	0.076929	18.07	88.56	44.07	2.25
Olive - Northern	18555.58	PF 1	1600.00	1248.03	1250.84	1252.42	1256.28	0.085064	18.72	85.48	43.51	2.35
Olive - Northern	18553.5*	PF 1	1600.00	1248.03	1250.78	1252.31	1256.06	0.084715	18.43	86.80	45.13	2.34
Olive - Northern	18551.5*	PF 1	1600.00	1248.03	1250.72	1252.20	1255.83	0.084326	18.14	88.20	46.88	2.33
Olive - Northern	18549.5*	PF 1	1600.00	1248.03	1250.66	1252.10	1255.61	0.083550	17.85	89.65	48.54	2.31
Olive - Northern	18547.5*	PF 1	1600.00	1248.02	1250.61	1252.00	1255.39	0.082733	17.56	91.13	50.24	2.30
Olive - Northern	18545.5*	PF 1	1600.00	1248.02	1253.72	1251.90	1254.17	0.002872	5.38	297.51	77.29	0.48

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	18543.5*	PF 1	1600.00	1248.02	1253.74		1254.15	0.002596	5.16	310.19	79.58	0.46
Olive - Northern	18541.5*	PF 1	1600.00	1248.02	1253.75		1254.13	0.002347	4.95	323.32	81.85	0.44
Olive - Northern	18539.5*	PF 1	1600.00	1248.02	1253.77		1254.12	0.002132	4.76	336.38	84.12	0.42
Olive - Northern	18537.5*	PF 1	1600.00	1248.02	1253.78		1254.11	0.001937	4.57	349.85	86.37	0.40
Olive - Northern	18535.5*	PF 1	1600.00	1248.02	1253.79		1254.10	0.001763	4.40	363.57	88.64	0.38
Olive - Northern	18533.5*	PF 1	1600.00	1248.01	1253.81		1254.08	0.001606	4.24	377.71	90.94	0.37
Olive - Northern	18531.5*	PF 1	1600.00	1248.01	1253.82		1254.08	0.001472	4.09	391.50	93.16	0.35
Olive - Northern	18529.5*	PF 1	1600.00	1248.01	1253.82		1254.07	0.001349	3.94	405.68	95.38	0.34
Olive - Northern	18527.58	PF 1	1600.00	1248.01	1253.83		1254.06	0.001240	3.81	419.83	97.58	0.32
Olive - Northern	18525.9*	PF 1	1600.00	1248.01	1253.84		1254.05	0.001140	3.74	427.57	100.13	0.32
Olive - Northern	18524.2*	PF 1	1600.00	1248.01	1253.84		1254.05	0.001111	3.68	435.04	102.63	0.31
Olive - Northern	18522.5*	PF 1	1600.00	1248.01	1253.84		1254.05	0.001025	3.62	441.96	105.09	0.31
Olive - Northern	18520.9*	PF 1	1600.00	1248.01	1253.85		1254.04	0.000944	3.56	448.99	107.54	0.31
Olive - Northern	18519.2*	PF 1	1600.00	1248.00	1253.85		1254.04	0.000922	3.51	456.17	110.02	0.30
Olive - Northern	18517.5*	PF 1	1600.00	1248.00	1253.85		1254.04	0.000851	3.46	462.62	112.39	0.30
Olive - Northern	18515.9*	PF 1	1600.00	1248.00	1253.85		1254.03	0.000784	3.41	468.90	114.74	0.30
Olive - Northern	18514.2*	PF 1	1600.00	1248.00	1253.85		1254.03	0.000771	3.37	474.88	117.03	0.29
Olive - Northern	18512.58	PF 1	1600.00	1248.00	1253.86		1254.03	0.000713	3.33	480.34	119.26	0.29
Olive - Northern	18476.2*	PF 1	1600.00	1247.97	1253.83		1254.00	0.000711	3.33	480.84	119.31	0.29
Olive - Northern	18439.8*	PF 1	1600.00	1247.94	1253.80		1253.98	0.000709	3.32	481.35	119.36	0.29
Olive - Northern	18403.5*	PF 1	1600.00	1247.91	1253.78		1253.95	0.000707	3.32	481.86	119.41	0.29
Olive - Northern	18367.14	PF 1	1600.00	1247.88	1253.75		1253.92	0.000704	3.32	482.38	119.47	0.29
Olive - Northern	18365.4*	PF 1	1600.00	1247.88	1253.75		1253.92	0.000765	3.36	476.37	117.18	0.29
Olive - Northern	18363.8*	PF 1	1600.00	1247.88	1253.74		1253.92	0.000778	3.40	470.18	114.83	0.30
Olive - Northern	18362.1*	PF 1	1600.00	1247.88	1253.73		1253.92	0.000845	3.45	463.73	112.46	0.30
Olive - Northern	18360.4*	PF 1	1600.00	1247.88	1253.73		1253.92	0.000919	3.50	456.64	110.03	0.30
Olive - Northern	18358.8*	PF 1	1600.00	1247.87	1253.72		1253.91	0.000940	3.56	449.66	107.63	0.31
Olive - Northern	18357.1*	PF 1	1600.00	1247.87	1253.71		1253.91	0.001020	3.61	442.66	105.15	0.31
Olive - Northern	18355.4*	PF 1	1600.00	1247.87	1253.70		1253.91	0.001114	3.68	434.63	102.60	0.32
Olive - Northern	18353.8*	PF 1	1600.00	1247.87	1253.69		1253.91	0.001146	3.75	426.79	100.06	0.32
Olive - Northern	18352.14	PF 1	1600.00	1247.87	1253.68		1253.90	0.001254	3.83	418.27	97.45	0.33
Olive - Northern	18350.4*	PF 1	1600.00	1247.87	1253.64		1253.90	0.001452	4.06	394.25	93.84	0.35
Olive - Northern	18348.8*	PF 1	1600.00	1247.87	1253.60		1253.89	0.001686	4.31	371.07	90.23	0.37
Olive - Northern	18347.1*	PF 1	1600.00	1247.87	1253.56		1253.89	0.001985	4.60	347.48	86.50	0.40
Olive - Northern	18345.4*	PF 1	1600.00	1247.87	1253.50		1253.88	0.002363	4.94	323.89	82.69	0.44
Olive - Northern	18343.8*	PF 1	1600.00	1247.86	1253.43		1253.87	0.002838	5.32	300.89	78.87	0.48
Olive - Northern	18342.1*	PF 1	1600.00	1247.86	1253.33		1253.85	0.003500	5.78	276.67	74.78	0.53
Olive - Northern	18340.4*	PF 1	1600.00	1247.86	1253.21		1253.84	0.004440	6.36	251.63	70.46	0.59
Olive - Northern	18338.8*	PF 1	1600.00	1247.86	1253.01		1253.81	0.006027	7.17	223.13	65.54	0.68

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	18337.14	PF 1	1600.00	1247.86	1252.26	1252.26	1253.73	0.013492	9.71	164.83	56.23	1.00
Olive - Northern	18335.1*	PF 1	1600.00	1247.36	1250.99	1251.76	1253.59	0.029898	12.92	123.85	50.07	1.45
Olive - Northern	18333.1*	PF 1	1600.00	1246.86	1250.23	1251.26	1253.46	0.040708	14.42	110.95	47.96	1.67
Olive - Northern	18331.1*	PF 1	1600.00	1246.36	1249.56	1250.76	1253.32	0.050347	15.55	102.88	46.59	1.84
Olive - Northern	18329.1*	PF 1	1600.00	1245.86	1248.93	1250.26	1253.16	0.059514	16.50	96.96	45.57	1.99
Olive - Northern	18327.1*	PF 1	1600.00	1245.36	1248.33	1249.76	1252.99	0.068299	17.32	92.36	44.75	2.13
Olive - Northern	18325.1*	PF 1	1600.00	1244.86	1247.74	1249.26	1252.81	0.076929	18.07	88.56	44.07	2.25
Olive - Northern	18323.14	PF 1	1600.00	1244.36	1247.17	1248.75	1252.61	0.085064	18.72	85.48	43.51	2.35
Olive - Northern	18321.1*	PF 1	1600.00	1244.36	1247.11	1248.64	1252.39	0.084715	18.43	86.80	45.13	2.34
Olive - Northern	18319.1*	PF 1	1600.00	1244.36	1247.05	1248.53	1252.16	0.084326	18.14	88.20	46.88	2.33
Olive - Northern	18317.1*	PF 1	1600.00	1244.36	1246.99	1248.43	1251.94	0.083558	17.85	89.64	48.54	2.31
Olive - Northern	18315.1*	PF 1	1600.00	1244.35	1246.94	1248.33	1251.72	0.082742	17.56	91.12	50.24	2.30
Olive - Northern	18313.1*	PF 1	1600.00	1244.35	1246.88	1248.23	1251.50	0.081593	17.26	92.69	51.92	2.28
Olive - Northern	18311.1*	PF 1	1600.00	1244.35	1249.90	1248.13	1250.35	0.002924	5.38	297.30	78.27	0.49
Olive - Northern	18309.1*	PF 1	1600.00	1244.35	1249.92		1250.33	0.002637	5.16	310.19	80.56	0.46
Olive - Northern	18307.1*	PF 1	1600.00	1244.35	1249.94		1250.32	0.002390	4.95	323.01	82.84	0.44
Olive - Northern	18305.1*	PF 1	1600.00	1244.35	1249.95		1250.30	0.002167	4.76	336.21	85.10	0.42
Olive - Northern	18303.1*	PF 1	1600.00	1244.35	1249.97		1250.29	0.001969	4.58	349.67	87.38	0.40
Olive - Northern	18301.1*	PF 1	1600.00	1244.34	1249.98		1250.28	0.001790	4.40	363.55	89.68	0.39
Olive - Northern	18299.1*	PF 1	1600.00	1244.34	1249.99		1250.27	0.001638	4.24	377.07	91.91	0.37
Olive - Northern	18297.1*	PF 1	1600.00	1244.34	1250.00		1250.26	0.001498	4.09	390.98	94.13	0.35
Olive - Northern	18295.14	PF 1	1600.00	1244.34	1250.01		1250.25	0.001376	3.95	404.87	96.35	0.34
Olive - Northern	18293.4*	PF 1	1600.00	1244.34	1250.01		1250.25	0.001265	3.88	412.23	98.84	0.33
Olive - Northern	18291.8*	PF 1	1600.00	1244.34	1250.02		1250.24	0.001233	3.82	419.33	101.28	0.33
Olive - Northern	18290.1*	PF 1	1600.00	1244.34	1250.02		1250.24	0.001139	3.76	425.88	103.67	0.33
Olive - Northern	18288.4*	PF 1	1600.00	1244.34	1250.02		1250.23	0.001049	3.70	432.55	106.06	0.32
Olive - Northern	18286.8*	PF 1	1600.00	1244.33	1250.02		1250.23	0.001025	3.64	439.35	108.47	0.32
Olive - Northern	18285.1*	PF 1	1600.00	1244.33	1250.03		1250.23	0.000946	3.59	445.44	110.78	0.32
Olive - Northern	18283.4*	PF 1	1600.00	1244.33	1250.03		1250.22	0.000873	3.54	451.36	113.05	0.31
Olive - Northern	18281.8*	PF 1	1600.00	1244.33	1250.03		1250.22	0.000859	3.50	457.00	115.26	0.31
Olive - Northern	18280.14	PF 1	1600.00	1244.33	1250.03		1250.22	0.000794	3.46	462.13	117.41	0.31
Olive - Northern	18241.5*	PF 1	1600.00	1244.30	1250.00		1250.19	0.000777	3.43	465.93	117.91	0.30
Olive - Northern	18202.8*	PF 1	1600.00	1244.27	1249.98		1250.16	0.000760	3.41	469.83	118.42	0.30
Olive - Northern	18164.2*	PF 1	1600.00	1244.24	1249.95		1250.13	0.000743	3.38	473.81	118.94	0.30
Olive - Northern	18125.5*	PF 1	1600.00	1244.21	1249.92		1250.10	0.000727	3.35	477.90	119.46	0.29
Olive - Northern	18086.94	PF 1	1600.00	1244.18	1249.90		1250.07	0.000710	3.32	482.09	119.99	0.29
Olive - Northern	18085.2*	PF 1	1600.00	1244.18	1249.89		1250.07	0.000770	3.36	476.09	117.67	0.29
Olive - Northern	18083.6*	PF 1	1600.00	1244.18	1249.88		1250.06	0.000785	3.41	469.57	115.30	0.30
Olive - Northern	18081.9*	PF 1	1600.00	1244.18	1249.88		1250.06	0.000855	3.46	462.78	112.91	0.30

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	18080.2*	PF 1	1600.00	1244.18	1249.87		1250.06	0.000930	3.51	455.73	110.46	0.30
Olive - Northern	18078.6*	PF 1	1600.00	1244.17	1249.86		1250.06	0.000951	3.57	448.79	108.04	0.31
Olive - Northern	18076.9*	PF 1	1600.00	1244.17	1249.85		1250.06	0.001035	3.62	441.48	105.54	0.31
Olive - Northern	18075.2*	PF 1	1600.00	1244.17	1249.84		1250.05	0.001129	3.69	433.49	102.97	0.32
Olive - Northern	18073.6*	PF 1	1600.00	1244.17	1249.83		1250.05	0.001164	3.76	425.37	100.42	0.32
Olive - Northern	18071.94	PF 1	1600.00	1244.17	1249.82		1250.05	0.001274	3.84	416.85	97.79	0.33
Olive - Northern	18070.2*	PF 1	1600.00	1244.17	1249.79		1250.04	0.001474	4.07	393.02	94.17	0.35
Olive - Northern	18068.6*	PF 1	1600.00	1244.17	1249.75		1250.04	0.001709	4.32	370.10	90.56	0.38
Olive - Northern	18066.9*	PF 1	1600.00	1244.17	1249.70		1250.03	0.002008	4.61	346.76	86.84	0.41
Olive - Northern	18065.2*	PF 1	1600.00	1244.17	1249.64		1250.02	0.002388	4.95	323.41	83.02	0.44
Olive - Northern	18063.6*	PF 1	1600.00	1244.16	1249.57		1250.01	0.002862	5.32	300.64	79.21	0.48
Olive - Northern	18061.9*	PF 1	1600.00	1244.16	1249.48		1250.00	0.003521	5.78	276.66	75.13	0.53
Olive - Northern	18060.2*	PF 1	1600.00	1244.16	1249.35		1249.98	0.004476	6.36	251.48	70.79	0.59
Olive - Northern	18058.6*	PF 1	1600.00	1244.16	1249.15		1249.95	0.006065	7.17	223.16	65.88	0.69
Olive - Northern	18056.94	PF 1	1600.00	1244.16	1248.42	1248.42	1249.87	0.013440	9.66	165.55	56.69	1.00
Olive - Northern	18054.9*	PF 1	1600.00	1243.66	1247.19	1247.92	1249.73	0.029303	12.79	125.14	50.61	1.43
Olive - Northern	18052.9*	PF 1	1600.00	1243.16	1246.45	1247.45	1249.61	0.039650	14.25	112.31	48.48	1.65
Olive - Northern	18050.9*	PF 1	1600.00	1242.66	1245.81	1246.97	1249.47	0.048915	15.36	104.18	47.05	1.82
Olive - Northern	18048.9*	PF 1	1600.00	1242.16	1245.19	1246.50	1249.32	0.057818	16.30	98.15	45.97	1.97
Olive - Northern	18046.9*	PF 1	1600.00	1241.66	1244.61	1246.01	1249.15	0.066089	17.10	93.57	45.10	2.09
Olive - Northern	18044.9*	PF 1	1600.00	1241.16	1244.05	1245.52	1248.98	0.074001	17.81	89.85	44.37	2.21
Olive - Northern	18042.94	PF 1	1600.00	1240.66	1243.50	1245.05	1248.78	0.081562	18.44	86.76	43.74	2.31
Olive - Northern	18040.9*	PF 1	1600.00	1240.66	1243.44	1244.94	1248.57	0.081386	18.18	88.02	45.35	2.30
Olive - Northern	18038.9*	PF 1	1600.00	1240.66	1243.38	1244.83	1248.35	0.081153	17.90	89.38	47.08	2.29
Olive - Northern	18036.9*	PF 1	1600.00	1240.66	1243.32	1244.73	1248.14	0.080570	17.63	90.77	48.72	2.28
Olive - Northern	18034.9*	PF 1	1600.00	1240.65	1243.26	1244.63	1247.93	0.079932	17.35	92.20	50.41	2.26
Olive - Northern	18032.9*	PF 1	1600.00	1240.65	1246.36	1244.53	1246.81	0.002839	5.36	298.74	77.42	0.48
Olive - Northern	18030.9*	PF 1	1600.00	1240.65	1246.38		1246.79	0.002567	5.14	311.45	79.71	0.46
Olive - Northern	18028.9*	PF 1	1600.00	1240.65	1246.40		1246.78	0.002321	4.93	324.60	81.98	0.44
Olive - Northern	18026.9*	PF 1	1600.00	1240.65	1246.41		1246.76	0.002109	4.74	337.69	84.24	0.42
Olive - Northern	18024.9*	PF 1	1600.00	1240.65	1246.43		1246.75	0.001916	4.56	351.18	86.49	0.40
Olive - Northern	18022.9*	PF 1	1600.00	1240.65	1246.44		1246.74	0.001745	4.38	364.92	88.76	0.38
Olive - Northern	18020.9*	PF 1	1600.00	1240.64	1246.45		1246.73	0.001590	4.22	379.09	91.06	0.36
Olive - Northern	18018.9*	PF 1	1600.00	1240.64	1246.46		1246.72	0.001457	4.07	392.90	93.28	0.35
Olive - Northern	18016.9*	PF 1	1600.00	1240.64	1246.47		1246.71	0.001335	3.93	407.11	95.50	0.34
Olive - Northern	18014.94	PF 1	1600.00	1240.64	1246.48		1246.70	0.001228	3.80	421.30	97.70	0.32
Olive - Northern	18013.2*	PF 1	1600.00	1240.64	1246.48		1246.70	0.001129	3.73	429.07	100.26	0.32
Olive - Northern	18011.6*	PF 1	1600.00	1240.64	1246.48		1246.69	0.001099	3.66	436.58	102.76	0.31
Olive - Northern	18009.9*	PF 1	1600.00	1240.64	1246.49		1246.69	0.001015	3.61	443.54	105.22	0.31

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	18008.2*	PF 1	1600.00	1240.64	1246.49		1246.69	0.000934	3.55	450.61	107.68	0.31
Olive - Northern	18006.6*	PF 1	1600.00	1240.63	1246.49		1246.68	0.000913	3.49	457.82	110.17	0.30
Olive - Northern	18004.9*	PF 1	1600.00	1240.63	1246.50		1246.68	0.000842	3.45	464.31	112.55	0.30
Olive - Northern	18003.2*	PF 1	1600.00	1240.63	1246.50		1246.68	0.000776	3.40	470.62	114.90	0.30
Olive - Northern	18001.6*	PF 1	1600.00	1240.63	1246.50		1246.67	0.000763	3.36	476.64	117.20	0.29
Olive - Northern	17999.94	PF 1	1600.00	1240.63	1246.50		1246.67	0.000705	3.32	482.14	119.44	0.29
Olive - Northern	17974.8*	PF 1	1600.00	1240.61	1246.48		1246.65	0.000704	3.32	482.41	119.47	0.29
Olive - Northern	17949.76	PF 1	1600.00	1240.59	1246.47		1246.64	0.000703	3.31	482.69	119.50	0.29
Olive - Northern	17948.0*	PF 1	1600.00	1240.59	1246.46		1246.63	0.000763	3.36	476.66	117.21	0.29
Olive - Northern	17946.4*	PF 1	1600.00	1240.59	1246.45		1246.63	0.000777	3.40	470.47	114.86	0.30
Olive - Northern	17944.7*	PF 1	1600.00	1240.59	1246.45		1246.63	0.000843	3.45	464.02	112.49	0.30
Olive - Northern	17943.0*	PF 1	1600.00	1240.59	1246.44		1246.63	0.000917	3.50	456.94	110.05	0.30
Olive - Northern	17941.4*	PF 1	1600.00	1240.58	1246.43		1246.63	0.000938	3.56	449.95	107.66	0.31
Olive - Northern	17939.7*	PF 1	1600.00	1240.58	1246.42		1246.62	0.001019	3.61	442.94	105.17	0.31
Olive - Northern	17938.0*	PF 1	1600.00	1240.58	1246.41		1246.62	0.001112	3.68	434.90	102.62	0.31
Olive - Northern	17936.4*	PF 1	1600.00	1240.58	1246.40		1246.62	0.001144	3.75	427.06	100.09	0.32
Olive - Northern	17934.76	PF 1	1600.00	1240.58	1246.39		1246.62	0.001251	3.82	418.53	97.48	0.33
Olive - Northern	17933.0*	PF 1	1600.00	1240.58	1246.36		1246.61	0.001449	4.06	394.50	93.86	0.35
Olive - Northern	17931.4*	PF 1	1600.00	1240.58	1246.32		1246.61	0.001683	4.31	371.31	90.25	0.37
Olive - Northern	17929.7*	PF 1	1600.00	1240.58	1246.27		1246.60	0.001981	4.60	347.72	86.52	0.40
Olive - Northern	17928.0*	PF 1	1600.00	1240.58	1246.21		1246.59	0.002358	4.94	324.14	82.71	0.44
Olive - Northern	17926.4*	PF 1	1600.00	1240.57	1246.14		1246.58	0.002832	5.31	301.14	78.89	0.48
Olive - Northern	17924.7*	PF 1	1600.00	1240.57	1246.05		1246.57	0.003490	5.78	276.93	74.81	0.53
Olive - Northern	17923.0*	PF 1	1600.00	1240.57	1245.92		1246.55	0.004426	6.35	251.90	70.49	0.59
Olive - Northern	17921.4*	PF 1	1600.00	1240.57	1245.73		1246.52	0.006003	7.16	223.44	65.57	0.68
Olive - Northern	17919.76	PF 1	1600.00	1240.57	1244.96	1244.96	1246.44	0.013731	9.77	163.79	56.09	1.01
Olive - Northern	17917.7*	PF 1	1600.00	1240.07	1243.70	1244.46	1246.29	0.029860	12.91	123.91	50.07	1.45
Olive - Northern	17915.7*	PF 1	1600.00	1239.57	1242.94	1243.96	1246.17	0.040646	14.41	111.01	47.97	1.67
Olive - Northern	17913.7*	PF 1	1600.00	1239.07	1242.27	1243.46	1246.02	0.050294	15.55	102.92	46.60	1.84
Olive - Northern	17911.7*	PF 1	1600.00	1238.57	1241.64	1242.96	1245.87	0.059468	16.50	96.99	45.57	1.99
Olive - Northern	17909.7*	PF 1	1600.00	1238.07	1241.04	1242.46	1245.70	0.068242	17.32	92.39	44.76	2.12
Olive - Northern	17907.7*	PF 1	1600.00	1237.57	1240.45	1241.96	1245.52	0.076863	18.06	88.59	44.07	2.24
Olive - Northern	17905.76	PF 1	1600.00	1237.07	1239.88	1241.46	1245.32	0.084990	18.71	85.51	43.51	2.35
Olive - Northern	17903.7*	PF 1	1600.00	1237.07	1239.82	1241.35	1245.10	0.084649	18.43	86.82	45.13	2.34
Olive - Northern	17901.7*	PF 1	1600.00	1237.07	1239.76	1241.24	1244.87	0.084258	18.14	88.23	46.88	2.33
Olive - Northern	17899.7*	PF 1	1600.00	1237.07	1239.70	1241.14	1244.65	0.083493	17.84	89.67	48.54	2.31
Olive - Northern	17897.7*	PF 1	1600.00	1237.06	1239.65	1241.04	1244.43	0.082681	17.55	91.15	50.24	2.30
Olive - Northern	17895.7*	PF 1	1600.00	1237.06	1242.77	1240.94	1243.22	0.002839	5.36	298.74	77.42	0.48
Olive - Northern	17893.7*	PF 1	1600.00	1237.06	1242.79		1243.20	0.002567	5.14	311.44	79.70	0.46

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	17891.7*	PF 1	1600.00	1237.06	1242.81		1243.19	0.002321	4.93	324.60	81.98	0.44
Olive - Northern	17889.7*	PF 1	1600.00	1237.06	1242.82		1243.17	0.002109	4.74	337.69	84.24	0.42
Olive - Northern	17887.7*	PF 1	1600.00	1237.06	1242.84		1243.16	0.001916	4.56	351.18	86.49	0.40
Olive - Northern	17885.7*	PF 1	1600.00	1237.06	1242.85		1243.15	0.001745	4.38	364.92	88.76	0.38
Olive - Northern	17883.7*	PF 1	1600.00	1237.05	1242.86		1243.14	0.001590	4.22	379.09	91.06	0.36
Olive - Northern	17881.7*	PF 1	1600.00	1237.05	1242.87		1243.13	0.001457	4.07	392.90	93.28	0.35
Olive - Northern	17879.7*	PF 1	1600.00	1237.05	1242.88		1243.12	0.001335	3.93	407.12	95.50	0.34
Olive - Northern	17877.76	PF 1	1600.00	1237.05	1242.89		1243.11	0.001228	3.80	421.30	97.70	0.32
Olive - Northern	17876.0*	PF 1	1600.00	1237.05	1242.89		1243.11	0.001129	3.73	429.08	100.26	0.32
Olive - Northern	17874.4*	PF 1	1600.00	1237.05	1242.90		1243.10	0.001099	3.66	436.58	102.76	0.31
Olive - Northern	17872.7*	PF 1	1600.00	1237.05	1242.90		1243.10	0.001015	3.61	443.54	105.22	0.31
Olive - Northern	17871.0*	PF 1	1600.00	1237.05	1242.90		1243.10	0.000934	3.55	450.62	107.68	0.31
Olive - Northern	17869.4*	PF 1	1600.00	1237.04	1242.90		1243.09	0.000913	3.49	457.83	110.17	0.30
Olive - Northern	17867.7*	PF 1	1600.00	1237.04	1242.91		1243.09	0.000842	3.45	464.31	112.55	0.30
Olive - Northern	17866.0*	PF 1	1600.00	1237.04	1242.91		1243.09	0.000776	3.40	470.63	114.90	0.30
Olive - Northern	17864.4*	PF 1	1600.00	1237.04	1242.91		1243.08	0.000763	3.36	476.64	117.20	0.29
Olive - Northern	17862.76	PF 1	1600.00	1237.04	1242.91		1243.08	0.000705	3.32	482.14	119.44	0.29
Olive - Northern	17837.6*	PF 1	1600.00	1237.02	1242.89		1243.06	0.000704	3.32	482.41	119.47	0.29
Olive - Northern	17812.59	PF 1	1600.00	1237.00	1242.88		1243.05	0.000703	3.31	482.70	119.50	0.29
Olive - Northern	17810.9*	PF 1	1600.00	1237.00	1242.87		1243.04	0.000763	3.36	476.68	117.21	0.29
Olive - Northern	17809.2*	PF 1	1600.00	1237.00	1242.86		1243.04	0.000776	3.40	470.49	114.86	0.30
Olive - Northern	17807.5*	PF 1	1600.00	1237.00	1242.86		1243.04	0.000843	3.45	464.04	112.49	0.30
Olive - Northern	17805.9*	PF 1	1600.00	1237.00	1242.85		1243.04	0.000917	3.50	456.95	110.06	0.30
Olive - Northern	17804.2*	PF 1	1600.00	1236.99	1242.84		1243.04	0.000938	3.56	449.96	107.66	0.31
Olive - Northern	17802.5*	PF 1	1600.00	1236.99	1242.83		1243.03	0.001018	3.61	442.96	105.17	0.31
Olive - Northern	17800.9*	PF 1	1600.00	1236.99	1242.82		1243.03	0.001111	3.68	434.91	102.62	0.31
Olive - Northern	17799.2*	PF 1	1600.00	1236.99	1242.81		1243.03	0.001144	3.75	427.07	100.09	0.32
Olive - Northern	17797.59	PF 1	1600.00	1236.99	1242.80		1243.03	0.001251	3.82	418.54	97.48	0.33
Olive - Northern	17795.9*	PF 1	1600.00	1236.99	1242.77		1243.02	0.001449	4.06	394.52	93.86	0.35
Olive - Northern	17794.2*	PF 1	1600.00	1236.99	1242.73		1243.02	0.001683	4.31	371.32	90.25	0.37
Olive - Northern	17792.5*	PF 1	1600.00	1236.99	1242.68		1243.01	0.001981	4.60	347.72	86.52	0.40
Olive - Northern	17790.9*	PF 1	1600.00	1236.99	1242.62		1243.00	0.002358	4.94	324.14	82.71	0.44
Olive - Northern	17789.2*	PF 1	1600.00	1236.98	1242.55		1242.99	0.002832	5.31	301.14	78.89	0.48
Olive - Northern	17787.5*	PF 1	1600.00	1236.98	1242.46		1242.98	0.003491	5.78	276.92	74.80	0.53
Olive - Northern	17785.9*	PF 1	1600.00	1236.98	1242.33		1242.96	0.004427	6.35	251.89	70.48	0.59
Olive - Northern	17784.2*	PF 1	1600.00	1236.98	1242.14		1242.93	0.006004	7.16	223.43	65.57	0.68
Olive - Northern	17782.59	PF 1	1600.00	1236.98	1241.37	1241.37	1242.85	0.013718	9.77	163.84	56.09	1.01
Olive - Northern	17780.5*	PF 1	1600.00	1236.48	1240.12	1240.87	1242.70	0.029857	12.91	123.91	50.08	1.45
Olive - Northern	17778.5*	PF 1	1600.00	1235.98	1239.35	1240.37	1242.58	0.040641	14.41	111.01	47.97	1.67

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	17776.5*	PF 1	1600.00	1235.48	1238.68	1239.87	1242.43	0.050285	15.55	102.92	46.60	1.84
Olive - Northern	17774.5*	PF 1	1600.00	1234.98	1238.05	1239.37	1242.28	0.059458	16.50	97.00	45.57	1.99
Olive - Northern	17772.5*	PF 1	1600.00	1234.48	1237.45	1238.87	1242.11	0.068242	17.32	92.39	44.76	2.12
Olive - Northern	17770.5*	PF 1	1600.00	1233.98	1236.86	1238.37	1241.93	0.076849	18.06	88.60	44.07	2.24
Olive - Northern	17768.5*	PF 1	1600.00	1233.48	1236.29	1237.87	1241.73	0.084990	18.71	85.51	43.51	2.35
Olive - Northern	17766.5*	PF 1	1600.00	1232.98	1235.73	1237.37	1241.52	0.092754	19.29	82.92	43.03	2.45
Olive - Northern	17764.59	PF 1	1600.00	1232.48	1235.18	1236.87	1241.29	0.100330	19.83	80.67	42.61	2.54
Olive - Northern	17762.6*	PF 1	1600.00	1232.48	1235.14	1236.77	1241.03	0.099272	19.48	82.13	44.28	2.52
Olive - Northern	17760.7*	PF 1	1600.00	1232.48	1235.09	1236.67	1240.77	0.097884	19.14	83.61	45.88	2.50
Olive - Northern	17758.7*	PF 1	1600.00	1232.48	1235.04	1236.57	1240.52	0.096222	18.78	85.20	47.53	2.47
Olive - Northern	17756.8*	PF 1	1600.00	1232.47	1234.99	1236.47	1240.27	0.094609	18.45	86.74	49.11	2.45
Olive - Northern	17754.9*	PF 1	1600.00	1232.47	1234.95	1236.38	1240.03	0.092586	18.09	88.45	50.77	2.42
Olive - Northern	17752.9*	PF 1	1600.00	1232.47	1234.90	1236.29	1239.79	0.090445	17.74	90.20	52.43	2.38
Olive - Northern	17751.0*	PF 1	1600.00	1232.47	1238.18	1236.20	1238.58	0.002488	5.07	315.84	80.66	0.45
Olive - Northern	17749.1*	PF 1	1600.00	1232.47	1238.19		1238.56	0.002273	4.88	327.89	82.78	0.43
Olive - Northern	17747.1*	PF 1	1600.00	1232.47	1238.21		1238.55	0.002074	4.70	340.37	84.89	0.41
Olive - Northern	17745.2*	PF 1	1600.00	1232.47	1238.22		1238.54	0.001903	4.54	352.71	86.98	0.40
Olive - Northern	17743.3*	PF 1	1600.00	1232.47	1238.23		1238.53	0.001744	4.38	365.49	89.07	0.38
Olive - Northern	17741.3*	PF 1	1600.00	1232.46	1238.24		1238.52	0.001602	4.23	378.44	91.21	0.37
Olive - Northern	17739.4*	PF 1	1600.00	1232.46	1238.25		1238.51	0.001474	4.09	391.56	93.30	0.35
Olive - Northern	17737.5*	PF 1	1600.00	1232.46	1238.26		1238.50	0.001358	3.95	404.82	95.37	0.34
Olive - Northern	17735.59	PF 1	1600.00	1232.46	1238.26		1238.49	0.001256	3.83	418.04	97.44	0.33
Olive - Northern	17733.9*	PF 1	1600.00	1232.46	1238.27		1238.49	0.001154	3.76	425.74	99.98	0.32
Olive - Northern	17732.2*	PF 1	1600.00	1232.46	1238.27		1238.48	0.001124	3.69	433.16	102.47	0.32
Olive - Northern	17730.5*	PF 1	1600.00	1232.46	1238.27		1238.48	0.001038	3.64	440.03	104.92	0.31
Olive - Northern	17728.9*	PF 1	1600.00	1232.46	1238.28		1238.48	0.000956	3.58	447.02	107.36	0.31
Olive - Northern	17727.2*	PF 1	1600.00	1232.45	1238.28		1238.47	0.000934	3.52	454.15	109.83	0.31
Olive - Northern	17725.5*	PF 1	1600.00	1232.45	1238.28		1238.47	0.000861	3.47	460.56	112.20	0.30
Olive - Northern	17723.9*	PF 1	1600.00	1232.45	1238.28		1238.47	0.000794	3.43	466.80	114.54	0.30
Olive - Northern	17722.2*	PF 1	1600.00	1232.45	1238.29		1238.46	0.000781	3.38	472.74	116.82	0.30
Olive - Northern	17720.59	PF 1	1600.00	1232.45	1238.29		1238.46	0.000722	3.35	478.16	119.04	0.29
Olive - Northern	17673.*	PF 1	1600.00	1232.41	1238.25		1238.43	0.000719	3.34	478.85	119.11	0.29
Olive - Northern	17625.4*	PF 1	1600.00	1232.38	1238.22		1238.39	0.000721	3.35	478.29	119.05	0.29
Olive - Northern	17577.8*	PF 1	1600.00	1232.34	1238.18		1238.36	0.000718	3.34	478.99	119.13	0.29
Olive - Northern	17530.2*	PF 1	1600.00	1232.30	1238.15		1238.32	0.000716	3.34	479.69	119.20	0.29
Olive - Northern	17482.6*	PF 1	1600.00	1232.27	1238.12		1238.29	0.000718	3.34	479.16	119.14	0.29
Olive - Northern	17435.0*	PF 1	1600.00	1232.23	1238.08		1238.25	0.000715	3.33	479.88	119.21	0.29
Olive - Northern	17387.5*	PF 1	1600.00	1232.20	1238.05		1238.22	0.000717	3.34	479.36	119.16	0.29
Olive - Northern	17339.9*	PF 1	1600.00	1232.16	1238.01		1238.19	0.000714	3.33	480.07	119.23	0.29

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	17292.3*	PF 1	1600.00	1232.12	1237.98		1238.15	0.000711	3.33	480.81	119.31	0.29
Olive - Northern	17244.7*	PF 1	1600.00	1232.09	1237.95		1238.12	0.000713	3.33	480.31	119.26	0.29
Olive - Northern	17197.1*	PF 1	1600.00	1232.05	1237.91		1238.08	0.000710	3.33	481.04	119.33	0.29
Olive - Northern	17149.5*	PF 1	1600.00	1232.02	1237.88		1238.05	0.000712	3.33	480.55	119.28	0.29
Olive - Northern	17101.9*	PF 1	1600.00	1231.98	1237.84		1238.02	0.000709	3.32	481.30	119.36	0.29
Olive - Northern	17054.4*	PF 1	1600.00	1231.94	1237.81		1237.98	0.000706	3.32	482.08	119.44	0.29
Olive - Northern	17006.8*	PF 1	1600.00	1231.91	1237.78		1237.95	0.000708	3.32	481.59	119.39	0.29
Olive - Northern	16959.23	PF 1	1600.00	1231.87	1237.74		1237.91	0.000705	3.32	482.37	119.46	0.29
Olive - Northern	16957.5*	PF 1	1600.00	1231.87	1237.73		1237.91	0.000779	3.39	472.10	116.12	0.30
Olive - Northern	16955.9*	PF 1	1600.00	1231.87	1237.72		1237.91	0.000800	3.45	463.14	112.88	0.30
Olive - Northern	16954.2*	PF 1	1600.00	1231.87	1237.72		1237.91	0.000876	3.52	454.72	110.01	0.30
Olive - Northern	16952.5*	PF 1	1600.00	1231.87	1237.71		1237.91	0.000956	3.58	447.04	107.40	0.31
Olive - Northern	16950.9*	PF 1	1600.00	1231.86	1237.70		1237.90	0.000972	3.63	441.17	105.13	0.31
Olive - Northern	16949.2*	PF 1	1600.00	1231.86	1237.69		1237.90	0.001055	3.68	434.71	102.95	0.32
Olive - Northern	16947.5*	PF 1	1600.00	1231.86	1237.68		1237.90	0.001142	3.73	428.75	100.95	0.32
Olive - Northern	16945.9*	PF 1	1600.00	1231.86	1237.68		1237.90	0.001163	3.78	423.41	99.17	0.32
Olive - Northern	16944.23	PF 1	1600.00	1231.86	1237.67		1237.89	0.001254	3.83	418.27	97.45	0.33
Olive - Northern	16942.5*	PF 1	1600.00	1231.86	1237.64		1237.89	0.001428	4.04	396.34	93.92	0.35
Olive - Northern	16940.9*	PF 1	1600.00	1231.86	1237.60		1237.88	0.001644	4.28	374.04	90.25	0.37
Olive - Northern	16939.2*	PF 1	1600.00	1231.86	1237.56		1237.88	0.001909	4.55	351.81	86.62	0.40
Olive - Northern	16937.5*	PF 1	1600.00	1231.86	1237.50		1237.87	0.002251	4.86	328.97	82.83	0.43
Olive - Northern	16935.9*	PF 1	1600.00	1231.85	1237.43		1237.86	0.002692	5.23	305.98	78.99	0.47
Olive - Northern	16934.2*	PF 1	1600.00	1231.85	1237.34		1237.85	0.003320	5.69	281.36	74.91	0.52
Olive - Northern	16932.5*	PF 1	1600.00	1231.85	1237.22		1237.83	0.004229	6.26	255.61	70.62	0.58
Olive - Northern	16930.9*	PF 1	1600.00	1231.85	1237.03		1237.80	0.005788	7.08	226.11	65.70	0.67
Olive - Northern	16929.23	PF 1	1600.00	1231.85	1236.24	1236.24	1237.72	0.013731	9.77	163.79	56.09	1.01
Olive - Northern	16927.2*	PF 1	1600.00	1231.35	1234.98	1235.74	1237.57	0.029860	12.91	123.91	50.07	1.45
Olive - Northern	16925.2*	PF 1	1600.00	1230.85	1234.22	1235.24	1237.45	0.040646	14.41	111.01	47.97	1.67
Olive - Northern	16923.2*	PF 1	1600.00	1230.35	1233.55	1234.74	1237.30	0.050294	15.55	102.92	46.60	1.84
Olive - Northern	16921.2*	PF 1	1600.00	1229.85	1232.92	1234.24	1237.15	0.059468	16.50	96.99	45.57	1.99
Olive - Northern	16919.2*	PF 1	1600.00	1229.35	1232.32	1233.74	1236.98	0.068242	17.32	92.39	44.76	2.12
Olive - Northern	16917.2*	PF 1	1600.00	1228.85	1231.73	1233.24	1236.80	0.076863	18.06	88.59	44.07	2.24
Olive - Northern	16915.2*	PF 1	1600.00	1228.35	1231.16	1232.74	1236.60	0.084990	18.71	85.51	43.51	2.35
Olive - Northern	16913.2*	PF 1	1600.00	1227.85	1230.60	1232.24	1236.39	0.092754	19.29	82.92	43.03	2.45
Olive - Northern	16911.23	PF 1	1600.00	1227.35	1230.05	1231.75	1236.16	0.100330	19.83	80.67	42.61	2.54
Olive - Northern	16909.3*	PF 1	1600.00	1227.35	1230.01	1231.64	1235.90	0.099272	19.48	82.13	44.28	2.52
Olive - Northern	16907.3*	PF 1	1600.00	1227.35	1229.96	1231.54	1235.64	0.097884	19.14	83.61	45.88	2.50
Olive - Northern	16905.4*	PF 1	1600.00	1227.35	1229.91	1231.44	1235.39	0.096210	18.78	85.21	47.53	2.47
Olive - Northern	16903.5*	PF 1	1600.00	1227.34	1229.86	1231.34	1235.14	0.094593	18.45	86.74	49.11	2.45

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	16901.5*	PF 1	1600.00	1227.34	1229.82	1231.25	1234.90	0.092586	18.09	88.45	50.77	2.42
Olive - Northern	16899.6*	PF 1	1600.00	1227.34	1229.77	1231.16	1234.66	0.090445	17.74	90.20	52.43	2.38
Olive - Northern	16897.7*	PF 1	1600.00	1227.34	1233.05	1231.07	1233.45	0.002485	5.06	315.98	80.68	0.45
Olive - Northern	16895.7*	PF 1	1600.00	1227.34	1233.06		1233.43	0.002270	4.88	328.03	82.79	0.43
Olive - Northern	16893.8*	PF 1	1600.00	1227.34	1233.08		1233.42	0.002072	4.70	340.51	84.90	0.41
Olive - Northern	16891.9*	PF 1	1600.00	1227.34	1233.09		1233.41	0.001900	4.53	352.85	87.00	0.40
Olive - Northern	16889.9*	PF 1	1600.00	1227.34	1233.10		1233.40	0.001742	4.38	365.62	89.09	0.38
Olive - Northern	16888.0*	PF 1	1600.00	1227.33	1233.11		1233.39	0.001601	4.23	378.57	91.22	0.37
Olive - Northern	16886.1*	PF 1	1600.00	1227.33	1233.12		1233.38	0.001473	4.08	391.69	93.32	0.35
Olive - Northern	16884.1*	PF 1	1600.00	1227.33	1233.13		1233.37	0.001357	3.95	404.96	95.38	0.34
Olive - Northern	16882.23	PF 1	1600.00	1227.33	1233.14		1233.36	0.001254	3.83	418.19	97.45	0.33
Olive - Northern	16880.5*	PF 1	1600.00	1227.33	1233.14		1233.36	0.001153	3.76	425.88	99.99	0.32
Olive - Northern	16878.9*	PF 1	1600.00	1227.33	1233.14		1233.35	0.001123	3.69	433.31	102.48	0.32
Olive - Northern	16877.2*	PF 1	1600.00	1227.32	1233.15		1233.35	0.001029	3.63	441.32	105.03	0.31
Olive - Northern	16875.5*	PF 1	1600.00	1227.32	1233.15		1233.35	0.000948	3.57	448.34	107.48	0.31
Olive - Northern	16873.9*	PF 1	1600.00	1227.32	1233.15		1233.34	0.000928	3.52	455.06	109.88	0.30
Olive - Northern	16872.2*	PF 1	1600.00	1227.32	1233.15		1233.34	0.000856	3.47	461.48	112.26	0.30
Olive - Northern	16870.5*	PF 1	1600.00	1227.31	1233.16		1233.34	0.000788	3.42	468.18	114.67	0.30
Olive - Northern	16868.9*	PF 1	1600.00	1227.31	1233.16		1233.33	0.000777	3.38	473.71	116.92	0.30
Olive - Northern	16867.23	PF 1	1600.00	1227.31	1233.16		1233.33	0.000716	3.34	479.59	119.19	0.29
Olive - Northern	16819.3*	PF 1	1600.00	1227.27	1233.13		1233.30	0.000713	3.33	480.29	119.26	0.29
Olive - Northern	16771.4*	PF 1	1600.00	1227.24	1233.09		1233.26	0.000715	3.34	479.75	119.20	0.29
Olive - Northern	16723.5*	PF 1	1600.00	1227.20	1233.06		1233.23	0.000712	3.33	480.45	119.27	0.29
Olive - Northern	16675.6*	PF 1	1600.00	1227.17	1233.02		1233.19	0.000715	3.33	479.89	119.21	0.29
Olive - Northern	16627.7*	PF 1	1600.00	1227.13	1232.99		1233.16	0.000712	3.33	480.60	119.29	0.29
Olive - Northern	16579.8*	PF 1	1600.00	1227.10	1232.95		1233.13	0.000714	3.33	480.07	119.23	0.29
Olive - Northern	16531.9*	PF 1	1600.00	1227.06	1232.92		1233.09	0.000711	3.33	480.77	119.30	0.29
Olive - Northern	16484.0*	PF 1	1600.00	1227.03	1232.88		1233.06	0.000713	3.33	480.23	119.25	0.29
Olive - Northern	16436.1*	PF 1	1600.00	1226.99	1232.85		1233.02	0.000710	3.33	480.94	119.32	0.29
Olive - Northern	16388.2*	PF 1	1600.00	1226.95	1232.82		1232.99	0.000707	3.32	481.67	119.39	0.29
Olive - Northern	16340.3*	PF 1	1600.00	1226.92	1232.78		1232.95	0.000710	3.33	481.14	119.34	0.29
Olive - Northern	16292.4*	PF 1	1600.00	1226.88	1232.75		1232.92	0.000706	3.32	481.89	119.42	0.29
Olive - Northern	16244.5*	PF 1	1600.00	1226.85	1232.71		1232.89	0.000709	3.32	481.38	119.37	0.29
Olive - Northern	16196.6*	PF 1	1600.00	1226.81	1232.68		1232.85	0.000706	3.32	482.11	119.44	0.29
Olive - Northern	16148.7*	PF 1	1600.00	1226.78	1232.65		1232.82	0.000708	3.32	481.61	119.39	0.29
Olive - Northern	16100.8*	PF 1	1600.00	1226.74	1232.61		1232.78	0.000705	3.32	482.37	119.46	0.29
Olive - Northern	16052.9*	PF 1	1600.00	1226.71	1232.58		1232.75	0.000707	3.32	481.87	119.41	0.29
Olive - Northern	16005.09	PF 1	1600.00	1226.67	1232.54		1232.72	0.000703	3.32	482.62	119.49	0.29
Olive - Northern	16003.4*	PF 1	1600.00	1226.67	1232.54		1232.71	0.000764	3.36	476.60	117.20	0.29

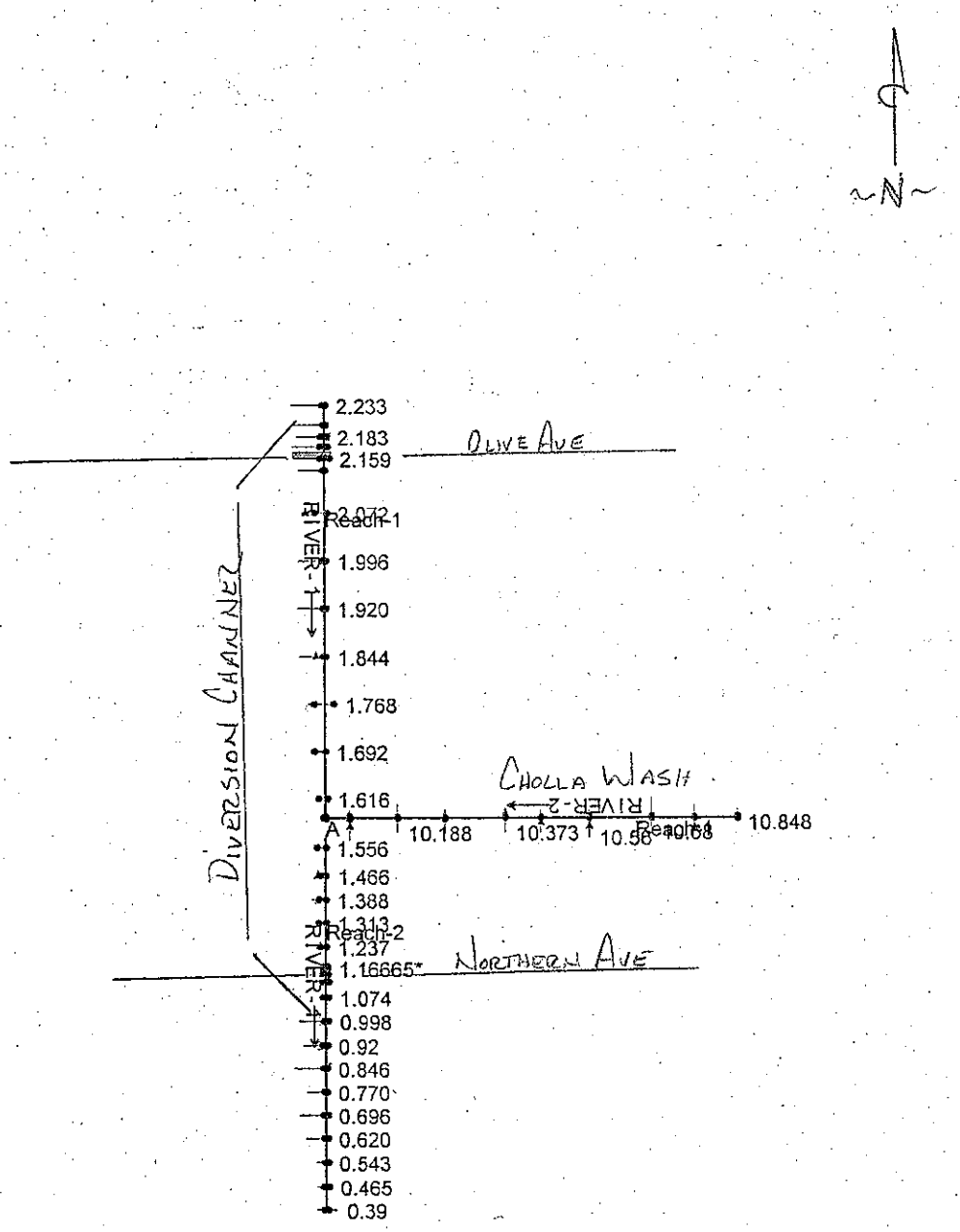
HEC-RAS Plan: (Continued)

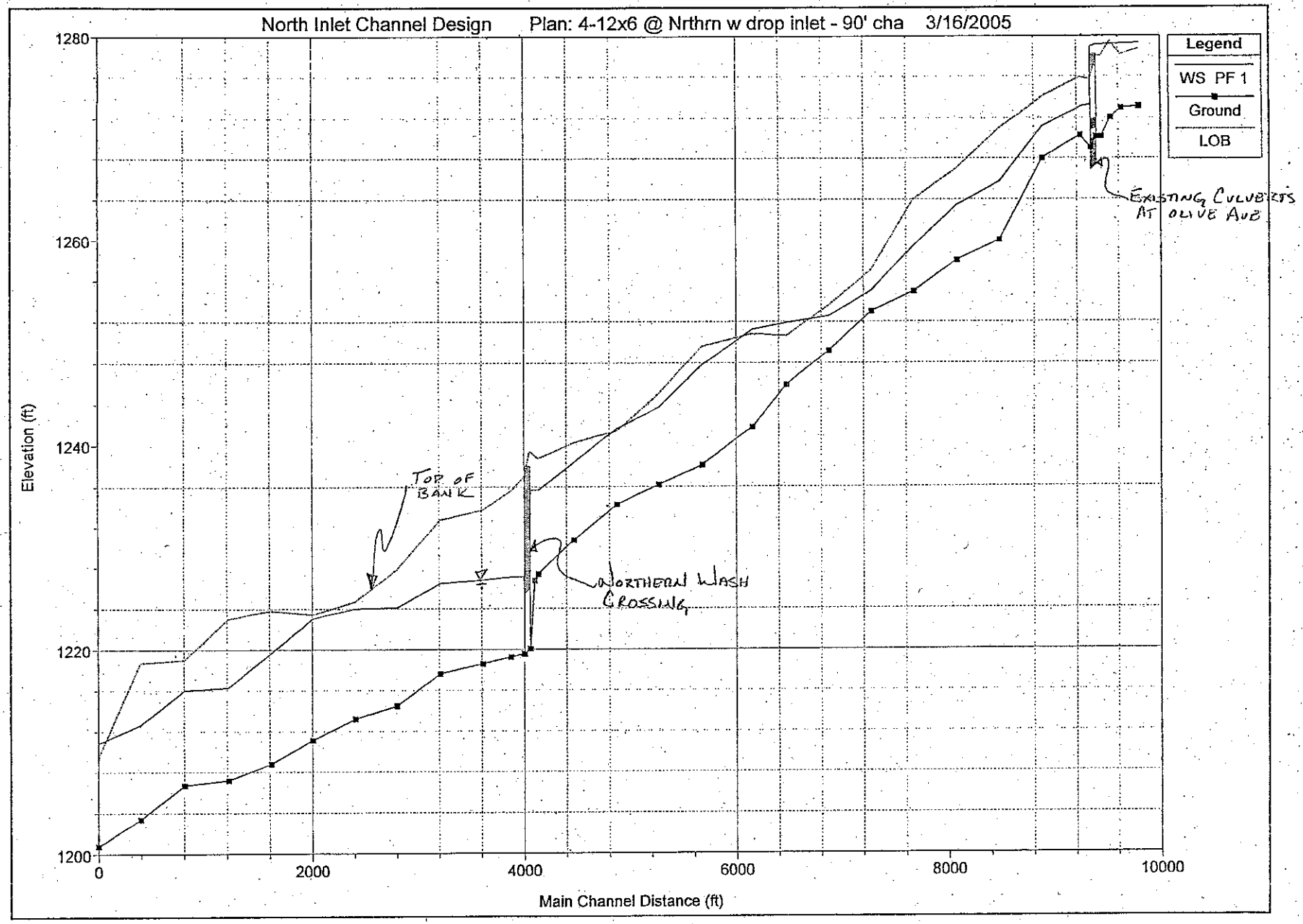
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	16001.7*	PF 1	1600.00	1226.67	1232.53		1232.71	0.000777	3.40	470.41	114.85	0.30
Olive - Northern	16000.0*	PF 1	1600.00	1226.67	1232.53		1232.71	0.000843	3.45	463.96	112.49	0.30
Olive - Northern	15998.4*	PF 1	1600.00	1226.67	1232.52		1232.71	0.000918	3.50	456.88	110.05	0.30
Olive - Northern	15996.7*	PF 1	1600.00	1226.66	1232.51		1232.71	0.000939	3.56	449.89	107.65	0.31
Olive - Northern	15995.0*	PF 1	1600.00	1226.66	1232.50		1232.70	0.001019	3.61	442.88	105.17	0.31
Olive - Northern	15993.4*	PF 1	1600.00	1226.66	1232.49		1232.70	0.001112	3.68	434.84	102.62	0.31
Olive - Northern	15991.7*	PF 1	1600.00	1226.66	1232.48		1232.70	0.001144	3.75	427.00	100.08	0.32
Olive - Northern	15990.09	PF 1	1600.00	1226.66	1232.47		1232.70	0.001252	3.82	418.47	97.47	0.33
Olive - Northern	15988.4*	PF 1	1600.00	1226.66	1232.44		1232.69	0.001450	4.06	394.45	93.86	0.35
Olive - Northern	15986.7*	PF 1	1600.00	1226.66	1232.40		1232.69	0.001684	4.31	371.26	90.24	0.37
Olive - Northern	15985.0*	PF 1	1600.00	1226.66	1232.35		1232.68	0.001982	4.60	347.66	86.52	0.40
Olive - Northern	15983.4*	PF 1	1600.00	1226.66	1232.29		1232.67	0.002360	4.94	324.07	82.71	0.44
Olive - Northern	15981.7*	PF 1	1600.00	1226.65	1232.22		1232.66	0.002833	5.31	301.07	78.89	0.48
Olive - Northern	15980.0*	PF 1	1600.00	1226.65	1232.13		1232.65	0.003493	5.78	276.87	74.80	0.53
Olive - Northern	15978.4*	PF 1	1600.00	1226.65	1232.00		1232.63	0.004430	6.35	251.82	70.48	0.59
Olive - Northern	15976.7*	PF 1	1600.00	1226.65	1231.80		1232.60	0.006010	7.16	223.35	65.56	0.68
Olive - Northern	15975.09	PF 1	1600.00	1226.65	1231.04	1231.04	1232.52	0.013664	9.75	164.08	56.13	1.01
Olive - Northern	15972.3*	PF 1	1600.00	1225.95	1229.49	1230.37	1232.34	0.033707	13.54	118.15	48.67	1.53
Olive - Northern	15969.5*	PF 1	1600.00	1225.26	1228.52	1229.68	1232.18	0.047345	15.34	104.32	46.01	1.80
Olive - Northern	15966.7*	PF 1	1600.00	1224.56	1227.64	1229.01	1232.00	0.060059	16.74	95.57	44.18	2.01
Olive - Northern	15963.9*	PF 1	1600.00	1223.86	1226.81	1228.31	1231.80	0.072229	17.93	89.25	42.75	2.19
Olive - Northern	15961.2*	PF 1	1600.00	1223.17	1226.02	1227.65	1231.59	0.083654	18.93	84.50	41.64	2.34
Olive - Northern	15958.4*	PF 1	1600.00	1222.47	1225.24	1226.95	1231.35	0.094882	19.85	80.62	40.67	2.48
Olive - Northern	15955.6*	PF 1	1600.00	1221.77	1224.47	1226.28	1231.09	0.105603	20.66	77.45	39.87	2.61
Olive - Northern	15952.8*	PF 1	1600.00	1221.08	1223.72	1225.59	1230.82	0.115870	21.39	74.80	39.17	2.73
Olive - Northern	15950.09	PF 1	1600.00	1220.38	1222.97	1224.91	1230.53	0.125942	22.08	72.48	38.53	2.84
Olive - Northern	15948.0*	PF 1	1600.00	1220.38	1222.94	1224.80	1230.19	0.122982	21.60	74.06	40.02	2.80
Olive - Northern	15946.0*	PF 1	1600.00	1220.38	1222.91	1224.71	1229.85	0.120143	21.14	75.67	41.57	2.76
Olive - Northern	15944.0*	PF 1	1600.00	1220.38	1222.88	1224.62	1229.52	0.117585	20.68	77.37	43.30	2.73
Olive - Northern	15942.0*	PF 1	1600.00	1220.38	1222.85	1224.53	1229.20	0.114172	20.22	79.14	44.88	2.68
Olive - Northern	15940.0*	PF 1	1600.00	1220.37	1222.82	1224.44	1228.90	0.111226	19.80	80.82	46.42	2.64
Olive - Northern	15938.0*	PF 1	1600.00	1220.37	1222.79	1224.35	1228.60	0.107767	19.35	82.68	48.03	2.60
Olive - Northern	15936.0*	PF 1	1600.00	1220.37	1222.75	1224.26	1228.31	0.104133	18.92	84.57	49.55	2.55
Olive - Northern	15934.0*	PF 1	1600.00	1220.37	1222.72	1224.18	1228.03	0.100385	18.49	86.55	51.11	2.50
Olive - Northern	15932.0*	PF 1	1600.00	1220.37	1226.16	1224.10	1226.57	0.002420	5.16	310.16	75.16	0.45
Olive - Northern	15930.0*	PF 1	1600.00	1220.37	1226.17		1226.56	0.002218	4.98	321.49	77.05	0.43
Olive - Northern	15928.0*	PF 1	1600.00	1220.37	1226.19		1226.54	0.002039	4.81	332.84	78.90	0.41
Olive - Northern	15926.0*	PF 1	1600.00	1220.37	1226.20		1226.53	0.001882	4.65	344.03	80.73	0.40
Olive - Northern	15924.0*	PF 1	1600.00	1220.36	1226.21		1226.52	0.001732	4.49	355.99	82.62	0.38

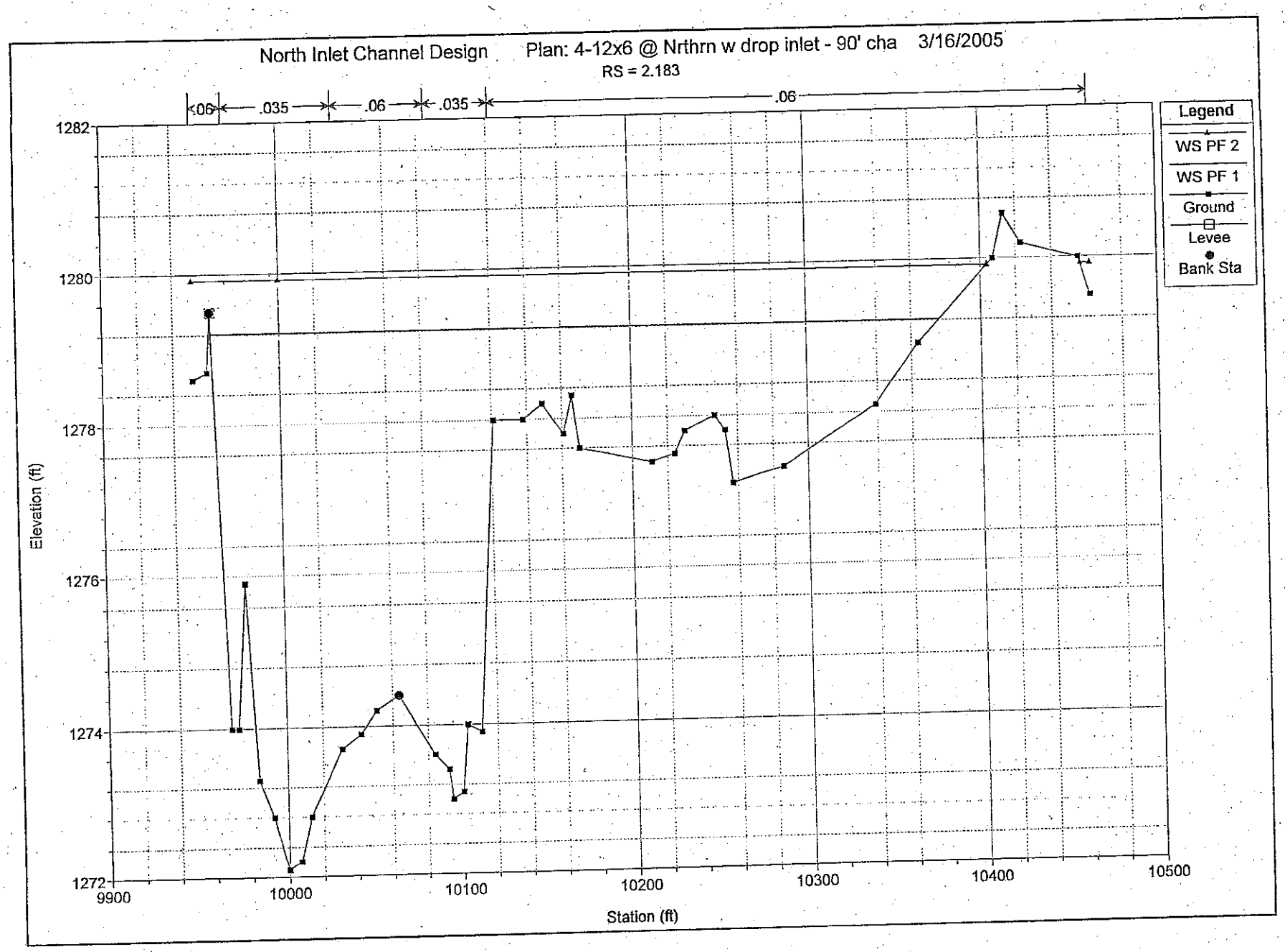
HEC-RAS Plan: (Continued)

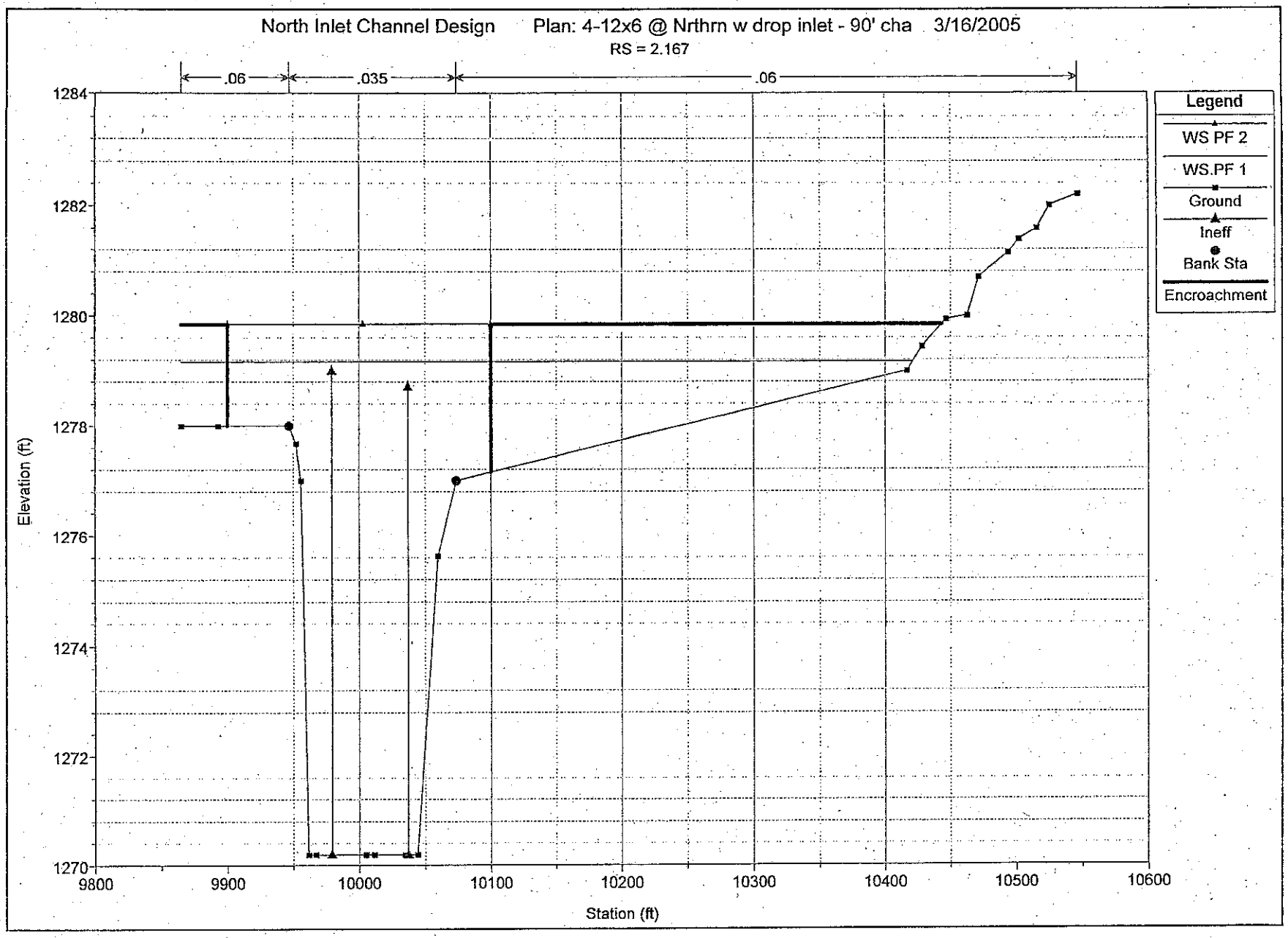
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Olive - Northern	15922.0*	PF 1	1600.00	1220.36	1226.22		1226.51	0.001599	4.35	367.80	84.44	0.37
Olive - Northern	15920.0*	PF 1	1600.00	1220.36	1226.23		1226.50	0.001482	4.22	379.58	86.28	0.35
Olive - Northern	15918.0*	PF 1	1600.00	1220.36	1226.24		1226.50	0.001371	4.08	391.78	88.12	0.34
Olive - Northern	15916.09	PF 1	1600.00	1220.36	1226.24		1226.49	0.001274	3.96	403.83	89.92	0.33
Olive - Northern	15914.4*	PF 1	1600.00	1220.36	1226.25		1226.48	0.001175	3.90	410.49	92.10	0.33
Olive - Northern	15912.7*	PF 1	1600.00	1220.36	1226.25		1226.48	0.001151	3.84	416.52	94.19	0.32
Olive - Northern	15911.0*	PF 1	1600.00	1220.36	1226.25		1226.47	0.001063	3.79	422.71	96.28	0.32
Olive - Northern	15909.4*	PF 1	1600.00	1220.36	1226.26		1226.47	0.000982	3.73	428.64	98.32	0.32
Olive - Northern	15907.7*	PF 1	1600.00	1220.35	1226.26		1226.47	0.000962	3.68	434.64	100.35	0.31
Olive - Northern	15906.0*	PF 1	1600.00	1220.35	1226.26		1226.46	0.000892	3.64	439.60	102.24	0.31
Olive - Northern	15904.4*	PF 1	1600.00	1220.35	1226.26		1226.46	0.000825	3.60	444.75	104.13	0.31
Olive - Northern	15902.7*	PF 1	1600.00	1220.35	1226.26		1226.46	0.000813	3.56	449.62	105.94	0.30
Olive - Northern	15901.09	PF 1	1600.00	1220.35	1226.26		1226.46	0.000753	3.52	454.06	107.67	0.30
Olive - Northern	15855.5*	PF 1	1600.00	1220.31	1226.23		1226.42	0.000750	3.52	454.68	107.73	0.30
Olive - Northern	15809.9*	PF 1	1600.00	1220.28	1226.20		1226.39	0.000753	3.52	454.17	107.68	0.30
Olive - Northern	15764.3*	PF 1	1600.00	1220.24	1226.16		1226.35	0.000750	3.52	454.81	107.74	0.30
Olive - Northern	15718.8*	PF 1	1600.00	1220.21	1226.13		1226.32	0.000752	3.52	454.31	107.69	0.30
Olive - Northern	15673.2*	PF 1	1600.00	1220.17	1226.09		1226.28	0.000749	3.52	454.93	107.75	0.30
Olive - Northern	15627.6*	PF 1	1600.00	1220.14	1226.06		1226.25	0.000751	3.52	454.43	107.71	0.30
Olive - Northern	15582.1*	PF 1	1600.00	1220.10	1226.02		1226.22	0.000748	3.52	455.07	107.76	0.30
Olive - Northern	15536.5*	PF 1	1600.00	1220.07	1225.99		1226.18	0.000751	3.52	454.58	107.72	0.30
Olive - Northern	15491.*	PF 1	1600.00	1220.04	1225.95		1226.15	0.000753	3.52	454.07	107.67	0.30
Olive - Northern	15445.43	PF 1	1600.00	1220.00	1225.92	1223.03	1226.11	0.000750	3.52	454.70	107.73	0.30

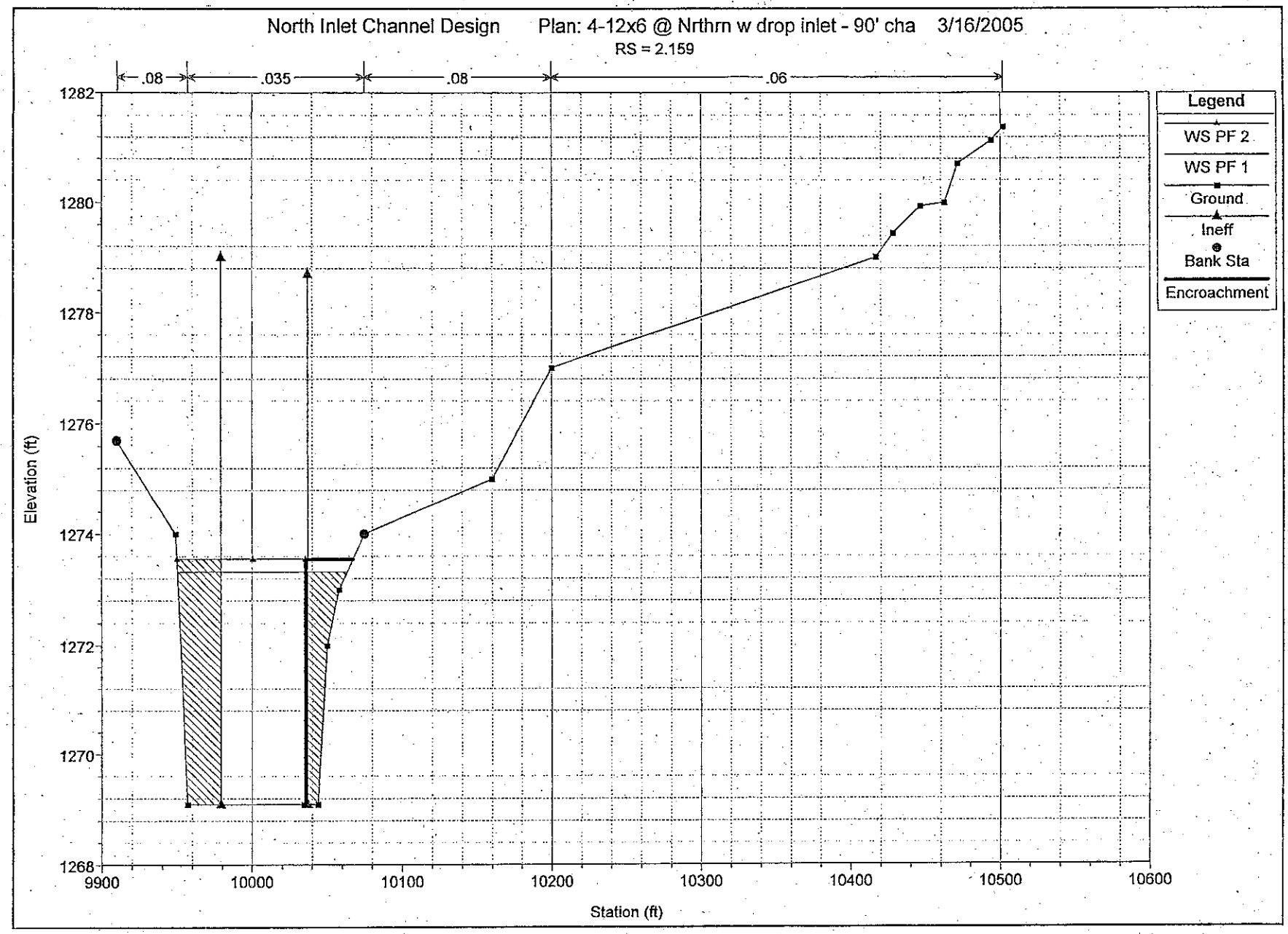
BEARDSLEY WASH/FRS #3 CHANNEL DESIGN

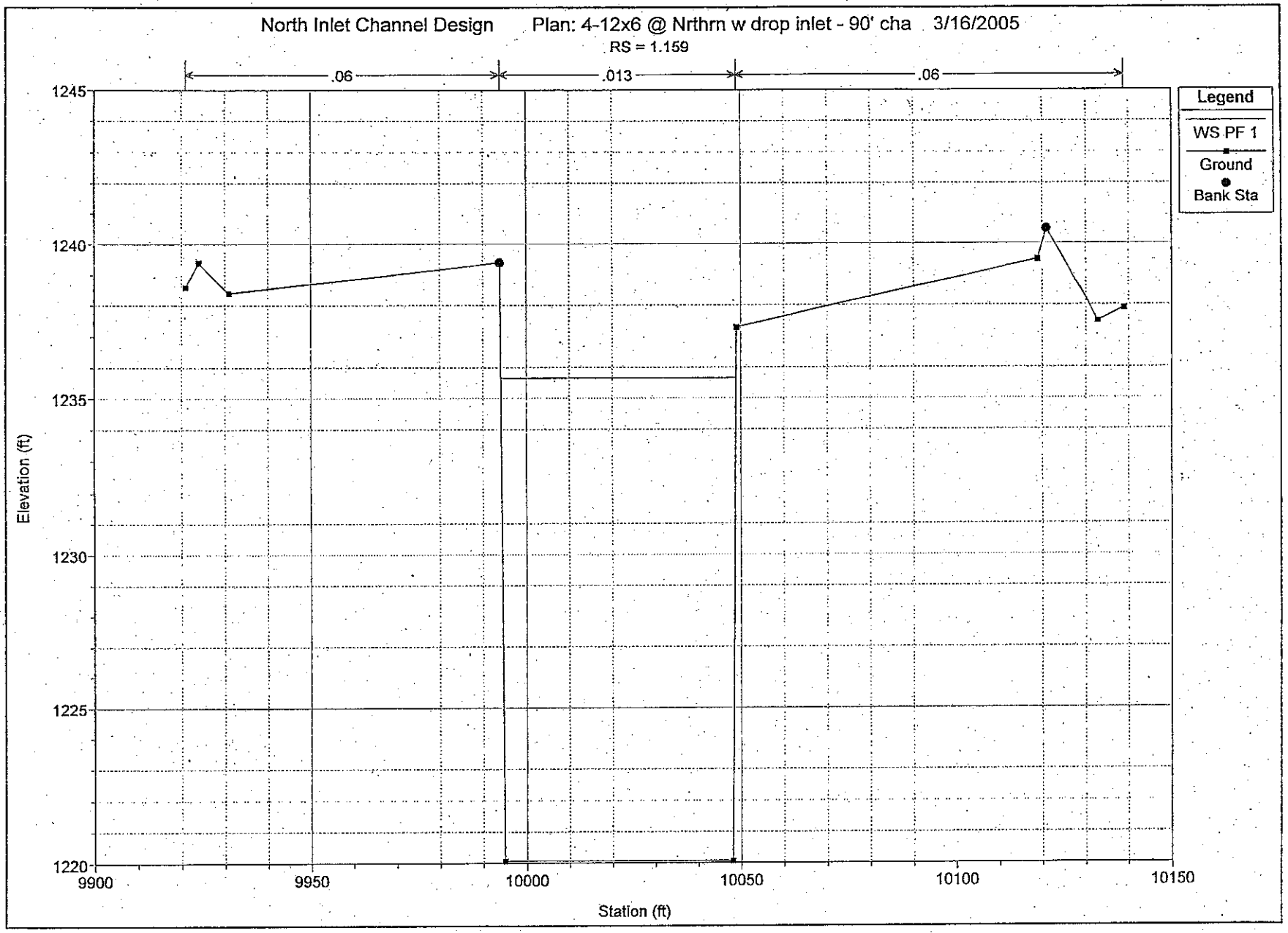


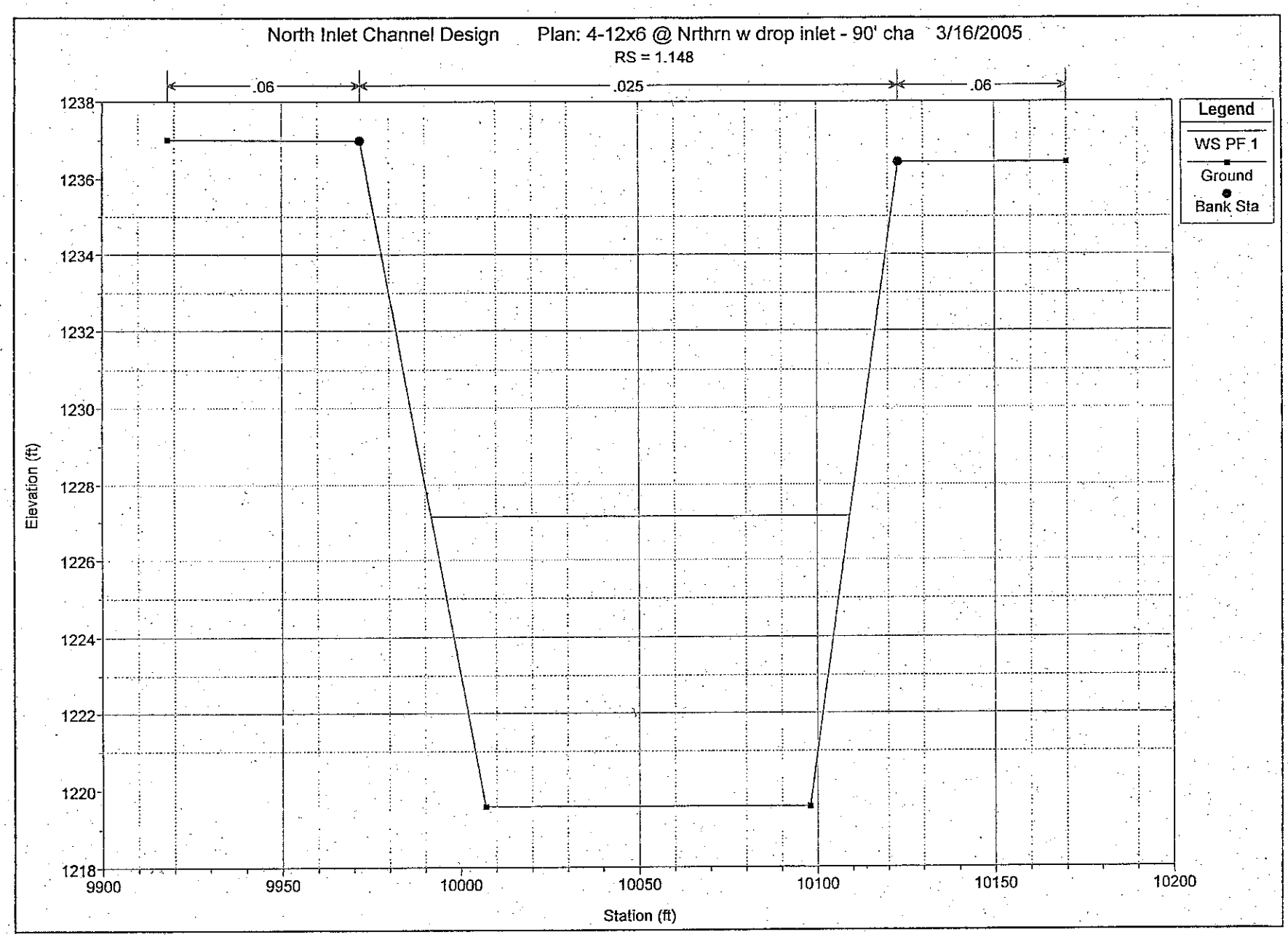

North Inlet Channel Design Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha 3/16/2005
Legend
WS PF 1
Ground
LOB
Elevation (ft)
1280
1260
1240
1220
1200
0
2000
4000
6000
8000
10000
Main Channel Distance (ft)
TOP OF BANK
NORTHERN WASH CROSSING
EXISTING CULVERTS AT OLIVE AVE

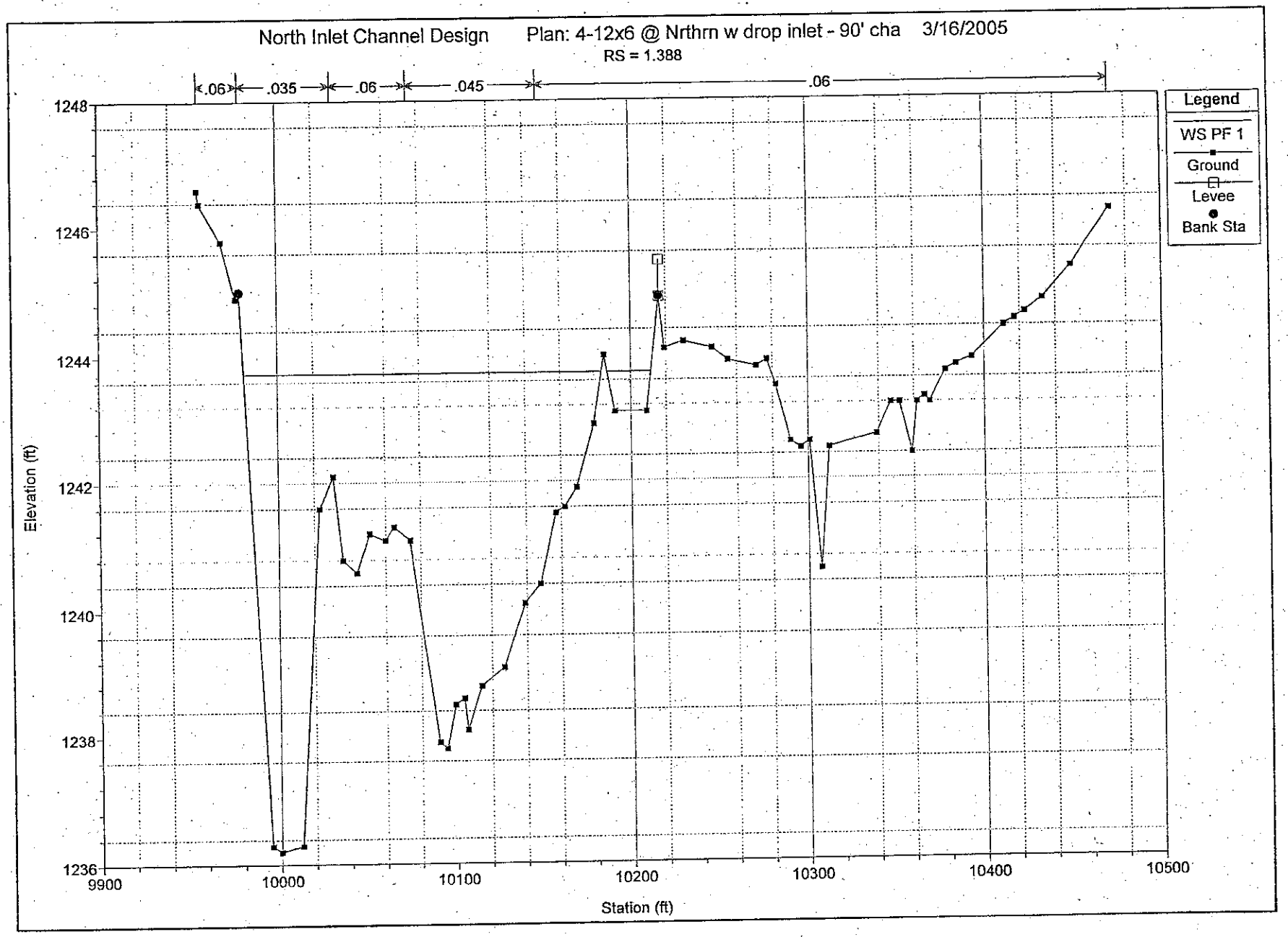

North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 2.183
.06
.035
.06
.035
.06
Legend
WS PF 2
WS PF 1
Ground
Levee
Bank Sta
Elevation (ft)
1282
1280
1278
1276
1274
1272
9900
10000
10100
10200
10300
10400
10500
Station (ft)

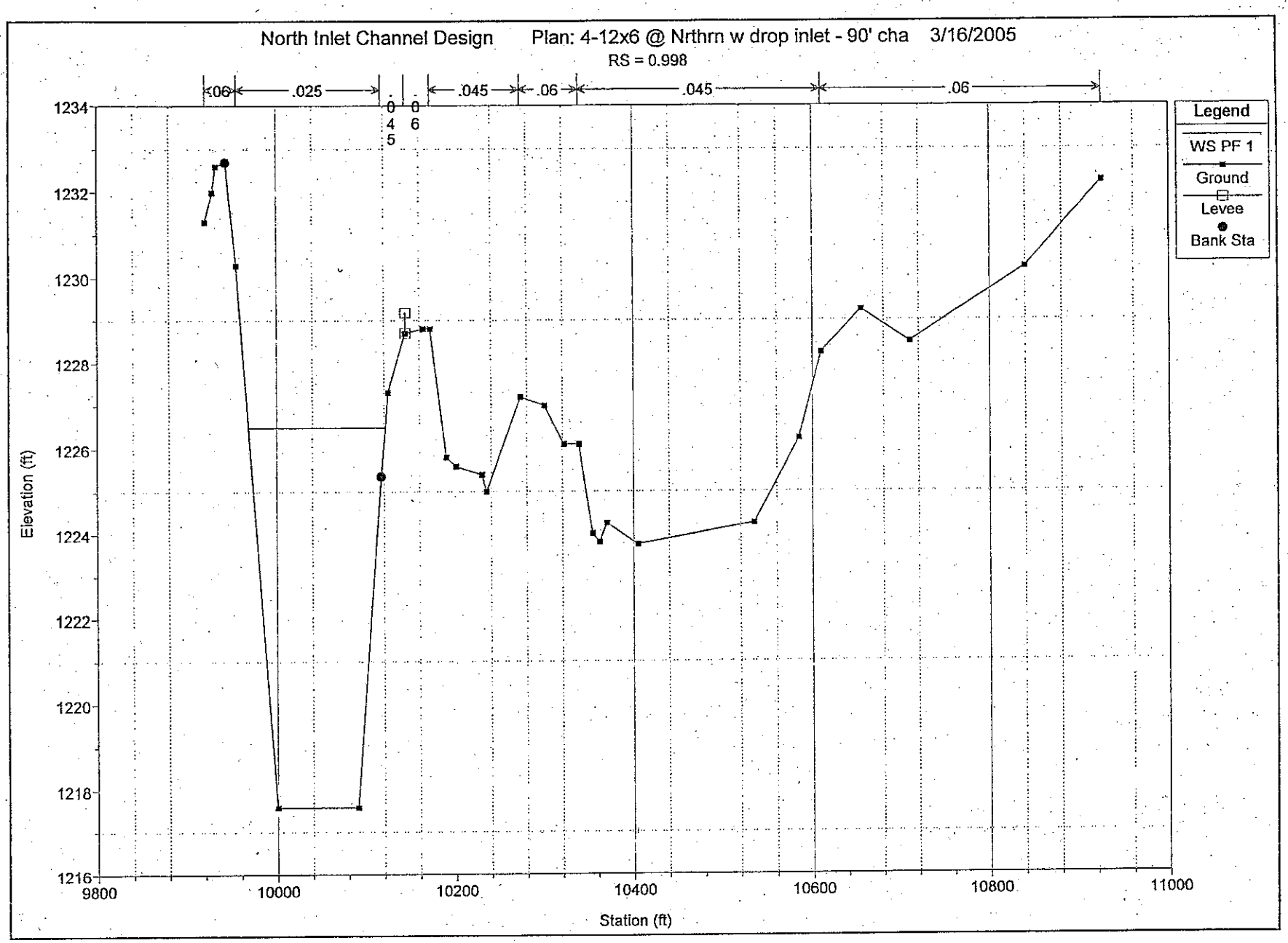

North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 2.167
.06
.035
.06
Legend
WS PF 2
WS.PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1284
1282
1280
1278
1276
1274
1272
1270
9800
9900
10000
10100
10200
10300
10400
10500
10600
Station (ft)

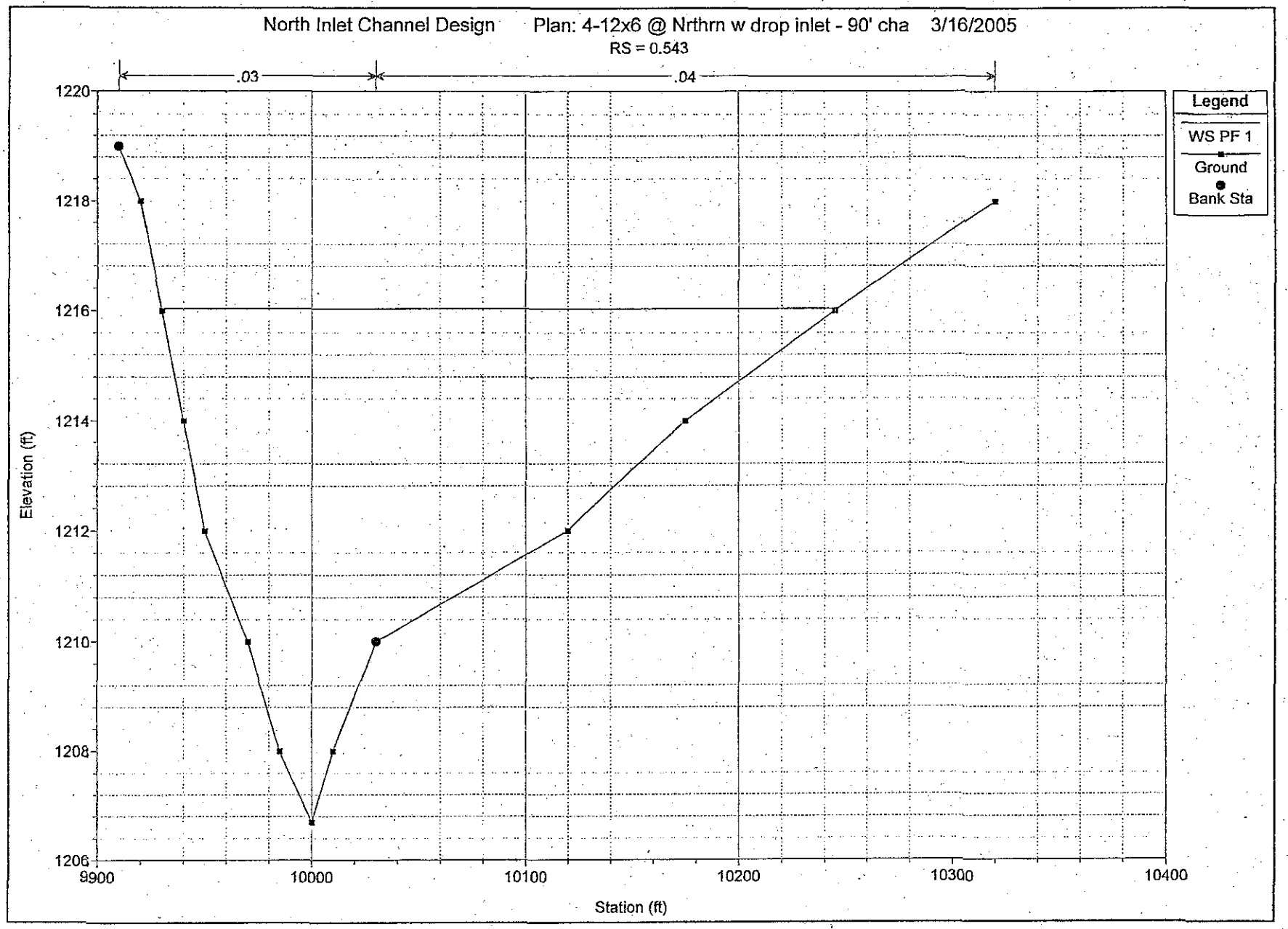

North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 2.159
.08
.035
.08
.06
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1282
1280
1278
1276
1274
1272
1270
1268
9900
10000
10100
10200
10300
10400
10500
10600
Station (ft)

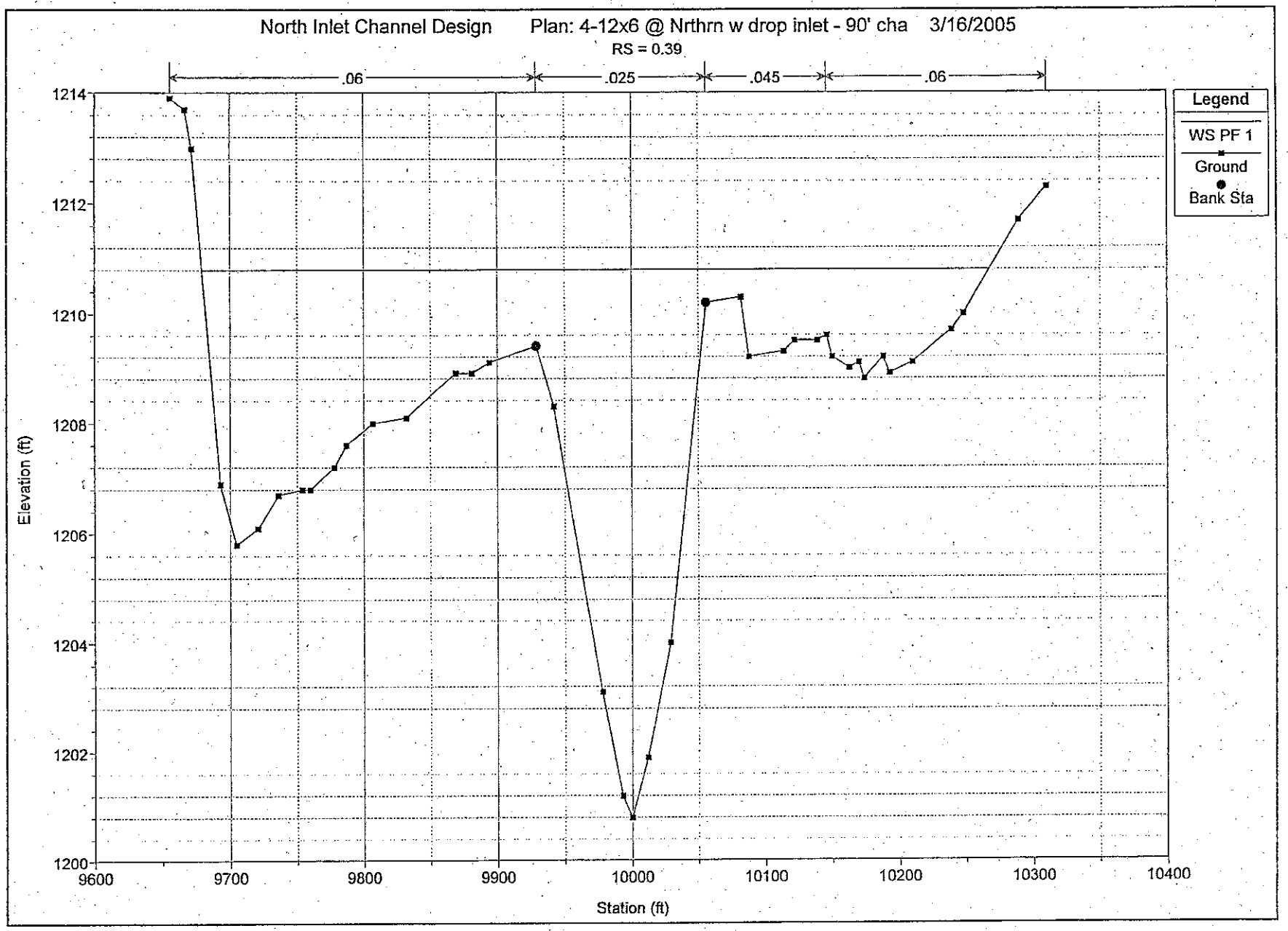

North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 1.159
.06
.013
.06
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1245
1240
1235
1230
1225
1220
9900
9950
10000
10050
10100
10150
Station (ft)


North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 1.148
.06
.025
.06
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1238
1236
1234
1232
1230
1228
1226
1224
1222
1220
1218
9900
9950
10000
10050
10100
10150
10200
Station (ft)


North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 1.388
.06
.035
.06
.045
.06
Legend
WS PF 1
Ground
Levee
Bank Sta
Elevation (ft)
1248
1246
1244
1242
1240
1238
1236
9900
10000
10100
10200
10300
10400
10500
Station (ft)


North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 0.998
.06
.025
.045
.06
.045
.06
Legend
WS PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1234
1232
1230
1228
1226
1224
1222
1220
1218
1216
9800
10000
10200
10400
10600
10800
11000


North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 0.543
.03
.04
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1220
1218
1216
1214
1212
1210
1208
1206
9900
10000
10100
10200
10300
10400
Station (ft)


North Inlet Channel Design
Plan: 4-12x6 @ Nrthrn w drop inlet - 90' cha
3/16/2005
RS = 0.39
.06
.025
.045
.06
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
1214
1212
1210
1208
1206
1204
1202
1200
9600
9700
9800
9900
10000
10100
10200
10300
10400
Station (ft)

HEC-RAS Plan: 4-12x6 wdrop Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2.233	PF 1	2655.00	1273.15	1279.30	1277.77	1279.47	0.001825	4.42	905.56	359.81	0.40
Reach-1	2.202	PF 1	2655.00	1273.00	1279.25		1279.35	0.000742	2.99	1081.37	452.04	0.26
Reach-1	2.183	PF 1	2655.00	1272.10	1279.21	1275.80	1279.30	0.000750	2.71	1207.17	414.83	0.20
Reach-1	2.167	PF 1	2655.00	1270.20	1279.17	1274.25	1279.27	0.000285	2.63	1418.52	556.13	0.17
Reach-1	2.163		Culvert									
Reach-1	2.159	PF 1	1055.00	1269.10	1273.32	1271.28	1273.61	0.001518	4.32	244.17	113.37	0.37
Reach-1	2.140	PF 1	1055.00	1270.30	1273.11		1273.36	0.004039	4.25	260.13	171.66	0.51
Reach-1	2.072	PF 1	1055.00	1268.00	1271.17	1270.59	1271.40	0.007574	3.92	269.41	172.00	0.55
Reach-1	1.996	PF 1	1055.00	1260.00	1265.70	1265.70	1267.32	0.013433	10.20	103.42	31.98	1.00
Reach-1	1.920	PF 1	1055.00	1258.00	1263.42	1261.80	1264.05	0.003586	6.35	166.01	180.39	0.54
Reach-1	1.844	PF 1	1055.00	1255.00	1259.42	1259.42	1261.01	0.021725	10.14	104.00	189.24	1.00
Reach-1	1.768	PF 1	1055.00	1253.00	1255.04	1254.59	1255.21	0.005829	3.29	320.80	276.90	0.54
Reach-1	1.692	PF 1	1055.00	1249.20	1252.55		1252.77	0.006353	3.75	281.28	170.83	0.52
Reach-1	1.616	PF 1	1055.00	1245.90	1251.89		1251.94	0.000927	1.88	566.33	173.00	0.17
Reach-2	1.556	PF 1	5539.00	1241.80	1251.25	1247.49	1251.43	0.001788	3.39	1638.14	294.51	0.25
Reach-2	1.466	PF 1	5539.00	1238.10	1247.81	1247.53	1249.25	0.021779	9.63	578.23	174.38	0.90
Reach-2	1.388	PF 1	5539.00	1236.20	1243.73	1242.75	1244.51	0.006683	7.11	778.68	226.81	0.68
Reach-2	1.313	PF 1	5539.00	1234.20	1241.63		1242.06	0.005323	5.25	1072.17	266.86	0.45
Reach-2	1.237	PF 1	5539.00	1230.70	1238.33		1239.05	0.010881	6.78	816.73	316.75	0.61
Reach-2	1.173	PF 1	5539.00	1227.40	1235.65		1236.47	0.005702	7.59	777.80	171.10	0.57
Reach-2	1.16665*	PF 1	5539.00	1226.77	1235.65		1236.34	0.001595	6.64	838.80	149.99	0.47
Reach-2	1.159	PF 1	5539.00	1220.08	1235.64	1227.03	1236.32	0.000156	6.61	838.01	54.71	0.30
Reach-2	1.154		Culvert									
Reach-2	1.148	PF 1	7139.00	1219.58	1227.14		1228.42	0.001921	9.06	788.00	117.42	0.62
Reach-2	1.124	PF 1	7139.00	1219.26	1227.10		1228.04	0.001472	7.75	921.45	144.96	0.54
Reach-2	1.074	PF 1	7139.00	1218.60	1226.82		1227.65	0.001245	7.31	976.37	147.66	0.50
Reach-2	0.998	PF 1	7139.00	1217.60	1226.50	1222.98	1227.18	0.000907	6.64	1078.00	152.89	0.43
Reach-2	0.92	PF 1	7139.00	1214.50	1224.11	1224.11	1226.28	0.005571	11.81	604.28	140.15	1.00
Reach-2	0.846	PF 1	7776.00	1213.20	1224.01	1221.77	1224.23	0.000558	4.94	2967.86	781.45	0.34
Reach-2	0.770	PF 1	7776.00	1211.10	1223.02		1223.84	0.001422	8.11	1677.95	538.06	0.54
Reach-2	0.696	PF 1	7776.00	1208.80	1219.68	1219.68	1222.66	0.005272	13.86	561.08	94.91	1.00
Reach-2	0.620	PF 1	7776.00	1207.20	1216.27	1217.52	1220.02	0.007946	15.88	629.12	314.58	1.22
Reach-2	0.543	PF 1	7776.00	1206.70	1216.04	1214.49	1216.80	0.002529	8.21	1297.43	316.50	0.59
Reach-2	0.465	PF 1	7776.00	1203.40	1212.64	1212.64	1215.18	0.005453	12.78	608.68	120.79	1.00
Reach-2	0.39	PF 1	7776.00	1200.80	1210.80	1209.82	1211.54	0.001640	7.83	1759.18	587.72	0.57

North Inlet Channel Analysis and Design

The channel was analyzed using a set of methods and checks with HEC-RAS and FlowMaster as follows:

1) The 1600 cfs flow to be contained within the channel was calculated from the HEC-RAS analysis shown in the previous section. The parameters for the shape and side slopes as well as the maximum velocity of the channel were set by the FCD, therefore only the bottom width and the slope had to be calculated using FlowMaster. FlowMaster calculated that a 55' bottom width and a 0.00075 ft/ft slope would contain the 1600 cfs flow at a velocity less than 4 ft/s (velocity is 3.37 ft/s).
2) The capacity and maximum velocity of the channel was checked in to ensure that it could handle all of the flow from Beardsley Wash, if necessary. The capacity was 3025 cfs, greater than the entire flow from Beardsley Wash, and the velocity is 4 ft/s. equal to the maximum permissible velocity.
3) A sensitivity analysis was completed in HEC-RAS to ensure that changes within the channel would not greatly affect its performance. The normal Manning's coefficient was set at 0.030 with a maximum Manning's coefficient (channel bottom moderately vegetated) of 0.035 and a minimum Manning's coefficient (channel bottom of bare earth post construction) of 0.025. The analysis proved that slight changes in vegetation would not greatly affect the performance of the channel.
4) **The HEC-RAS analysis at Northern Avenue will be updated during the NIC South Design. For purposes of illustrating the hydraulic grade line on the plans the elevations were kept the same as the 90% plans.**

Results:

- Channel to measure 55' bottom width with a slope of 0.00075 ft/ft, with a capacity of 3025 cfs.
- Small changes in vegetation will not affect the performance of the channel.

NIC Channel with 1600 cfs Diversion
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	NIC@1600cfs
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.000750	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	55.00	ft
Discharge	1,600.00	cfs

Results		
Depth	5.42	ft
Flow Area	474.3	ft²
Wetted Perimeter	120.93	ft
Top Width	120.03	ft
Critical Depth	2.68	ft
Critical Slope	0.010172	ft/ft
Velocity	3.37	ft/s
Velocity Head	0.18	ft
Specific Energy	5.60	ft
Froude Number	0.30	
Flow Type	Subcritical	

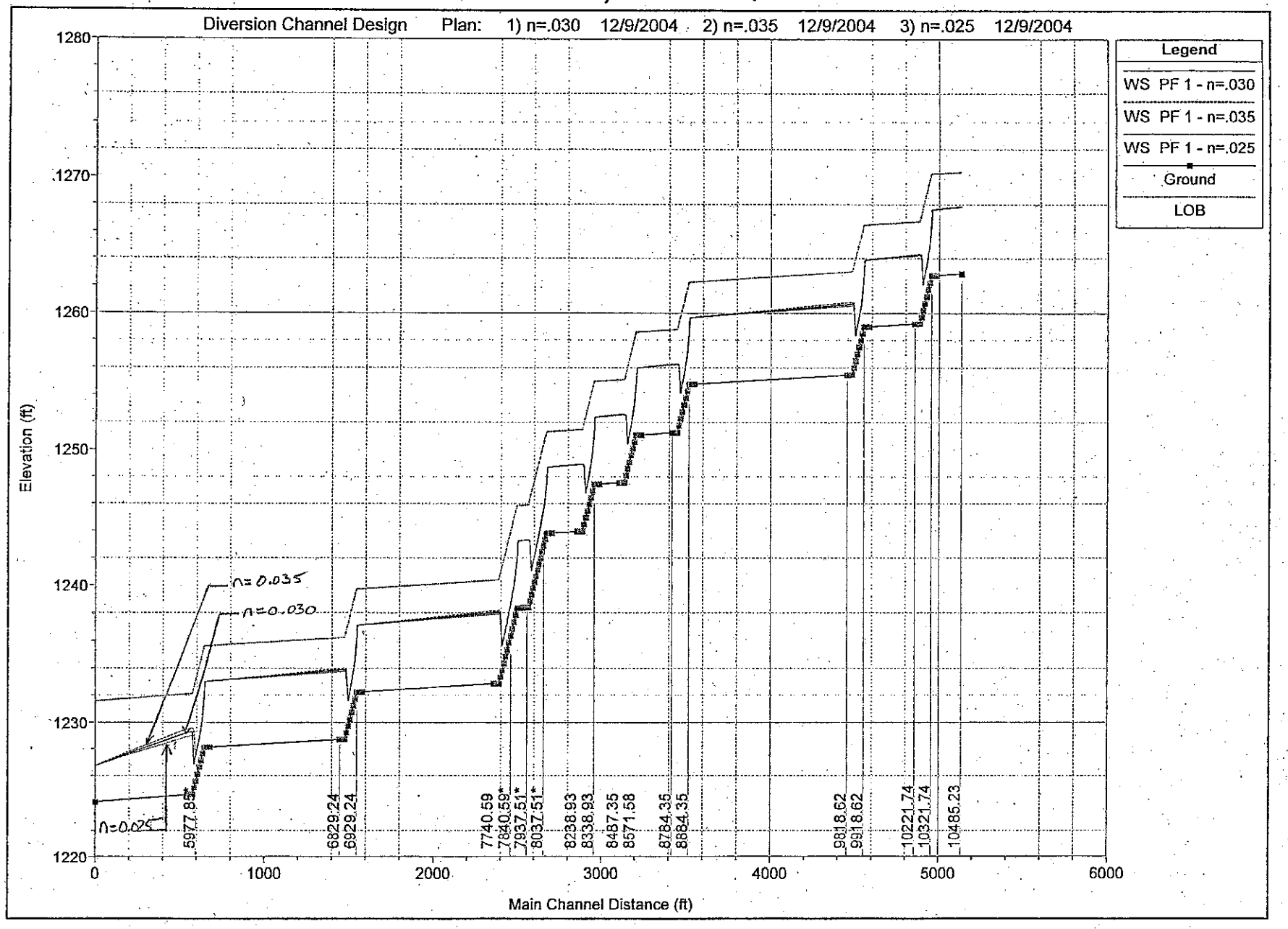
Capacity of NIC Channel
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	NIC
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.000750	ft/ft
Depth	7.50	ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	55.00	ft

Results		
Discharge	3,025.47	cfs ← BANKFULL CAPACITY OF NIC
Flow Area	750.0	ft²
Wetted Perimeter	146.24	ft
Top Width	145.00	ft
Critical Depth	3.91	ft
Critical Slope	0.009157	ft/ft
Velocity	4.03	ft/s ← VELOCITY
Velocity Head	0.25	ft
Specific Energy	7.75	ft
Froude Number	0.31	
Flow Type	Subcritical	

SENSITIVITY ANALYSIS



NORTH INLET CHANNEL CONTROL POINTS

CSI 10-8-04

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CEI – SURVEY FEATURE CODES

BUILDING	
BBC#	BUILDING CORNER
BCC	CONC CORNER
BCOL	CORNER COLUMN
BFE	FOOTING ELEV
BFF	FINISHED FLOOR
BOH#	BUILDING OVERHANG
BPL	PLANTER
BRD	ROOF DRAIN
CONTROL	
CAC	ALUM CAP
CACF	ALUM CAP FLUSH
CACHH	ALUM CAP HH
CAI	ANGLE IRON
CBCF	BRASS CAP FLUSH
CBCHH	BRASS CAP HH
CCEI#	CEI REBAR
CCPS	COTTON PICKER SPINDLE
CCX	CHISELLED X
CHB	HUB
CHK	CHECK
CHKROD#	CHKROD
CINIT#	INITIALIZATION POINT
CIP	IRON PIPE
CLC	CALC POINT
CN	NAIL
CP#	CONTROL POINT
CPK	PK NAIL
CRB	REBAR
CRM	ROW MARKER
CRRS	RR SPIKE
CSM	STONE MOUND
CST	STONE
CWSTK	WOODSTAKE
DRAINAGE	
DBC	BOX CULV
DCB	CONC CANAL BOT
DCBC	CATCH BASIN CONC
DCBG	CATCH BASIN GRATE
DCMP	CORR. METAL PIPE
DCT#	CONC CANAL TOP
DDB#	DIRT DITCH BOT
DDT#	DIRT DITCH TOP
DDW	DRYWELL
DFL#	FLOW LINE

DHW#	HEADWALL
DHWO	HEADWALL ' O/S
DPI	PIPE INV
DPVC	PVC PIPE
DRCP	REINF. CONCRETE PIPE
DRR	RIP RAP
DSC	SCUPPER IN WALL
DSD	STORM DRAIN
DSM	MH STORM
DTP	TOP OF PIPE
DWW	WINGWALL
DWWL	WING LEFT
DWWR	WING RIGHT
FENCE	
FBH#	BRICK HEADER
FBW#	BARBED WIRE
FCH#	CONC HEADER
FCL#	CHAIN LINK
FDG	DOUBLE GATE
FFP	FENCE POST
FPF#	PIPE FENCE
FRW#	RETAINING WALL
FSG	SINGLE GATE
FWD	WOOD FENCE
FWF#	WIRE FENCE
FWH#	WOOD HEADER
FWI#	WROUGHT IRON
FWL#	BLOCK WALL
FWT#	WALL TOP ELEV
GROUND	
GATE	GATE
GG#	GROUND
GGB#	GRADE BREAK
GHP#	HIGH POINT
GLP#	LOW POINT
GTO#	TOE
GTP#	TOP
IRRIGATION	
IIL	IRRIGATION LINE
IINV	IRRIGATION INV
IIP	IRRIGATION STANDPIPE
IIS	IRRIGATION STRUCTURE
IIV	IRRIGATION VALVE
IIZ	IRRIGATION MISC
INVD	DRAINAGE INVERT

INVI	IRRIGATION INVERT
INVTI	IRRIGATION PIPE TOP
OS#	OFFSET
OFFSET #	OFFSET
PHOTO#	PHOTO
ROADWAY	
RAP	PAVEMENT ELEVATION
RBAR	BARRICADE
RBBE	BRIDGE END
RBBG	BRIDGE EDGE
RBBR	BRIDGE RAILING
RBW#	BACK OF WALK
RCG	CATTLE GUARD
RCL#	CL ROAD
RCO	CURB OPENING
RCP#	CONC PVMT ELEV
RDC#	DEPRESSED CURB
RDP	DIRT TO PAVEMENT
RDR#	DIRT ROAD ELEV
RDS#	STRIPE DASHED
REB#	EDGE BRICK
RECB#	EXTRUDED CURB BACK
RECF#	EXTRUDED CURB FACE
REP#	EDGE PAVEMENT
RER#	EDGE DIRT ROAD
RES#	STRIPE EDGE
REW#	EDGE SIDEWALK
RFL#	FLOW LINE
RGB#	ROAD GRADE BREAK
RGL#	GUTTER LINE
RGR#	EDGE GRAVEL ROAD
RGRL#	GUARD RAIL
RGS	GROUND
RHC	HANDICAP RAMP
RHCS	HANDICAP SYMB
RHP#	HIGH POINT
RLD#	LOOP DETECTOR
RLG#	GUTTER LIP
RLP#	LOW POINT
ROL#	EDGE PVMT OVERLAY
RPC#	PRECAST CURB
RPM	PARKING METER
RPS	STRIPE PARKING
RRBCB#	CURB RIBBON BACK
RRBCF#	CURB RIBBON FACE

RRCB#	CURB ROLL BACK
RRR#	CL RAILROAD
RSCB#	CURB SINGLE BACK
RSCF#	CURB SINGLE FACE
RSCP	SCUPPER
RSS#	STRIPE SOLID
RTL#	EDGE TRAVEL LANE
RVCB#	CURB VERT BACK
RVCF#	CURB VERT FACE
RVG#	VALLEY GUTTER
RWGB	BOTTOM WING
RWGT	TOP WING
SIGNS	
SBBL	BILLBOARD OVERHEAD
SBBP	BILLBOARD POST
SBOLT	SIGN BOLT PATTERN
SBP	BARRIER POST
SBR	BRIDGE SIGN
SCS	SIGN CANTALEVER
SDL	DELINEATOR
SDP	SIGN DOUBLE POST
SMP	MILEPOST
SOS	SIGN-OVERHEAD
SRR	RAILROAD
SSE	SIGN EDGE
SSP	SIGN SINGLE POST
SSPE	SPEED SIGN
SST	STOP SIGN
UTILITIES	
UARV	AIR RELEASE VALVE
UBFP	BACKFLOW PREVENTOR
UBSE#	BS ELECTRIC
UBSG#	BS GAS
UBSI#	BS IRRIGATION
UBSS#	BS SEWER
UBSST#	BS STORM
UBST#	BS TELEPHONE
UBSTV#	BS TV
UBSW#	BS WATER
UEB	E BOX
UEL	E LINE
UELM	E LINE MARKER
UEM	ELECTRIC MH
UEO	E OUTLET
UET	E TRANSFORMER
UEU	ELECTRIC UNDERGROUND

UEZ	E MISC
UFH	FIRE HYDRANT
UFHR	FIRE HYDRANT RISER
UFO	FIBRE OPTIC MARKER
UFR	FIBRE OPTIC RISER
UGLM	GAS LINE MARKER
UGLR	GAS LINE RISER
UGM	GAS METER
UGMH	GAS MANHOLE
UGS	GAS SERVICE
UGUY	GUY ANCHOR
UGV	GAS VALVE
UGVT	GAS VENT
UGZ	GAS MISC
UHTT	HI-TENSION TOWER FOOT
UINV	SEWER INVERT
UIPI	IRR PIPE INV
UIS	IRR STRUCTURE
UIV	IRR VALVE
UJBE	JUNCTION BOX ELEC
UJBT	JUNCTION BOX TEL
UJBTV	JUNCTION BOX TV
UJBZ	JUNCTION BOX MISC
ULA	LIGHT AREA
ULP	LIGHT PARKING
ULS	LIGHT STREET
ULSP	SPRINKLER
UMW	MONITOR WELL
UOW	OH WIRES
UPB	PULL BOX
UPP	POWER POLE
UPPL	UP W/LIGHT
UPPTR	UP W/TRANSFORMER
UPPUG	UP W/UGND
USC	SEWER CLEANOUT
USL	SEWER LINE
USLI	SEWER LINE INV
USM	SEWER MH
USZ	SEWER MISC
UTB	TELEPHONE BOOTH
UTM	TELEPHONE MH
UTO	TELEPHONE OH
UTP	TELEPHONE POLE
UTR	TELEPHONE RISER
UTRJB	TRAFFIC J BOX
UTS	TRAFFIC SIGNAL POLE
UTT	TRANSMISSION TOWER
UTVM	TV MARKER

UTVR	TV RISER
UTZ	TV MISC
UWBO	WATER BLOW OFF
UWL	WATER LINE
UWM	WATER METER
UWT	WATER TAP
UWV	WATER VALVE
UWZ	WATER MISC
VEGETATION	
VAP	ASPEN TREE
VBC	CACTUS (BARREL)
VBU	BUSH
VCA	CACTUS
VCH	CHOLLA
VCW	COTTONWOOD
VEU	EUCALYPTUS
VGRS	EDGE GRASS
VHG	HEDGE
VIW	IRONWOOD
VML	MULBERRY
VMQ	MESQUITE
VOK	OAK TREE
VOL	OLEANDER
VOO	OLIVE
VOT	OCOTILLO
VPM	PALM
VPN	PINE
VPV	PALO VERDE
VSG	SAGUARO
VSP	SALT PINE
VTX	TREE
VYC	YUCCA
MISCELLANEOUS	
XAW	AWNING
XBL	BOLLARD
XBO	BOULDER
XBORE	XBORE
XCROP	CROP
XFP	FLAGPOLE
XEDGE#	EDGE
XGRVL	EDGE GRAVEL
XLK	LAKE
XMB	MAILBOX
XPST#	POST
XRB	RUBBLE
XTK	STORAGE TANK

XTT	TRASH
XTWR	TOWER
XWL	WELL
XWM	WINDMILL
XXX	UNKNOWN (SEE-NOTE)

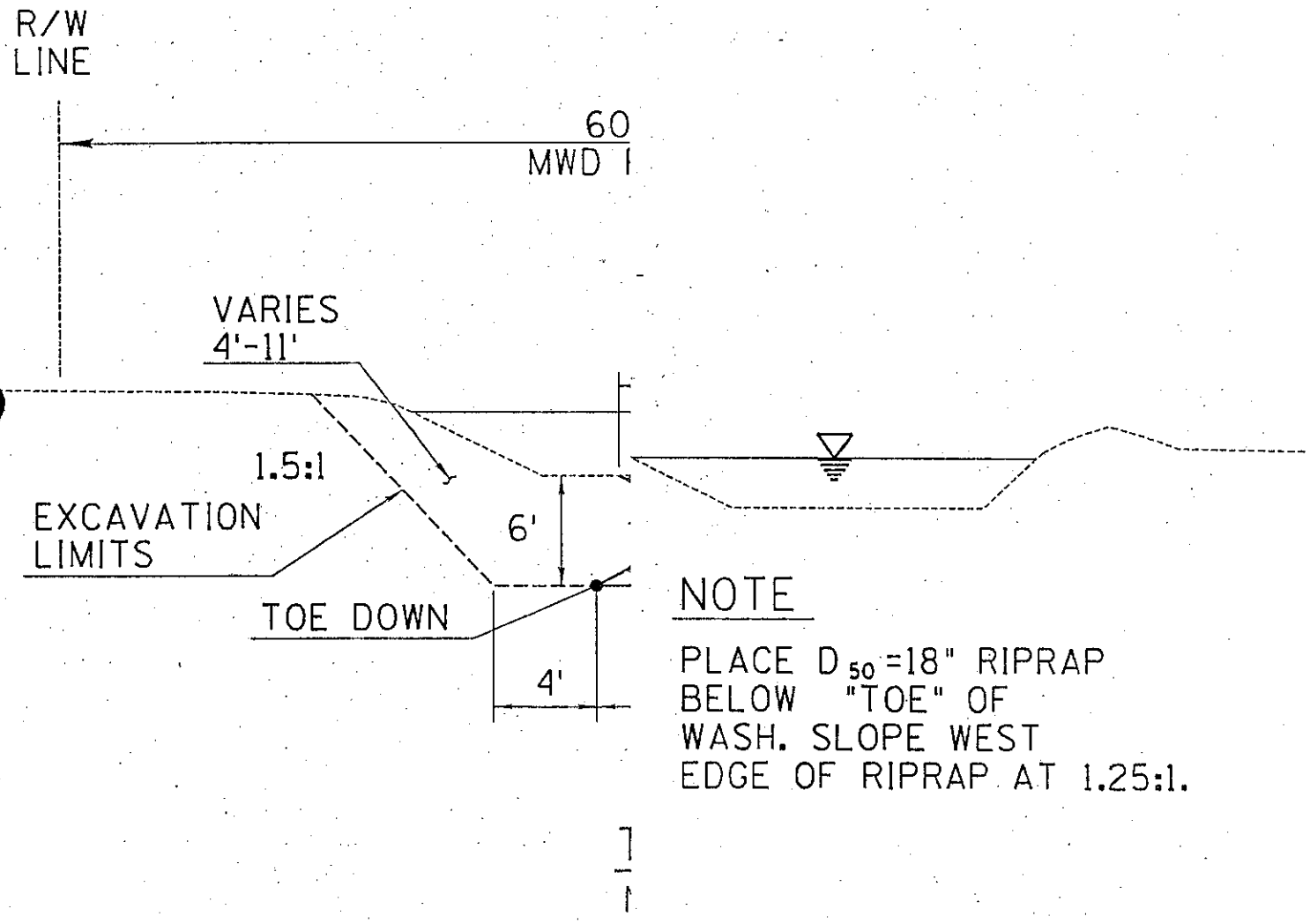
Cholla Wash Confluence Analysis and Design

The channel was analyzed using a set of methods and checks with HEC-RAS and hand calculations as follows:

1) HEC-RAS was used to determine the extent of soil cement needed at the confluence.
2) Standard Watercourse System Sediment Balance was calculated for the section of the Cholla/Beardsley Wash confluence (per State Standard 5-96). The stream degradation upstream of the confluence was calculated at 3.8' requiring a 6'toe down for the soil cement. The stream degradation downstream of the confluence was calculated at 8.4' requiring an 8.5' soil cement toe down.
3) Standards set forth by the Drainage Design Manual for Maricopa County were followed providing a minimum 8' width and a slope of 2:1.

Results:

- Soil cement to be placed for 900' of east bank of Beardsley Wash at Cholla Wash confluence
- Toe down depths vary from 6' upstream to 8.5' downstream.
- Soil cement to be 8' in width and slope at 2:1.



NOTE

PLACE D_{50}=18" RIPRAP BELOW "TOE" OF WASH. SLOPE WEST EDGE OF RIPRAP AT 1.25:1.

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DRAINAGE DESIGN MANUAL FOR MARICOPA COUNTY
VOLUME II, HYDRAULICS

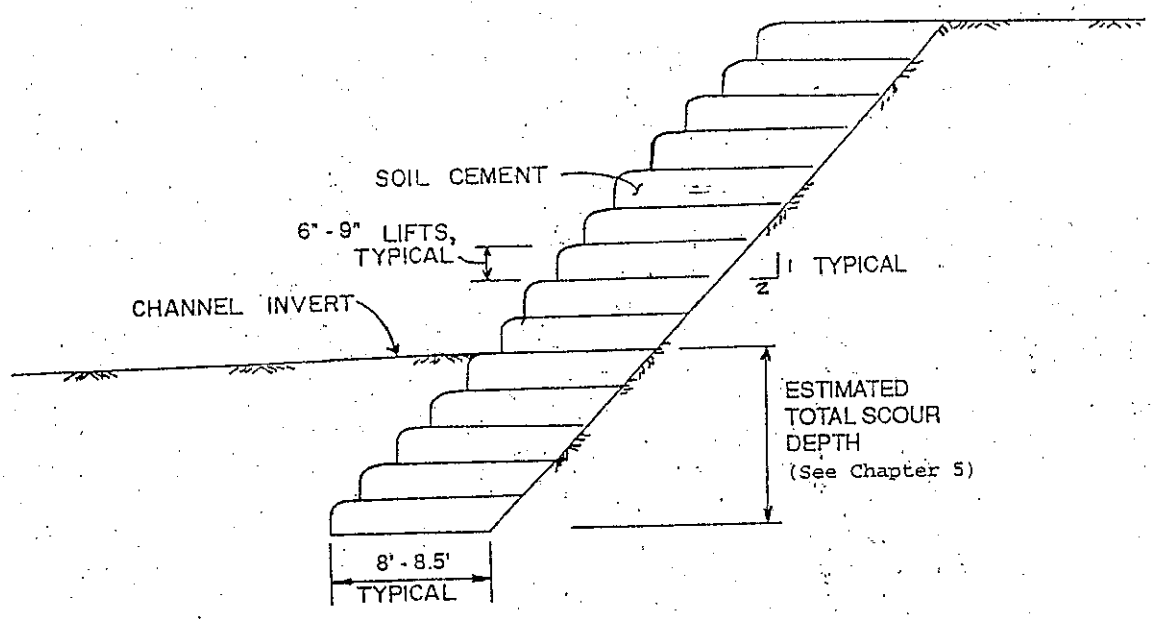

Figure 6.5
Soil Cement Placement Detail
(Not to Scale)

State Standard 5-96 Watercourse System Sediment Balance				
Beardsley Canal Wash and North Inlet Channel Estimated Channel Degradation				
Location on	100-yr Peak	Degradation (ft)		
Channel	Discharge (cfs)	General	Long Term	Total
Olive Ave. (u/s)	2655	3.7	2.3	6.0
Olive Ave. (d/s)	1055	2.5	1.3	3.8
Cholla Wash (before confl.)	4868	4.7	3.3	8.0
Cholla Wash (at BCW)	5539	4.9	3.5	8.4
Northern Ave. (d/s)	7139	5.5	4.1	9.6
1200' d/s of Northern Ave.	7776	5.7	4.3	10.0
North Inlet Channel (div.1)	1600	3.0	1.7	4.7
North Inlet Channel (div.2)	1200	2.7	1.4	4.1

ARIZONA DEPARTMENT OF WATER RESOURCES
FLOOD WARNING AND DAM SAFETY SECTION

State Standard

for

Watercourse System Sediment Balance

Under authority of ARS 48-3605(a), the Director of the Arizona Department of Water Resources establishes the following standard for identification of and development within erosion hazard areas and areas affected by a net system sediment deficit or surplus in Arizona:

The guidelines outlined in State Standard Attachment 5-96 entitled "Watercourse System Sediment Balance" or by an alternative procedure reviewed and accepted by the Director will be used in the identification of, or regulation of development within erosion hazard areas, and watercourses affected by a net system sediment deficit or surplus in Arizona for fulfilling the requirements of Flood Insurance Studies, and local community and county flood damage prevention ordinances.

For the purpose of application of these guidelines, erosion hazard area and watercourse system sediment balance standards will apply to all watercourses identified by the Federal Emergency Management Agency as part of the National Flood Insurance Program, all watercourses which have been identified by the local floodplain administrator as having significant potential flood hazards and all watercourses with drainage areas more than 1/4 square mile or a 100-year discharge estimate of more than 500 cubic feet per second. Application of these guidelines will not be necessary if the local community or county has in effect a drainage, grading or stormwater ordinance which, in the opinion of the Department, results in the same or greater level of flood protection as application of these guidelines would ensure.

This requirement is effective October 1, 1996. Copies of this State Standard and State Standard Attachment 5-96 can be obtained by contacting the Department's Flood Warning and Dam Safety Section at (602) 417-2445.

NOTICE

This document is available in alternative formats. Contact the Department of Water Resources, Flood Warning and Dam Safety Section at (602) 417-2445 or (602) 417-2455 (TDD).

ARIZONA DEPARTMENT OF WATER RESOURCES
FLOOD WARNING AND DAM SAFETY SECTION

Watercourse System Sediment Balance

500 North Third Street
Phoenix, Arizona 85004

(602) 417-2445

STATE STANDARD ATTACHMENT
SSA 5-96

SEPTEMBER 1996

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Example Application	8

Introduction

Channel degradation occurs within watercourses composed of erodible material, where local or general differentials in sediment transport capacity exist. Numerous factors control the short and long term degradation potential of channel reaches, including the size and cohesiveness of the material of which the channel is composed, the vegetation type and density in the channel, the hydraulic characteristics generated within the channel under flood events, and the existence of flow redirection or concentration structures within the channel. A key factor, however, is the amount of variation in channel properties from reach to reach. A channel reach attempts to adjust to conditions imposed on it by factors occurring up- and downstream; thus, the more uniform the channel is along the system under study, the less the potential exists for channel degradation to be a significant factor. Natural and man-made discontinuities along the system can create local increases in sediment transport potential, which often result in local degradation of the channel. System-wide disturbances, such as those associated with urbanization of the watershed or dam construction, have more far reaching impact, as the entire channel is forced to adjust to a change in sediment supply.

This document presents procedures that may be used for estimation of channel degradation in unlined watercourses within Arizona. Three levels of procedures are provided, with data requirements, procedural complexity, and accuracy of results all increasing as the analysis level is incremented. The Level I approach provides an initial estimate of local channel degradation potential for generally stable, natural channel conditions. The resulting initial estimate may be reduced through use of the more rigorous Level II methodologies. Level III procedures are outlined for situations that warrant more detailed channel degradation determination.

Procedure

General

Three levels of procedures for estimation of channel degradation depth are described in the following paragraphs. The first level of analysis provides an initial estimate of the potential scour depth to consider for design of structures to be placed near a streambed or along the banks of a channel. This first level of analysis is recommended only for channel reaches that are expected to be in general balance with the surrounding system -- i.e. no major disturbances (dams, bridges, encroachments, etc..) are evident in the site vicinity -- and where the desire is to establish a "safe" scour depth to allow for the concentration of flows that can naturally occur within channels composed of erodible material. The Level II procedures provided are methods for demonstrating the site specific limits to erosion potential, involving computations which require local hydraulic information and sediment size distributions, or historical evidence of channel performance. The third level of procedures outlined will provide more definitive determination of channel stability in the reaches under study. This level of analysis is recommended in areas where local flow characteristics are complex, where the channel has been redirected or otherwise modified by acts of man, or where the safety of local paralleling or crossing structures is of high concern.

Level I

This level of analysis requires the following information :

> Peak discharge associated with the 100-year flood (Q_{100}). May be estimated using simplified methodologies such as ADWR State Standard #2 (SS 2-96), USGS regression equations, or other appropriate local or more detailed methods.

The total scour depth, d_s, is the combination of general degradation and long term degradation and can be computed as follows:

$$d_s = d_{gs} + d_{lts}$$

where:

d_s = Total scour depth, in feet
d_{gs} = General degradation, in feet
d_{lts} = Long term degradation, in feet

General degradation can be computed as follows:

$$d_{gs} = 0.157(Q_{100})^{0.4} \quad \text{for straight channel reaches.}$$

and

$$d_{gs} = 0.219(Q_{100})^{0.4} \quad \text{for channel reaches with curvature.}$$

The second equation will give the worst-case scour for channel curvature, and is not recommended unless significant curvature is evident along the channel reach.

Long term degradation can be computed as follows:

$$d_{lts} = 0.02(Q_{100})^{0.6}$$

This equation for long term degradation should only be used when no downstream controls exist within the channel system.

The total scour depth, d_s, should be applied to the lowest point in the local cross section for determination of the elevation to which scour will occur.

For Level I, the minimum total scour depth, d_s, shall be 3 feet.

Level II

The Level II approaches presented below may be used to demonstrate the ability of the existing channel system to resist degradation, and to justify a lesser burial requirement than that computed using the Level I equations.

Erodibility evaluation

Three procedures for determination of the erodibility of local channel material under computed hydraulic conditions are presented in the ADWR's State Standard for Lateral Migration Setback Allowance for Riverine Floodplains in Arizona. These procedures are: (1) the allowable velocity approach; (2) the tractive stress approach; and, (3) the tractive power approach. One or more of these procedures can be used to demonstrate the adequacy of the material of which the channel is composed to resist the erosive action of the flow under 100 year flow conditions.

Armoring potential evaluation.

An evaluation of relative channel stability can be made by evaluating incipient motion parameters and determining armoring potential. The definition of incipient motion is based on the critical or threshold condition where hydrodynamic forces acting on a grain of sediment have reached a value that, if increased even slightly, will move the grain. Under critical conditions, or at the point of incipient motion, the hydrodynamic forces acting on the grain are just balanced by the resisting forces of the particle. For given hydrodynamic forces, or equivalently for a given discharge, incipient motion conditions will exist for a single particle size. Particles smaller than this will be transported downstream and particles equal to or larger than this will remain in place.

SECTION 311

SOIL CEMENT BASE COURSE

311.1 DESCRIPTION:

This item shall consist of a base course composed of a mixture of local soil, portland cement, and water compacted at optimum moisture content.

311.2 MATERIALS:

Portland cement and water shall comply with Sections 725 and 225. The soil for the mixture shall consist of the material in the area to be paved. The material shall not contain more than 5 percent gravel or stone retained on a 3 inch sieve. It shall be demonstrated by laboratory tests that the plasticity and hardening characteristics of the soil will be adequately modified by the specified cement content.

311.3 EQUIPMENT:

An ample number of machines, combination of machines and equipment shall be provided and used to produce the complete soil cement base course meeting the requirements for soil pulverization, cement distribution, water application, incorporation of materials, compaction, finishing, and for application of the curing material as provided in these specifications.

Mixing shall be accomplished by means of multiple-pass soil-cement mixer, single-pass soil-cement mixer or central plant mixer.

Water may be applied through the mixer or with the water trucks equipped with pressure sprays. Water trucks providing fine fog-type sprays shall be furnished for finishing and curing. Properly adjusted garden type nozzles on a pressure bar may be used to produce fog spray if approved by the Engineer.

Cement spreader shall be a specially constructed device to distribute bulk cement uniformly at rate specified either in windrows or on the flat as determined by method of mixing.

311.4 CONSTRUCTION METHODS:

Before undertaking construction of the soil cement base course, the area to be paved shall be brought to a compacted condition, true to line and grade as directed by the Engineer or as shown on the plans. During this process any unsuitable soil or material, including excess material retained on a 3 inch sieve, shall be removed and replaced with acceptable material. The compacted surface shall be at the proper elevation as specified, shown on the plans, or as directed by the Engineer, for the top of the soil cement base. At completion of this phase, the material and surface shall be approved by the Engineer before proceeding with the next step.

The material shall be scarified, pulverized, mixed with water and cement, compacted and finished and cured in lengths permitting the full roadway width to be complete in not more than 4 hours from the time that cement is exposed to water. Such lengths will generally be not less than 600 feet or the length of one City block and preferably more. Where a gutter section exists the material shall be pulled back from the gutter face for the full depth of the course before processing.

311.4.1 Pulverizing: Before application of cement, soil to be processed shall be scarified to depth of base. The material should be damp at time of scarifying to reduce the dust to a minimum and to aid in pulverization. If the soil contains clods, it shall be pulverized until not less than 80 percent, exclusive of gravel or stone, will pass a No. 4 sieve.

311.4.2 Application of Cement: The quantity of cement shall be by weight as a percentage of the dry weight of the soil as determined by the laboratory and/or as directed by the Engineer and shall be applied uniformly on the soil in a manner satisfactory to the Engineer. The allowable deviation in uniformity shall not exceed 10 percent. The entire operation of spreading and mixing shall be conducted in such a manner as will result in a uniform soil cement and water mixture for the full design width and depth.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of the soil and cement during mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture.

311.4.3 Mixing: Mixing with addition of water as required shall be continued until the product is uniform in color and at optimum moisture content. Any mixture of soil and cement which has not been compacted and finished shall not remain undisturbed for more than 30 minutes but shall be agitated by remixing.

311.4.4 Optimum Moisture: Optimum moisture requirements and field tests of moisture density shall be determined in accordance with AASHTO T-134, T-191, T-217, or ASTM D-558, D-2922, D-3017 on representative samples of soil cement mixture obtained from the area being processed. At time of laydown, the moisture content shall not be below optimum moisture, and shall be less than that quantity which will cause the base course to become unstable during the compaction and finishing process. Any area which becomes so unstable shall be removed and replaced with new cement stabilized material.

311.4.5 Compaction: After mixing is complete, the mixture shall be carefully placed in a uniform loose depth which will provide a surface true to grade and section when compacted. Unless otherwise directed by the Engineer, initial compaction shall be by means of a tamping, grid, or pneumatic roller. After the tamping roller has partially walked out, pneumatic rollers shall be used. Density of final product shall be not less than 95 percent as determined by AASHTO or ASTM as specified above.

311.4.6 Finishing: As compaction nears completion, the surface of the base course shall be shaped to required lines, grades and cross-section. When required, the surface shall be lightly scarified with spike tooth harrows or other approved equipment to remove imprints left by equipment or to prevent slippage planes. During the finishing process the surface shall be kept moist by means of fog-type sprays. Surface finish and final compaction shall be completed in not more than 2 hours from time of laydown. The completed base course shall be true to line, grade, cross-section and shall not vary more than ½ inch in thickness and not more than 1 inch in surface tolerance when tested with a 10 foot straight edge. It shall be free of surface cleavage planes, cracks, or loose material. As a final operation, the surface shall be very lightly scalped with a motor grader, wet with a fog spray and rolled with a pneumatic roller as directed by the Engineer.

311.4.7 Deficiency: When in the opinion of the Engineer there is reason to believe that a deficiency in thickness exists, cores will be taken in the same pattern as that defined in Section 321. If the base has been covered or it is otherwise impractical to correct the deficiency, the corrective measures, listed in Table 310-1 for Type I or II deficiencies, shall be taken by the Contractor at no additional cost to the Contracting Agency.

311.4.8 Curing: After completion of the final finishing process, the soil-cement shall be cured with a bituminous curing seal applied at the end of each construction day. This seal may be either an emulsion or cut-back asphalt applied at a minimum rate of 0.20 gal./sq. yd. The finished soil-cement shall be kept continuously moist until the bituminous cure seal is applied, using fog or gravity bar spray. The spray equipment shall be approved by the Engineer before construction is begun.

311.4.9 Construction Joints: At the end of each day's work, a construction joint shall be made transverse to the centerline of the road by cutting back into the work to provide a full depth vertical joint. Except where specifically authorized by the Engineer, no other construction joints will be permitted. Where authorized, such joints shall be full depth vertical joints.

311.4.10 Maintenance: The Contractor shall maintain the surface until it has been covered with the designated bituminous wearing course. In case it is necessary to replace any soil cement, it shall be for the full depth. No skin patches or soil cement will be permitted. Minor surface pits may be filled with compacted bituminous surfacing, if authorized by the Engineer. Immediately prior to the placing of the bituminous wearing course, the surface shall be broomed to removed all loosened material from the surface.

311.5 MEASUREMENT:

Measurement of soil cement will be the number of square yards constructed to the required depth, completed and accepted.

Measurement of portland cement will be the number of tons of cement mixed with local soil.

Side Weir Analysis and Design

The side weir was analyzed using a set of methods and checks with CulvertMaster, HEC-RAS and hand weir calculations as follows:

1) Existing culverts at Olive Avenue were analyzed for the 100-year discharge in Waterfall Wash minus the allocated diversion of 1600 cfs into the proposed North Inlet Channel.
2) The HEC-RAS model indicated that the headwater elevation for this discharge was determined to be 1276.83.
3) The proposed diversion culvert was analyzed and sized to insure the headwater produced for a diversion of 1600 cfs would be far enough below the proposed weir crest so as not to impede a free-flowing nappe (weir crest elev = 1275.00; headwater for 2-10'x5' box culvert = 1270.62). This forces the side weir to become the "bottleneck" in the diversion system thereby limiting the diversion the desired quantity.
4) A table of values for the side weir crest length were obtained using the standard weir equation and Excel for varying headwater depths and weir coefficients.
5) A side weir was sized and designed using a HEC-RAS model for Waterfall Wash at Olive Avenue. The HEC-RAS model included the existing culverts at Olive Avenue, sediment blockage and new cross-section info for Waterfall Wash based on aerial survey. Iterations were performed to arrive at a weir configuration that produced a 1600 cfs diversion of flow. Beginning weir configurations for iterating in HEC-RAS were obtained by using the table of values in step (4).
6) The headwater value obtained from HEC-RAS (1276.37) was input into the hand calculations for the weir as a back check.

Results:

- HEC-RAS sizing for side weir resulted in a crest length of 216 feet.
- Hand calculations for side weir resulted in a crest length of 216.00 feet.
- CulvertMaster analysis for proposed diversion culvert resulted in a culvert size of: 2-barrel 10'x5' box culvert with invert elevation of 1258.50 and producing a headwater of 1270.62. Headwater elevation of diversion culvert is 3.50 feet below weir crest.

Culvert Designer/Analyzer Report
Olive Ave (Diversion Structure)

Comments: Verifies that headwater is not above weir crest.

Peak Discharge Method: User-Specified			
Design Discharge	1,600.00 cfs	Check Discharge	0.00 cfs

Grades Model: Inverts			
Invert Upstream	1,258.50 ft	Invert Downstream	1,256.43 ft
Length	315.00 ft	Slope	0.006571 ft/ft
Drop	2.07 ft		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	1,278.00 ft

Tailwater properties: Trapezoidal Channel

Tailwater conditions for Design Storm.			
Discharge	1,600.00 cfs	Bottom Elevation	1,256.43 ft
Depth	5.42 ft	Velocity	3.37 ft/s

Name	Description	Discharge	HW Elev.	Velocity
x Trial-2	2-10 x 5 ft Box	1,600.00 cfs	1,270.62 ft	

Culvert Designer/Analyzer Report
Olive Ave (Diversion Structure)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	1,278.00	ft	Storm Event	Design	
Computed Headwater Elev	1,270.62	ft	Discharge	1,600.00	cfs
Headwater Depth/Height	2.42		Tailwater Elevation	1,261.85	ft
Inlet Control HW Elev.	1,270.62	ft	Control Type	Inlet Control	
Outlet Control HW Elev.	1,269.75	ft			

Grades					
Upstream Invert	1,258.50	ft	Downstream Invert	1,256.43	ft
Length	315.00	ft	Constructed Slope	0.006571	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	5.42	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	5.00	ft
Velocity Downstream	16.00	ft/s	Critical Slope	0.009916	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 5 ft		Rise	5.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	1,269.75	ft	Upstream Velocity Head	3.98	ft
Ke	0.20		Entrance Loss	0.80	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,270.62	ft	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	100.0	ft^2
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Weir Calculations

Notes:

1) These hand calculations were used to estimate required weir length and configuration for input into HEC-RAS and to compare with HEC-RAS results.
2) Weir Coefficient of 3.00 was assumed for design due to backwater at existing Olive Avenue culverts.
3) Calculations indicate required weir length is approximately 216 feet to produce 1600 cfs diversion.
4) HEC-RAS analysis indicates a weir length of 216 feet is required to produce 1600 cfs diversion.

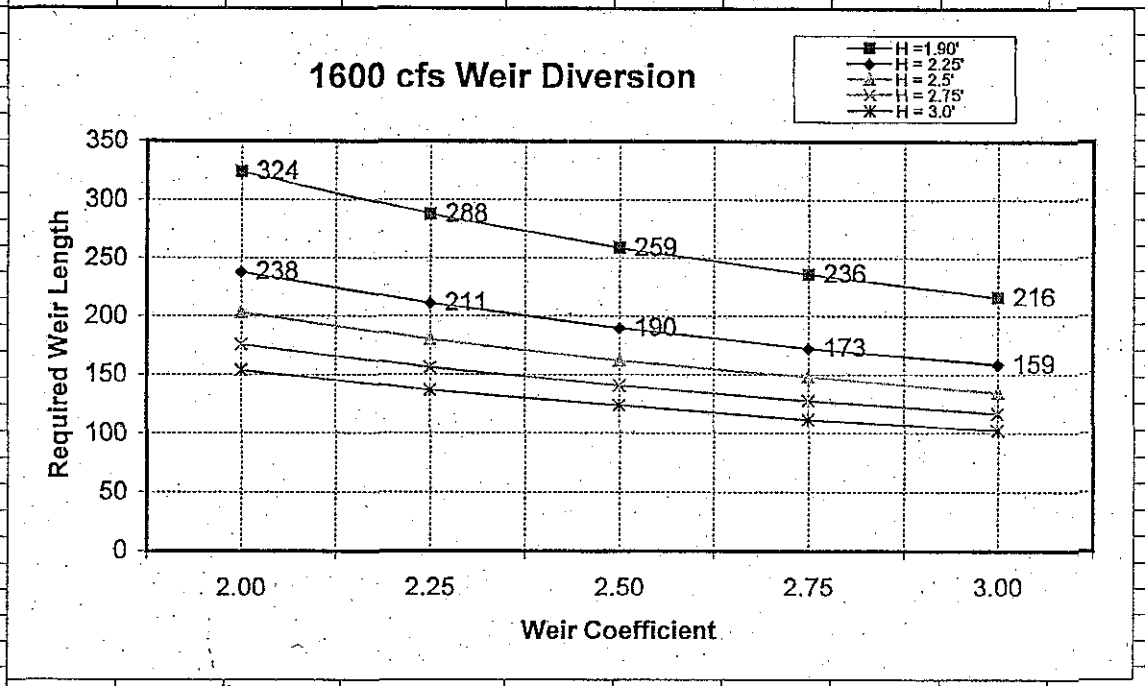
$Q = CLH^{3/2}$

where Q = Total flow over the weir
C = Coefficient of discharge
L = Effective length of weir
H = Difference between energy upstream and crest

Actual Weir Length = 216.5 (Sht ST1)

Average Weir Crest Elevation	HEC-RAS Headwater Elev at Olive Avenue	H
1275.00	1276.83	1.83

proposed diversion Q =	coeff C	length L	depth H
1600	2.00	324	1.83
1600	2.25	288	1.83
1600	2.50	259	1.83
1600	2.75	236	1.83
1600	3.00	216	1.83
1600	2.00	238	2.25
1600	2.25	211	2.25
1600	2.50	190	2.25
1600	2.75	173	2.25
1600	3.00	159	2.25
1600	2.00	203	2.50
1600	2.25	180	2.50
1600	2.50	162	2.50
1600	2.75	148	2.50
1600	3.00	135	2.50
1600	2.00	176	2.75
1600	2.25	156	2.75
1600	2.50	141	2.75
1600	2.75	128	2.75
1600	3.00	117	2.75
1600	2.00	154	3.00
1600	2.25	137	3.00
1600	2.50	124	3.00
1600	2.75	112	3.00
1600	3.00	103	3.00

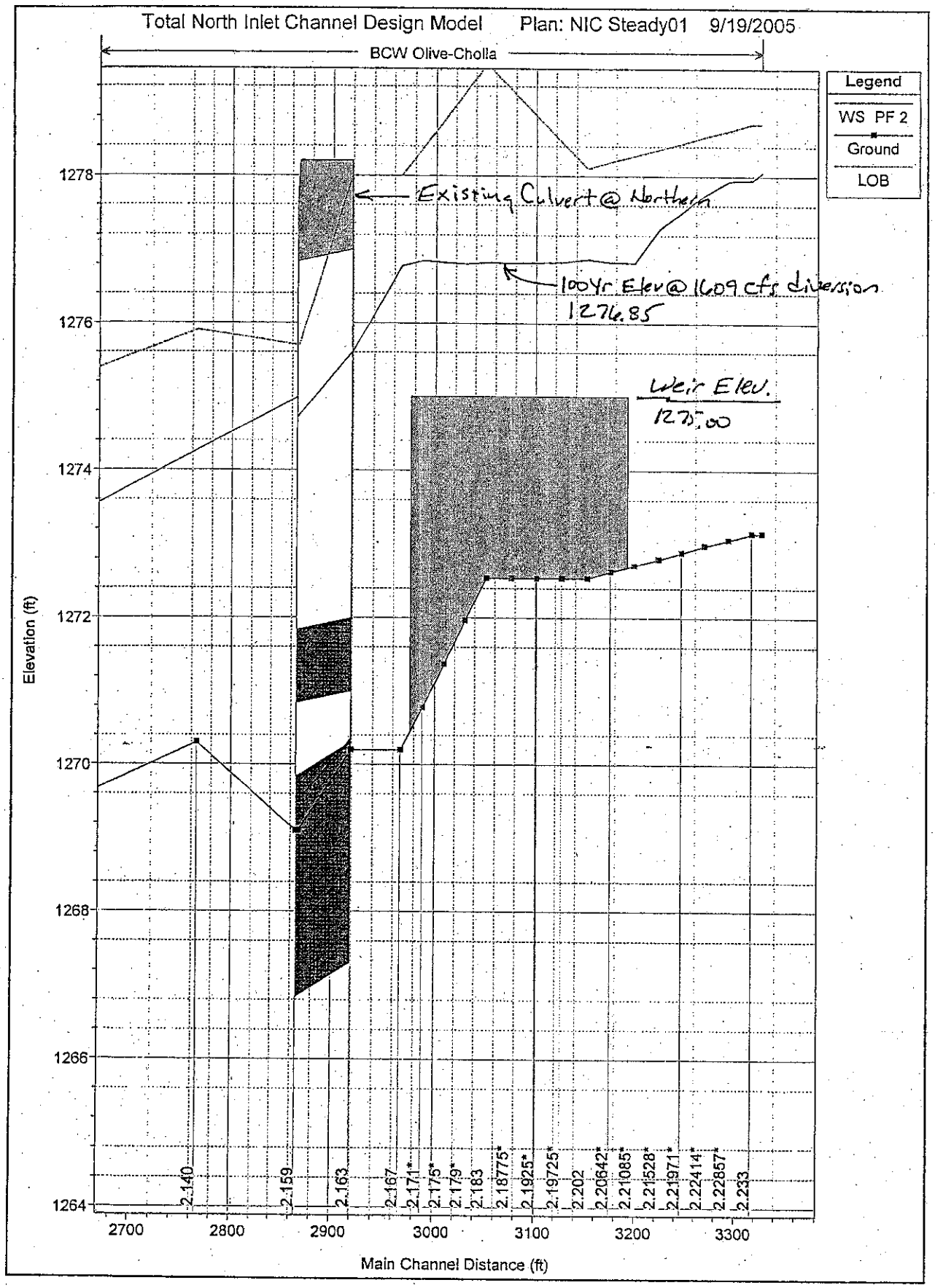


HEC-RAS SIDE WEIR

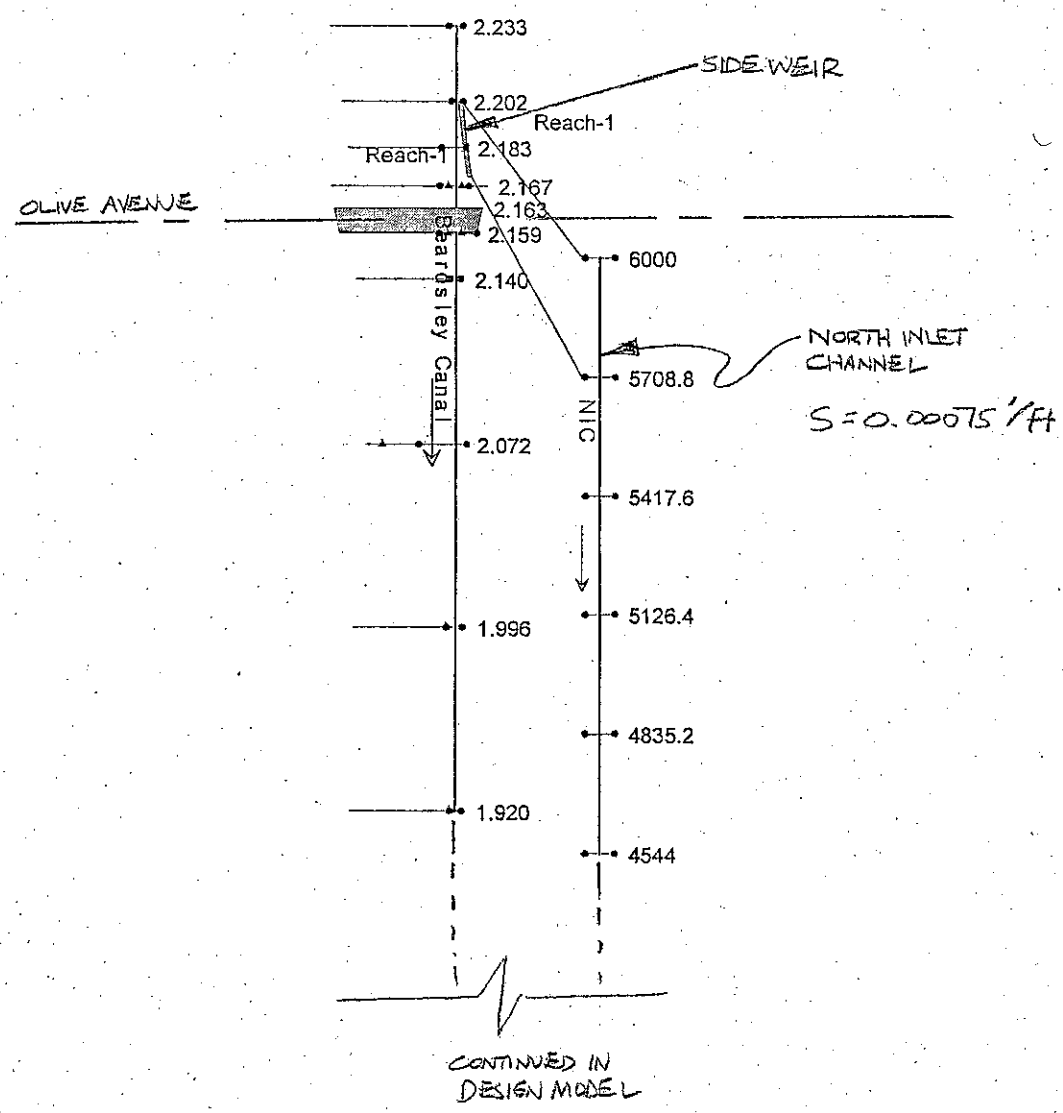
HEC-RAS Plan: Steady01 River: BCW Reach: Olive-Cholla Profile: PF 2

Reach	River Sta	Profile	Q US	Q Leaving Total	Q DS	Q Weir	Q Gates	Wr Top Wdth	Weir Max Depth	Weir Avg Depth	Min El Weir Flow	E.G. US	W.S. US	E.G. DS	W.S. DS
			(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
Olive-Cholla	2.21	PF 2	2722.00	1609.22	1141.95	1609.22		216.00	1.88	1.83	1275.00	1277.61	1276.83	1276.93	1276.81

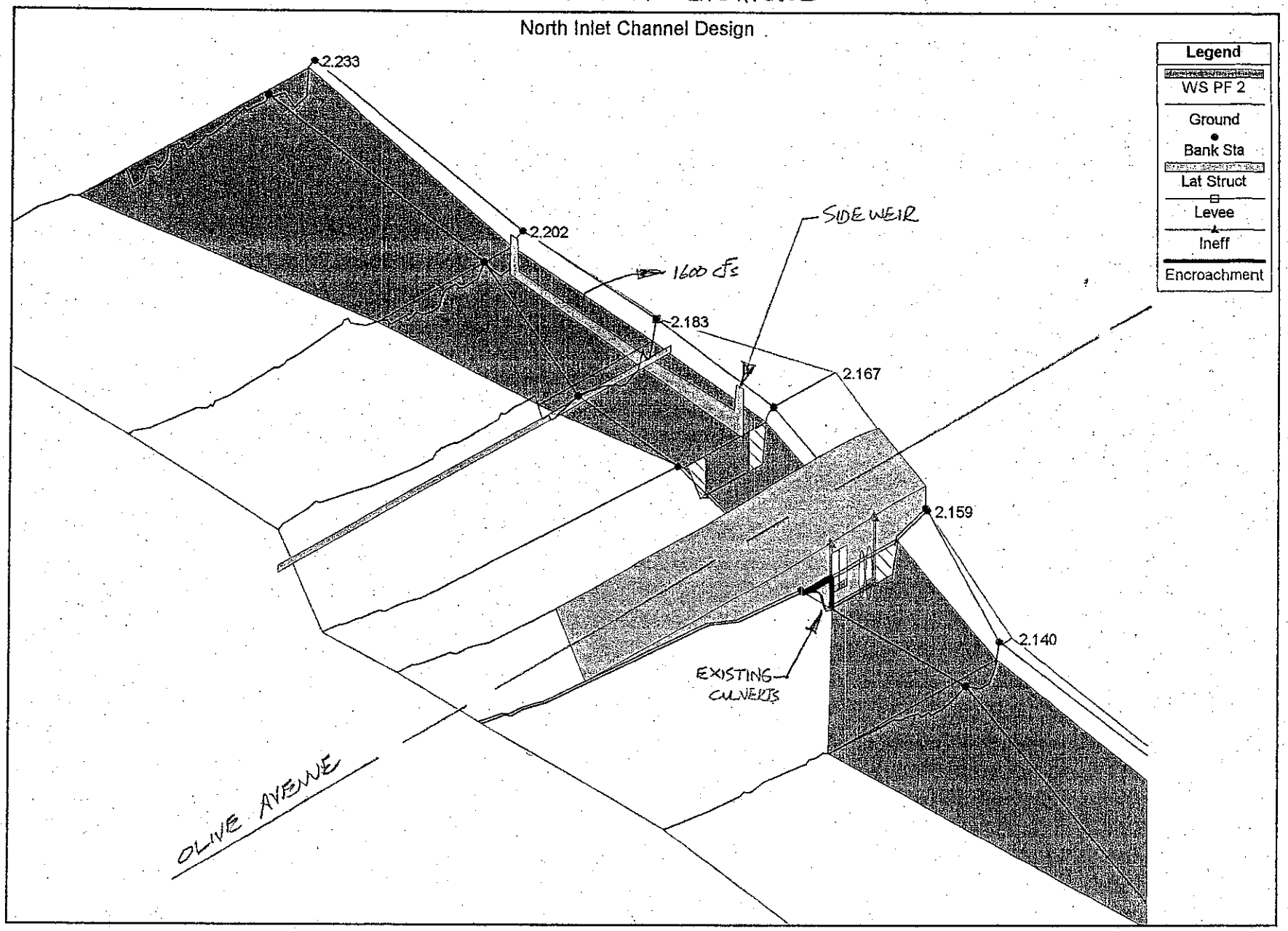
HEC-RAS Results



SIDE WEIR AT OLIVE AVENUE



SIDE WEIR AT OLIVE AVENUE



MODIFICATIONS TO STANDARD ADOT CULVERT DRAWINGS

Location	Standard No.	Parameter	Standard Value	Modified Value
Northern Avenue Wash Culvert Outlet	B-04.10	E	11' 0"	15' 6"
		G	11' 0"	15' 6"
	B-06.20	A	14' 3 3/4"	14' 8 7/8"
		B	62' 7 1/2"	53' 11 1/8"
		C	5' 2 1/2"	5' 4 3/8"
Northern Avenue Wash Box Culvert	B-02.40	H	8' 0"	6' 0"
Northern Avenue NIC Diversion Culvert Outlet	B-04.10	E	9' 6"	22' 0"
		G	9' 6"	22' 0"
	B-06.20	A	9' 5 1/4"	21' 2 1/4"
		B	52' 8 1/4"	41' 9 3/4"
		C	3' 5 1/4"	7' 8 1/2"
Northern Avenue NIC Diversion Culvert Inlet	B-04.30	E	8' 6"	12' 0"
		G	8' 6"	12' 0"
Olive Avenue NIC Diversion Culvert Outlet	B-04.10	E	9' 6"	12' 0"
		G	9' 6"	15' 6"
		Θ_1	70°	90°
		Θ_2	70°	45°
	B-06.20	A	7' 6"	12' 0"
		B	30' 10 1/4"	25' 2 3/8"
		C	14' 9 5/8"	12' 0"
		D	8' 6 5/8"	12' 0"

TABLE I
0' - 10' FILL

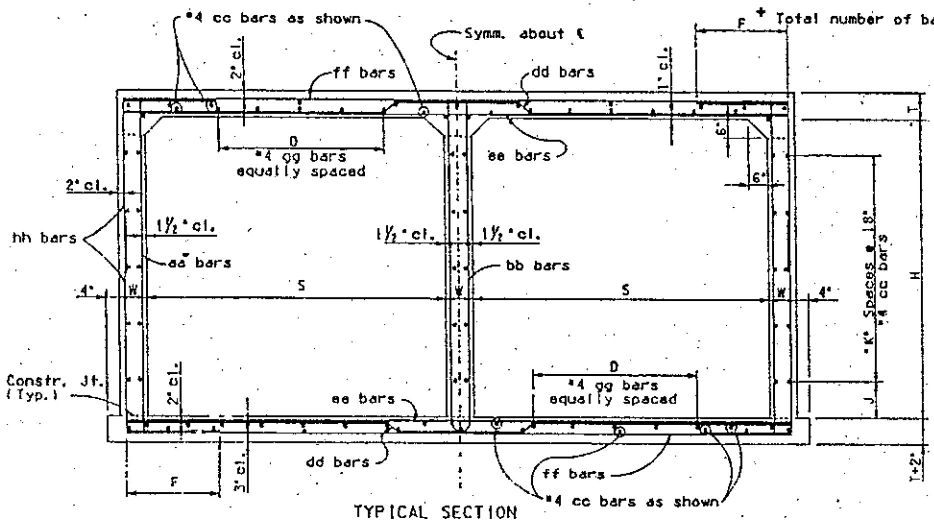
Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Bar Size	aa Spacing	aa Length	bb Bar Size	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	gg D	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	9½"	8"	5	12"	4'-4	5	12"	8'-9	48	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	5'-1	2'-5
	4'	9½"	8"	5	12"	5'-4	5	12"	10'-9	54	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	5'-7	2'-5
	5'	9½"	8"	5	12"	6'-4	5	12"	12'-9	54	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	6'-1	2'-5
	6'	9½"	8"	5	12"	7'-4	5	12"	14'-9	60	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	6'-7	2'-5
	7'	9½"	8"	5	12"	8'-4	5	12"	16'-9	66	5	13"	13'-2	4'-7	2'-7	6½"	5	13"	13'-7	5	13"	13'-7	20	3'-0	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	5	12"	4'-4	5	12"	8'-9	48	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	5'-6	2'-6
	4'	9½"	9"	5	12"	5'-4	5	12"	10'-9	54	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	6'-0	2'-6
	5'	9½"	9"	5	12"	6'-4	5	12"	12'-9	54	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	6'-6	2'-6
	6'	9½"	9"	5	12"	7'-4	5	12"	14'-9	60	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	7'-0	2'-6
	7'	9½"	9"	5	12"	8'-4	5	12"	16'-9	66	6	13"	17'-2	6'-1	3'-8	6½"	6	13"	17'-10	6	13"	17'-10	28	4'-0	5	6½"	7'-5	2'-6
	8'	9½"	9"	5	12"	9'-4	5	12"	18'-9	66	6	13"	17'-2	6'-1	3'-8	6½"	6	13"	17'-10	6	13"	17'-10	28	4'-0	6	6½"	8'-0	2'-6
10'	3'	10½"	11"	5	12"	4'-6	5	12"	9'-2	48	7	17"	21'-5	7'-7	4'-8	7½"	6	17"	22'-4	7	17"	22'-4	32	5'-0	6	8½"	6'-0	3'-0
	4'	10½"	11"	5	12"	5'-6	5	12"	11'-2	54	7	17"	21'-5	7'-7	4'-8	7½"	6	17"	22'-4	7	17"	22'-4	32	5'-0	6	8½"	6'-7	3'-0
	5'	10½"	11"	5	12"	6'-6	5	12"	13'-2	54	6	12"	21'-5	7'-7	4'-8	7½"	5	12"	22'-4	6	12"	22'-4	32	5'-0	5	6"	6'-8	2'-8
	6'	10½"	11"	5	12"	7'-6	5	12"	15'-2	60	6	12"	21'-5	7'-7	4'-8	7½"	5	12"	22'-4	6	12"	22'-4	32	5'-0	5	6"	7'-2	2'-8
	7'	10½"	11"	5	12"	8'-6	5	12"	17'-2	66	7	15"	21'-5	7'-7	4'-8	7½"	5	15"	22'-4	7	15"	22'-4	32	5'-0	5	7½"	7'-9	2'-8
	8'	10½"	11"	5	12"	9'-6	5	12"	19'-2	66	7	15"	21'-5	7'-7	4'-8	7½"	5	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	8'-3	2'-8
	9'	10½"	11"	5	12"	10'-6	5	12"	21'-2	72	7	15"	21'-5	7'-7	4'-8	7½"	6	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	8'-9	2'-8
	10'	10½"	11"	5	12"	11'-6	5	12"	23'-2	78	7	14"	21'-5	7'-7	4'-8	7½"	5	14"	22'-4	7	14"	22'-4	32	5'-0	6	7"	9'-3	2'-8
12'	8'	12½"	13"	5	12"	9'-10	5	12"	20'-0	66	7	13"	25'-8	9'-1	5'-6	9½"	5	13"	26'-10	7	13"	26'-10	40	6'-0	6	6½"	8'-6	2'-10
	9'	12½"	13"	5	12"	10'-10	5	12"	22'-0	72	8	16"	25'-8	9'-1	5'-6	9½"	5	16"	26'-10	8	16"	26'-10	40	6'-0	6	8"	9'-0	2'-10
	10'	12½"	13"	5	12"	11'-10	5	12"	24'-0	78	8	16"	25'-8	9'-1	5'-6	9½"	5	16"	26'-10	8	16"	26'-10	40	6'-0	6	8"	9'-6	2'-10
	11'	12½"	13"	5	12"	12'-10	5	12"	26'-0	78	7	12"	25'-8	9'-1	5'-6	9½"	4	12"	26'-10	7	12"	26'-10	40	6'-0	6	6"	10'-0	2'-10
	12'	12½"	13"	5	12"	13'-10	5	12"	28'-0	84	7	12"	25'-8	9'-1	5'-6	9½"	5	12"	26'-10	7	12"	26'-10	40	6'-0	6	6"	10'-6	2'-10

Olive Diversion Culvert

TABLE NO. II
10' - 15' FILL

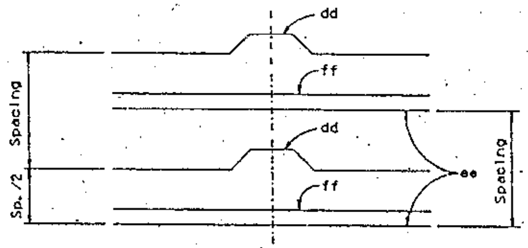
Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Bar Size	aa Spacing	aa Length	bb Bar Size	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	gg D	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	8"	8"	5	12"	4'-1	5	12"	8'-3	48	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	5'-0	2'-5
	4'	8"	8"	5	12"	5'-1	5	12"	10'-3	54	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	5'-6	2'-5
	5'	8"	8"	5	12"	6'-1	5	12"	12'-3	54	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	6'-0	2'-5
	6'	8"	8"	5	12"	7'-1	5	12"	14'-3	60	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	6'-6	2'-5
	7'	8"	8"	5	12"	8'-1	5	12"	16'-3	66	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	7'-0	2'-5
8'	3'	10½"	9"	5	12"	4'-6	5	12"	9'-2	48	6	13"	17'-3	6'-1	3'-6	7½"	5	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	5'-3	2'-6
	4'	10½"	9"	5	12"	5'-6	5	12"	11'-2	54	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	5'-9	2'-6
	5'	10½"	9"	5	12"	6'-6	5	12"	13'-2	54	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	6'-3	2'-6
	6'	10½"	9"	5	12"	7'-6	5	12"	15'-2	60	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	6'-9	2'-6
	7'	10½"	9"	5	12"	8'-6	5	12"	17'-2	66	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	7'-3	2'-6
	8'	10½"	9"	5	12"	9'-6	5	12"	19'-2	66	6	12"	17'-3	6'-1	3'-6	7½"	4	12"	17'-10	6	12"	17'-10	20	4'-0	4	6"	7'-9	2'-6
10'	3'	12½"	11"	5	12"	4'-10	5	12"	9'-10	48	7	14"	21'-6	7'-7	4'-4	9½"	4	14"	22'-4	7	14"	22'-4	24	5'-0	5	7"	5'-10	2'-8
	4'	12½"	11"	5	12"	5'-10	5	12"	11'-10	54	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	4	6½"	6'-4	2'-8
	5'	12½"	11"	5	12"	6'-10	5	12"	13'-10	54	7	14"	21'-6	7'-7	4'-4	9½"	4	14"	22'-4	7	14"	22'-4	24	5'-0	5	7"	6'-10	2'-8
	6'	12½"	11"	5	12"	7'-10	5	12"	15'-10	60	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	7'-4	2'-8
	7'	12½"	11"	5	12"	8'-10	5	12"	17'-10	66	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	7'-10	2'-8
	8'	12½"	11"	5	12"	9'-10	5	12"	19'-10	66	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	8'-4	2'-8
	9'	12½"	11"	5	12"	10'-10	5	12"	21'-10	72	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	8'-10	2'-8
	10'	12½"	11"	5	12"	11'-10	5	12"	23'-10	78	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	9'-4	2'-8
12'	8'	15"	13"	5	12"	10'-3	5	12"	20'-9	66	8	15"	25'-10	9'-1	5'-1	12"	4	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	8'-9	2'-11
	9'	15"	13"	5	12"	11'-3	5	12"	22'-9	72	8	15"	25'-10	9'-1	5'-1	12"	4	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	9'-3	2'-11
	10'	15"	13"	5	12"	12'-3	5	12"	24'-9	78	8	15"	25'-10	9'-1	5'-1	12"	5	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	9'-9	2'-11
	11'	15"	13"	5	12"	13'-3	5	12"	26'-9	78	8	14"	25'-10	9'-1	5'-1	12"	4	14"	26'-10	8	14"	26'-10	28	6'-0	5	7"	10'-9	3'-5
	12'	15"	13"	5	12"	14'-3	5	12"	28'-9	84	8	14"	25'-10	9'-1	5'-1	12"	5	14"	26'-10	8	14"	26'-10	28	6'-0	6	7"	11'-3	3'-5

+ Total number of bars in the cross-section.

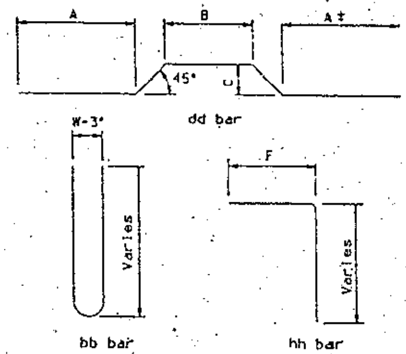


TYPICAL SECTION

Height "H"	"J" Dim.	"K" Spaces
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11'	12"	6
12'	9"	7



REINFORCING BAR PLACING DIAGRAM



BENDS

NOTE:

See B-02.25 for Tables III thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

NOTE:

Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 4-92
APPROVED FOR DISTRIBUTION	DOUBLE BARREL BOX CULVERT	STANDARD NO. B-02.20

DOUBLE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	1.172	172.1	1.039	167.5	1.172	177.7	1.305	190.0	1.437	187.7
	4	1.246	183.8	1.113	178.2	1.246	189.8	1.379	202.3	1.511	199.0
	5	1.320	191.6	1.187	187.0	1.320	197.8	1.453	210.7	1.585	206.3
	6	1.394	203.3	1.261	198.7	1.394	209.8	1.527	223.0	1.659	225.1
	7	1.468	224.5	1.335	210.5	1.468	221.8	1.601	235.4	1.734	237.5
8'	3	1.475	241.6	1.590	236.4	1.762	253.5	1.991	256.6	2.221	242.2
	4	1.558	274.9	1.673	248.5	1.845	265.8	2.075	268.9	2.304	253.5
	5	1.642	284.3	1.756	256.5	1.928	274.1	2.158	273.3	2.387	280.5
	6	1.725	291.6	1.840	268.5	2.012	286.5	2.241	289.6	2.471	292.8
	7	1.808	301.3	1.923	280.5	2.095	298.9	2.325	302.0	2.554	305.2
	8	1.892	337.1	2.006	304.5	2.178	307.2	2.406	310.3	2.637	313.5
10'	3	1.965	296.9	2.250	303.7	2.606	325.7	2.891	329.2	3.176	354.8
	4	2.067	310.0	2.352	333.8	2.708	337.8	2.993	341.2	3.278	367.1
	5	2.168	318.4	2.453	323.2	2.810	345.8	3.095	349.3	3.380	375.4
	6	2.270	330.7	2.555	353.9	2.912	357.8	3.197	361.3	3.481	387.8
	7	2.372	355.9	2.657	365.9	3.013	369.9	3.299	373.3	3.583	400.2
	8	2.474	364.5	2.759	373.5	3.115	377.5	3.400	381.3	3.685	408.5
	9	2.576	394.3	2.861	385.9	3.217	389.9	3.502	393.4	3.787	420.8
	10	2.678	410.1	2.963	358.0	3.319	401.5	3.604	405.4	3.889	434.4
12'	8	3.282	456.2	3.704	458.6	4.218	465.8	4.644	485.8	5.070	505.6
	9	3.403	453.7	3.828	471.6	4.339	477.5	4.765	504.1	5.190	519.0
	10	3.523	466.4	3.943	484.6	4.459	523.2	4.885	522.4	5.311	532.3
	11	3.643	523.5	4.063	491.1	4.580	532.5	5.005	536.9	5.431	541.6
	12	3.764	537.7	4.189	538.3	4.700	545.8	5.126	542.1	5.551	584.6

OLIVE DIVERSION CULVERT

TRIPLE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	1.687	237.6	1.493	231.1	1.687	244.7	1.882	261.0	2.076	262.9
	4	1.786	252.8	1.592	246.3	1.786	260.2	1.980	276.8	2.175	277.6
	5	1.885	262.6	1.690	256.1	1.885	270.3	2.079	287.2	2.274	287.0
	6	1.984	277.8	1.789	271.3	1.984	285.7	2.178	303.0	2.372	305.8
	7	2.082	305.2	1.888	286.5	2.082	301.2	2.277	318.8	2.471	321.5
8'	3	2.135	358.1	2.303	330.0	2.557	356.4	2.854	360.3	3.231	344.1
	4	2.246	374.8	2.415	348.2	2.668	372.2	3.005	376.1	3.343	358.8
	5	2.357	386.3	2.526	358.4	2.779	382.6	3.116	386.5	3.454	381.2
	6	2.468	403.0	2.637	373.8	2.890	398.4	3.227	402.3	3.565	407.0
	7	2.579	415.4	2.748	389.3	3.001	414.2	3.338	418.0	3.676	422.8
	8	2.690	453.3	2.859	420.9	3.112	424.6	3.450	428.5	3.787	433.2
10'	3	2.851	430.6	3.271	433.3	3.795	464.5	4.215	469.1	4.635	503.4
	4	2.987	446.4	3.406	472.5	3.931	479.9	4.351	484.5	4.771	519.2
	5	3.122	459.1	3.542	458.3	4.067	490.0	4.487	494.7	4.906	529.7
	6	3.258	474.9	3.678	500.0	4.203	505.5	4.622	510.1	5.042	545.4
	7	3.394	504.9	3.814	515.5	4.338	520.9	4.758	525.6	5.178	561.2
	8	3.550	516.0	3.950	525.6	4.474	531.1	4.894	535.7	5.314	571.6
	9	3.666	556.8	4.085	541.0	4.610	546.5	5.030	551.1	5.450	587.4
	10	3.801	574.5	4.221	556.5	4.746	562.0	5.166	566.6	5.585	604.3
12'	8	4.705	646.9	5.330	645.6	6.083	662.3	6.711	695.8	7.338	705.2
	9	4.863	649.1	5.491	660.0	6.244	677.5	6.871	711.7	7.498	722.0
	10	5.024	665.2	5.651	676.4	6.404	726.5	7.032	728.4	7.659	738.7
	11	5.184	733.7	5.812	695.0	6.565	737.9	7.192	745.0	7.820	750.2
	12	5.345	752.3	5.972	745.4	6.725	754.7	7.353	764.1	7.980	806.9

NORTHERN DIVERSION CULVERT

FOUR BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	2.203	305.2	1.947	295.8	2.203	313.5	2.459	334.3	2.716	340.3
	4	2.326	323.8	2.070	314.4	2.326	332.8	2.582	353.5	2.838	356.4
	5	2.450	335.7	2.193	326.3	2.450	345.0	2.706	366.0	2.962	369.9
	6	2.573	354.3	2.317	344.9	2.573	363.9	2.829	385.2	3.085	388.5
	7	2.697	388.1	2.440	363.5	2.697	382.8	2.953	404.4	3.209	401.7
8'	3	2.794	465.8	3.017	431.4	3.351	461.5	3.797	466.4	4.242	447.4
	4	2.933	486.0	3.156	450.3	3.490	480.7	3.936	485.6	4.381	465.6
	5	3.072	499.5	3.295	462.5	3.629	493.2	4.075	498.1	4.520	504.1
	6	3.211	518.8	3.434	481.3	3.768	512.4	4.213	517.3	4.659	523.3
	7	3.350	541.0	3.573	500.2	3.907	531.6	4.352	536.5	4.798	542.5
	8	3.489	581.0	3.712	539.7	4.046	544.2	4.481	549.1	4.931	555.0
10'	3	3.737	542.2	4.291	564.5	4.985	605.5	5.539	611.2	6.094	655.6
	4	3.907	561.5	4.461	615.2	5.154	624.3	5.709	630.1	6.263	674.8
	5	4.076	578.5	4.631	595.5	5.324	636.5	5.879	642.3	6.433	687.3
	6	4.246	597.1	4.801	648.2	5.494	655.4	6.048	661.2	6.603	706.5
	7	4.416	632.1	4.970	667.1	5.664	674.3	6.218	680.0	6.773	725.7
	8	4.586	645.2	5.140	679.3	5.833	686.5	6.388	692.2	6.942	738.2
	9	4.755	698.3	5.310	698.2	6.003	705.4	6.558	711.1	7.112	757.4
	10	4.925	717.3	5.480	717.1	6.173	724.9	6.727	730.0	7.282	777.8
12'	8	6.123	819.5	6.353	831.8	7.548	860.9	8.778	885.4	9.603	907.0
	9	6.324	826.6	7.153	851.6	8.149	879.5	8.978	915.6	9.808	927.7
	10	6.524	846.1	7.354	871.4	8.349	931.2	9.179	935.8	10.008	947.3
	11	6.725	926.2	7.555	901.1	8.550	944.7	9.379	954.4	10.209	960.8
	12	6.926	947.3	7.755	954.2	8.751	964.9	9.580	988.5	10.409	1032.1

FIVE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	2.718	369.1	2.400	364.3	2.718	386.4	3.036	411.2	3.354	421.8
	4	2.866	381.1	2.548	386.3	2.866	408.7	3.184	433.9	3.502	443.4
	5	3.014	405.1	2.697	400.3	3.014	423.0	3.332	448.5	3.650	457.0
	6	3.163	427.1	2.845	422.3	3.163	445.3	3.480	471.1	3.798	475.1
	7	3.311	467.6	2.993	444.3	3.311	467.6	3.629	493.7	3.947	497.7
8'	3	3.454	567.4	3.731	535.9	4.146	573.2	4.700	578.9	5.253	557.7
	4	3.621	591.0	3.898	558.6	4.313	595.9	4.866	601.5	5.420	579.3
	5	3.788	606.6	4.064	572.4	4.479	610.5	5.033	616.1	5.586	623.2
	6	3.954	630.2	4.231	594.7	4.646	633.1	5.200	638.8	5.753	645.4
	7	4.121	661.4	4.398	617.0	4.813	655.7	5.366	661.4	5.920	668.4
	8	4.288	702.8	4.564	664.6	4.979	670.3	5.533	676.0	6.086	683.0
10'	3	4.623	685.6	5.140	705.8	6.174	756.5	6.863	763.1	7.552	820.4
	4	4.827	708.3	5.516	768.0	6.378	778.8	7.067	785.4	7.756	843.0
	5	5.030	730.0	5.720	741.9	6.581	793.0	7.271	799.6	7.960	857.6
	6	5.234	752.6	5.923	806.5	6.785	815.3	7.474	821.9	8.164	880.2
	7	5.438	792.1	6.127	828.8	6.989	837.6	7.678	844.2	8.367	902.8
	8	5.641	808.0	6.331	843.1	7.192	851.9	7.882	858.5	8.571	917.4
	9	5.845	872.4	6.534	865.4	7.396	874.2	8.085	880.8	8.775	940.1
	10	6.049	894.1	6.738	887.7	7.600	896.5	8.289	903.1	8.978	963.9
12'	8	7.544	1025.0	8.575	1031.1	9.815	1072.9	10.844	1109.2	11.876	1122.1
	9	7.784	1031.5	8.816	1054.4	10.053	1095.0	11.085	1132.8	12.116	1145.7
	10	8.025	1060.4	9.057	1077.6	10.294	1150.9	11.326	1156.4	12.357	1169.3
	11	8.266	1151.9	9.297	1120.8	10.535	1166.5	11.566	1177.1	12.598	1184.9
	12	8.507	1176.3	9.538	1178.5	10.776	1190.3	11.807	1221.3	12.838	1269.1

SIX BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	3.234	431.8	2.854	415.4	3.234	439.6	3.613	467.0	3.993	481.4
	4	3.406	457.2	3.027	440.5	3.406	465.3	3.786	493.0	4.166	506.4
	5	3.579	473.3	3.200	457.0	3.579	481.1	3.959	509.7	4.338	522.1
	6	3.752	498.8	3.372	482.4	3.752	507.4	4.132	535.3	4.511	541.3
	7	3.925	545.3	3.545	507.9	3.925	533.3	4.306	561.8	4.684	567.3
8'	3	4.164	619.4	4.445	609.6	4.941	650.2	5.602	656.3	6.264	634.1
	4	4.304	706.4	4.639	635.3	5.139	676.2	5.797	682.6	6.458	659.1
	5	4.503	724.0	4.834	651.7	5.330	692.9	5.991	699.1	6.653	709.0
	6	4.697	751.1	5.028	677.4	5.524	718.9	6.186	725.1	6.847	735.1
	7	4.892	790.1	5.222	703.1	5.719	745.0	6.380	751.2	7.042	761.1
	8	5.086	834.3	5.417	756.6	5.913	761.3	6.575	767.8	7.236	777.8
10'	3	5.509	816.5	6.333	801.8	7.363	857.8	8.187	864.3	9.011	926.5
	4	5.747	842.6	6.571	873.6	7.601	883.5	8.425	890.0	9.249	952.6
	5	5.984	868.7	6.808	843.3	7.838	889.9	8.663	906.4	9.487	963.3
	6	6.222	894.7	7.046	916.3	8.076	925.6	8.900	932.1	9.724	995.3
	7	6.460	939.5	7.284	942.1	8.314	951.3	9.138	957.8	9.962	1021.3
	8	6.697	956.9	7.521	958.4	8.551	963.7	9.376	974.2	10.200	1038.0
	9	6.935	1032.7	7.759	984.1	8.789	993.4	9.613	999.9	10.437	1064.1
	10	7.173	1056.3	7.997	1005.9	9.027	1015.8	9.851	1025.6	10.675	1091.3
12'	8	8.964	1208.2	10.196	1172.4	11.637	1220.6	12.911	1257.4	14.144	1270.0
	9	9.245	1225.6	10.476	1199.5	11.858	1246.3	13.192	1284.4	14.425	1292.1
	10	9.526	1252.0	10.759	1226.2	12.239	1305.6	13.472	1311.4	14.706	1324.1
	11	9.807	1354.6	11.040	1277.5	12.520	1323.3	13.753	1334.3	14.987	1341.0
	12	10.088	1382.5	11.321	1339.2	12.801	1350.3	14.034	1395.4	15.267	1440.3

NOTE:

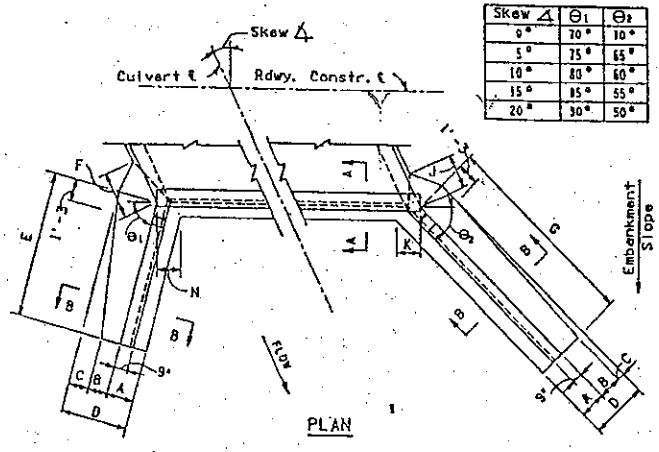
Quantities shown in tables are per lin. foot of culvert length.

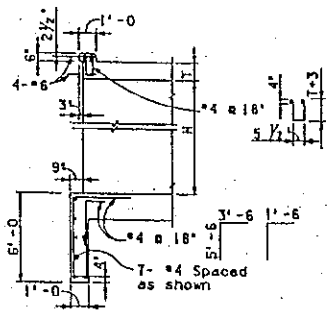
DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS		REVISION
APPROVED FOR DISTRIBUTION	CULVERT QUANTITIES		STANDARD NO. B-02.70

NORTHERN DIVERSION OUTLET
&
OLIVE DIVERSION OUTLET

NORTHERN WASH OUTLET

Skew Δ	θ1	θ2
0°	70°	70°
5°	75°	65°
10°	80°	60°
15°	85°	55°
20°	90°	50°



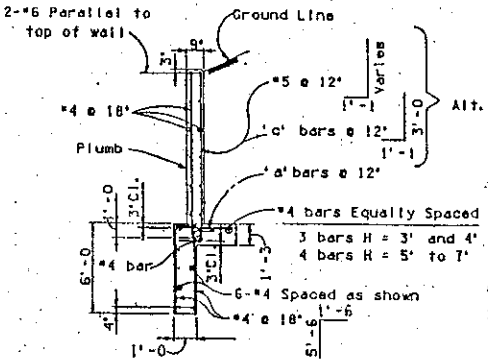


SECTION A-A

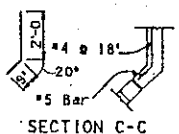
2 : 1 Slope Dimensions	Skew Δ	0°					5°					10°					15°					20°				
	Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
	A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
	B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
	C	4"	7"	1'-0	1'-5	1'-10	4"	7"	1'-0	1'-5	1'-10	5"	8"	1'-1	1'-6	1'-11	5"	8"	1'-1	1'-7	2'-0	6"	9"	1'-2	1'-7	2'-1
	D	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-8	3'-2	3'-8	4'-2	4'-8	2'-8	3'-2	3'-8	4'-3	4'-9	2'-9	3'-3	3'-9	4'-3	4'-10
	E	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-0	7'-6	9'-0	10'-6	12'-0	6'-0	7'-6	9'-0	10'-6	12'-0
	F	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
	G	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	10'-8	11'-6	13'-0	7'-0	8'-6	10'-0	12'-0	13'-6	7'-0	9'-0	10'-6	12'-6	14'-0	7'-6	9'-6	11'-0	13'-0	14'-6
	J	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
	K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
	L	1'-0	1'-4	1'-7	1'-11	2'-2	11"	1'-2	1'-6	1'-9	2'-0	10"	1'-1	1'-5	1'-8	1'-11	1'-1	1'-4	1'-7	1'-10	2'-1	1'-1	1'-4	1'-7	1'-10	2'-1
	M	1'-0	1'-4	1'-7	1'-11	2'-2	1'-1	1'-5	1'-6	1'-10	2'-2	1'-0	1'-5	1'-9	1'-10	2'-3	1'-2	1'-5	1'-9	1'-11	2'-4	1'-2	1'-5	1'-10	2'-1	2'-6
	N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-6	1'-6	1'-6	1'-6	1'-6

4 : 1 Slope Dimensions	Skew Δ	0°					5°					10°					15°					20°				
	Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
	A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
	B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
	C	4"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9	3"	6"	11"	1'-4	1'-9	3"	7"	1'-0	1'-5	1'-10
	D	2'-7	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-1	3'-7	4'-1	4'-7
	E	10'-0	12'-6	15'-0	17'-6	20'-0	10'-0	12'-6	15'-0	17'-0	19'-6	10'-0	12'-6	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6
	F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-9	2'-4	3'-0	3'-8
	G	10'-0	12'-6	15'-0	17'-6	20'-0	10'-6	13'-0	15'-6	18'-0	20'-6	10'-6	13'-0	16'-0	18'-6	21'-0	11'-0	13'-6	16'-0	19'-0	21'-6	11'-6	14'-0	17'-0	19'-6	22'-6
	J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-9	2'-4	3'-0	3'-8
	K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
	L	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-5	2'-11	3'-4	1'-7	2'-0	2'-6	2'-11	3'-3	1'-7	2'-1	2'-5	2'-10	3'-2	1'-7	2'-1	2'-5	2'-10	3'-2
	M	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-7	3'-0	3'-5	1'-9	2'-3	2'-7	3'-1	3'-6	1'-10	2'-4	2'-9	3'-2	3'-8	1'-10	2'-5	2'-10	3'-4	3'-9
	N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-6	1'-6	1'-6	1'-6	1'-6

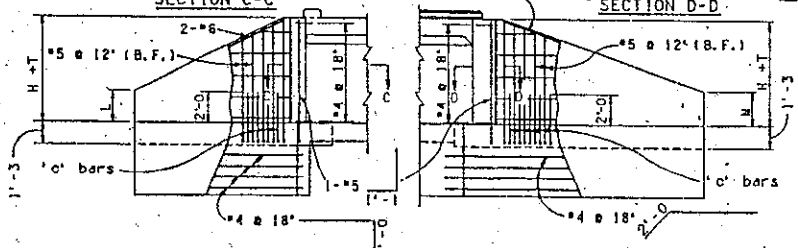
6 : 1 Slope Dimensions	Skew Δ	0°					5°					10°					15°					20°				
	Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
	A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
	B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
	C	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9	3"	6"	11"	1'-4	1'-9
	D	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6
	E	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	15'-6	18'-6	21'-6	24'-6	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0
	F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
	G	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	16'-0	19'-0	22'-0	25'-0	13'-0	16'-0	19'-6	22'-6	25'-6	13'-6	16'-6	20'-0	23'-0	26'-6	13'-6	17'-0	20'-6	23'-6	27'-0
	J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
	K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
	L	2'-1	2'-8	3'-2	3'-8	4'-3	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-1	4'-1
	M	2'-1	2'-8	3'-2	3'-8	4'-3	2'-2	2'-8	3'-2	3'-9	4'-3	2'-2	2'-9	3'-3	3'-10	4'-5	2'-3	2'-10	3'-4	3'-11	4'-5	2'-4	2'-11	3'-5	4'-1	4'-7
	N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-6	1'-6	1'-6	1'-6	1'-6



SECTION B-B

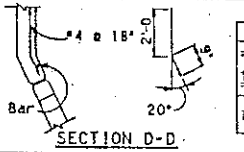


SECTION C-C



SHORT WING ELEVATION

LONG WING ELEVATION



SECTION D-D

Hgt. H	Slope	'c' bars Short Wing 0° to 10°	'c' bars Long Wing 0° to 20°
7'	2 : 1	3 - #5	3 - #5
	4 : 1	5 - #5	5 - #5

Height H	'a' bars Short Wing 0° to 20°	'a' bars Long Wing 0° & 5°	'a' bars Long Wing 10° to 20°
3'	#4	#4	#4
4'	#4	#4	#4
5'	#4	#4	#4
6'	#4	#4	#5
7'	#4	#4	#6

NOTE :

For General Notes and Miscellaneous Details see 8-01.10.
For Headwall Quantities see 8-05.10, 8-05.20 and 8-05.30.

DESIGN APPROVED

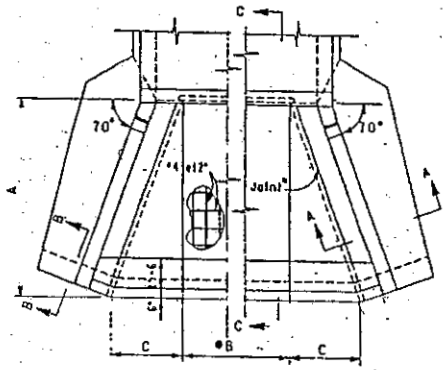
APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

OUTLET WINGS
CULVERT HEIGHT 3' to 7'
SKEW 0° to 20°

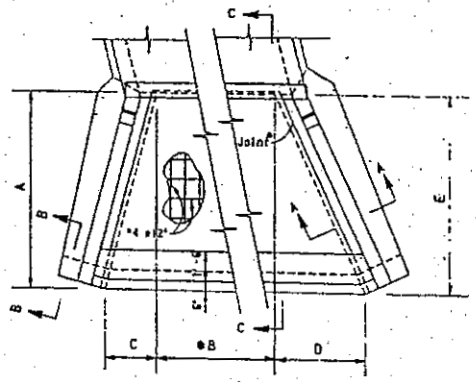
REVISION 7-88

STANDARD NO. 8-04.10



PLAN

Apron for 0° skew box culvert



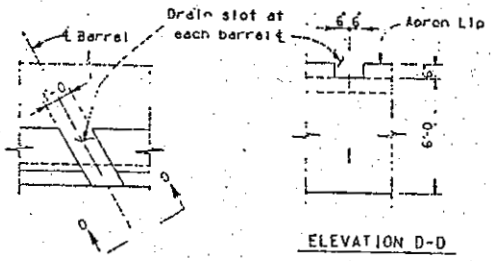
PLAN

Apron for 0° to 15° skew box culvert

* Optional construction joint. Apron may be poured with wingwall footings and bottom slab of barrel.

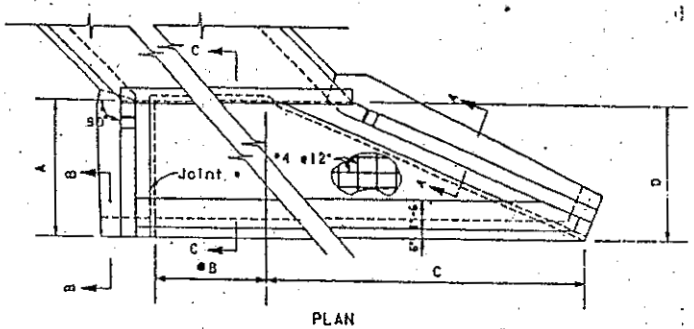
Span	0° Skew	5° Skew	10° Skew	15° Skew	20° Skew	25° Skew	30° Skew	35° Skew	40° Skew	45° Skew
	△									
6'	6'-8	6'-8¼	6'-9⅛	6'-10⅞	7'-1½	7'-4⅞	7'-8⅝	8'-1⅜	8'-8⅝	9'-5⅞
8'	8'-9	8'-9⅝	8'-10⅝	9'-0⅞	9'-3⅞	9'-7⅛	10'-1⅞	10'-8⅞	11'-5⅞	12'-4½
10'	10'-11	10'-11½	11'-1	11'-3⅝	11'-7⅝	12'-0½	12'-7⅞	13'-3⅞	14'-3	15'-5⅞
12'	13'-1	13'-1⅝	13'-3⅝	13'-6½	13'-11½	14'-5⅞	15'-1⅞	15'-11⅝	17'-1	18'-6

* Dimension varies with number of barrels. △ equals length to be added to dimension 'B' for each additional barrel.



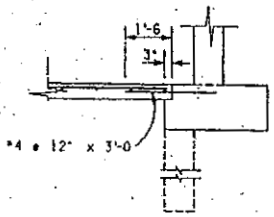
ELEVATION D-D

APRON DRAIN DETAIL

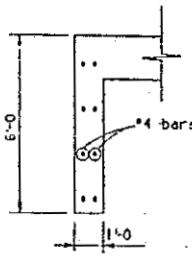


PLAN

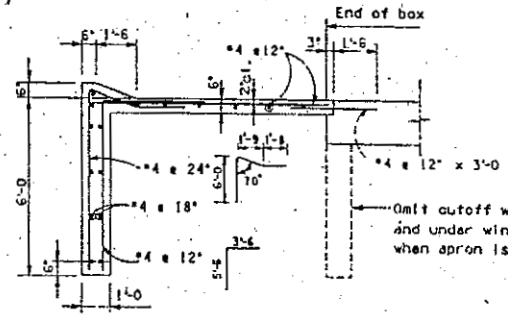
Apron for 20° to 45° skew box culvert



SECTION A-A



SECTION B-B



SECTION C-C

NOTES:

For General Notes and miscellaneous details see B-01.10.

See B-06.20, B-06.30 and B-06.40 for apron dimensions and quantities.

The apron quantities take into consideration the cutoff walls being omitted along outlet headwall and shall be used on new box culverts only.

DESIGN APPROVED

APPROVED FOR INSTRUCTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

CUTLET APRON DETAILS

STANDARD NO.
B-06.10

DIMENSIONS

Span	Hgt.	0° Skew A	0° Skew B	0° Skew C	5° Skew A	5° Skew B	5° Skew C	5° Skew D	5° Skew E	10° Skew A	10° Skew B	10° Skew C	10° Skew D	10° Skew E
6'	3'	6'-7 1/2	4'-8 1/4	2'-4 3/8	6'-8	4'-8 1/2	1'-9 3/4	3'-0 1/2	6'-6 1/4	6'-8	4'-9 1/4	1'-2 1/4	3'-11 1/4	6'-9 1/4
	4'	8'-0 3/4	4'-8 1/4	2'-11 1/4	8'-1 3/4	4'-8 1/2	2'-2 1/4	3'-8 1/4	7'-10 3/4	8'-1 3/4	4'-9 1/4	1'-5 1/4	4'-8 1/4	8'-1 3/4
	5'	9'-5 1/4	4'-8 1/4	3'-5 1/4	9'-6 1/4	4'-8 1/2	2'-6 1/4	4'-6 1/4	9'-8 3/4	9'-7 3/4	4'-9 1/4	1'-8 3/4	5'-5 1/4	9'-4 3/4
	6'	10'-10 1/4	4'-8 1/4	3'-11 3/4	11'-0 1/4	4'-8 1/2	2'-11 3/4	5'-1 3/4	11'-0 3/4	11'-1 1/4	4'-9 1/4	1'-11 1/4	6'-5 1/4	11'-1 1/4
	7'	12'-3 1/4	4'-8 1/4	4'-5 1/4	12'-5 1/2	4'-8 1/2	3'-4 1/4	5'-9 1/2	12'-5	12'-6 3/4	4'-9 1/4	2'-2 3/4	7'-2 1/4	12'-5 1/4
8'	3'	6'-7 1/2	6'-10 1/4	2'-4 3/8	6'-8	6'-10 1/2	1'-9 3/4	3'-0 1/2	6'-6 1/4	6'-8	6'-11 1/4	1'-2 1/4	3'-11 1/4	6'-9 1/4
	4'	8'-0 3/4	6'-10 1/4	2'-11 1/4	8'-1 3/4	6'-10 1/2	2'-2 1/4	3'-8 1/4	7'-10 3/4	8'-1 3/4	6'-11 1/4	1'-5 1/4	4'-8 1/4	8'-1 3/4
	5'	9'-5 1/4	6'-10 1/4	3'-5 1/4	9'-6 1/4	6'-10 1/2	2'-6 1/4	4'-6 1/4	9'-8 3/4	9'-7 3/4	6'-11 1/4	1'-8 3/4	5'-5 1/4	9'-4 3/4
	6'	10'-10 1/4	6'-10 1/4	3'-11 3/4	11'-0 1/4	6'-10 1/2	2'-11 3/4	5'-1 3/4	11'-0 3/4	11'-1 1/4	6'-11 1/4	1'-11 1/4	6'-5 1/4	11'-1 1/4
	7'	12'-3 1/4	6'-10 1/4	4'-5 1/4	12'-5 1/2	6'-10 1/2	3'-4 1/4	5'-9 1/4	12'-5	12'-6 3/4	6'-11 1/4	2'-2 3/4	7'-2 1/4	12'-5 1/4
	8'	14'-3 1/4	5'-9 1/2	5'-2 1/2	14'-0 1/2	5'-9 1/4	3'-9 1/4	6'-6 1/4	13'-11 3/4	14'-1 3/4	5'-10 1/2	2'-5 3/4	8'-0 3/4	13'-11 3/4
10'	3'	6'-7 1/2	9'-0 1/4	2'-4 3/8	6'-8	9'-0 3/4	1'-9 3/4	3'-0 1/2	6'-6 1/4	6'-8	9'-1 3/4	1'-2 1/4	3'-11 1/4	6'-9 1/4
	4'	8'-0 3/4	9'-0 1/4	2'-11 1/4	8'-1 3/4	9'-0 3/4	2'-2 1/4	3'-8 1/4	7'-10 3/4	8'-1 3/4	9'-1 3/4	1'-5 1/4	4'-8 1/4	8'-1 3/4
	5'	9'-5 1/4	9'-0 1/4	3'-5 1/4	9'-6 1/4	9'-0 3/4	2'-6 1/4	4'-6 1/4	9'-8 3/4	9'-7 3/4	9'-1 3/4	1'-8 3/4	5'-5 1/4	9'-4 3/4
	6'	10'-10 1/4	9'-0 1/4	3'-11 3/4	11'-0 1/4	9'-0 3/4	2'-11 3/4	5'-1 3/4	11'-0 3/4	11'-1 1/4	9'-1 3/4	1'-11 1/4	6'-5 1/4	11'-1 1/4
	7'	12'-3 1/4	9'-0 1/4	4'-5 1/4	12'-5 1/2	9'-0 3/4	3'-4 1/4	5'-9 1/2	12'-5	12'-6 3/4	9'-1 3/4	2'-2 3/4	7'-2 1/4	12'-5 1/4
	8'	14'-3 1/4	7'-11 1/2	5'-2 1/2	14'-0 1/2	7'-11 1/4	3'-9 1/4	6'-6 1/4	13'-11 3/4	14'-1 3/4	8'-0 3/4	2'-5 3/4	8'-0 3/4	13'-11 3/4
	9'	15'-9	7'-9 3/4	5'-8 1/4	15'-6 1/4	7'-9 3/4	4'-1 3/4	7'-4 3/4	15'-10	15'-7 1/2	7'-10 1/4	2'-9	9'-1 1/4	15'-9 1/4
	10'	17'-2 1/4	7'-7 1/4	6'-3	16'-11 3/4	7'-7 1/2	4'-6 3/4	8'-0 3/4	17'-2 1/4	17'-1 3/4	7'-8 1/2	3'-0 1/4	9'-10 1/2	17'-1 1/4
12'	8'	14'-3 1/4	10'-3 1/4	5'-2 1/2	14'-0 1/4	10'-3 3/4	3'-9 1/4	6'-6 1/4	13'-11 3/4	14'-1 3/4	10'-5 1/4	2'-5 3/4	8'-0 3/4	13'-11 3/4
	9'	15'-9	10'-1	5'-8 1/4	15'-6 1/2	10'-1 1/4	4'-1 3/4	7'-4 3/4	15'-10	15'-7 1/2	10'-3 1/4	2'-9	9'-1 1/4	15'-9 1/4
	10'	17'-2 1/4	9'-11 1/4	6'-3	16'-11 3/4	9'-11 3/4	4'-6 3/4	8'-0 3/4	17'-2 1/4	17'-1 3/4	10'-1	3'-0 1/4	9'-10 1/2	17'-1 1/4
	11'	18'-7 1/2	9'-9 1/4	6'-9 3/4	18'-5 3/4	9'-9 1/2	4'-11 3/4	8'-8 1/4	18'-7 1/2	18'-2 3/4	9'-10 1/4	3'-3 3/4	10'-3 1/4	18'-5 3/4
	12'	20'-0 1/4	9'-7	7'-3 3/4	19'-11 1/4	9'-7 3/4	5'-4 1/4	9'-4	20'-0 1/4	20'-1 1/4	9'-8 3/4	3'-6 1/4	11'-4 1/4	20'-2 3/4

Span	Hgt.	15° Skew A	15° Skew B	15° Skew C	15° Skew D	15° Skew E	20° Skew A	20° Skew B	20° Skew C	20° Skew D	25° Skew A	25° Skew B	25° Skew C	25° Skew D
6'	3'	6'-1 1/4	4'-10 1/4	6 3/8"	4'-7 3/4	6'-7 1/4	6'-0	4'-11 1/4	5'-7 1/2	6'-8 1/2	6'-0	5'-2 3/4	6'-8 3/4	6'-8 3/4
	4'	7'-7 1/4	4'-10 1/4	8"	5'-9 1/4	8'-2 1/4	7'-6	4'-11 1/4	6'-11	8'-2 3/4	7'-6	5'-2 3/4	8'-1 3/4	8'-1 3/4
	5'	9'-1 1/4	4'-10 1/4	9 1/2"	6'-7 1/2	9'-5 1/2	9'-0	4'-11 1/4	7'-10 1/2	9'-4 3/4	8'-6	5'-2 3/4	9'-2 1/4	9'-2 1/4
	6'	10'-7 1/4	4'-10 1/4	11 1/8"	7'-9 1/4	11'-1 1/4	10'-6	4'-11 1/4	9'-2	10'-11 1/4	10'-0	5'-2 3/4	10'-7 1/4	10'-7 1/4
	7'	12'-1	4'-10 1/4	1'-0 3/4	8'-7 3/4	12'-3 3/4	12'-0	4'-11 1/4	10'-1 1/2	12'-0 3/4	11'-6	5'-2 3/4	12'-0 1/4	12'-0 1/4
8'	3'	6'-1 1/4	7'-1 1/4	6 3/8"	4'-7 3/4	6'-7 1/4	6'-0	7'-3 3/4	5'-7 1/2	6'-8 1/2	6'-0	7'-7 3/4	6'-8 3/4	6'-8 3/4
	4'	7'-7 1/4	7'-1 1/4	8"	5'-9 1/4	8'-2 1/4	7'-6	7'-3 3/4	6'-11	8'-2 3/4	7'-6	7'-7 3/4	8'-1 3/4	8'-1 3/4
	5'	9'-1 1/4	7'-1 1/4	9 1/2"	6'-7 1/2	9'-5 1/2	9'-0	7'-3 3/4	7'-10 1/2	9'-4 3/4	8'-6	7'-7 3/4	9'-2 1/4	9'-2 1/4
	6'	10'-7 1/4	7'-1 1/4	11 1/8"	7'-9 1/4	11'-1 1/4	10'-6	7'-3 3/4	9'-2	10'-11 1/4	10'-0	7'-7 3/4	10'-7 1/4	10'-7 1/4
	7'	12'-1	7'-1 1/4	1'-0 3/4	8'-7 3/4	12'-3 3/4	12'-0	7'-3 3/4	10'-1 1/2	12'-0 3/4	11'-6	7'-7 3/4	12'-0 1/4	12'-0 1/4
	8'	13'-7 1/4	5'-11 1/4	1'-2 1/4	9'-8 3/4	13'-10 1/4	13'-6	6'-1 1/2	11'-8 1/4	13'-11 1/4	13'-0	6'-4 3/4	13'-9 1/2	13'-9 1/2
10'	3'	6'-1 1/4	9'-4	6 3/8"	4'-7 3/4	6'-7 1/4	6'-0	9'-7	5'-7 1/2	6'-8 1/2	13'-0	10'-0	6'-8 3/4	6'-8 3/4
	4'	7'-7 1/4	9'-4	8"	5'-9 1/4	8'-2 1/4	7'-6	9'-7	6'-11	8'-2 3/4	7'-6	10'-0	8'-1 3/4	8'-1 3/4
	5'	9'-1 1/4	9'-4	9 1/2"	6'-7 1/2	9'-5 1/2	9'-0	9'-7	7'-10 1/2	9'-4 3/4	8'-6	10'-0	9'-2 1/4	9'-2 1/4
	6'	10'-7 1/4	9'-4	11 1/8"	7'-9 1/4	11'-1 1/4	10'-6	9'-7	9'-2	10'-11 1/4	10'-0	10'-0	10'-7 1/4	10'-7 1/4
	7'	12'-1	9'-4	1'-0 3/4	8'-7 3/4	12'-3 3/4	12'-0	9'-7	10'-1 1/2	12'-0 3/4	11'-6	10'-0	12'-0 1/4	12'-0 1/4
	8'	13'-7 1/4	8'-2 3/4	1'-2 1/4	9'-8 3/4	13'-10 1/4	13'-6	8'-5 1/4	11'-8 1/4	13'-11 1/4	13'-0	8'-9 1/2	13'-9 1/2	13'-9 1/2
	9'	15'-1 1/4	8'-0 3/4	1'-3 3/4	10'-10 1/4	15'-6 3/4	15'-0	8'-2 3/4	13'-0 1/4	15'-6 1/2	14'-6	8'-7 1/4	15'-3 1/4	15'-3 1/4
	10'	16'-7 1/2	7'-10 1/4	1'-5 1/2	11'-9 1/4	16'-9 3/4	16'-5	8'-0 3/4	14'-0 1/4	16'-8 3/4	15'-6	8'-4 1/4	16'-4 3/4	16'-4 3/4
12'	8'	13'-7 1/4	10'-7 3/4	1'-2 1/4	9'-8 3/4	13'-10 1/4	13'-6	10'-11	11'-8 1/4	13'-11 1/4	13'-0	11'-4 3/4	13'-9 1/2	13'-9 1/2
	9'	15'-1 1/2	10'-5 3/4	1'-3 3/4	10'-10 1/4	15'-6 3/4	15'-0	10'-8 1/4	13'-0 1/4	15'-6 1/4	14'-6	11'-2	15'-3 1/4	15'-3 1/4
	10'	16'-7 1/2	10'-3 1/4	1'-5 1/2	11'-9 1/4	16'-9 3/4	16'-5	10'-6 3/4	14'-0 1/4	16'-8 3/4	15'-6	10'-11 3/4	16'-4 3/4	16'-4 3/4
	11'	18'-1 1/2	10'-1	1'-7	12'-11 3/4	18'-5 3/4	18'-0	10'-4 1/4	15'-4 1/4	18'-3 3/4	17'-0	10'-9 1/2	17'-10 1/4	17'-10 1/4
	12'	19'-7 1/2	9'-10 1/4	1'-8 3/4	13'-10 1/4	19'-8 1/4	19'-6	10'-1 1/4	16'-4 3/4	19'-6	18'-6	10'-6 1/4	19'-3 3/4	19'-3 3/4

Span	Hgt.	30° Skew A	30° Skew B	30° Skew C	30° Skew D	35° Skew A	35° Skew B	35° Skew C	35° Skew D	40° Skew A	40° Skew B	40° Skew C	40° Skew D	45° Skew A	45° Skew B	45° Skew C	45° Skew D
6'	3'	5'-6	5'-6 3/4	7'-10 3/4	6'-7 3/4	5'-6	5'-10 3/4	9'-1 1/2	6'-4 1/4	5'-0	6'-4 1/2	10'-10 3/4	6'-3 3/4	5'-0	6'-11 1/4	12'-5 1/4	5'-9 3/4
	4'	7'-0	5'-6 3/4	9'-5	7'-10 1/4	6'-6	5'-10 3/4	10'-9 1/4	7'-6 1/2	6'-6	6'-4 1/2	12'-7 1/4	7'-3 3/4	6'-0	6'-11 1/4	15'-1 1/4	7'-0 1/4
	5'	8'-0	5'-6 3/4	10'-11 3/4	9'-2 1/4	8'-0	5'-10 3/4	12'-9 1/4	8'-11 3/4	7'-6	6'-4 1/2	14'-3 3/4	8'-6 3/4	7'-0	6'-11 1/4	17'-5	8'-1 1/2
	6'	9'-6	5'-6 3/4	12'-5 1/4	10'-5 3/4	9'-0	5'-10 3/4	14'-5 3/4	10'-1 3/4	8'-6	6'-4 1/2	16'-11 3/4	9'-5 3/4	8'-6	6'-11 1/4	19'-8 1/4	9'-2 1/2
	7'	11'-0	5'-6 3/4	14'-0 1/4	11'-9	10'-6	5'-10 3/4	16'-1 1/4	11'-3 1/4	10'-0	6'-4 1/2	19'-1 3/4	11'-0 3/4	9'-6	6'-11 1/4	21'-11 3/4	10'-2 1/4
8'	3'	5'-6	8'-0 3/4	7'-10 3/4	6'-7 3/4	5'-6	8'-6 3/4	9'-1 1/2	6'-4 1/4	5'-0	9'-2 3/4	10'-10 3/4	6'-3 3/4	5'-0	9'-11 3/4	12'-5 1/4	5'-9 3/4
	4'	7'-0	8'-0 3/4	9'-5	7'-10 1/4	6'-6	8'-6 3/4	10'-9 1/4	7'-6 1/2	6'-6	9'-2 3/4	12'-7 1/4	7'-3 3/4	6'-0	9'-11 3/4	15'-1 1/4	7'-0 1/4
	5'	8'-0	8'-0 3/4	10'-11 3/4	9'-2 1/4	8'-0	8'-6 3/4	12'-9 1/4	8'-11 3/4	7'-6	9'-2 3/4	14'-3 3/4	8'-6 3/4	7'-0	9'-11 3/4	17'-5	8'-1 1/2
	6'	9'-6	8'-0 3/4	12'-5 1/4	10'-5 3/4	9'-0	8'-6 3/4	14'-5 3/4	10'-1 3/4	8'-6	9'-2 3/4	16'-11 3/4	9'-5 3/4	8'-6	9'-11 3/4	19'-8 1/4	9'-2 1/2
	7'	11'-0	8'-0 3/4	14'-0 1/4	11'-9	10'-6	8'-6 3/4	16'-1 1/4	11'-3 1/4	10'-0	9'-2 3/4	19'-1 3/4	11'-0 3/4	9'-6	9'-11 3/4	21'-11 3/4	10'-2 1/4
	8'	12'-0	6'-9	16'-0	13'-5 1/4	11'-6	7'-2 1/4	18'-8 3/4	13'-1 3/4	11'-0	7'-8 3/4	21'-7 1/4	12'-5 1/4	11'-0	8'-3 1/4	25'-3 3/4	10'-11 1/4
10'	3'	5'-6	10'-6 3/4	7'-10 3/4	6'-7 3/4	5'-6	11'-2 3/4	9'-1 1/2	6'-4 1/4	5'-0	12'-0 3/4	10'-10 3/4	6'-3 3/4	5'-0	13'-0 1/4	12'-5 1/4	5'-9 3/4
	4'	7'-0	10'-6 3/4	9'-5	7'-10 1/4	6'-6	11'-2 3/4	10'-9 1/4	7'-6 1/2	6'-6	12'-0 3/4	12'-7 1/4	7'-3 3/4	6'-0	13'-0 1/4	15'-1 1/4	7'-0 1/4
	5'	8'-0	10'-6 3/4	10'-11 3/4	9'-2 1/4	8'-0	11'-2 3/4	12'-9 1/4	8'-11 3/4	7'-6	12'-0 3/4	14'-3 3/4	8'-6 3/4	7'-0	13'-0 1/4	17'-5	8'-1 1/2
	6'	9'-6	10'-6 3/4	12'-5 1/4	10'-5 3/4	9'-0	11'-2 3/4	14'-5 3/4	10'-1 3/4	8'-6	12'-0 3/4	16'-11 3/4	9'-5 3/4	8'-6	13'-0 1/4	19'-8 1/4	9'-2 1/2
	7'	11'-0	10'-6 3/4	14'-0 1/4	11'-9	10'-6	11'-2 3/4	16'-1 1/4	11'-3 1/4	10'-0	12'-0 3/4	19'-1 3/4	11'-0 3/4	9'-6	13'-0 1/4	21'-11 3/4	10'-2 1/4
	8'	12'-0	9'-3	16'-0	13'-5 1/4	11'-6	9'-9 3/4	18'-8 3/4	13'-1 3/4	11'-0	10'-6 3/4	21'-7 1/4	12'-5 1/4	11'-0	11'-4 1/4	25'-3 3/4	11'-11 1/4
	9'	13'-6	9'-0 3/4	17'-7 1/4	14'-9 1/4	13'-0	9'-7 1/4	20'-5 1/4	14'-3 3/4	12'-6	10'-3 3/4	23'-10 1/4	13'-9 3/4	12'-0	11'-1 1/4	28'-0 1/4	13'-1
	10'	15'-0	8'-9 3/4	19'-2 3/4	16'-1 1/2	14'-0	9'-4 3/4	22'-7 1/4	15'-9 3/4	13'-6	10'-0 3/4	26'-2 3/4	15'-1 1/2	13'-0	10'-9 1/4	30'-5 3/4	14'-2 3/4
12'	8'	12'-0	11'-11 3/4	16'-0	13'-5 1/4	11'-6	12'-8 1/4	18'-8 3/4	13'-1 3/4	11'-0	13'-6 3/4	21'-7 1/4	12'-5 1/4	11'-0	14'-8 1/4	25'-3 3/4	11'-11 1/4
	9'	13'-6	11'-8 3/4	17'-7 1/4	14'-9 1/4	13'-0	12'-5 3/4	20'-5 1/4	14'-3 3/4	12'-6	13'-3 3/4	23'-10 1/4	13'-9 3/4	12'-0	14'-4 1/4	28'-0 1/4	13'-1
	10'	15'-0	11'-6 1/4	19'-2 3/4	16'-1 1/2	14'-0	12'-2 3/4	22'-7 1/4	15'-9 3/4	13'-6	13'-0 3/4	26'-2 3/4	15'-1 1/2	13'-0	14'-1 3/4	30'-5 3/4	14'-2 3/4
	11'	16'-0	11'-3 1/4	20'-9 3/4	17'-5 3/4	15'-6	11'-11 3/4	24'-4 1/4	17'-0 1/2	15'-0	12'-9 3/4	28'-5 3/4	16'-5 3/4	14'-6	13'-10	32'-11 1/4	15'-4 1/4
	12'	17'-6	11'-1 1/4	22'-5 1/4	18'-9 3/4	16'-6	11'-9 1/4	26'-0 3/4	18'-3 1/4	16'-0	12'-6 3/4	30'-4 1/4	17'-6 1/4	15'-6	13'-6 3/4	35'-5 3/4	16'-1 3/4

QUANTITIES

Span	Hgt.	0° Skew Conc. C.Y. 1Bbl.	0° Δc	0° Steel lbs. 1Bbl.	0° Δs	5° Skew Conc. C.Y. 1Bbl.	5° Δc	5° Steel lbs. 1Bbl.	5° Δs	10° Skew Conc. C.Y. 1Bbl.	10° Δc	10° Steel lbs. 1Bbl.	10° Δs	15° Skew Conc. C.Y. 1Bbl.	15° Δc	15° Steel lbs. 1Bbl.	15° Δs	20° Skew Conc. C.Y. 1Bbl.	20° Δc	20° Steel lbs. 1Bbl.	20° Δs
6'	3'	0.44	1.05	22	91	0.44	1.05	22	91	0.46	1.08	25	94	0.50	1.06	27	92	0.55	1.08	33	94
	4'	0.50	1.23	31	104	0.50	1.23	31	104	0.51	1.26	34	107	0.57	1.26	39	107	0.62	1.28	45	108
	5'	0.52	1.40	47	117	0.53	1.43	44	119	0.54	1.43	44	120	0.59	1.43	49	120	0.64	1.46	54	122
	6'	0.57	1.58	54	130	0.56	1.61	57	132	0.61	1.63	61	135	0.66	1.63	65	135	0.72	1.66	71	137
	7'	0.65	1.75	69	143	0.66	1.78	72	145	0.69	1.81	76	148	0.74	1.80	80	148	0.79	1.83	85	150
8'	3'	0.84	1.45	51	118	0.84	1.45	51	118	0.86	1.49	55	122	0.90	1.46	56	119	0.96	1.50	63	122
	4'	0.95	1.68	64	135	0.95	1.68	64	135	0.97	1.72	68	138	1.03	1.72	73	139	1.10	1.76	79	142
	5'	1.03	1.91	79	152	1.05	1.95	82	155	1.05	1.95	83	155	1.11	1.95	87	156	1.17	1.99	93	159
	6'	1.13	2.14	96	169	1.16	2.17	99	172	1.19	2.21	104	175	1.25	2.21	108	175	1.31	2.25	115	178
	7'	1.27	2.36	115	186	1.29	2.40	119	189	1.33	2.44	123	192	1.38	2.44	127	192	1.44	2.48	133	195
	8'	1.56	2.70	112	210	1.54	2.66	108	208	1.59	2.70	113	211	1.64	2.70	117	211	1.76	2.77	130	217
10'	3'	1.28	1.88	85	147	1.28	1.88	85	148	1.32	1.93	89	151	1.35	1.89	90	146	1.42	1.94	97	153
	4'	1.45	2.16	102	169	1.46	2.16	102	169	1.49	2.22	107	173	1.55	2.21	111	173	1.63	2.27	119	177
	5'	1.59	2.45	121	190	1.62	2.50	125	193	1.63	2.50	126	194	1.69	2.50	130	194	1.76	2.55	138	198
	6'	1.76	2.73	143	211	1.79	2.78	147	214	1.84	2.83	152	218	1.89	2.83	157	218	1.97	2.88	164	222
	7'	1.95	3.02	166	232	1.99	3.07	171	236	2.04	3.11	176	239	2.09	3.11	180	239	2.11	3.16	187	243
	8'	2.33	3.43	169	263	2.30	3.39	166	259	2.36	3.43	171	263	2.41	3.43	175	263	2.56	3.52	189	270
	9'	2.56	3.72	190	284	2.57	3.72	191	284	2.64	3.77	197	288	2.69	3.77	201	288	2.85	3.86	216	295
	10'	2.81	4.01	212	306	2.82	4.01	213	306	2.89	4.06	219	310	2.94	4.06	223	311	3.10	4.15	237	316
12'	8'	3.15	4.21	227	315	3.11	4.16	223	311	3.17	4.22	229	315	3.23	4.22	233	315	3.39	4.33	249	324
	9'	3.44	4.56	253	341	3.45	4.56	254	341	3.52	4.62	260	345	3.58	4.62	265	345	3.76	4.73	281	353
	10'	3.75	4.91	279	367	3.76	4.91	280	366	3.83	4.97	287	371	3.89	4.97	291	371	4.07	5.08	307	379
	11'	4.07	5.26	307	392	4.08	5.26	308	392	4.16	5.32	315	397	4.29	5.37	326	400	4.47	5.47	342	409
	12'	4.42	5.61	337	418	4.43	5.61	338	418	4.58	5.72	352	427	4.63	5.71	355	426	4.83	5.82	371	434

Span	Hgt.	25° Skew Conc. C.Y. 1Bbl.	25° Δc	25° Steel lbs. 1Bbl.	25° Δs	30° Skew Conc. C.Y. 1Bbl.	30° Δc	30° Steel lbs. 1Bbl.	30° Δs	35° Skew Conc. C.Y. 1Bbl.	35° Δc	35° Steel lbs. 1Bbl.	35° Δs	40° Skew Conc. C.Y. 1Bbl.	40° Δc	40° Steel lbs. 1Bbl.	40° Δs	45° Skew Conc. C.Y. 1Bbl.	45° Δc	45° Steel lbs. 1Bbl.	45° Δs
6'	3'	0.77	1.13	52	98	1.03	1.13	73	99	1.27	1.18	95	104	1.58	1.22	123	108	1.84	1.26	147	113
	4'	0.89	1.32	67	113	1.20	1.33	92	114	1.50	1.34	116	116	1.84	1.42	147	123	2.25	1.47	185	128
	5'	0.98	1.46	81	123	1.37	1.50	113	126	1.75	1.57	146	132	2.15	1.60	180	136	2.60	1.65	220	141
	6'	1.11	1.66	101	138	1.55	1.69	137	141	2.00	1.73	173	144	2.50	1.78	216	150	3.02	1.88	260	158
	7'	1.28	1.86	124	153	1.78	1.89	164	156	2.28	1.93	204	159	2.91	2.00	257	166	3.46	2.06	302	171
8'	3'	1.19	1.55	83	127	1.46	1.57	105	129	1.72	1.64	128	134	2.05	1.69	151	139	2.33	1.77	183	146
	4'	1.38	1.81	103	146	1.69	1.83	126	148	2.00	1.85	153	150	2.37	1.95	186	159	2.81	2.03	226	166
	5'	1.51	2.00	120	160	1.91	2.04	154	164	2.32	2.14	189	172	2.74	2.19	223	176	3.21	2.27	265	183
	6'	1.71	2.26	145	179	2.17	2.30	182	183	2.62	2.35	220	188	3.14	2.43	264	194	3.71	2.56	311	205
	7'	1.95	2.52	173	199	2.46	2.56	214	203	2.98	2.61	254	207	3.63	2.72	311	216	4.21	2.80	357	223
	8'	2.35	2.81	175	220	2.93	2.81	220	221	3.58	2.89	273	228	4.24	2.97	326	235	5.12	3.16	396	250
10'	3'	1.67	2.01	119	158	1.94	2.03	141	160	2.22	2.12	166	167	2.57	2.19	197	173	2.88	2.30	224	182
	4'	1.93	2.34	144	182	2.25	2.36	169	184	2.56	2.39	195	187	2.97	2.52	230	198	3.43	2.63	272	206
	5'	2.11	2.57	165	199	2.52	2.63	199	204	2.96	2.75	236	214	3.40	2.82	273	220	3.90	2.92	316	228
	6'	2.38	2.89	195	224	2.85	2.95	233	228	3.32	3.02	272	234	3.87	3.12	318	241	4.47	3.29	368	255
	7'	2.68	3.22	228	248	3.21	3.28	270	253	3.74	3.34	312	258	4.43	3.48	370	269	5.03	3.58	419	277
	8'	3.16	3.58	236	275	3.74	3.59	281	276	4.42	3.69	336	284	5.10	3.80	390	293	6.03	4.04	465	311
	9'	3.52	3.91	268	299	4.16	3.92	317	300	4.91	4.03	376	309	5.75	4.17	444	320	6.69	4.35	518	334
	10'	3.80	4.15	291	317	4.62	4.25	355	325	5.48	4.34	426	332	6.38	4.48	497	343	7.37	4.65	574	357
12'	8'	4.01	4.40	297	329	4.60	4.42	342	330	5.31	4.55	399	340	6.02	4.69	455	351	7.01	4.99	534	373
	9'	4.44	4.80	334	359	5.09	4.82	383	360	5.87	4.95	445	370	6.75	5.13	514	384	7.73	5.35	592	400
	10'	4.78	5.08	361	380	5.63	5.21	427	389	6.50	5.32	499	398	7.44	5.50	572	411	8.48	5.72	652	427
	11'	5.26	5.48	402	409	6.12	5.54	469	414	7.13	5.72	549	427	8.26	5.95	638	441	9.39	6.37	722	461
	12'	5.77	5.88	445	439	6.71	5.94	517	444	7.72	6.05	598	452	8.91	6.27	690	468	10.36	6.57	800	491

NOTATIONS:

Δc = Apron concrete quantity per additional barrel.

Δs = Apron steel quantity per additional barrel.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

OUTLET APRON
DIMENSIONS & QUANTITIES
2 : 1 SLOPE

REVISION 7-86

STANDARD NO. B-06.20

Northern Diversion Culvert Analysis and Design

The diversion culvert at Northern Ave. was analyzed using HEC-RAS and CulvertMaster as follows:

1) Flows and elevations used in CulvertMaster to determine that a 3-barrel 10'X 5' box culvert is needed. With the culvert the headwater elevation is 1227.66. **Please note that the HEC-RAS model was run with a 4 barrel box which was the design before NIC-South was proposed. The NIC South proposed project will allow the use of a 3 barrel box and will lower the water surface profile substantially. The revised HEC-RAS model will be submitted with the NIC-South design.**
2) ADOT standard drawings used for design of culvert and inlet wing walls.
3) A modified ADOT standard drawing used for outlet wing walls. The wing wall lengths were extended from 11' to 15.5' to ensure that the slope and stability of the soil behind the walls would be maintained. This is because of approximate 15' from culvert invert to top of roadway behind the headwall.

Results:

- Culvert at Northern Ave. diversion to be ADOT standard 3-barrel 10' x 5' box culvert.
- ADOT standard inlet wing walls to be used.
- ADOT standard outlet wing walls to be modified to 15.5'.
- Conjoined headwall and apron provided to allow the addition of a future stepped concrete drop structure under the NIC- South project.

Culvert Designer/Analyzer Report
Northern Ave (Diversion Structure)

Peak Discharge Method: User-Specified			
Design Discharge	1,600.00 cfs	Check Discharge	0.00 cfs

Grades Model: Inverts			
Invert Upstream	1,220.00 ft	Invert Downstream	1,217.75 ft
Length	336.00 ft	Slope	0.006696 ft/ft
Drop	2.25 ft		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	1,221.18 ft

Name	Description	Discharge	HW Elev.	Velocity
x Trial-2	3-10 x 5 ft Box	1,600.00 cfs	1,227.66 ft	

Culvert Designer/Analyzer Report
Northern Ave (Diversion Structure)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	ft	Storm Event	Design	
Computed Headwater Elev	1,227.66	ft	Discharge	1,600.00	cfs
Headwater Depth/Height	1.53		Tailwater Elevation	1,221.18	ft
Inlet Control HW Elev.	1,227.66	ft	Control Type	Inlet Control	
Outlet Control HW Elev.	1,227.13	ft			

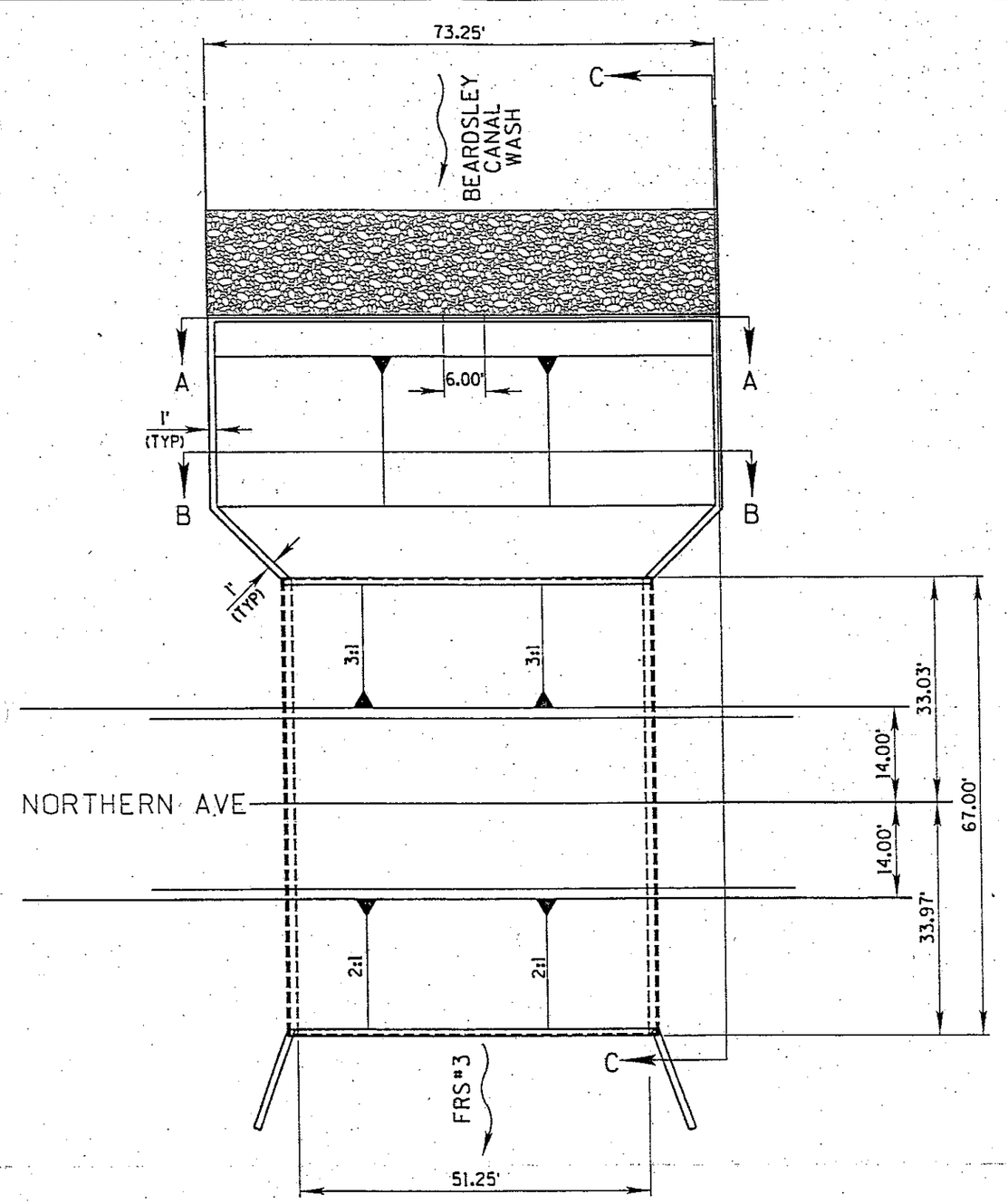
Grades					
Upstream Invert	1,220.00	ft	Downstream Invert	1,217.75	ft
Length	336.00	ft	Constructed Slope	0.006696	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	3.57	ft
Slope Type	Steep		Normal Depth	3.52	ft
Flow Regime	Supercritical		Critical Depth	4.45	ft
Velocity Downstream	14.93	ft/s	Critical Slope	0.003500	ft/ft

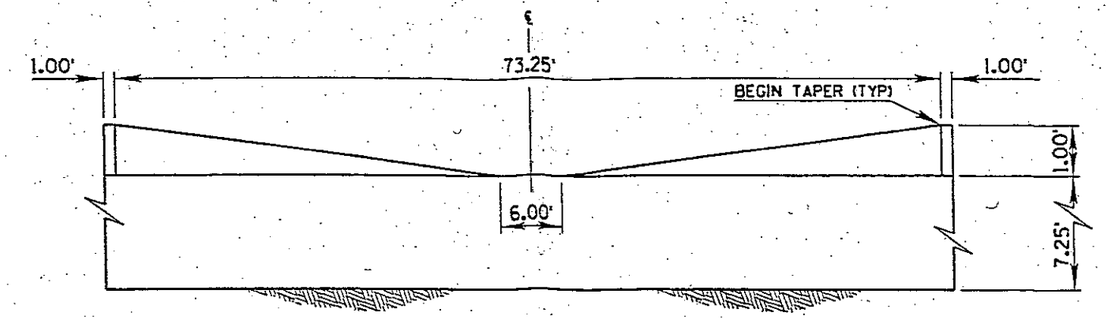
Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 5 ft		Rise	5.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	1,227.13	ft	Upstream Velocity Head	2.23	ft
Ke	0.20		Entrance Loss	0.45	ft

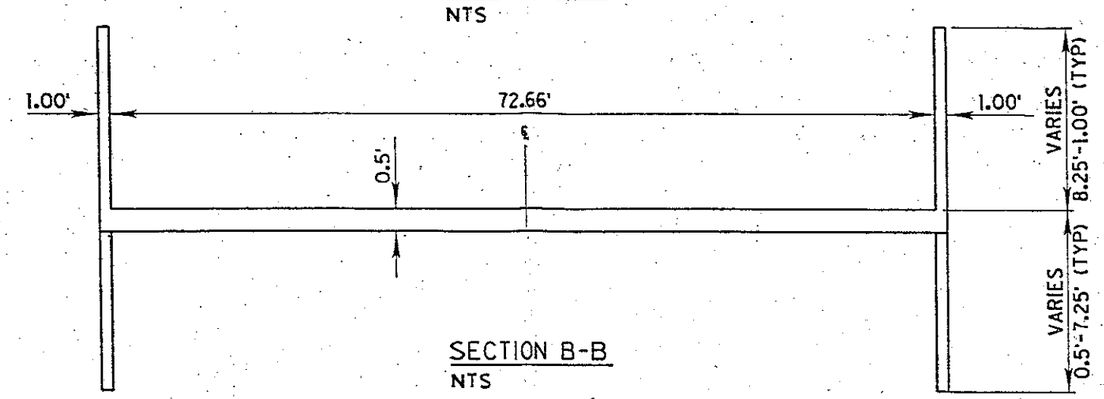
Inlet Control Properties					
Inlet Control HW Elev.	1,227.66	ft	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	150.0	ft²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				



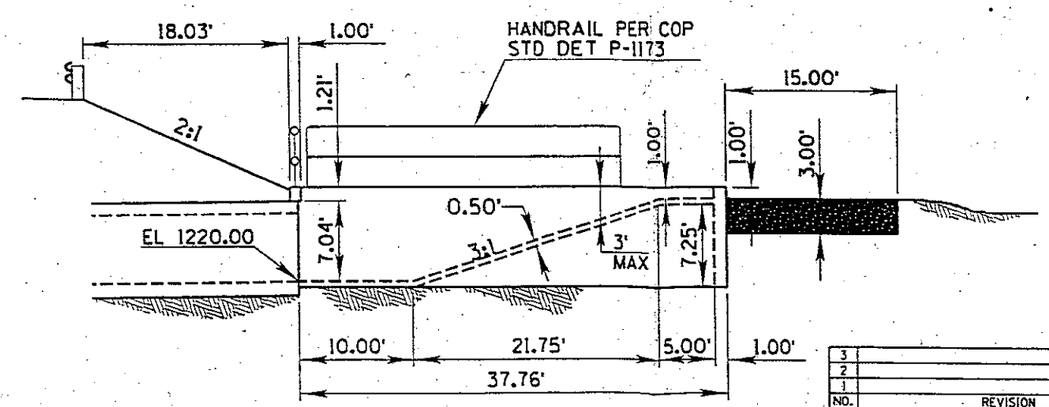
NORTHERN WASH DROP STRUCTURE
NTS



SECTION A-A
NTS



SECTION B-B
NTS



SECTION C-C
NTS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

DRAWING NO. DS2

BCW @ NORTHERN CULVERT INLET DETAIL

SHEET OF X XXX

MODIFICATIONS TO STANDARD ADOT CULVERT DRAWINGS

Location	Standard No.	Parameter	Standard Value	Modified Value
Northern Avenue Wash Culvert Outlet	B-04.10	E	11' 0"	15' 6"
		G	11' 0"	15' 6"
	B-06.20	A	14' 3 3/4"	14' 8 7/8"
		B	62' 7 1/2"	53' 11 1/8"
		C	5' 2 1/2"	5' 4 3/8"
Northern Avenue Wash Box Culvert	B-02.40	H	8' 0"	6' 0"
Northern Avenue NIC Diversion Culvert Outlet	B-04.10	E	9' 6"	22' 0"
		G	9' 6"	22' 0"
	B-06.20	A	9' 5 1/4"	21' 2 1/4"
		B	52' 8 1/4"	41' 9 3/4"
		C	3' 5 1/4"	7' 8 1/2"
Northern Avenue NIC Diversion Culvert Inlet	B-04.30	E	8' 6"	12' 0"
		G	8' 6"	12' 0"
Olive Avenue NIC Diversion Culvert Outlet	B-04.10	E	9' 6"	12' 0"
		G	9' 6"	15' 6"
		Θ_1	70°	90°
		Θ_2	70°	45°
	B-06.20	A	7' 6"	12' 0"
		B	30' 10 1/4"	25' 2 3/8"
		C	14' 9 5/8"	12' 0"
		D	8' 6 5/8"	12' 0"

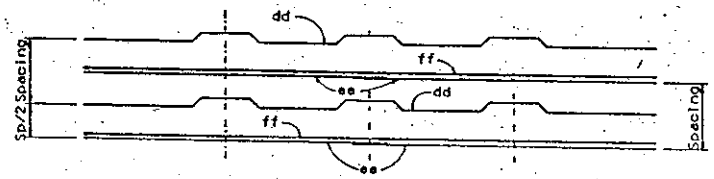
TABLE I
0'-10' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	9½"	6"	12"	4'-6	12"	8'-9	88	5	14"	21'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	5'-1	2'-5
	4'	9½"	6"	12"	5'-4	12"	10'-9	98	5	14"	21'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	5'-7	2'-5
	5'	9½"	6"	12"	6'-4	12"	12'-9	98	5	14"	21'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	6'-1	2'-5
	6'	9½"	6"	12"	7'-4	12"	14'-9	108	5	14"	21'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	6'-7	2'-5
	7'	9½"	6"	12"	8'-4	12"	16'-9	118	5	13"	21'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	40	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	12"	4'-4	12"	8'-9	88	6	14"	35'-7	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	5	7"	5'-5	2'-6
	4'	9½"	9"	12"	5'-4	12"	10'-9	98	6	14"	35'-7	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	5	7"	6'-0	2'-6
	5'	9½"	9"	12"	6'-4	12"	12'-9	98	6	14"	35'-7	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	5	7"	6'-6	2'-6
	6'	9½"	9"	12"	7'-4	12"	14'-9	108	6	14"	35'-7	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	5	7"	6'-11	2'-6
	7'	9½"	9"	12"	8'-4	12"	16'-9	118	6	13"	35'-7	6'-1	3'-8	6½"	4'-2	6	13"	18'-3	6	13"	35'-4	56	5	6½"	7'-5	2'-6
	8'	9½"	9"	12"	9'-4	12"	18'-9	118	6	13"	35'-7	6'-1	3'-8	6½"	4'-2	6	13"	18'-3	6	13"	35'-4	56	5	6½"	8'-0	2'-6
10'	3'	10½"	11"	12"	4'-4	12"	8'-2	88	7	17"	44'-2	7'-1	4'-8	7½"	5'-2	6	17"	22'-8	7	17"	44'-2	64	6	8½"	6'-1	3'-0
	4'	10½"	11"	12"	5'-4	12"	11'-2	98	7	17"	44'-2	7'-1	4'-8	7½"	5'-2	6	17"	22'-8	7	17"	44'-2	64	6	8½"	6'-7	3'-0
	5'	10½"	11"	12"	6'-4	12"	13'-2	98	6	12"	44'-2	7'-1	4'-8	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	6"	6'-8	2'-8
	6'	10½"	11"	12"	7'-4	12"	15'-2	108	6	12"	44'-2	7'-1	4'-8	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	6"	7'-2	2'-8
	7'	10½"	11"	12"	8'-4	12"	17'-2	116	7	15"	44'-2	7'-1	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	7'-9	2'-8
	8'	10½"	11"	12"	9'-4	12"	19'-2	118	7	15"	44'-2	7'-1	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	8'-3	2'-8
	9'	10½"	11"	12"	10'-4	12"	21'-2	128	7	15"	44'-2	7'-1	4'-8	7½"	5'-2	6	15"	22'-8	7	15"	44'-2	64	6	7½"	8'-8	2'-8
	10'	10½"	11"	12"	11'-4	12"	23'-2	138	7	14"	44'-2	7'-1	4'-8	7½"	5'-2	5	14"	22'-8	7	14"	44'-2	64	6	7"	9'-3	2'-8
12'	8'	12½"	13"	12"	9'-10	12"	20'-0	118	7	13"	53'-0	8'-1	5'-6	8½"	6'-2	5	13"	26'-0	7	13"	53'-0	88	6	6½"	8'-7	2'-10
	9'	12½"	13"	12"	10'-10	12"	22'-0	128	8	16"	53'-0	8'-1	5'-6	8½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	6	8"	9'-1	2'-10
	10'	12½"	13"	12"	11'-10	12"	24'-0	138	8	16"	53'-0	8'-1	5'-6	8½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	6	8"	9'-7	2'-10
	11'	12½"	13"	12"	12'-10	12"	26'-0	138	7	12"	53'-0	8'-1	5'-6	8½"	6'-2	4	12"	27'-0	7	12"	53'-0	88	6	6"	10'-1	2'-10
	12'	12½"	13"	12"	13'-10	12"	28'-0	148	7	12"	53'-0	8'-1	5'-6	8½"	6'-2	5	12"	27'-0	7	12"	53'-0	88	6	6"	10'-7	2'-10

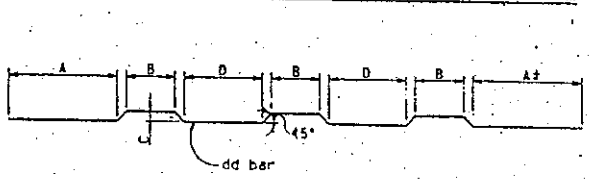
+ Total number of bars in the cross-section.

NORTHERN DIVERSION CULVERT

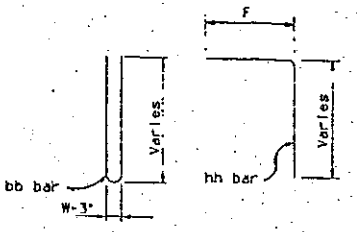
NORTHERN WASH CULVERT

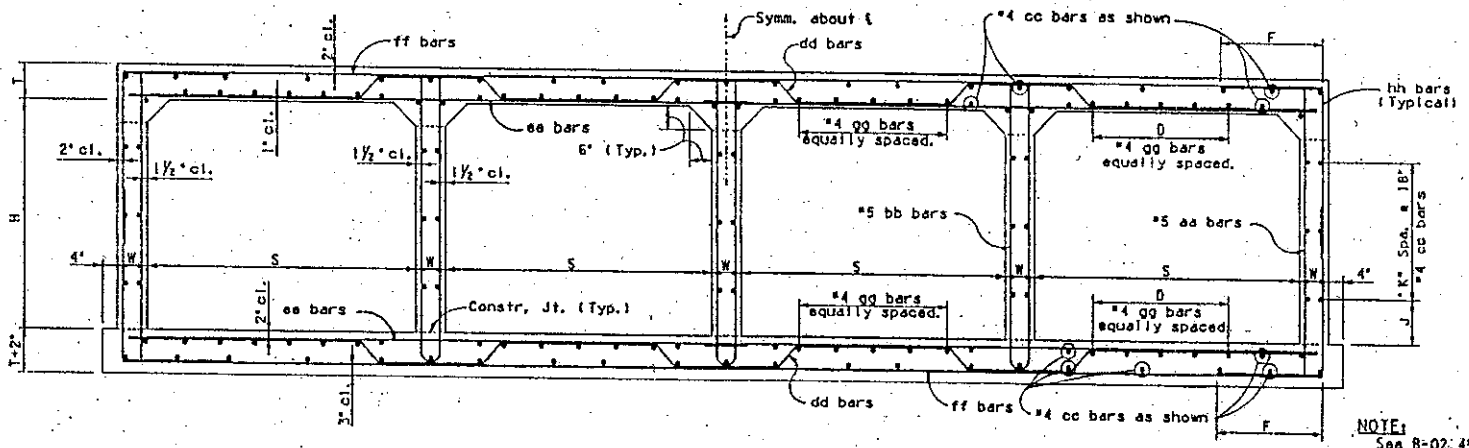


REINFORCING BAR PLACING DIAGRAM



BENDS





Height "H"	Dia. "J"	Spaces "K"
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11	12"	6
12'	9"	7

TYPICAL SECTION

NOTE:
Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.

NOTE:
See B-02.45 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

FOUR BARREL
BOX CULVERT

REVISION 4-92

STANDARD NO. B-02.40

	No.	Description of Revision	Made By	Date
	1	Total Redesign of Box	J.H.	1-88
	2			
	3			
	4			

TABLE II
10'-15' FILL

Span "S"	Height "R"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	8"	8"	12"	4'-1"	12"	8'-0"	88	5	14"	26'-11"	4'-7"	2'-10"	5"	3'-1"	5	14"	14'-0"	5	14"	26'-11"	32	4	7"	5'-0"	2'-5"
	4'	8"	8"	12"	5'-1"	12"	10'-0"	98	5	14"	26'-11"	4'-7"	2'-10"	5"	3'-1"	5	14"	14'-0"	5	14"	26'-11"	32	4	7"	5'-6"	2'-5"
	5'	8"	8"	12"	6'-1"	12"	12'-0"	98	5	14"	26'-11"	4'-7"	2'-10"	5"	3'-1"	5	14"	14'-0"	5	14"	26'-11"	32	4	7"	6'-0"	2'-5"
	6'	8"	8"	12"	7'-1"	12"	14'-0"	108	5	14"	26'-11"	4'-7"	2'-10"	5"	3'-1"	5	14"	14'-0"	5	14"	26'-11"	32	4	7"	6'-6"	2'-5"
	7'	8"	8"	12"	8'-1"	12"	16'-0"	118	5	14"	26'-11"	4'-7"	2'-10"	5"	3'-1"	5	14"	14'-0"	5	14"	26'-11"	32	4	7"	7'-0"	2'-5"
8'	3'	10½"	9"	12"	4'-6"	12"	9'-2"	88	6	13"	35'-9"	6'-1"	3'-6"	7½"	4'-2"	5	13"	18'-3"	6	13"	35'-4"	40	4	6½"	5'-3"	2'-6"
	4'	10½"	9"	12"	5'-6"	12"	11'-2"	98	6	13"	35'-9"	6'-1"	3'-6"	7½"	4'-2"	4	13"	18'-3"	6	13"	35'-4"	40	4	6½"	5'-9"	2'-6"
	5'	10½"	9"	12"	6'-6"	12"	13'-2"	98	6	13"	35'-9"	6'-1"	3'-6"	7½"	4'-2"	4	13"	18'-3"	6	13"	35'-4"	40	4	6½"	6'-3"	2'-6"
	6'	10½"	9"	12"	7'-6"	12"	15'-2"	108	6	13"	35'-9"	6'-1"	3'-6"	7½"	4'-2"	4	13"	18'-3"	6	13"	35'-4"	40	4	6½"	6'-9"	2'-6"
	7'	10½"	9"	12"	8'-6"	12"	17'-2"	118	6	13"	35'-9"	6'-1"	3'-6"	7½"	4'-2"	4	13"	18'-3"	6	13"	35'-4"	40	4	6½"	7'-3"	2'-6"
	8'	10½"	9"	12"	9'-6"	12"	19'-2"	118	6	12"	35'-9"	6'-1"	3'-6"	7½"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-9"	2'-6"
10'	3'	12½"	11"	12"	4'-10"	12"	9'-8"	88	7	14"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	14"	22'-8"	7	14"	44'-2"	48	5	7"	5'-10"	2'-8"
	4'	12½"	11"	12"	5'-10"	12"	11'-8"	98	7	13"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	4	6½"	6'-4"	2'-8"
	5'	12½"	11"	12"	6'-10"	12"	13'-8"	98	7	14"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	14"	22'-8"	7	14"	44'-2"	48	5	7"	6'-10"	2'-8"
	6'	12½"	11"	12"	7'-10"	12"	15'-8"	108	7	13"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	7'-4"	2'-8"
	7'	12½"	11"	12"	8'-10"	12"	17'-8"	118	7	13"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	7'-10"	2'-8"
	8'	12½"	11"	12"	9'-10"	12"	19'-8"	118	7	13"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	8'-4"	2'-8"
	9'	12½"	11"	12"	10'-10"	12"	21'-8"	128	7	13"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	8'-10"	2'-8"
	10'	12½"	11"	12"	11'-10"	12"	23'-8"	138	7	13"	44'-7"	7'-7"	4'-4"	9½"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	9'-4"	2'-8"
12'	8'	15"	13"	12"	10'-3"	12"	20'-6"	118	8	15"	53'-6"	9'-1"	5'-1"	12"	6'-2"	4	15"	27'-0"	8	15"	53'-0"	56	6	7½"	8'-10"	2'-11"
	9'	15"	13"	12"	11'-3"	12"	22'-6"	128	8	15"	53'-6"	9'-1"	5'-1"	12"	6'-2"	4	15"	27'-0"	8	15"	53'-0"	56	6	7½"	9'-4"	2'-11"
	10'	15"	13"	12"	12'-3"	12"	24'-6"	138	8	15"	53'-6"	9'-1"	5'-1"	12"	6'-2"	5	15"	27'-0"	8	15"	53'-0"	56	6	7½"	9'-10"	2'-11"
	11'	15"	13"	12"	13'-3"	12"	26'-6"	138	8	14"	53'-6"	9'-1"	5'-1"	12"	6'-2"	4	14"	27'-0"	8	14"	53'-0"	56	5	7"	10'-9"	3'-5"
	12'	15"	13"	12"	14'-3"	12"	28'-6"	148	8	14"	53'-6"	9'-1"	5'-1"	12"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	11'-2"	3'-5"

Northern Diversion Culvert → (10' span, 5' height)

TABLE III
15'-20' FILL

Span "S"	Height "R"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	9½"	8"	12"	4'-4"	12"	8'-9"	88	5	13"	27'-3"	4'-7"	2'-7"	6½"	3'-1"	5	13"	14'-0"	5	13"	26'-11"	32	4	6½"	5'-1"	2'-5"
	4'	9½"	8"	12"	5'-4"	12"	10'-9"	98	5	13"	27'-3"	4'-7"	2'-7"	6½"	3'-1"	5	13"	14'-0"	5	13"	26'-11"	32	4	6½"	5'-7"	2'-5"
	5'	9½"	8"	12"	6'-4"	12"	12'-9"	98	5	13"	27'-3"	4'-7"	2'-7"	6½"	3'-1"	5	13"	14'-0"	5	13"	26'-11"	32	4	6½"	6'-1"	2'-5"
	6'	9½"	8"	12"	7'-4"	12"	14'-9"	108	5	13"	27'-3"	4'-7"	2'-7"	6½"	3'-1"	5	13"	14'-0"	5	13"	26'-11"	32	4	6½"	6'-7"	2'-5"
	7'	9½"	8"	12"	8'-4"	12"	16'-9"	118	5	13"	27'-3"	4'-7"	2'-7"	6½"	3'-1"	5	13"	14'-0"	5	13"	26'-11"	32	4	6½"	7'-1"	2'-5"
8'	3'	12"	9"	12"	4'-9"	12"	9'-8"	88	6	12"	36'-1"	6'-1"	3'-3"	9"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	5'-5"	2'-6"
	4'	12"	9"	12"	5'-9"	12"	11'-8"	98	6	12"	36'-1"	6'-1"	3'-3"	9"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	5'-11"	2'-6"
	5'	12"	9"	12"	6'-9"	12"	13'-8"	98	6	12"	36'-1"	6'-1"	3'-3"	9"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	6'-5"	2'-6"
	6'	12"	9"	12"	7'-9"	12"	15'-8"	108	6	12"	36'-1"	6'-1"	3'-3"	9"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	6'-11"	2'-6"
	7'	12"	9"	12"	8'-9"	12"	17'-8"	118	6	12"	36'-1"	6'-1"	3'-3"	9"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-5"	2'-6"
	8'	12"	9"	12"	9'-9"	12"	19'-8"	118	6	12"	36'-1"	6'-1"	3'-3"	9"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-11"	2'-6"
10'	3'	15"	11"	12"	5'-3"	12"	10'-8"	88	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	6'-0"	2'-8"
	4'	15"	11"	12"	6'-3"	12"	12'-8"	98	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	6'-6"	2'-8"
	5'	15"	11"	12"	7'-3"	12"	14'-8"	98	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	7'-0"	2'-8"
	6'	15"	11"	12"	8'-3"	12"	16'-8"	108	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	7'-6"	2'-8"
	7'	15"	11"	12"	9'-3"	12"	18'-8"	118	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	8'-0"	2'-8"
	8'	15"	11"	12"	10'-3"	12"	20'-8"	118	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	8'-6"	2'-8"
	9'	15"	11"	12"	11'-3"	12"	22'-8"	128	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	9'-0"	2'-8"
	10'	15"	11"	12"	12'-3"	12"	24'-8"	138	7	13"	45'-1"	7'-7"	3'-11"	1'-0"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	9'-7"	2'-8"
12'	8'	18"	13"	12"	10'-9"	12"	21'-6"	118	8	14"	54'-2"	9'-1"	4'-7"	1'-3"	6'-2"	4	14"	27'-0"	8	14"	53'-0"	56	5	7"	9'-6"	3'-5"
	9'	18"	13"	12"	11'-9"	12"	23'-6"	128	8	14"	54'-2"	9'-1"	4'-7"	1'-3"	6'-2"	4	14"	27'-0"	8	14"	53'-0"	56	5	7"	10'-0"	3'-5"
	10'	18"	13"	12"	12'-9"	12"	25'-6"	138	8	14"	54'-2"	9'-1"	4'-7"	1'-3"	6'-2"	4	14"	27'-0"	8	14"	53'-0"	56	6	7"	10'-6"	3'-5"
	11'	18"	13"	12"	13'-9"	12"	27'-6"	138	8	14"	54'-2"	9'-1"	4'-7"	1'-3"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	11'-0"	3'-5"
	12'	18"	13"	12"	14'-9"	12"	29'-6"	148	8	14"	54'-2"	9'-1"	4'-7"	1'-3"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	11'-6"	3'-5"

TABLE IV
20'-25' FILL

Span "S"	Height "R"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	11"	8"	12"	4'-7"	12"	9'-2"	88	5	12"	27'-7"	4'-7"	2'-4"	8"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	5'-3"	2'-5"
	4'	11"	8"	12"	5'-7"	12"	11'-2"	98	5	12"	27'-7"	4'-7"	2'-4"	8"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	5'-9"	2'-5"
	5'	11"	8"	12"	6'-7"	12"	13'-2"	98	5	12"	27'-7"	4'-7"	2'-4"	8"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	6'-3"	2'-5"
	6'	11"	8"	12"	7'-7"	12"	15'-2"	108	5	12"	27'-7"	4'-7"	2'-4"	8"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	6'-9"	2'-5"
	7'	11"	8"	12"	8'-7"	12"	17'-2"	118	5	12"	27'-7"	4'-7"	2'-4"	8"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	7'-3"	2'-5"
8'	3'	14"	9"	12"	5'-1"	12"	10'-2"	88	6	12"	36'-6"	6'-1"	2'-11"	11"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	5'-7"	2'-6"
	4'	14"	9"	12"	6'-1"	12"	12'-2"	98	6	12"	36'-6"	6'-1"	2'-11"	11"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	6'-1"	2'-6"
	5'	14"	9"	12"	7'-1"	12"	14'-2"	98	6	12"	36'-6"	6'-1"	2'-11"	11"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	6'-7"	2'-6"
	6'	14"	9"	12"	8'-1"	12"	16'-2"	108	6	12"	36'-6"	6'-1"	2'-11"	11"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-1"	2'-6"
	7'	14"	9"	12"	9'-1"	12"	18'-2"	118	6	12"	36'-6"	6'-1"	2'-11"	11"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-7"	2'-6"
	8'	14"	9"	12"	10'-1"	12"	20'-2"	118	6	12"	36'-6"	6'-1"	2'-11"	11"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	8'-1"	2'-6"
10'	3'	17"	11"	12"	5'-7"	12"	11'-2"	88	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	6'-3"	2'-9"
	4'	17"	11"	12"	6'-7"	12"	13'-2"	98	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	6'-9"	2'-9"
	5'	17"	11"	12"	7'-7"	12"	15'-2"	98	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	7'-3"	2'-9"
	6'	17"	11"	12"	8'-7"	12"	17'-2"	108	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	7'-9"	2'-9"
	7'	17"	11"	12"	9'-7"	12"	19'-2"	118	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	8'-3"	2'-9"
	8'	17"	11"	12"	10'-7"	12"	21'-2"	118	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	8'-9"	2'-9"
	9'	17"	11"	12"	11'-7"	12"	23'-2"	128	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	9'-3"	2'-9"
	10'	17"	11"	12"	12'-7"	12"	25'-2"	138	7	13"	45'-6"	7'-7"	3'-7"	1'-2"	5'-2"	4	13"	22'-8"	7	13"	44'-2"	48	5	6½"	9'-9"	2'-9"
12'	8'	20½"	13"	12"	11'-2"	12"	22'-6"	118	8	14"	54'-8"	9'-1"	4'-2"	1'-5½"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	9'-4"	2'-11"
	9'	20½"	13"	12"	12'-2"	12"	24'-6"	128	8	14"	54'-8"	9'-1"	4'-2"	1'-5½"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	9'-10"	2'-11"
	10'	20½"	13"	12"	13'-2"	12"	26'-6"	138	8	14"	54'-8"	9'-1"	4'-2"	1'-5½"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	10'-4"	2'-11"
	11'	20½"	13"	12"	14'-2"	12"	28'-6"	138	8	14"	54'-8"	9'-1"	4'-2"	1'-5½"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	11'-4"	3'-5"
	12'	20½"	13"	12"	15'-2"	12"	30'-6"	148	8	13"	54'-8"	9'-1"	4'-2"	1'-5½"	6'-2"	5	13"	27'-0"	8	13"	53'-0"	56	5	6½"	11'-9"	3'-5"

TABLE V
25'-30' FILL

Span "S"	Height "R"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	12½"	8"	12"	4'-8"	12"	9'-10"	88	6	16"	27'-9"	4'-7"	2'-1"	9½"	3'-1"	6	16"	14'-0"	6	16"	26'-11"	32	4	8"	5'-4"	2'-5"
	4'	12½"	8"	12"	5'-8"	12"	11'-10"	98	6	16"	27'-9"	4'-7"	2'-1"	9½"	3'-1"	6	16"	14'-0"	6	16"	26'-11"	32	4	8"	5'-10"	2'-5"
	5'	12½"	8"	12"	6'-8"	12"	13'-10"	98	6	16"	27'-9"	4'-7"	2'-1"	9½"	3'-1"	6	16"	14'-0"	6	16"	26'-11"	32	4	8"	6'-4"	2'-5"
	6'	12½"	8"	12"	7'-8"	12"	15'-10"	108	5	12"	27'-9"	4'-7"	2'-1"	9½"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	6'-10"	2'-5"
	7'	12½"	8"	12"	8'-8"	12"	17'-10"	118	5	12"	27'-9"	4'-7"	2'-1"	9½"	3'-1"	5	12"	14'-0"	5	12"	26'-11"	32	4	6"	7'-4"	2'-5"
8'	3'	16"	9"	12"	5'-5"	12"	11'-1"	88	7	16"	36'-10"	6'-1"	2'-7"	1'-1"	4'-2"	4	16"	18'-3"	7	16"	35'-4"	40	5	8"	6'-0"	2'-7"
	4'	16"	9"	12"	6'-5"	12"	13'-1"	98	7	16"	36'-10"	6'-1"	2'-7"	1'-1"	4'-2"	4	16"	18'-3"	7	16"	35'-4"	40	5	8"	6'-6"	2'-7"
	5'	16"	9"	12"	7'-5"	12"	15'-1"	98	6	12"	36'-10"	6'-1"	2'-7"	1'-1"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	6'-9"	2'-6"
	6'	16"	9"	12"	8'-5"	12"	17'-1"	108	6	12"	36'-10"	6'-1"	2'-7"	1'-1"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-3"	2'-6"
	7'	16"	9"	12"	9'-5"	12"	19'-1"	118	6	12"	36'-10"	6'-1"	2'-7"	1'-1"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	7'-9"	2'-6"
	8'	16"	9"	12"	10'-5"	12"	21'-1"	118	6	12"	36'-10"	6'-1"	2'-7"	1'-1"	4'-2"	4	12"	18'-3"	6	12"	35'-4"	40	4	6"	8'-3"	2'-6"
10'	3'	19"	11"	12"	5'-11"	12"	11'-9"	88	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	6'-4"	2'-9"
	4'	19"	11"	12"	6'-11"	12"	13'-9"	98	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	6'-10"	2'-9"
	5'	19"	11"	12"	7'-11"	12"	15'-9"	98	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	7'-4"	2'-9"
	6'	19"	11"	12"	8'-11"	12"	17'-9"	108	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	7'-10"	2'-9"
	7'	19"	11"	12"	9'-11"	12"	19'-9"	118	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	8'-4"	2'-9"
	8'	19"	11"	12"	10'-11"	12"	21'-9"	118	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	8'-10"	2'-9"
	9'	19"	11"	12"	11'-11"	12"	23'-9"	128	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	9'-4"	2'-9"
	10'	19"	11"	11½"	12'-11"	12"	25'-9"	138	7	12"	45'-11"	7'-7"	3'-3"	1'-4"	5'-2"	4	12"	22'-8"	7	12"	44'-2"	48	5	6"	9'-10"	2'-9"
12'	8'	23"	13"	12"	11'-7"	12"	23'-0"	118	8	14"	55'-2"	9'-1"	3'-9"	1'-8"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	10'-0"	3'-5"
	9'	23"	13"	12"	12'-7"	12"	25'-0"	128	8	14"	55'-2"	9'-1"	3'-9"	1'-8"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	10'-6"	3'-5"
	10'	23"	13"	12"	13'-7"	12"	27'-0"	138	8	14"	55'-2"	9'-1"	3'-9"	1'-8"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	11'-0"	3'-5"
	11'	23"	13"	12"	14'-7"	12"	29'-0"	138	8	14"	55'-2"	9'-1"	3'-9"	1'-8"	6'-2"	5	14"	27'-0"	8	14"	53'-0"	56	6	7"	11'-6"	3'-5"
	12'	23"	13"	9½"	15'-7"	12"	31'-0"	148	8	14"	55'-2"	9'-1"	3'-9"	1'-8"	6'-2"	6	14"	27'-0"	8	14"	53'-0"	56	6	7"	12'-0"	3'-5"

+ Total number of bars in the cross-section.

	DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION
	J.D. Davis		1-88
	APPROVED FOR DISTRIBUTION	FOUR BARREL BOX CULVERT	STANDARD NO.
	T.A. Bryant, Jr.		B-02.45

DOUBLE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	1.172	172.1	1.039	167.5	1.172	171.7	1.305	190.0	1.437	187.7
	4	1.246	183.8	1.113	179.2	1.246	189.8	1.379	202.3	1.511	199.0
	5	1.320	191.6	1.187	187.0	1.320	197.8	1.453	210.7	1.585	206.3
	6	1.394	203.3	1.261	198.7	1.394	209.8	1.527	223.0	1.659	225.1
	7	1.468	224.5	1.335	210.5	1.468	221.6	1.601	235.4	1.734	237.5
8'	3	1.475	261.6	1.590	236.4	1.762	253.5	1.931	256.6	2.221	242.2
	4	1.558	274.9	1.673	248.5	1.845	265.8	2.075	268.9	2.304	253.5
	5	1.642	284.3	1.756	256.5	1.928	274.1	2.158	277.3	2.387	280.5
	6	1.725	297.6	1.840	268.5	2.012	286.5	2.241	289.6	2.471	292.8
	7	1.808	301.3	1.923	280.5	2.095	298.9	2.325	302.0	2.554	305.2
	8	1.892	337.1	2.006	304.5	2.118	301.2	2.408	310.3	2.631	313.5
10'	3	1.365	296.9	2.250	303.7	2.606	325.7	2.851	329.2	3.176	354.8
	4	2.067	310.0	2.462	333.8	2.704	337.6	2.993	341.2	3.278	367.1
	5	2.168	318.4	2.453	323.2	2.810	345.8	3.095	349.3	3.380	375.4
	6	2.270	330.1	2.555	353.9	2.912	357.8	3.197	361.3	3.481	387.8
	7	2.372	355.9	2.657	365.9	3.013	365.9	3.298	373.3	3.583	400.2
	8	2.474	364.9	2.759	373.9	3.115	377.9	3.400	381.3	3.685	408.5
	9	2.576	394.3	2.861	385.9	3.217	389.9	3.502	393.4	3.787	420.8
	10	2.678	410.1	2.963	398.0	3.319	401.9	3.604	405.4	3.889	434.4
12'	8	3.282	456.2	3.704	458.6	4.219	465.8	4.644	495.8	5.070	505.6
	9	3.403	453.7	3.828	471.6	4.339	473.5	4.765	509.1	5.190	519.0
	10	3.523	466.4	3.949	484.6	4.459	523.2	4.885	522.4	5.311	532.3
	11	3.643	523.5	4.069	491.1	4.580	532.5	5.005	536.9	5.431	541.8
	12	3.764	537.7	4.189	538.3	4.700	545.8	5.126	542.1	5.551	584.6

OLIVE DIVERSION CULVERT

TRIPLE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	1.687	237.6	1.483	231.1	1.687	244.7	1.882	261.0	2.076	262.9
	4	1.786	252.8	1.582	246.3	1.786	260.2	1.980	276.8	2.175	277.6
	5	1.885	262.6	1.680	256.1	1.885	270.3	2.075	287.2	2.274	287.0
	6	1.984	277.8	1.779	271.3	1.984	285.7	2.178	303.0	2.372	306.8
	7	2.082	305.2	1.888	286.5	2.082	301.2	2.277	318.8	2.471	321.5
8'	3	2.155	358.1	2.303	330.0	2.557	356.4	2.894	360.3	3.231	344.1
	4	2.246	374.9	2.415	348.2	2.668	372.2	3.005	376.1	3.343	359.8
	5	2.357	386.3	2.526	358.4	2.779	382.6	3.116	386.5	3.454	391.2
	6	2.468	403.0	2.637	373.8	2.890	398.4	3.227	402.3	3.565	401.0
	7	2.578	415.4	2.748	389.3	3.001	414.2	3.338	418.0	3.676	422.8
	8	2.690	453.3	2.859	420.9	3.112	424.6	3.450	428.5	3.787	433.2
10'	3	2.851	430.6	3.271	433.3	3.795	464.5	4.215	469.1	4.635	503.4
	4	2.987	446.4	3.406	472.5	3.931	478.9	4.351	484.5	4.771	519.2
	5	3.122	458.1	3.542	458.3	4.067	490.0	4.487	494.7	4.906	529.7
	6	3.258	474.9	3.678	500.0	4.203	505.5	4.622	510.1	5.047	545.4
	7	3.394	504.9	3.814	515.5	4.338	520.5	4.758	525.6	5.178	561.2
	8	3.530	516.0	3.950	525.6	4.474	531.1	4.854	535.7	5.314	571.6
	9	3.666	556.4	4.085	541.0	4.610	546.5	5.030	551.1	5.450	587.4
	10	3.801	574.5	4.221	556.5	4.746	562.0	5.165	566.6	5.585	604.3
12'	8	4.703	646.9	5.330	643.6	6.083	662.3	6.711	695.8	7.338	705.2
	9	4.863	649.1	5.491	660.0	6.244	677.5	6.871	711.7	7.498	722.0
	10	5.024	665.2	5.651	676.4	6.404	726.5	7.032	728.4	7.659	738.7
	11	5.184	733.7	5.812	685.0	6.565	737.9	7.192	745.0	7.820	750.2
	12	5.345	752.3	5.972	745.4	6.725	754.1	7.353	764.1	7.980	806.5

FOUR BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	2.203	305.2	1.947	295.8	2.203	313.9	2.459	334.3	2.715	340.3
	4	2.326	323.8	2.070	314.4	2.326	332.8	2.582	353.5	2.838	358.4
	5	2.450	335.7	2.193	326.3	2.450	345.0	2.706	366.0	2.962	369.9
	6	2.573	354.3	2.317	344.9	2.573	363.5	2.829	385.2	3.085	388.9
	7	2.697	388.1	2.440	363.5	2.697	382.8	2.953	404.4	3.209	407.3
8'	3	2.794	465.8	3.017	431.4	3.351	461.5	3.797	468.4	4.242	447.4
	4	2.933	486.0	3.156	450.3	3.490	480.7	3.936	485.6	4.381	465.6
	5	3.072	499.5	3.295	462.5	3.629	493.2	4.075	498.1	4.520	504.1
	6	3.211	518.8	3.434	481.3	3.768	512.4	4.213	517.3	4.659	523.3
	7	3.350	541.0	3.573	500.2	3.901	531.6	4.352	536.5	4.798	542.5
	8	3.483	581.0	3.712	539.7	4.046	544.2	4.491	549.1	4.931	555.0
10'	3	3.737	542.2	4.291	564.9	4.985	605.5	5.539	611.2	6.094	655.6
	4	3.907	561.5	4.461	615.2	5.154	624.3	5.709	630.1	6.263	674.8
	5	4.076	578.0	4.631	595.5	5.324	636.5	5.879	642.3	6.433	687.3
	6	4.246	597.7	4.801	643.2	5.494	655.4	6.048	661.2	6.603	706.5
	7	4.416	632.1	4.970	667.1	5.664	674.3	6.218	680.0	6.773	725.7
	8	4.586	645.2	5.140	679.3	5.833	686.5	6.388	692.2	6.942	738.2
	9	4.755	685.3	5.310	698.2	6.003	705.4	6.558	711.1	7.112	757.4
	10	4.925	717.3	5.480	717.1	6.173	724.9	6.727	730.0	7.282	777.8
12'	8	6.123	819.9	6.953	831.8	7.948	860.9	8.778	895.4	9.603	907.0
	9	6.324	826.6	7.153	851.6	8.149	879.5	8.978	915.6	9.808	927.2
	10	6.524	846.1	7.354	871.4	8.349	931.2	9.179	935.8	10.008	947.3
	11	6.725	926.2	7.555	901.1	8.550	944.7	9.379	954.4	10.209	960.8
	12	6.926	947.3	7.755	954.2	8.751	964.8	9.580	988.5	10.409	1032.1

NORTHERN DIVERSION CULVERT

FIVE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	2.718	369.1	2.400	364.3	2.718	386.4	3.036	411.2	3.354	421.8
	4	2.866	391.1	2.548	386.3	2.866	408.7	3.184	433.9	3.502	443.4
	5	3.014	405.1	2.697	400.3	3.014	423.0	3.332	448.5	3.650	457.0
	6	3.163	427.1	2.845	422.3	3.163	445.3	3.480	471.1	3.798	475.1
	7	3.311	467.6	2.993	444.3	3.311	467.6	3.629	493.7	3.947	497.7
8'	3	3.454	567.4	3.731	535.9	4.146	573.2	4.700	578.9	5.253	557.7
	4	3.621	591.0	3.898	558.1	4.313	595.9	4.866	601.5	5.420	578.3
	5	3.788	606.6	4.064	572.4	4.479	610.5	5.033	616.1	5.586	623.2
	6	3.954	630.2	4.231	594.7	4.646	633.1	5.200	638.8	5.753	645.8
	7	4.121	661.4	4.398	613.0	4.813	655.7	5.366	661.4	5.920	668.4
	8	4.288	702.8	4.564	664.4	4.979	670.3	5.533	676.0	6.086	683.0
10'	3	4.623	685.6	5.140	705.8	6.174	756.5	6.863	763.1	7.552	820.4
	4	4.827	708.3	5.516	768.0	6.378	778.8	7.067	785.4	7.756	843.0
	5	5.030	730.0	5.720	741.9	6.581	793.0	7.271	799.6	7.960	857.6
	6	5.234	752.6	5.923	806.5	6.785	815.3	7.474	821.9	8.164	880.2
	7	5.438	792.7	6.127	828.8	6.989	837.6	7.678	844.2	8.367	902.8
	8	5.641	808.0	6.331	845.1	7.192	851.9	7.882	858.5	8.571	917.4
	9	5.845	872.4	6.534	865.4	7.396	874.2	8.085	880.8	8.775	940.1
	10	6.049	894.1	6.738	883.7	7.600	896.5	8.289	903.1	8.978	963.9
12'	8	7.544	1025.0	8.575	1031.1	9.815	1072.9	10.844	1108.2	11.876	1122.1
	9	7.784	1037.5	8.816	1054.4	10.053	1095.0	11.085	1132.8	12.116	1145.7
	10	8.025	1060.4	9.057	1077.6	10.294	1150.9	11.326	1156.4	12.357	1169.3
	11	8.266	1151.9	9.297	1120.8	10.535	1166.5	11.566	1171.1	12.598	1184.5
	12	8.507	1176.3	9.538	1178.5	10.776	1190.1	11.807	1227.3	12.838	1269.7

SIX BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	3.234	431.8	2.854	415.4	3.234	438.6	3.613	467.0	3.993	481.4
	4	3.408	457.2	3.027	440.9	3.408	465.9	3.788	493.0	4.166	506.4
	5	3.579	473.3	3.200	457.0	3.579	481.7	3.959	509.7	4.338	522.1
	6	3.752	498.8	3.372	482.4	3.752	501.4	4.132	535.7	4.511	541.3
	7	3.925	545.3	3.545	507.9	3.925	533.1	4.305	561.8	4.684	567.3
8'	3	4.316	678.4	4.445	609.6	4.941	650.2	5.602	656.3	6.264	634.1
	4	4.308	706.4	4.639	635.3	5.135	676.2	5.797	682.4	6.458	659.1
	5	4.503	724.0	4.834	651.7	5.330	692.9	5.991	699.1	6.653	705.0
	6	4.697	751.1	5.028	677.4	5.524	718.9	6.186	725.1	6.847	735.1
	7	4.892	790.1	5.222	703.1	5.719	745.0	6.380	751.2	7.042	761.1
	8	5.086	834.3	5.417	756.6	5.913	761.1	6.575	767.8	7.236	773.8
10'	3	5.509	816.5	6.333	801.8	7.363	857.8	8.187	864.3	9.011	926.5
	4	5.747	842.6	6.571	873.6	7.601	883.5	8.425	890.0	9.249	952.6
	5	5.984	868.7	6.808	843.3	7.838	899.9	8.663	906.4	9.487	969.3
	6	6.222	894.7	7.046	916.3	8.076	925.6	8.900	932.1	9.724	995.3
	7	6.460	939.5	7.284	942.1	8.314	951.3	9.138	957.8	9.962	1021.3
	8	6.697	956.9	7.521	958.4	8.551	967.7	9.376	974.2	10.200	1038.0
	9	6.935	1032.7	7.759	984.1	8.789	993.4	9.613	999.9	10.437	1064.1
	10	7.173	1056.3	7.997	1009.5	9.027	1018.8	9.851	1025.6	10.675	1091.3
12'	8	8.964	1208.2	10.159	1172.8	11.677	1220.8	12.911	1253.4	14.144	1210.0
	9	9.245	1225.6	10.478	1199.5	11.954	1246.3	13.192	1284.4	14.425	1297.1
	10	9.526	1252.0	10.759	1226.2	12.239	1305.6	13.472	1311.4	14.706	1324.1
	11	9.807	1354.6	11.040	1271.5	12.520	1323.3	13.753	1334.3	14.987	1341.0
	12	10.088	1382.5	11.321	1339.2	12.801	1350.3	14.034	1395.4	15.267	1440.3

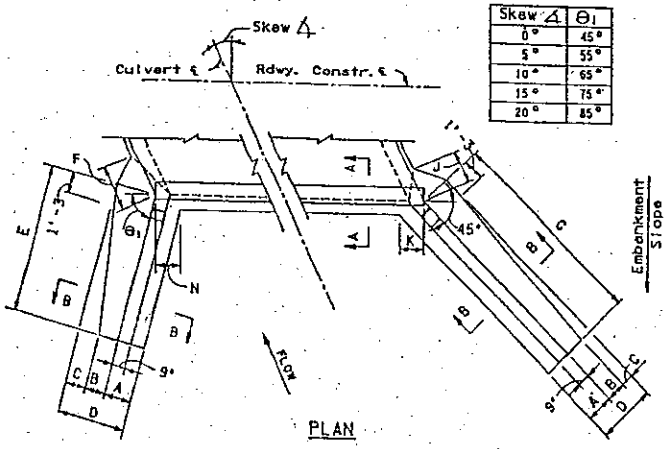
NOTE:

- Quantities shown in tables are per lin. foot of culvert length.

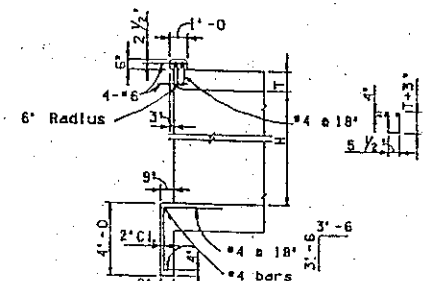
DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION
APPROVED FOR DISTRIBUTION	CULVERT QUANTITIES	STANDARD NO. B-02.70

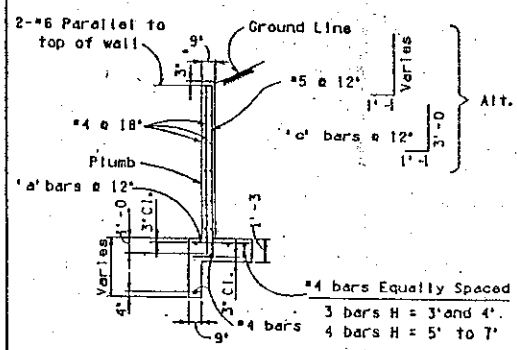
NORTHBOUND DIVERSION INLET

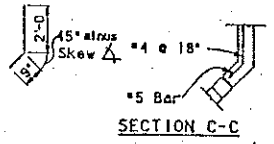
Skew Δ	θ1
0°	45°
5°	55°
10°	65°
15°	75°
20°	85°

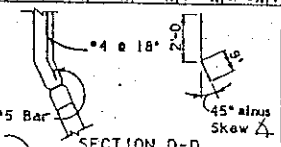


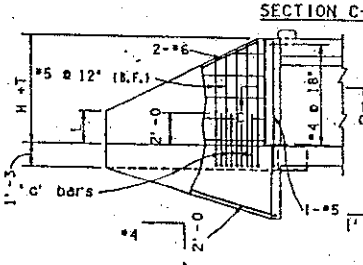
Slope	Skew Δ	Height H	0° 3'	0° 4'	0° 5'	0° 6'	0° 7'	5° 3'	5° 4'	5° 5'	5° 6'	5° 7'	10° 3'	10° 4'	10° 5'	10° 6'	10° 7'	15° 3'	15° 4'	15° 5'	15° 6'	15° 7'	20° 3'	20° 4'	20° 5'	20° 6'	20° 7'
2 : 1 Slope	Dimensions	A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
		B	9'	1'-0	1'-1	1'-2	1'-3	9'	1'-0	1'-1	1'-2	1'-3	9'	1'-0	1'-1	1'-2	1'-3	9'	1'-0	1'-1	1'-2	1'-3	9'	1'-0	1'-1	1'-2	1'-3
		C	6'	9'	1'-3	1'-8	2'-1	6'	9'	1'-3	1'-8	2'-1	6'	9'	1'-3	1'-8	2'-1	6'	9'	1'-3	1'-8	2'-1	6'	9'	1'-3	1'-8	2'-1
		D	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10
		E	6'-0	7'-6	8'-6	10'-0	11'-6	5'-6	7'-0	8'-6	10'-0	11'-0	5'-6	7'-0	8'-6	9'-6	11'-0	5'-6	7'-0	8'-6	10'-0	11'-0	6'-0	7'-6	8'-6	10'-0	11'-6
		F	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	2'-11	3'-8	4'-4	1'-5	2'-1	2'-11	3'-7	4'-3	1'-4	2'-0	2'-9	3'-5	4'-1
		G	6'-0	7'-6	8'-6	10'-0	11'-6	6'-0	7'-6	9'-6	10'-6	12'-0	6'-6	8'-0	9'-6	11'-0	12'-6	7'-0	8'-6	10'-0	12'-0	13'-6	7'-6	9'-0	11'-0	12'-6	14'-6
		J	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	2'-11	3'-8	4'-4	1'-5	2'-1	2'-11	3'-7	4'-3	1'-4	2'-0	2'-9	3'-5	4'-1
		K	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½
		L	1'-11	2'-5	3'-1	3'-6	4'-0	1'-10	2'-2	2'-5	3'-0	3'-7	1'-7	1'-11	2'-3	2'-9	3'-1	1'-5	1'-8	1'-11	2'-3	2'-9	1'-1	1'-4	1'-10	2'-1	2'-4
		M	1'-11	2'-5	3'-1	3'-6	4'-0	1'-11	2'-5	2'-11	3'-4	3'-10	1'-9	2'-3	2'-8	3'-2	3'-8	1'-7	2'-1	2'-6	2'-10	3'-3	1'-5	1'-11	2'-2	2'-8	2'-11
		N	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼
4 : 1 Slope	Dimensions	A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
		B	9'	1'-0	1'-1	1'-4	1'-8	9'	1'-0	1'-1	1'-3	1'-7	9'	1'-0	1'-1	1'-2	1'-6	9'	1'-0	1'-1	1'-2	1'-5	9'	1'-0	1'-1	1'-2	1'-3
		C	4'	7'	1'-0	1'-3	1'-6	4'	7'	1'-0	1'-4	1'-6	4'	7'	1'-0	1'-5	1'-7	4'	7'	1'-0	1'-5	1'-8	4'	7'	1'-0	1'-5	1'-10
		D	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7
		E	8'-0	9'-6	11'-6	13'-6	15'-6	8'-0	10'-0	11'-6	13'-6	15'-6	8'-0	10'-0	12'-0	14'-0	16'-0	8'-6	10'-6	12'-6	14'-6	16'-6	9'-0	11'-0	13'-6	15'-6	17'-6
		F	1'-3	1'-11	2'-8	3'-4	4'-1	1'-3	1'-11	2'-7	3'-4	4'-0	1'-2	1'-11	2'-7	3'-3	4'-0	1'-2	1'-10	2'-6	3'-3	3'-11	1'-2	1'-10	2'-5	3'-1	3'-9
		G	8'-0	9'-6	11'-6	13'-6	15'-6	8'-6	10'-6	12'-6	14'-6	16'-6	9'-0	11'-0	13'-0	15'-6	17'-6	9'-6	12'-0	14'-6	16'-6	19'-0	10'-6	13'-0	15'-6	18'-6	21'-0
		J	1'-3	1'-11	2'-8	3'-4	4'-1	1'-3	1'-11	2'-7	3'-4	4'-0	1'-2	1'-11	2'-7	3'-3	4'-0	1'-2	1'-10	2'-6	3'-3	3'-11	1'-2	1'-10	2'-5	3'-1	3'-9
		K	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½
		L	2'-8	3'-5	4'-0	4'-8	5'-4	2'-5	3'-0	3'-8	4'-4	4'-11	2'-3	2'-10	3'-4	3'-11	4'-5	2'-0	2'-6	3'-1	3'-7	4'-1	1'-10	2'-4	2'-8	3'-2	3'-8
		M	2'-8	3'-5	4'-0	4'-8	5'-4	2'-7	3'-2	3'-10	4'-6	5'-2	2'-6	3'-1	3'-9	4'-4	5'-0	2'-5	2'-11	3'-6	4'-2	4'-8	2'-2	2'-9	3'-4	3'-10	4'-4
		N	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼
6 : 1 Slope	Dimensions	A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
		B	9'	1'-0	1'-3	1'-7	2'-0	9'	1'-0	1'-2	1'-7	1'-11	9'	1'-0	1'-1	1'-6	1'-10	9'	1'-0	1'-1	1'-4	1'-8	9'	1'-0	1'-1	1'-3	1'-7
		C	3'	6'	9'	11'	1'-0	3'	6'	10'	11'	1'-1	3'	6'	11'	1'-0	1'-2	3'	6'	11'	1'-2	1'-4	3'	6'	11'	1'-3	1'-5
		D	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6
		E	8'-6	11'-0	13'-0	15'-0	17'-0	9'-0	11'-0	13'-6	15'-6	17'-6	9'-6	11'-6	14'-0	16'-6	18'-6	10'-0	12'-6	15'-0	17'-6	19'-6	11'-0	13'-6	16'-0	19'-0	21'-6
		F	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-9	2'-6	3'-2	3'-10	1'-1	1'-9	2'-5	3'-1	3'-9	1'-0	1'-8	2'-4	3'-0	3'-8
		G	8'-6	11'-0	13'-0	15'-0	17'-0	9'-6	11'-6	14'-0	16'-0	18'-6	10'-0	12'-6	15'-0	17'-6	20'-0	11'-0	14'-0	16'-6	19'-6	22'-0	12'-6	15'-6	18'-6	21'-6	24'-6
		J	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-9	2'-6	3'-2	3'-10	1'-1	1'-9	2'-5	3'-1	3'-9	1'-0	1'-8	2'-4	3'-0	3'-8
		K	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½
		L	3'-1	3'-9	4'-6	5'-4	6'-1	2'-10	3'-7	4'-3	4'-11	5'-8	2'-8	3'-4	3'-11	4'-7	5'-3	2'-5	3'-1	3'-8	4'-3	4'-11	2'-3	2'-10	3'-5	3'-11	4'-6
		M	3'-1	3'-9	4'-6	5'-4	6'-1	2'-11	3'-8	4'-5	5'-2	5'-11	2'-11	3'-7	4'-4	5'-0	5'-8	2'-9	3'-5	4'-1	4'-9	5'-6	2'-7	3'-3	3'-11	4'-6	5'-2
		N	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼

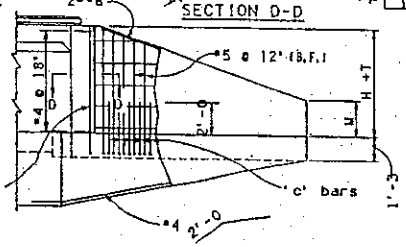












'c' bars			
Hgt. H	Slope	Short Wing 0° to 10°	Long Wing 0° to 20°
7'	2 : 1	3 - #5	3 - #5
	4 : 1	5 - #5	5 - #5

'a' bars		
Height H	Short Wing 0° to 10° / 15° & 20°	Long Wing 0° to 20°
3'	#4	#4
4'	#4	#4
5'	#4	#4
6'	#5	#5
7'	#6	#6

NOTE :

For General Notes and Miscellaneous Details see B-01.10.
For Headwall Quantities see B-05.10, B-05.20 and B-05.30.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

INLET WINGS
CULVERT HEIGHT 3' to 7'
SKEW 0° to 20°

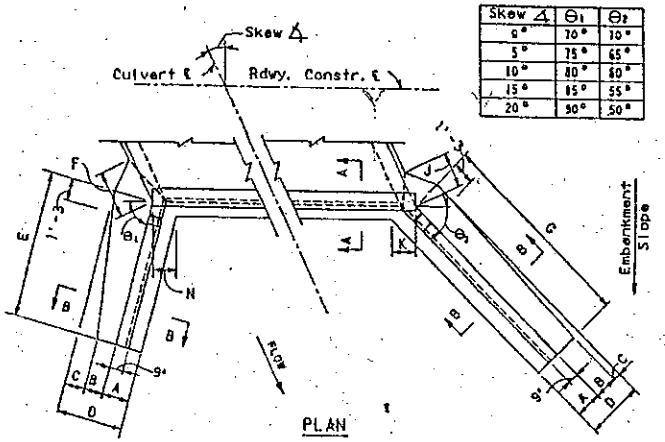
REVISION 3-88

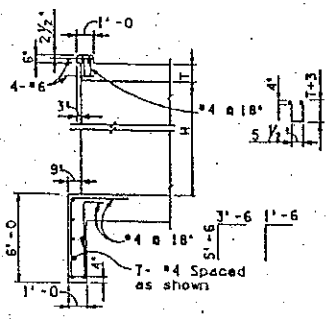
STANDARD NO. B-04.30

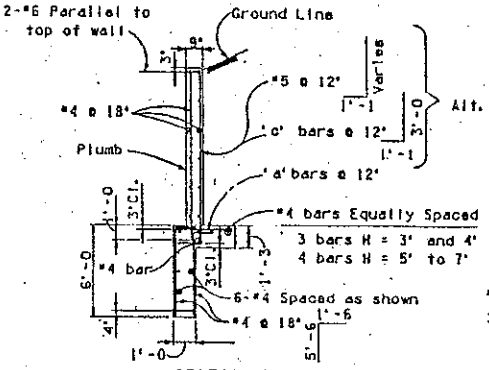
NORTHERN DIVERSION OUTLET
?
OLIVE DIVERSION OUTLET

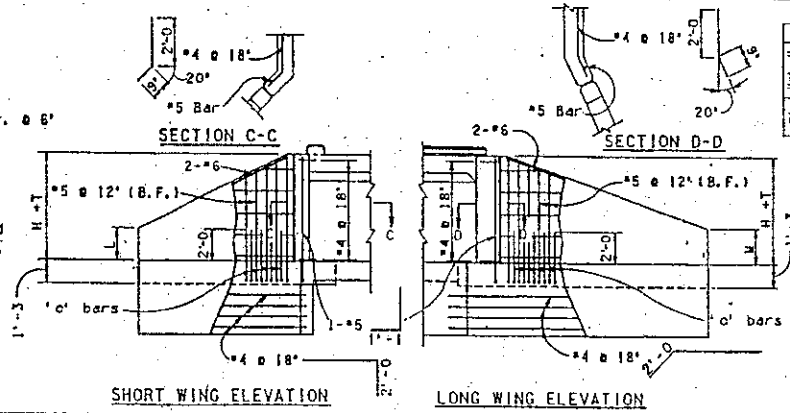
NORTHERN WASH OUTLET

Skew Δ	θ1	θ2
0°	70°	70°
5°	75°	65°
10°	80°	60°
15°	85°	55°
20°	90°	50°









Skew Δ	0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
2 : 1 Slope Dimensions A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	4"	7"	1'-0	1'-5	1'-10	4"	7"	1'-0	1'-5	1'-10	5"	8"	1'-1	1'-6	1'-11	5"	8"	1'-1	1'-7	2'-0	6"	9"	1'-2	1'-7	2'-1
D	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-8	3'-2	3'-8	4'-2	4'-8	2'-8	3'-2	3'-8	4'-2	4'-8	2'-9	3'-3	3'-9	4'-3	4'-10
E	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-9	8'-3	9'-9	11'-3	12'-9
F	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10
G	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	10'-0	11'-6	13'-0	7'-0	8'-6	10'-0	12'-0	13'-6	7'-0	9'-0	10'-6	12'-6	14'-0	7'-6	9'-6	11'-0	13'-0	14'-6
J	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3	1'-11	2'-7	3'-3	4'-0
L	1'-0	1'-4	1'-7	1'-11	2'-2	11"	1'-2	1'-6	1'-9	2'-0	10"	1'-1	1'-5	1'-8	1'-11	1'-1	1'-4	1'-7	1'-10	2'-1	1'-1	1'-4	1'-7	1'-10	2'-1
M	1'-0	1'-4	1'-7	1'-11	2'-2	1'-1	1'-5	1'-8	1'-10	2'-2	1'-0	1'-5	1'-9	1'-10	2'-3	1'-2	1'-5	1'-9	1'-11	2'-4	1'-2	1'-5	1'-10	2'-1	2'-6
N	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-7¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-6	1'-6	1'-6	1'-6	1'-6

Skew Δ	0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
4 : 1 Slope Dimensions A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	4"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9
D	2'-7	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-1	3'-7	4'-1	4'-7
E	10'-0	12'-6	15'-0	17'-6	20'-0	10'-0	12'-6	15'-0	17'-0	19'-6	10'-0	12'-6	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6
F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-5	2'-4	3'-0	3'-8
G	10'-0	12'-6	15'-0	17'-6	20'-0	10'-6	13'-0	15'-6	18'-0	20'-6	10'-6	13'-0	16'-0	18'-6	21'-0	11'-0	13'-6	16'-0	18'-0	21'-6	11'-6	14'-0	17'-0	19'-6	22'-6
J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-5	2'-4	3'-0	3'-8
K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
L	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-5	2'-11	3'-4	1'-7	2'-0	2'-6	2'-11	3'-3	1'-7	2'-1	2'-5	2'-10	3'-2	1'-7	2'-1	2'-5	2'-10	3'-2
M	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-7	3'-0	3'-5	1'-9	2'-3	2'-7	3'-1	3'-6	1'-10	2'-4	2'-9	3'-2	3'-6	1'-10	2'-5	2'-10	3'-4	3'-9
N	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-6	1'-6	1'-6	1'-6	1'-6

Skew Δ	0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
6 : 1 Slope Dimensions A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9	3"	6"	11"	1'-4	1'-9
D	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6
E	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	15'-6	18'-6	21'-6	24'-6	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0
F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
G	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	16'-0	19'-0	22'-0	25'-0	13'-0	16'-0	19'-6	22'-6	25'-6	13'-6	16'-6	20'-0	23'-0	26'-6	13'-6	17'-0	20'-6	23'-6	27'-0
J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
L	2'-1	2'-8	3'-2	3'-8	4'-3	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1
M	2'-1	2'-8	3'-2	3'-8	4'-3	2'-2	2'-8	3'-2	3'-9	4'-3	2'-2	2'-9	3'-3	3'-10	4'-5	2'-3	2'-10	3'-4	3'-11	4'-5	2'-4	2'-11	3'-5	4'-1	4'-7
N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-6	1'-6	1'-6	1'-6	1'-6

'c' bars			
Hgt. H	Slope	Short Wing 0° to 10°	Long Wing 0° to 20°
7'	2 : 1	3 - #5	3 - #5
	4 : 1	5 - #5	5 - #5

'a' bars			
Height H	Short Wing 0° to 20°	Long Wing 0° & 5°	Long Wing 10° to 20°
3'	#4	#4	#4
4'	#4	#4	#4
5'	#4	#4	#4
6'	#4	#4	#5
7'	#4	#4	#6

NOTE :

For General Notes and Miscellaneous Details see B-01.10.
For Headwall Quantities see B-05.10, B-05.20 and B-05.30.

DESIGN APPROVED

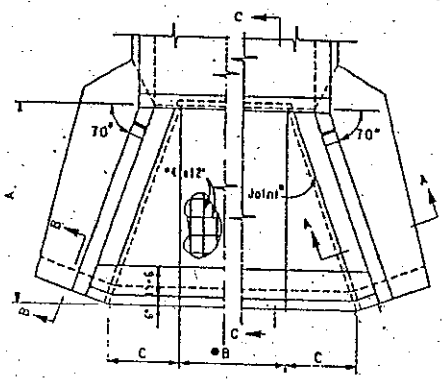
APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

OUTLET WINGS
CULVERT HEIGHT 3' to 7'
SKEW 0° to 20°

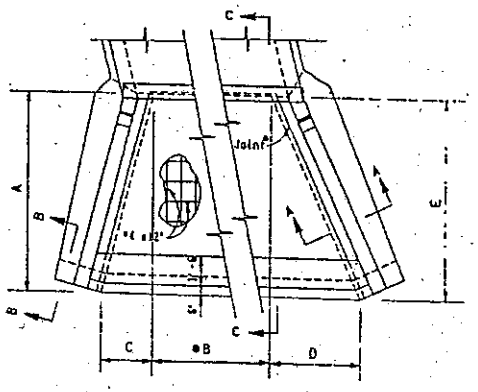
REVISION 7-88

STANDARD NO. B-04.10



PLAN

Apron for 0° skew box culvert



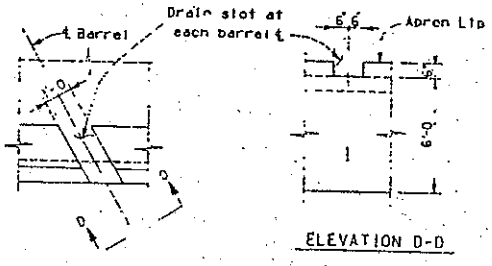
PLAN

Apron for 0° to 15° skew box culvert

* Optional construction joint. Apron may be poured with wingwall footings and bottom slab of barrel.

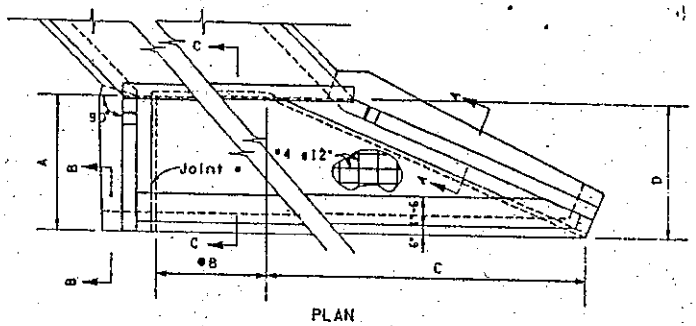
Span	0° Skew	5° Skew	10° Skew	15° Skew	20° Skew	25° Skew	30° Skew	35° Skew	40° Skew	45° Skew
	△									
6'	6'-8	6'-8 1/2	6'-9 1/2	6'-10 3/8	7'-1 1/8	7'-4 1/2	7'-8 1/2	8'-1 3/8	8'-8 3/8	9'-5 1/8
8'	8-9	8'-9 5/8	8'-10 3/4	9'-0 1/8	9'-3 1/8	9'-7 1/8	10'-1 1/4	10'-8 1/4	11'-5 1/4	12'-4 1/2
10'	10' 11	10'-11 1/2	11'-1	11'-3 1/8	11'-7 1/8	12'-0 1/8	12'-7 1/4	13'-3 1/4	14'-3	15'-5 1/4
12'	13'-1	13'-1 5/8	13'-3 1/8	13'-5 1/2	13'-11 1/8	14'-5 1/2	15'-1 1/4	15'-11 1/8	17'-1	18'-6

* Dimension varies with number of barrels. △ equals length to be added to dimension 'B' for each additional barrel.



ELEVATION D-D

APRON DRAIN DETAIL



PLAN

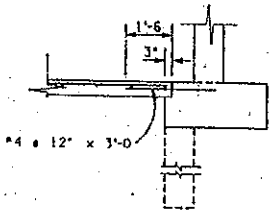
Apron for 20° to 45° skew box culvert

NOTES:

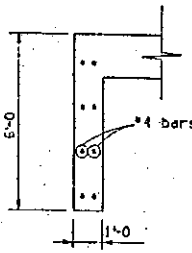
For General Notes and miscellaneous details see B-01.10.

See B-05.20, B-06.30 and B-06.40 for apron dimensions and quantities.

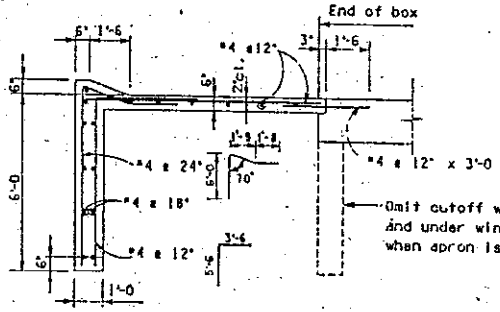
The apron quantities take into consideration the cutoff walls being omitted along outlet headwall and shall be used on new box culverts only.



SECTION A-A



SECTION B-B



SECTION C-C

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

CUTOFF APRON DETAILS

REVISION

STANDARD NO.
B-06.10

DIMENSIONS

Span	Hgt.	0° Skew A	0° Skew B	0° Skew C	5° Skew A	5° Skew B	5° Skew C	5° Skew D	5° Skew E	10° Skew A	10° Skew B	10° Skew C	10° Skew D	10° Skew E
6'	3'	6'-7 1/2	4'-8 1/2	2'-4 3/4	6'-8	4'-8 1/2	1'-9 3/4	3'-0 1/2	6'-6 1/2	6'-8	4'-9 1/2	1'-2 1/2	3'-11 1/4	6'-9 1/4
	4'	8'-0 3/4	4'-8 1/2	2'-11 1/4	8'-1 3/4	4'-8 1/2	2'-2 1/2	3'-8 1/4	7'-10 3/4	8'-1 3/4	4'-9 1/2	1'-5 1/4	4'-8 1/4	8'-1 3/4
	5'	9'-5 1/4	4'-8 1/2	3'-5 1/4	9'-6 1/4	4'-8 1/2	2'-6 1/4	4'-6 1/4	9'-8 3/4	9'-7 3/4	4'-9 1/2	1'-8 3/4	5'-5 1/4	9'-4 3/4
	6'	10'-10 1/4	4'-8 1/2	3'-11 3/4	11'-0 1/4	4'-8 1/2	2'-11 3/4	5'-1 3/4	11'-0 3/4	11'-1 1/4	4'-9 1/2	1'-11 1/2	6'-5 1/4	11'-1 1/4
	7'	12'-3 1/4	4'-8 1/2	4'-5 1/2	12'-5 1/2	4'-8 1/2	3'-4 1/4	5'-9 1/2	12'-5	12'-6 3/4	4'-9 1/2	2'-2 3/4	7'-2 1/4	12'-5 1/4
8'	3'	6'-7 1/2	6'-10 1/2	2'-4 3/4	6'-8	6'-10 1/2	1'-9 3/4	3'-0 1/2	6'-6 1/2	6'-8	6'-11 1/2	1'-2 1/2	3'-11 1/4	6'-9 1/4
	4'	8'-0 3/4	6'-10 1/2	2'-11 1/4	8'-1 3/4	6'-10 1/2	2'-2 1/2	3'-8 1/4	7'-10 3/4	8'-1 3/4	6'-11 1/2	1'-5 1/4	4'-8 1/4	8'-1 3/4
	5'	9'-5 1/4	6'-10 1/2	3'-5 1/4	9'-6 1/4	6'-10 1/2	2'-6 1/4	4'-6 1/4	9'-8 3/4	9'-7 3/4	6'-11 1/2	1'-8 3/4	5'-5 1/4	9'-4 3/4
	6'	10'-10 1/4	6'-10 1/2	3'-11 3/4	11'-0 1/4	6'-10 1/2	2'-11 3/4	5'-1 3/4	11'-0 3/4	11'-1 1/4	6'-11 1/2	1'-11 1/2	6'-5 1/4	11'-1 1/4
	7'	12'-3 1/4	6'-10 1/2	4'-5 1/2	12'-5 1/2	6'-10 1/2	3'-4 1/4	5'-9 1/2	12'-5	12'-6 3/4	6'-11 1/2	2'-2 3/4	7'-2 1/4	12'-5 1/4
	8'	14'-3 1/4	5'-9 1/2	5'-2 1/2	14'-0 1/2	5'-9 1/2	3'-9 1/4	6'-6 1/2	13'-11 3/4	14'-1 3/4	5'-10 1/2	2'-5 3/4	8'-0 3/4	13'-11 3/4
10'	3'	6'-7 1/2	9'-0 1/2	2'-4 3/4	6'-8	9'-0 3/4	1'-9 3/4	3'-0 1/2	6'-6 1/2	6'-8	9'-1 3/4	1'-2 1/2	3'-11 1/4	6'-9 1/4
	4'	8'-0 3/4	9'-0 1/2	2'-11 1/4	8'-1 3/4	9'-0 3/4	2'-2 1/2	3'-8 1/4	7'-10 3/4	8'-1 3/4	9'-1 3/4	1'-5 1/4	4'-8 1/4	8'-1 3/4
	5'	9'-5 1/4	9'-0 1/2	3'-5 1/4	9'-6 1/4	9'-0 3/4	2'-6 1/4	4'-6 1/4	9'-8 3/4	9'-7 3/4	9'-1 3/4	1'-8 3/4	5'-5 1/4	9'-4 3/4
	6'	10'-10 1/4	9'-0 1/2	3'-11 3/4	11'-0 1/4	9'-0 3/4	2'-11 3/4	5'-1 3/4	11'-0 3/4	11'-1 1/4	9'-1 3/4	1'-11 1/2	6'-5 1/4	11'-1 1/4
	7'	12'-3 1/4	9'-0 1/2	4'-5 1/2	12'-5 1/2	9'-0 3/4	3'-4 1/4	5'-9 1/2	12'-5	12'-6 3/4	9'-1 3/4	2'-2 3/4	7'-2 1/4	12'-5 1/4
	8'	14'-3 1/4	7'-11 1/2	5'-2 1/2	14'-0 1/2	7'-11 1/4	3'-9 1/4	6'-6 1/2	13'-11 3/4	14'-1 3/4	8'-0 3/4	2'-5 3/4	8'-0 3/4	13'-11 3/4
	9'	15'-9	7'-9 3/4	5'-8 1/2	15'-6 1/2	7'-9 3/4	4'-1 3/4	7'-4 3/4	15'-10	15'-7 1/2	7'-10 1/2	2'-9	9'-1 1/4	15'-9 1/4
	10'	17'-2 1/4	7'-7 1/2	6'-3	16'-11 3/4	7'-7 1/2	4'-6 3/4	8'-0 3/4	17'-2 1/4	17'-1 3/4	7'-8 1/2	3'-0 1/4	9'-10 1/2	17'-1 1/4
12'	8'	14'-3 1/4	10'-3 1/2	5'-2 1/2	14'-0 1/2	10'-3 3/4	3'-9 1/4	6'-6 1/2	13'-11 3/4	14'-1 3/4	10'-5 1/4	2'-5 3/4	8'-0 3/4	13'-11 3/4
	9'	15'-9	10'-1	5'-8 1/2	15'-6 1/2	10'-1 1/4	4'-1 3/4	7'-4 3/4	15'-10	15'-7 1/2	10'-3 1/2	2'-9	9'-1 1/4	15'-9 1/4
	10'	17'-2 1/4	9'-11 1/4	6'-3	16'-11 3/4	9'-11 3/4	4'-6 3/4	8'-0 3/4	17'-2 1/4	17'-1 3/4	10'-1	3'-0 1/4	9'-10 1/2	17'-1 1/4
	11'	18'-7 1/2	9'-9 1/2	6'-9 3/4	18'-5 3/4	9'-9 1/2	4'-11 3/4	8'-8 1/2	18'-7 1/2	18'-7 3/4	9'-10 1/2	3'-3 3/4	10'-7 1/4	18'-5 3/4
	12'	20'-0 1/4	9'-7	7'-3 3/4	19'-11 1/2	9'-7 3/4	5'-4 1/4	9'-4	20'-0 1/4	20'-1 1/4	9'-8 3/4	3'-6 1/2	11'-8 1/2	20'-2 3/4

Span	Hgt.	15° Skew A	15° Skew B	15° Skew C	15° Skew D	15° Skew E	20° Skew A	20° Skew B	20° Skew C	20° Skew D	25° Skew A	25° Skew B	25° Skew C	25° Skew D
6'	3'	6'-1 1/4	4'-10 1/2	6 3/8"	4'-7 3/4	6'-7 1/2	6'-0	4'-11 1/2	5'-7 1/2	6'-8 1/2	6'-0	5'-2 3/4	6'-8 3/4	6'-8 3/4
	4'	7'-7 1/4	4'-10 1/2	8"	5'-9 1/2	8'-2 1/2	7'-6	4'-11 1/2	6'-11	8'-2 3/4	7'-6	5'-2 3/4	8'-1 3/4	8'-1 3/4
	5'	9'-1 1/2	4'-10 1/2	9 1/2"	6'-7 1/2	9'-5 1/2	9'-0	4'-11 1/2	7'-10 1/2	9'-4 1/2	8'-6	5'-2 3/4	9'-2 1/2	9'-2 1/2
	6'	10'-7 1/4	4'-10 1/2	11 1/8"	7'-9 1/4	11'-1 1/4	10'-6	4'-11 1/2	9'-2	10'-11 1/2	10'-0	5'-2 3/4	10'-7 1/2	10'-7 1/2
	7'	12'-1	4'-10 1/2	1'-0 3/4	8'-7 3/4	12'-3 3/4	12'-0	4'-11 1/2	10'-1 1/2	12'-0 3/4	11'-6	5'-2 3/4	12'-0 1/2	12'-0 1/2
8'	3'	6'-1 1/4	7'-1 1/2	6 3/8"	4'-7 3/4	6'-7 1/2	6'-0	7'-3 3/4	5'-7 1/2	6'-8 1/2	6'-0	7'-7 3/4	6'-8 3/4	6'-8 3/4
	4'	7'-7 1/4	7'-1 1/2	8"	5'-9 1/2	8'-2 1/2	7'-6	7'-3 3/4	6'-11	8'-2 3/4	7'-6	7'-7 3/4	8'-1 3/4	8'-1 3/4
	5'	9'-1 1/2	7'-1 1/2	9 1/2"	6'-7 1/2	9'-5 1/2	9'-0	7'-3 3/4	7'-10 1/2	9'-4 1/2	8'-6	7'-7 3/4	9'-2 1/2	9'-2 1/2
	6'	10'-7 1/4	7'-1 1/2	11 1/8"	7'-9 1/4	11'-1 1/4	10'-6	7'-3 3/4	9'-2	10'-11 1/2	10'-0	7'-7 3/4	10'-7 1/2	10'-7 1/2
	7'	12'-1	7'-1 1/2	1'-0 3/4	8'-7 3/4	12'-3 3/4	12'-0	7'-3 3/4	10'-1 1/2	12'-0 3/4	11'-6	7'-7 3/4	12'-0 1/2	12'-0 1/2
	8'	13'-7 1/2	5'-11 1/2	1'-2 1/2	9'-8 3/4	13'-10 1/2	13'-6	6'-1 1/2	11'-8 1/2	13'-11 1/2	13'-0	6'-4 3/4	13'-9 1/2	13'-9 1/2
10'	3'	6'-1 1/4	9'-4	6 3/8"	4'-7 3/4	6'-7 1/2	6'-0	9'-7	5'-7 1/2	6'-8 1/2	13'-0	10'-0	6'-8 3/4	6'-8 3/4
	4'	7'-7 1/4	9'-4	8"	5'-9 3/4	8'-2 1/2	7'-6	9'-7	6'-11	8'-2 3/4	7'-6	10'-0	8'-1 3/4	8'-1 3/4
	5'	9'-1 1/2	9'-4	9 1/2"	6'-7 1/2	9'-5 1/2	9'-0	9'-7	7'-10 1/2	9'-4 1/2	8'-6	10'-0	9'-2 1/2	9'-2 1/2
	6'	10'-7 1/4	9'-4	11 1/8"	7'-9 1/4	11'-1 1/4	10'-6	9'-7	9'-2	10'-11 1/2	10'-0	10'-0	10'-7 1/2	10'-7 1/2
	7'	12'-1	9'-4	1'-0 3/4	8'-7 3/4	12'-3 3/4	12'-0	9'-7	10'-1 1/2	12'-0 3/4	11'-6	10'-0	12'-0 1/2	12'-0 1/2
	8'	13'-7 1/2	8'-2 3/4	1'-2 1/2	9'-8 3/4	13'-10 1/2	13'-6	8'-5 1/4	11'-8 1/2	13'-11 1/2	13'-0	8'-9 1/2	13'-9 1/2	13'-9 1/2
	9'	15'-1 1/2	8'-0 3/4	1'-3 3/4	10'-10 1/2	15'-6 3/4	15'-0	8'-2 3/4	13'-0 1/2	15'-6 1/2	14'-6	8'-7 1/2	15'-3 1/2	15'-3 1/2
	10'	16'-7 1/2	7'-10 1/2	1'-5 1/2	11'-9 1/4	16'-9 3/4	16'-5	8'-0 3/4	14'-0 1/4	16'-8 3/4	15'-6	8'-4 1/2	16'-4 3/4	16'-4 3/4
12'	8'	13'-7 1/2	10'-7 3/4	1'-2 1/2	9'-8 3/4	13'-10 1/2	13'-6	10'-11	11'-8 1/2	13'-11 1/2	13'-0	11'-4 3/4	13'-9 1/2	13'-9 1/2
	9'	15'-1 1/2	10'-5 3/4	1'-3 3/4	10'-10 1/2	15'-6 3/4	15'-0	10'-8 1/4	13'-0 1/2	15'-6 1/2	14'-6	11'-2	15'-3 1/2	15'-3 1/2
	10'	16'-7 1/2	10'-3 1/2	1'-5 1/2	11'-9 1/4	16'-9 3/4	16'-5	10'-6 3/4	14'-0 1/2	16'-8 3/4	15'-6	10'-11 3/4	16'-4 3/4	16'-4 3/4
	11'	18'-1 1/2	10'-1	1'-7	12'-11 3/4	18'-5 3/4	18'-0	10'-4 1/2	15'-4 1/2	18'-3 3/4	17'-0	10'-8 1/2	17'-10 1/2	17'-10 1/2
	12'	19'-7 1/2	9'-10 1/2	1'-8 3/4	13'-10 1/2	19'-9 1/4	19'-6	10'-1 1/2	16'-4 3/4	19'-4	18'-6	10'-6 1/2	19'-3 3/4	19'-3 3/4

Span	Hgt.	30° Skew A	30° Skew B	30° Skew C	30° Skew D	35° Skew A	35° Skew B	35° Skew C	35° Skew D	40° Skew A	40° Skew B	40° Skew C	40° Skew D	45° Skew A	45° Skew B	45° Skew C	45° Skew D
6'	3'	5'-6	5'-6 3/4	7'-10 3/4	6'-7 3/4	5'-6	5'-10 3/4	9'-1 1/2	6'-4 1/2	5'-0	6'-4 1/2	10'-10 3/4	6'-3 3/4	5'-0	6'-11 1/2	12'-5 1/2	5'-9 3/4
	4'	7'-0	5'-6 3/4	9'-5	7'-10 1/2	6'-6	5'-10 3/4	10'-9 1/2	7'-6 1/2	5'-6	6'-4 1/2	12'-7 1/2	7'-3 3/4	6'-0	6'-11 1/2	15'-1 1/4	7'-0 1/4
	5'	8'-0	5'-6 3/4	10'-11 3/4	9'-2 1/2	8'-0	5'-10 3/4	12'-9 1/2	8'-11 3/4	7'-6	6'-4 1/2	14'-9 3/4	8'-6 3/4	7'-0	6'-11 1/2	17'-5	8'-1 1/2
	6'	9'-6	5'-6 3/4	12'-5 1/2	10'-5 3/4	9'-0	5'-10 3/4	14'-5 3/4	10'-1 3/4	8'-6	6'-4 1/2	16'-11 3/4	9'-9 3/4	8'-6	6'-11 1/2	19'-8 1/2	9'-2 1/2
	7'	11'-0	5'-6 3/4	14'-0 1/2	11'-9	10'-6	5'-10 3/4	16'-1 1/2	11'-3 1/2	10'-0	6'-4 1/2	19'-1 3/4	11'-0 3/4	9'-6	6'-11 1/2	21'-11 3/4	10'-2 1/2
8'	3'	5'-6	8'-0 3/4	7'-10 3/4	6'-7 3/4	5'-6	8'-6 3/4	9'-1 1/2	6'-4 1/2	5'-0	9'-2 3/4	10'-10 3/4	6'-3 3/4	5'-0	9'-11 3/4	12'-5 1/2	5'-9 3/4
	4'	7'-0	8'-0 3/4	9'-5	7'-10 1/2	6'-6	8'-6 3/4	10'-9 1/2	7'-6 1/2	6'-6	9'-2 3/4	12'-7 1/2	7'-3 3/4	6'-0	9'-11 3/4	15'-1 1/4	7'-0 1/4
	5'	8'-0	8'-0 3/4	10'-11 3/4	9'-2 1/2	8'-0	8'-6 3/4	12'-9 1/2	8'-11 3/4	7'-6	9'-2 3/4	14'-9 3/4	8'-6 3/4	7'-0	9'-11 3/4	17'-5	8'-1 1/2
	6'	9'-6	8'-0 3/4	12'-5 1/2	10'-5 3/4	9'-0	8'-6 3/4	14'-5 3/4	10'-1 3/4	8'-6	9'-2 3/4	16'-11 3/4	9'-9 3/4	8'-6	9'-11 3/4	19'-8 1/2	9'-2 1/2
	7'	11'-0	8'-0 3/4	14'-0 1/2	11'-9	10'-6	8'-6 3/4	16'-1 1/2	11'-3 1/2	10'-0	9'-2 3/4	19'-1 3/4	11'-0 3/4	9'-6	9'-11 3/4	21'-11 3/4	10'-2 1/2
	8'	12'-0	6'-9	16'-0	13'-5 1/2	11'-6	7'-2 1/2	18'-8 3/4	13'-1 3/4	11'-0	7'-8 3/4	21'-7 1/2	12'-5 1/2	11'-0	8'-3 1/2	25'-3 3/4	11'-11 1/2
10'	3'	5'-6	10'-6 3/4	7'-10 3/4	6'-7 3/4	5'-6	11'-2 3/4	9'-1 1/2	6'-4 1/2	5'-0	12'-0 3/4	10'-10 3/4	6'-3 3/4	5'-0	13'-0 1/2	12'-5 1/2	5'-9 3/4
	4'	7'-0	10'-6 3/4	9'-5	7'-10 1/2	6'-6	11'-2 3/4	10'-9 1/2	7'-6 1/2	6'-6	12'-0 3/4	12'-7 1/2	7'-3 3/4	6'-0	13'-0 1/2	15'-1 1/4	7'-0 1/4
	5'	8'-0	10'-6 3/4	10'-11 3/4	9'-2 1/2	8'-0	11'-2 3/4	12'-9 1/2	8'-11 3/4	7'-6	12'-0 3/4	14'-9 3/4	8'-6 3/4	7'-0	13'-0 1/2	17'-5	8'-1 1/2
	6'	9'-6	10'-6 3/4	12'-5 1/2	10'-5 3/4	9'-0	11'-2 3/4	14'-5 3/4	10'-1 3/4	8'-6	12'-0 3/4	16'-11 3/4	9'-9 3/4	8'-6	13'-0 1/2	19'-8 1/2	9'-2 1/2
	7'	11'-0	10'-6 3/4	14'-0 1/2	11'-9	10'-6	11'-2 3/4	16'-1 1/2	11'-3 1/2	10'-0	12'-0 3/4	19'-1 3/4	11'-0 3/4	9'-6	13'-0 1/2	21'-11 3/4	10'-2 1/2
	8'	12'-0	9'-3	16'-0	13'-5 1/2	11'-6	9'-9 3/4	18'-8 3/4	13'-1 3/4	11'-0	10'-6 3/4	21'-7 1/2	12'-5 1/2	11'-0	11'-4 1/2	25'-3 3/4	11'-11 1/2
	9'	13'-6	9'-0 1/2	17'-7 1/2	14'-9 1/2	13'-0	9'-7 1/2	20'-5 1/2	14'-3 3/4	12'-6	10'-3 3/4	23'-10 3/4	13'-9 3/4	12'-0	11'-1 1/2	28'-0 1/2	13'-1
	10'	15'-0	8'-9 3/4	19'-2 3/4	16'-1 1/2	14'-0	9'-4 3/4	22'-7 1/2	15'-9 3/4	13'-6	10'-0 3/4	26'-2 3/4	15'-1 1/2	13'-0	10'-9 1/2	30'-5 3/4	14'-2 3/4
12'	8'	12'-0	11'-11 3/4	16'-0	13'-5 1/2	11'-6	12'-8 1/2	18'-8 3/4	13'-1 3/4	11'-0	13'-6 3/4	21'-7 1/2	12'-5 1/2	11'-0	14'-8 1/2	25'-3 3/4	11'-11 1/2
	9'	13'-6	11'-9 3/4	17'-7 1/2	14'-9 1/2	13'-0	12'-5 3/4	20'-5 1/2	14'-3 3/4	12'-6	13'-3 3/4	23'-10 3/4	13'-9 3/4	12'-0	14'-4 1/2	28'-0 1/2	13'-1
	10'	15'-0	11'-6 1/2	19'-2 3/4	16'-1 1/2	14'-0	12'-2 3/4	22'-7 1/2	15'-9 3/4	13'-6	13'-0 3/4	26'-2 3/4	15'-1 1/2	13'-0	14'-1 3/4	30'-5 3/4	14'-2 3/4
	11'	16'-0	11'-3 1/2	20'-9 3/4	17'-5 3/4	15'-6	11'-11 3/4	24'-4 1/2	17'-0 1/2	15'-0	12'-9 3/4	28'-5 3/4	16'-5 3/4	14'-6	13'-10	32'-11 1/2	15'-4 1/2
	12'	17'-6	11'-1 1/2	22'-5 1/2	18'-9 3/4	16'-6	11'-9 1/2	26'-0 3/4	18'-3 1/2	16'-0	12'-6 3/4	30'-8 1/2	17'-8 1/2	15'-6	13'-6 3/4	35'-5 3/4	16'-1 3/4

QUANTITIES

Span	Hgt.	0° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	5° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	10° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	15° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	20° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs
6'	3'	0.44	1.05	22	91	0.44	1.05	22	91	0.46	1.08	25	94	0.50	1.06	27	92	0.55	1.08	33	94
	4'	0.50	1.23	31	104	0.50	1.23	31	104	0.51	1.26	34	107	0.57	1.26	39	107	0.62	1.28	45	109
	5'	0.52	1.40	42	117	0.53	1.43	44	119	0.54	1.43	44	120	0.59	1.43	49	120	0.64	1.46	54	122
	6'	0.57	1.58	54	130	0.58	1.61	57	132	0.61	1.63	61	135	0.66	1.63	65	135	0.72	1.66	71	137
	7'	0.65	1.75	69	143	0.66	1.78	72	145	0.69	1.81	76	148	0.74	1.80	80	148	0.79	1.83	85	150
8'	3'	0.84	1.45	51	118	0.84	1.45	51	118	0.86	1.49	55	122	0.90	1.46	56	119	0.96	1.50	63	122
	4'	0.95	1.68	64	135	0.95	1.68	64	135	0.97	1.72	68	138	1.03	1.72	73	139	1.10	1.76	79	142
	5'	1.03	1.91	79	152	1.05	1.95	82	155	1.05	1.95	83	155	1.11	1.95	87	156	1.18	1.99	93	159
	6'	1.13	2.14	96	169	1.16	2.17	99	172	1.19	2.21	104	175	1.25	2.21	108	175	1.31	2.25	115	178
	7'	1.27	2.36	115	186	1.29	2.40	119	189	1.33	2.44	123	192	1.36	2.44	127	192	1.44	2.48	133	195
	8'	1.56	2.70	112	210	1.54	2.66	108	206	1.59	2.70	113	211	1.64	2.70	117	211	1.76	2.77	130	217
10'	3'	1.28	1.88	85	147	1.28	1.88	85	148	1.32	1.93	89	151	1.35	1.89	90	148	1.42	1.94	97	153
	4'	1.45	2.16	102	169	1.46	2.16	102	169	1.49	2.22	107	173	1.55	2.21	111	173	1.63	2.27	119	177
	5'	1.59	2.45	121	190	1.62	2.50	125	193	1.65	2.50	126	194	1.69	2.50	130	194	1.76	2.55	138	198
	6'	1.76	2.73	143	211	1.79	2.78	147	214	1.84	2.83	152	218	1.89	2.83	157	218	1.97	2.88	164	222
	7'	1.95	3.02	166	232	1.99	3.07	171	236	2.04	3.11	176	239	2.09	3.11	180	239	2.17	3.16	187	243
	8'	2.33	3.43	169	263	2.30	3.39	166	259	2.36	3.43	171	263	2.41	3.43	175	263	2.56	3.52	189	270
	9'	2.56	3.72	190	284	2.57	3.72	191	284	2.64	3.77	197	288	2.69	3.77	201	288	2.85	3.86	216	295
	10'	2.81	4.01	212	306	2.82	4.01	213	306	2.89	4.06	215	310	2.94	4.06	223	311	3.10	4.15	237	316
12'	8'	3.15	4.21	221	315	3.11	4.16	223	311	3.17	4.22	229	315	3.23	4.22	233	315	3.39	4.33	249	324
	9'	1.44	4.56	253	341	3.45	4.56	254	341	3.52	4.62	260	345	3.58	4.62	265	345	3.76	4.73	281	353
	10'	3.75	4.91	279	67	3.76	4.91	280	366	3.83	4.97	287	371	3.89	4.97	291	371	4.07	5.08	307	379
	11'	4.07	5.26	307	392	4.08	5.26	308	392	4.16	5.32	315	397	4.29	5.37	326	400	4.47	5.41	342	409
	12'	4.42	5.61	337	418	4.43	5.61	338	418	4.58	5.72	352	427	4.63	5.71	355	426	4.83	5.82	371	434

Span	Hgt.	25° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	30° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	35° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	40° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs	45° Skew Conc. C.Y. 1Bbl.	Δc	Steel lbs. 1Bbl.	Δs
6'	3'	0.77	1.13	52	98	1.03	1.13	73	99	1.27	1.18	95	104	1.58	1.22	123	108	1.84	1.28	147	113
	4'	0.89	1.32	67	113	1.20	1.33	92	114	1.50	1.34	116	116	1.84	1.42	147	123	2.25	1.47	185	128
	5'	0.94	1.46	81	123	1.37	1.50	113	126	1.75	1.57	146	132	2.15	1.60	180	136	2.60	1.65	220	141
	6'	1.11	1.66	101	138	1.55	1.69	137	141	2.00	1.73	173	144	2.50	1.78	216	150	3.02	1.88	260	158
	7'	1.28	1.86	124	153	1.78	1.89	164	156	2.28	1.93	204	159	2.81	2.00	257	166	3.46	2.06	302	171
8'	3'	1.19	1.55	83	127	1.46	1.57	105	129	1.72	1.64	128	134	2.05	1.69	157	139	2.33	1.77	183	146
	4'	1.38	1.81	103	146	1.69	1.83	128	148	2.00	1.85	153	150	2.37	1.95	186	159	2.81	2.03	226	166
	5'	1.51	2.00	120	160	1.91	2.04	154	164	2.32	2.14	189	172	2.74	2.19	223	176	3.21	2.27	265	183
	6'	1.71	2.26	145	179	2.17	2.30	182	183	2.62	2.35	220	188	3.14	2.43	264	194	3.71	2.56	311	205
	7'	1.95	2.52	173	199	2.46	2.56	214	203	2.98	2.61	254	207	3.63	2.72	311	216	4.21	2.80	357	223
	8'	2.35	2.81	175	220	2.93	2.81	220	221	3.58	2.89	273	228	4.24	2.97	326	235	5.12	3.16	396	250
10'	3'	1.67	2.01	119	158	1.94	2.03	141	160	2.22	2.12	166	167	2.51	2.19	197	173	2.88	2.30	224	182
	4'	1.93	2.34	144	182	2.25	2.36	169	184	2.56	2.39	195	187	2.97	2.52	230	198	3.43	2.63	272	206
	5'	2.11	2.57	165	199	2.52	2.63	199	204	2.96	2.75	236	214	3.40	2.82	273	220	3.90	2.92	316	228
	6'	2.38	2.89	195	224	2.85	2.95	233	228	3.32	3.02	272	234	3.87	3.12	318	241	4.47	3.29	368	255
	7'	2.68	3.22	228	248	3.21	3.28	270	253	3.74	3.34	312	258	4.43	3.48	370	269	5.03	3.58	419	277
	8'	3.16	3.58	236	275	3.74	3.59	281	276	4.42	3.69	336	284	5.10	3.80	390	293	6.03	4.04	465	311
	9'	3.52	3.92	264	299	4.16	3.92	317	300	4.91	4.03	376	309	5.75	4.17	444	320	6.69	4.35	518	334
	10'	3.80	4.15	291	317	4.62	4.25	355	325	5.48	4.34	426	332	6.38	4.48	497	343	7.37	4.65	574	357
12'	8'	4.01	4.40	297	329	4.60	4.42	342	330	5.31	4.55	393	340	6.02	4.69	455	351	7.01	4.99	534	373
	9'	4.44	4.80	334	355	5.09	4.82	383	360	5.87	4.95	445	370	6.75	5.13	514	384	7.73	5.35	592	400
	10'	4.78	5.08	361	380	5.63	5.21	427	389	6.50	5.32	499	398	7.44	5.50	572	411	8.48	5.72	652	427
	11'	5.26	5.48	402	409	6.12	5.54	469	434	7.13	5.72	549	427	8.26	5.95	638	441	9.39	6.17	722	461
	12'	5.77	5.88	445	439	6.71	5.94	517	444	7.72	6.05	598	452	8.91	6.27	690	468	10.36	6.57	800	491

NOTATIONS:

Δc = Apron concrete quantity per additional barrel.

Δs = Apron steel quantity per additional barrel.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION
J.D. Dean		7-88
APPROVED FOR DISTRIBUTION	OUTLET APRON DIMENSIONS & QUANTITIES 2 : 1 SLOPE	STANDARD NO.
T.A. Bryant, II		8-06.20

Northern Wash Inlet/Culvert Analysis and Design

The inlet and culvert were analyzed using HEC-RAS and CulvertMaster as follows:

1) The flow in Beardsley Canal Wash was analyzed in CulvertMaster to determine the box culvert size required to keep the water elevation below the top of bank . A 4-barrel 12' X 6' box culvert is required, providing a headwater elevation of 1235.83.
2) An ADOT standard outlet is used for the wing walls and apron.
3) In order to keep the upstream flow from overtopping the roadway, a 7.25 ft deep drop inlet had to be added.
4) NIC South proposes a 4.25 foot drop at the outlet of this culvert which was joined to the headwall of the Northern Avenue Diversion Culvert. **Because of the future NIC South channel, the HEC RAS will be updated during the NIC South design to accurately depict the water surface profile near Northern Avenue. For purposes of the hydraulic grade line shown on the plans the elevations were left the same as the 90% plans.**

Results:

- ADOT standard culvert and outlet used.
- A 7.25' drop inlet required.
- Conjoined Apron and headwall used

Culvert Designer/Analyzer Report
Northern Ave Wash Culvert

Comments: See HECRAS Model - does not include drop structure inlet.

Analysis Component			
Storm Event	Design	Discharge	5,678.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	5,678.00 cfs	Check Discharge	0.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	1,221.18 ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	4-12 x 6 ft Box	5,678.05 cfs	1,235.83 ft	21.00 ft/s
Weir	Roadway	0.00 cfs	1,235.83 ft	N/A
Total	----------	5,678.05 cfs	1,235.83 ft	N/A

Culvert Designer/Analyzer Report
Northern Ave Wash Culvert

Component:Culvert-1

Culvert Summary					
Computed Headwater Elev	1,235.83	ft	Discharge	5,678.05	cfs
Inlet Control HW Elev.	1,235.83	ft	Tailwater Elevation	1,221.18	ft
Outlet Control HW Elev.	1,232.00	ft	Control Type	Inlet Control	
Headwater Depth/Height	2.85				

Grades					
Upstream Invert	1,218.75	ft	Downstream Invert	1,217.75	ft
Length	66.50	ft	Constructed Slope	0.015038	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	5.63	ft
Slope Type	Steep		Normal Depth	4.50	ft
Flow Regime	Supercritical		Critical Depth	6.00	ft
Velocity Downstream	21.00	ft/s	Critical Slope	0.011807	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	12.00	ft
Section Size	12 x 6 ft		Rise	6.00	ft
Number Sections	4				

Outlet Control Properties					
Outlet Control HW Elev.	1,232.00	ft	Upstream Velocity Head	6.04	ft
Ke	0.20		Entrance Loss	1.21	ft

Inlet Control Properties					
Inlet Control HW Elev.	1,235.83	ft	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	288.0	ft^2
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Designer/Analyzer Report
Northern Ave Wash Culvert

Component:Weir

Hydraulic Component(s): Roadway

Discharge	0.00	cfs	Allowable HW Elevation	1,235.83	ft
Roadway Width	28.00	ft	Overtopping Coefficient	2.50	US
Low Point	1,236.00	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.50		Submergence Factor (Kt)	1.00	
Tailwater Elevation	1,221.18	ft			

Sta (ft)	Elev. (ft)
2,302.84	1,237.00
2,466.86	1,236.00
2,606.21	1,236.50
2,640.48	1,236.54

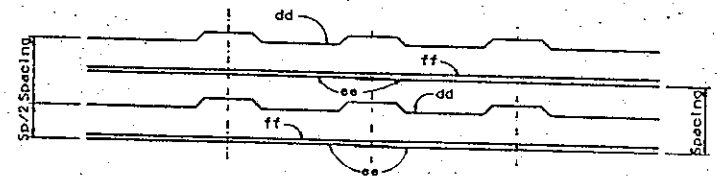
TABLE I
0'-10' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	9½"	8"	12"	6'-4	12"	8'-9	84	5	14"	27'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	1"	5'-1	2'-5
	4'	9½"	8"	12"	5'-4	12"	10'-9	96	5	14"	27'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	1"	5'-1	2'-5
	5'	9½"	8"	12"	6'-4	12"	12'-9	96	5	14"	27'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	1"	6'-1	2'-5
	6'	9½"	8"	12"	7'-4	12"	14'-9	108	5	14"	27'-3	4'-7	2'-7	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	1"	6'-1	2'-5
	7'	9½"	8"	12"	8'-4	12"	16'-9	118	5	13"	27'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	40	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	12"	6'-4	12"	8'-9	88	6	14"	35'-7	6'-1	3'-1	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	1"	5'-6	2'-6
	4'	9½"	9"	12"	5'-4	12"	10'-9	98	6	14"	35'-7	6'-1	3'-1	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	1"	5'-6	2'-6
	5'	9½"	9"	12"	6'-4	12"	12'-9	98	6	14"	35'-7	6'-1	3'-1	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	1"	6'-0	2'-6
	6'	9½"	9"	12"	7'-4	12"	14'-9	108	6	14"	35'-7	6'-1	3'-1	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	1"	5'-6	2'-6
	7'	9½"	9"	12"	8'-4	12"	16'-9	118	6	13"	35'-7	6'-1	3'-1	6½"	4'-2	6	13"	18'-3	6	13"	35'-4	56	6	1"	6'-11	2'-6
	8'	9½"	9"	12"	9'-4	12"	18'-9	118	6	13"	35'-7	6'-1	3'-1	6½"	4'-2	6	13"	18'-3	6	13"	35'-4	56	5	6½"	7'-5	2'-6
10'	3'	10½"	11"	12"	6'-6	12"	8'-9	88	7	17"	44'-2	7'-7	4'-1	7½"	5'-2	6	13"	18'-3	6	13"	35'-4	56	6	6½"	8'-0	2'-6
	4'	10½"	11"	12"	5'-6	12"	11'-2	98	7	17"	44'-2	7'-7	4'-1	7½"	5'-2	6	12"	22'-8	7	17"	44'-2	64	6	6½"	6'-1	3'-0
	5'	10½"	11"	12"	6'-6	12"	13'-2	98	6	12"	44'-2	7'-7	4'-1	7½"	5'-2	6	12"	22'-8	7	17"	44'-2	64	6	6½"	6'-7	3'-0
	6'	10½"	11"	12"	7'-6	12"	15'-2	108	6	12"	44'-2	7'-7	4'-1	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	6"	6'-6	2'-6
	7'	10½"	11"	12"	8'-6	12"	17'-2	118	7	15"	44'-2	7'-7	4'-1	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	5	6"	7'-2	2'-6
	8'	10½"	11"	12"	9'-6	12"	19'-2	118	7	15"	44'-2	7'-7	4'-1	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	5	7½"	7'-6	2'-6
	9'	10½"	11"	12"	10'-6	12"	21'-2	128	8	15"	44'-2	7'-7	4'-1	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	5	7½"	8'-3	2'-6
	10'	10½"	11"	12"	11'-6	12"	23'-2	138	8	14"	44'-2	7'-7	4'-1	7½"	5'-2	5	14"	22'-8	7	14"	44'-2	64	5	7"	9'-3	2'-6
12'	4'	12½"	13"	12"	5'-10	12"	20'-0	118	7	13"	53'-0	8'-1	5'-5	8½"	6'-2	5	13"	27'-0	7	13"	53'-0	88	5	6½"	9'-7	2'-10
	5'	12½"	13"	12"	6'-10	12"	22'-0	128	6	16"	53'-0	8'-1	5'-5	8½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	5	8"	9'-1	2'-10
	10'	12½"	13"	12"	11'-10	12"	24'-0	138	8	15"	53'-0	8'-1	5'-5	8½"	6'-2	5	15"	27'-0	8	15"	53'-0	88	5	8"	9'-7	2'-10
	11'	12½"	13"	12"	12'-10	12"	26'-0	138	7	12"	53'-0	8'-1	5'-5	8½"	6'-2	4	12"	27'-0	7	12"	53'-0	88	5	8"	10'-1	2'-10
	12'	12½"	13"	12"	13'-10	12"	28'-0	148	7	12"	53'-0	8'-1	5'-5	8½"	6'-2	5	12"	27'-0	7	12"	53'-0	88	5	8"	10'-1	2'-10

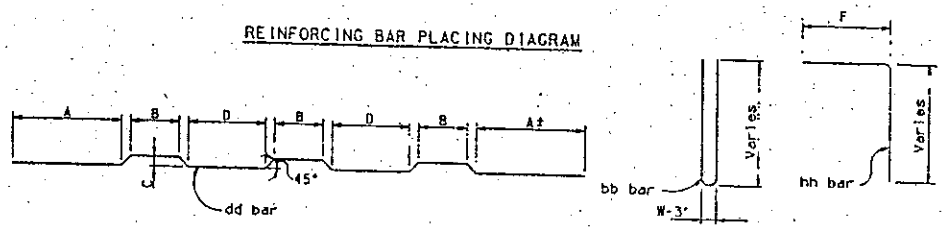
+ Total number of bars in the cross-section.

NORTHERN DIVERSION CULVERT

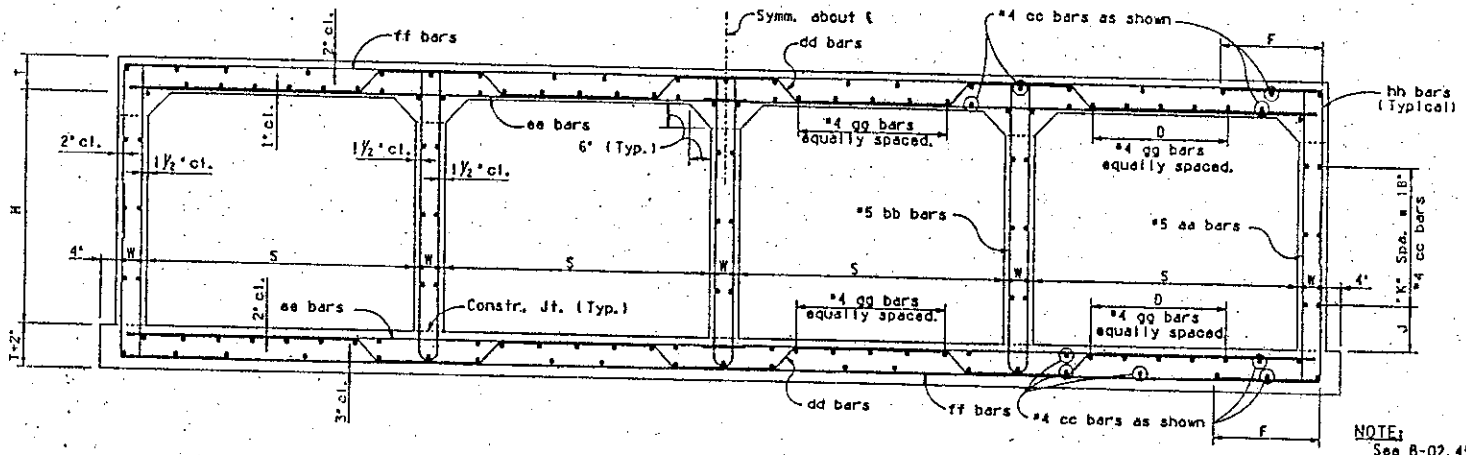
NORTHERN WASH CULVERT



REINFORCING BAR PLACING DIAGRAM



BENDS



Height "H"	"J" Dim.	"K" Spaces
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11	12"	6
12'	9"	7

TYPICAL SECTION

NOTE:
Reinforcing shown is for placement location only. Use the appropiate table to determine the reinforcing requirements.

NOTE:
See B-02.45 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

FOUR BARREL
BOX CULVERT

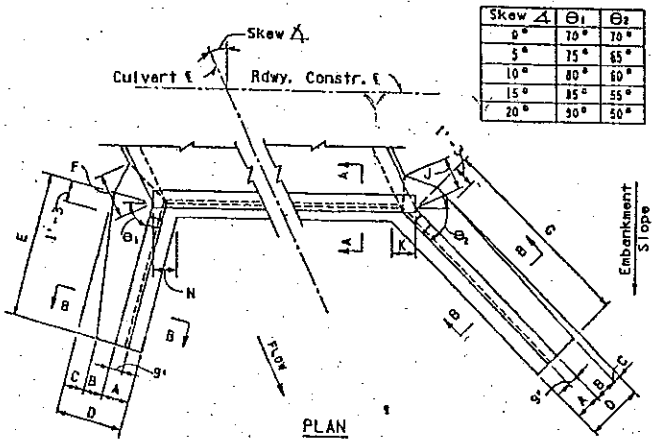
REVISION 4-92

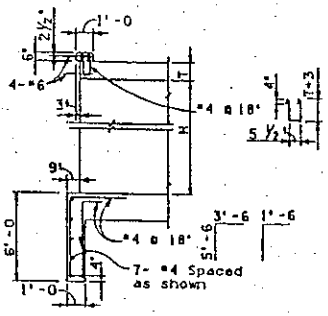
STANDARD NO. B-02.40

NORTHERN DIVERSION OUTLET
&
OLIVE DIVERSION OUTLET
BOTH ARE MODIFIED

NORTHERN WASH OUTLET
MODIFIED

Skew ∠	θ1	θ2
0°	70°	70°
5°	75°	65°
10°	80°	60°
15°	85°	55°
20°	90°	50°

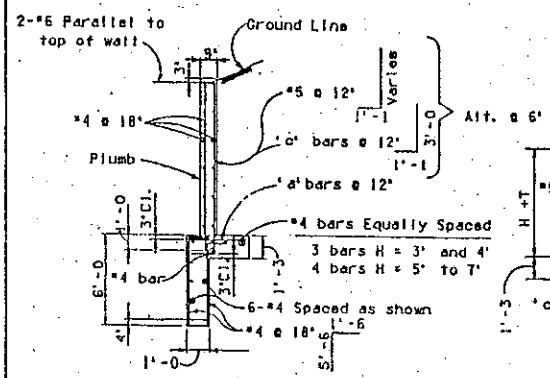


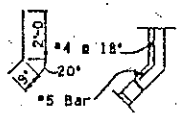


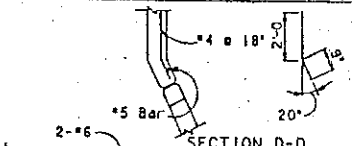
2 : 1 Slope Dimensions	Skew ∠ 0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	4"	7"	1'-0	1'-5	1'-10	4"	7"	1'-0	1'-5	1'-10	5"	8"	1'-1	1'-6	1'-11	5"	8"	1'-1	1'-7	2'-0	6"	9"	1'-2	1'-7	2'-1
D	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-8	3'-2	3'-8	4'-2	4'-8	2'-8	3'-2	3'-8	4'-3	4'-9	2'-9	3'-3	3'-9	4'-3	4'-10
E	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-0	7'-6	9'-0	10'-6	12'-0	6'-0	7'-6	9'-0	10'-6	12'-0
F	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
G	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	10'-0	11'-6	13'-0	7'-0	8'-6	10'-0	12'-0	13'-6	7'-0	9'-0	10'-6	12'-6	14'-0	7'-6	9'-6	11'-0	13'-0	14'-6
J	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
L	1'-0	1'-4	1'-2	1'-11	2'-2	11"	1'-2	1'-6	1'-9	2'-0	10"	1'-1	1'-5	1'-8	1'-11	1'-1	1'-4	1'-7	1'-10	2'-1	1'-1	1'-4	1'-7	1'-10	2'-1
M	1'-0	1'-4	1'-7	1'-11	2'-2	1'-1	1'-5	1'-6	1'-10	2'-2	1'-0	1'-5	1'-9	1'-10	2'-3	1'-2	1'-5	1'-8	1'-11	2'-4	1'-2	1'-5	1'-10	2'-1	2'-6
N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-7¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-6	1'-6	1'-6	1'-6	1'-6

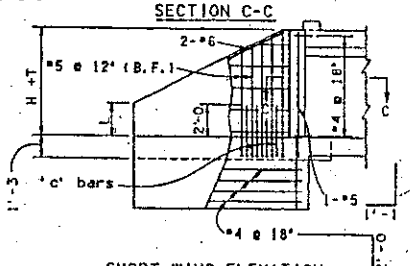
4 : 1 Slope Dimensions	Skew ∠ 0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	4"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	7"	1'-0	1'-5	1'-10
D	2'-7	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-1	3'-7	4'-1	4'-7
E	10'-0	12'-6	15'-0	17'-6	20'-0	10'-0	12'-6	15'-0	17'-0	19'-6	10'-0	12'-6	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6
F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-9	2'-4	3'-0	3'-8
G	10'-0	12'-6	15'-0	17'-6	20'-0	10'-6	13'-0	15'-6	18'-0	20'-6	10'-6	13'-0	16'-0	18'-6	21'-0	11'-0	13'-6	16'-0	19'-0	21'-6	11'-6	14'-0	17'-0	19'-6	22'-6
J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-9	2'-4	3'-0	3'-8
K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
L	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-5	2'-11	3'-4	1'-7	2'-0	2'-6	2'-11	3'-3	1'-7	2'-1	2'-5	2'-10	3'-2	1'-7	2'-1	2'-5	2'-10	3'-2
M	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-7	3'-0	3'-5	1'-9	2'-3	2'-7	3'-1	3'-6	1'-10	2'-4	2'-9	3'-2	3'-8	1'-10	2'-5	2'-10	3'-4	3'-9
N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-6	1'-6	1'-6	1'-6	1'-6

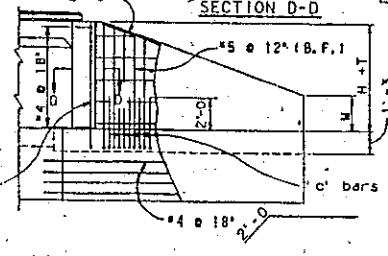
6 : 1 Slope Dimensions	Skew ∠ 0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9
D	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6
E	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	15'-6	18'-6	21'-6	24'-6	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0
F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
G	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	16'-0	19'-0	22'-0	25'-0	13'-0	16'-0	19'-6	22'-6	25'-6	13'-6	16'-6	20'-0	23'-0	26'-6	13'-6	17'-0	20'-6	23'-6	27'-0
J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
K	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4	1'-4	1'-4	1'-4	1'-4
L	2'-1	2'-8	3'-2	3'-8	4'-3	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1
M	2'-1	2'-8	3'-2	3'-8	4'-3	2'-2	2'-8	3'-2	3'-9	4'-3	2'-2	2'-9	3'-3	3'-10	4'-5	2'-3	2'-10	3'-4	3'-11	4'-5	2'-4	2'-11	3'-5	4'-1	4'-7
N	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-3⅜	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-6	1'-6	1'-6	1'-6	1'-6











'c' bars			
Hgt. H	Slope	Short Wing 0° to 10°	Long Wing 0° to 20°
7'	2 : 1	3 - #5	3 - #5
	4 : 1	5 - #5	5 - #5

'a' bars			
Height H	Short Wing 0° to 20°	Long Wing 0° & 5°	Long Wing 10° to 20°
3'	#4	#4	#4
4'	#4	#4	#4
5'	#4	#4	#4
6'	#4	#4	#5
7'	#4	#4	#6

NOTE 1

For General Notes and Miscellaneous Details see B-01.10.
For Headwall Quantities see B-05.10, B-05.20 and B-05.30.

DESIGN APPROVED

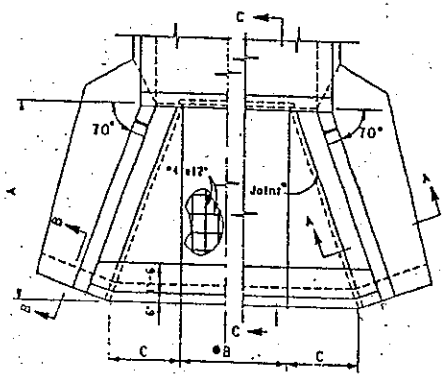
APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

OUTLET WINGS
CULVERT HEIGHT 3' to 7'
SKEW 0° to 20°

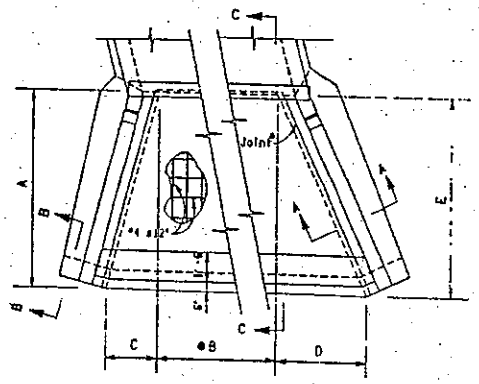
REVISION 7-88

STANDARD NO. B-04.10



PLAN

Apron for 0° skew box culvert



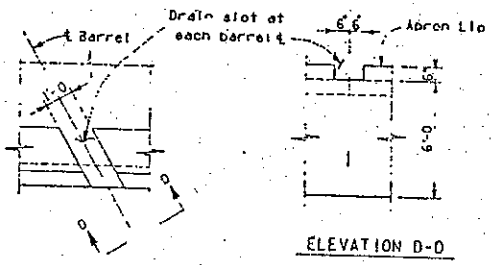
PLAN

Apron for 0° to 15° skew box culvert

* Optional construction joint. Apron may be poured with wingwall footings and bottom slab of barrel.

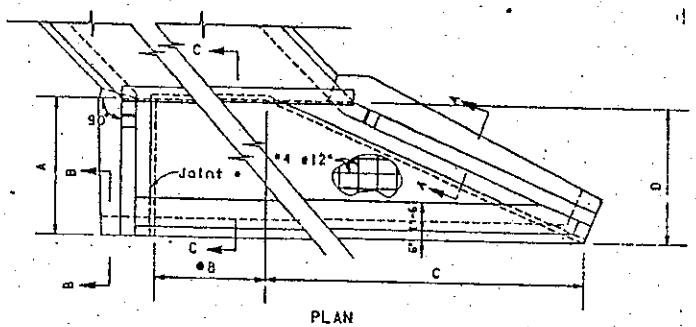
Span	△									
	0° Skew	5° Skew	10° Skew	15° Skew	20° Skew	25° Skew	30° Skew	35° Skew	40° Skew	45° Skew
6'	6'-8	6'-8½	6'-9¾	6'-10½	7'-1½	7'-4¼	7'-8½	8'-1⅝	8'-8⅝	9'-5½
8'	8'-9	8'-9⅝	8'-10⅝	9'-0¼	9'-3¼	9'-7⅜	10'-1¾	10'-8⅛	11'-5½	12'-4½
10'	10'-11	10'-11½	11'-1	11'-3⅝	11'-7⅝	12'-0½	12'-7½	13'-3⅛	14'-3	15'-5¾
12'	13'-1	13'-1⅝	13'-3⅝	13'-6½	13'-11½	14'-5¼	15'-1¼	15'-11⅝	17'-1	18'-6

• Dimension varies with number of barrels. △ equals length to be added to dimension 'B' for each additional barrel.



ELEVATION D-D

APRON DRAIN DETAIL



PLAN

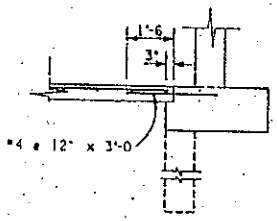
Apron for 20° to 45° skew box culvert

NOTES:

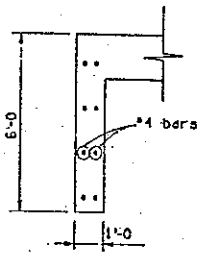
For General Notes and miscellaneous details see B-01.10.

See B-06.20, B-06.30 and B-06.40 for apron dimensions and quantities.

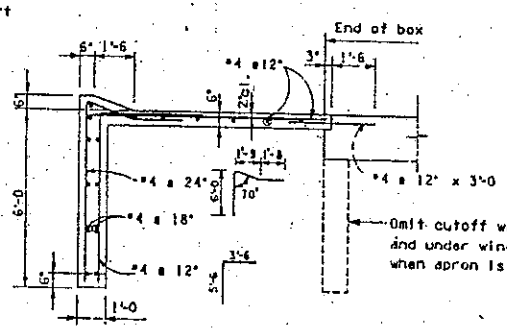
The apron quantities take into consideration the cutoff walls being omitted along outlet headwall and shall be used on new box culverts only.



SECTION A-A



SECTION B-B



SECTION C-C

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

REVISION

CULVERT APRON DETAILS

STANDARD NO.
B-06.10

DIMENSIONS

Span	Hgt.	0° Skew A	0° Skew B	0° Skew C	5° Skew A	5° Skew B	5° Skew C	5° Skew D	5° Skew E	10° Skew A	10° Skew B	10° Skew C	10° Skew D	10° Skew E	15° Skew A	15° Skew B	15° Skew C	15° Skew D	15° Skew E
6'	3'	6'-7½	4'-8½	2'-4⅜	6'-8	4'-8½	1'-9⅜	3'-0½	6'-6½	6'-8	4'-9½	1'-2½	3'-11½	6'-9½	6'-1½	4'-10½	6 3/8"	4'-7⅜	6'-7½
	4'	8'-0⅜	4'-8½	2'-11½	8'-1⅜	4'-8½	2'-2½	3'-8½	7'-10⅜	8'-1⅜	4'-9½	1'-5½	4'-0½	8'-1⅜	7'-7½	4'-10½	8"	5'-9½	8'-2½
	5'	9'-5½	4'-8½	3'-5½	9'-6½	4'-8½	2'-6½	4'-6½	9'-1⅜	9'-7⅜	4'-9½	1'-8⅜	5'-5½	9'-4⅜	9'-1½	4'-10½	9 1/2"	6'-7½	9'-5½
	6'	10'-10½	4'-8½	3'-11⅜	11'-0½	4'-8½	2'-11⅜	5'-1⅜	11'-0⅜	11'-1½	4'-9½	1'-11½	6'-5½	11'-1½	10'-7½	4'-10½	11 1/8"	7'-9½	11'-1½
	7'	12'-3½	4'-8½	4'-5½	12'-5½	4'-8½	3'-4½	5'-9½	12'-5	12'-6⅜	4'-9½	2'-2⅜	7'-2½	12'-5½	12'-1	4'-10½	1'-0⅜	8'-7⅜	12'-3⅜
8'	3'	6'-7½	6'-10½	2'-4⅜	6'-8	6'-10½	1'-9⅜	3'-0½	6'-6½	6'-8	6'-11½	1'-2½	3'-11½	6'-9½	6'-1½	7'-1½	6 3/8"	4'-7⅜	6'-7½
	4'	8'-0⅜	6'-10½	2'-11½	8'-1⅜	6'-10½	2'-2½	3'-8½	7'-10⅜	8'-1⅜	6'-11½	1'-5½	4'-0½	8'-1⅜	7'-7½	7'-1½	8"	5'-9½	8'-2½
	5'	9'-5½	6'-10½	3'-5½	9'-6½	6'-10½	2'-6½	4'-6½	9'-1⅜	9'-7⅜	6'-11½	1'-8⅜	5'-5½	9'-4⅜	9'-1½	7'-1½	9 1/2"	6'-7½	9'-5½
	6'	10'-10½	6'-10½	3'-11⅜	11'-0½	6'-10½	2'-11⅜	5'-1⅜	11'-0⅜	11'-1½	6'-11½	1'-11½	6'-5½	11'-1½	10'-7½	7'-1½	11 1/8"	7'-9½	11'-1½
	7'	12'-3½	6'-10½	4'-5½	12'-5½	6'-10½	3'-4½	5'-9½	12'-5	12'-6⅜	6'-11½	2'-2⅜	7'-2½	12'-5½	12'-1	7'-1½	1'-0⅜	8'-7⅜	12'-3⅜
	8'	14'-3½	5'-9½	5'-2½	14'-0½	5'-9½	3'-9½	6'-6½	13'-11⅜	14'-1⅜	5'-10½	2'-5⅜	8'-0⅜	13'-11⅜	13'-7½	5'-11½	1'-2½	9'-8⅜	13'-10½
10'	3'	6'-7½	9'-0½	2'-4⅜	6'-8	9'-0⅜	1'-9⅜	3'-0½	6'-6½	6'-8	9'-1⅜	1'-2½	3'-11½	5'-9½	6'-1½	9'-4	6 3/8"	4'-7⅜	6'-7½
	4'	8'-0⅜	9'-0½	2'-11½	8'-1⅜	9'-0⅜	2'-2½	3'-8½	7'-10⅜	8'-1⅜	9'-1⅜	1'-5½	4'-0½	8'-1⅜	7'-7½	9'-4	8"	5'-9½	8'-2½
	5'	9'-5½	9'-0½	3'-5½	9'-6½	9'-0⅜	2'-6½	4'-6½	9'-1⅜	9'-7⅜	9'-1⅜	1'-8⅜	5'-5½	9'-4⅜	9'-1½	9'-4	9 1/2"	6'-7½	9'-5½
	6'	10'-10½	9'-0½	3'-11⅜	11'-0½	9'-0⅜	2'-11⅜	5'-1⅜	11'-0⅜	11'-1½	9'-1⅜	1'-11½	6'-5½	11'-1½	10'-7½	9'-4	11 1/8"	7'-9½	11'-1½
	7'	12'-3½	9'-0½	4'-5½	12'-5½	9'-0⅜	3'-4½	5'-9½	12'-5	12'-6⅜	9'-1⅜	2'-2⅜	7'-2½	12'-5½	12'-1	9'-4	1'-0⅜	8'-7⅜	12'-3⅜
	8'	14'-3½	7'-11½	5'-2½	14'-0½	7'-11½	3'-9½	6'-6½	13'-11⅜	14'-1⅜	8'-0⅜	2'-5⅜	8'-0⅜	13'-11⅜	13'-7½	8'-2⅜	1'-2½	9'-8⅜	13'-10½
	9'	15'-9	7'-9⅜	5'-8½	15'-6½	7'-9⅜	4'-1⅜	7'-4⅜	15'-10	15'-7½	7'-10½	2'-9	9'-1½	15'-9½	15'-1½	8'-0⅜	1'-3⅜	10'-10½	15'-6⅜
	10'	17'-2½	7'-7½	6'-3	16'-11½	7'-7½	4'-6⅜	8'-0⅜	17'-2½	17'-1⅜	7'-8½	3'-0½	9'-10½	17'-1½	16'-7½	7'-10½	1'-5½	11'-9½	16'-9⅜
12'	8'	14'-3½	10'-3½	5'-2½	14'-0½	10'-3⅜	3'-9½	6'-6½	13'-11⅜	14'-1⅜	10'-5½	2'-5⅜	8'-0⅜	13'-11⅜	13'-7½	10'-7⅜	1'-2½	9'-8⅜	13'-10½
	9'	15'-9	10'-1	5'-8½	15'-6½	10'-1⅜	4'-1⅜	7'-4⅜	15'-10	15'-7½	10'-3½	2'-9	9'-1½	15'-9½	15'-1½	10'-5⅜	1'-3⅜	10'-10½	15'-6⅜
	10'	17'-2½	9'-11½	6'-3	16'-11½	9'-11⅜	4'-6⅜	8'-0⅜	17'-2½	17'-1⅜	10'-1	3'-0½	9'-10½	17'-1½	16'-7½	10'-3½	1'-5½	11'-9½	16'-9⅜
	11'	18'-7½	9'-9½	6'-9⅜	18'-5⅜	9'-9½	4'-11⅜	8'-8½	18'-7½	18'-7⅜	9'-10½	3'-3⅜	10'-7½	18'-5⅜	18'-6½	10'-1	1'-7	12'-11⅜	18'-5⅜
	12'	20'-0½	9'-7	7'-3⅜	19'-11½	9'-7⅜	5'-4½	9'-4	20'-0½	20'-1½	9'-8⅜	3'-6½	11'-0½	20'-2⅜	19'-7½	9'-10½	1'-8⅜	13'-10½	19'-1½

Span	Hgt.	20° Skew A	20° Skew B	20° Skew C	20° Skew D	25° Skew A	25° Skew B	25° Skew C	25° Skew D	30° Skew A	30° Skew B	30° Skew C	30° Skew D	35° Skew A	35° Skew B	35° Skew C	35° Skew D	40° Skew A	40° Skew B	40° Skew C	40° Skew D	45° Skew A	45° Skew B	45° Skew C	45° Skew D
6'	3'	6'-0	4'-11½	5'-2½	5'-8½	6'-0	5'-2⅜	6'-8⅜	6'-8⅜	5'-6	5'-6⅜	7'-10⅜	6'-7⅜	5'-6	5'-10⅜	9'-1½	6'-4½	5'-0	6'-4½	10'-10⅜	6'-3⅜	5'-0	6'-11½	12'-5½	5'-9⅜
	4'	7'-6	4'-11½	6'-11	8'-2⅜	7'-6	5'-2⅜	8'-1⅜	8'-1⅜	7'-0	5'-6⅜	9'-5	7'-10½	6'-6	5'-10⅜	10'-9½	7'-6½	6'-6	6'-4½	12'-7½	7'-3⅜	6'-0	6'-11½	15'-1½	7'-0½
	5'	9'-0	4'-11½	7'-10½	9'-4½	8'-6	5'-2⅜	9'-2½	9'-2½	8'-0	5'-6⅜	10'-11⅜	9'-2½	8'-0	5'-10⅜	12'-9½	8'-11⅜	7'-6	6'-4½	14'-9⅜	8'-6⅜	7'-0	6'-11½	17'-5	8'-1½
	6'	10'-6	4'-11½	9'-2	10'-11½	10'-0	5'-2⅜	10'-7½	10'-7½	9'-6	5'-6⅜	12'-5½	10'-5⅜	9'-0	5'-10⅜	14'-5⅜	10'-1⅜	8'-6	6'-4½	16'-11⅜	9'-9⅜	8'-6	6'-11½	19'-8½	9'-2½
	7'	12'-0	4'-11½	10'-1½	12'-0⅜	11'-6	5'-2⅜	12'-0½	12'-0½	11'-0	5'-6⅜	14'-0½	11'-9	10'-6	5'-10⅜	16'-1½	11'-3½	10'-0	6'-4½	19'-1⅜	11'-0⅜	9'-6	6'-11½	21'-11⅜	10'-2½
8'	3'	6'-0	7'-3⅜	5'-7½	5'-8½	6'-0	7'-7⅜	6'-8⅜	6'-8⅜	5'-6	8'-0⅜	7'-10⅜	6'-7⅜	5'-6	8'-6⅜	9'-1½	6'-4½	5'-0	9'-2⅜	10'-10⅜	6'-3⅜	5'-0	9'-11⅜	12'-5½	5'-9⅜
	4'	7'-6	7'-3⅜	6'-11	8'-2⅜	7'-6	7'-7⅜	8'-1⅜	8'-1⅜	7'-0	8'-0⅜	9'-5	7'-10½	6'-6	8'-6⅜	10'-9½	7'-6½	6'-6	9'-2⅜	12'-7½	7'-3⅜	6'-0	9'-11⅜	15'-1½	7'-0½
	5'	9'-0	7'-3⅜	7'-10½	9'-4½	8'-6	7'-7⅜	9'-2½	9'-2½	8'-0	8'-0⅜	10'-11⅜	9'-2½	8'-0	8'-6⅜	12'-9½	8'-11⅜	7'-6	9'-2⅜	14'-9⅜	8'-6⅜	7'-0	9'-11⅜	17'-5	8'-1½
	6'	10'-6	7'-3⅜	9'-2	10'-11½	10'-0	7'-7⅜	10'-7½	10'-7½	9'-6	8'-0⅜	12'-5½	10'-5⅜	9'-0	8'-6⅜	14'-5⅜	10'-1⅜	8'-6	9'-2⅜	16'-11⅜	9'-9⅜	8'-6	9'-11⅜	19'-8½	9'-2½
	7'	12'-0	7'-3⅜	10'-1½	12'-0⅜	11'-6	7'-7⅜	12'-0½	12'-0½	11'-0	8'-0⅜	14'-0½	11'-9	10'-6	8'-6⅜	16'-1½	11'-3½	10'-0	9'-2⅜	19'-1⅜	11'-0⅜	9'-6	9'-11⅜	21'-11⅜	10'-2½
	8'	13'-6	6'-1½	11'-8½	13'-11½	13'-0	6'-4⅜	13'-9½	13'-9½	12'-0	6'-9	16'-0	13'-5½	11'-6	7'-2½	18'-1⅜	13'-1⅜	11'-0	7'-8⅜	21'-7½	12'-5½	11'-0	8'-3½	25'-7⅜	11'-11½
10'	3'	6'-0	9'-1	5'-7½	6'-8½	13'-0	10'-0	6'-8⅜	6'-8⅜	5'-6	10'-6⅜	7'-10⅜	6'-7⅜	5'-6	11'-2⅜	9'-1½	6'-4½	5'-0	12'-0⅜	10'-10⅜	6'-3⅜	5'-0	13'-0½	12'-5½	5'-9⅜
	4'	7'-6	9'-7	6'-11	8'-2⅜	7'-6	10'-0	8'-1⅜	8'-1⅜	7'-0	10'-6⅜	9'-5	7'-10½	6'-6	11'-2⅜	10'-9½	7'-6½	6'-6	12'-0⅜	12'-7½	7'-3⅜	6'-0	13'-0½	15'-1½	7'-0½
	5'	9'-0	9'-7	7'-10½	9'-4½	8'-6	10'-0	9'-2½	9'-2½	8'-0	10'-6⅜	10'-11⅜	9'-2½	8'-0	11'-2⅜	12'-9½	8'-11⅜	7'-6	12'-0⅜	14'-9⅜	8'-6⅜	7'-0	13'-0½	17'-5	8'-1½
	6'	10'-6	9'-7	9'-2	10'-11½	10'-0	10'-0	10'-7½	10'-7½	9'-6	10'-6⅜	12'-5½	10'-5⅜	9'-0	11'-2⅜	14'-5⅜	10'-1⅜	8'-6	12'-0⅜	16'-11⅜	9'-9⅜	8'-6	13'-0½	19'-8½	9'-2½
	7'	12'-0	9'-7	10'-1½	12'-0⅜	11'-6	10'-0	12'-0½	12'-0½	11'-0	10'-6⅜	14'-0½	11'-9	10'-6	11'-2⅜	16'-1½	11'-3½	10'-0	12'-0⅜	19'-1⅜	11'-0⅜	9'-6	13'-0½	21'-11⅜	10'-2½
	8'	13'-6	8'-5½	11'-8½	13'-11½	13'-0	8'-9½	13'-9½	13'-9½	12'-0	9'-3	16'-0	13'-5½	11'-6	9'-9⅜	18'-0⅜	13'-1⅜	11'-0	10'-6⅜	21'-7½	12'-5½	11'-0	11'-4½	25'-7⅜	11'-11½
	9'	15'-0	8'-2⅜	13'-0½	15'-6½	14'-6	8'-7½	15'-3½	15'-3½	13'-6	9'-0½	17'-7½	14'-9½	13'-0	9'-7½	20'-5½	14'-3⅜	12'-6	10'-3⅜	23'-10½	13'-9⅜	12'-0	11'-1½	28'-0½	13'-1
	10'	16'-5	8'-0⅜	14'-0½	16'-8⅜	15'-6	8'-4½	16'-4⅜	16'-4⅜	15'-0	8'-9⅜	19'-2⅜	16'-1½	14'-0	9'-4⅜	22'-1½	15'-9⅜	13'-6	10'-0⅜	26'-2⅜	15'-1½	13'-0	10'-9½	30'-5⅜	14'-2⅜
12'	8'	13'-6	10'-11	11'-4½	13'-11½	13'-0	11'-4⅜	13'-9½	13'-9½	12'-0	11'-11⅜	16'-0	13'-5½	11'-6	12'-8½	18'-0⅜	13'-1⅜	11'-0	13'-6⅜	21'-7½	12'-5½	11'-0	14'-8½	25'-7⅜	11'-11½
	9'	15'-0	10'-8⅜	13'-0½	15'-6½	14'-6	11'-2	15'-3½	15'-3½	13'-6	11'-8⅜	17'-7½	14'-9½	13'-0	12'-5⅜	20'-5½	14'-3⅜	12'-6	13'-3⅜	23'-10½	13'-9⅜	12'-0	14'-4½	28'-0½	13'-1
	10'	16'-5	10'-6⅜	14'-0½	16'-8⅜	15'-6	10'-11⅜	16'-4⅜	16'-4⅜	15'-0	11'-6½	19'-2⅜	16'-1½	14'-0	12'-2⅜	22'-1½	15'-9⅜	13'-6	13'-0⅜	26'-2⅜	15'-1½	13'-0	14'-1⅜	30'-5⅜	14'-2⅜
	11'	18'-0	10'-4½	15'-4½	18'-3⅜	17'-0	10'-9½	17'-10½	17'-10½	16'-0	11'-3½	20'-9⅜	17'-5⅜	15'-6	11'-11⅜	24'-4½	17'-0½	15'-0	12'-9⅜	28'-5⅜	16'-5⅜	14'-6	13'-10	32'-11½	15'-4½
	12'	19'-6	10'-3½	16'-4⅜	19'-6	18'-6	10'-6½	19'-3⅜	19'-3⅜	17'-6	11'-1½	22'-5½	18'-9⅜	16'-6	11'-9½	25'-0⅜	18'-3½	16'-0	12'-6⅜	30'-4½	17'-6½	15'-6	13'-6⅜	35'-9⅜	16'-8⅜

QUANTITIES

Span	Hgt.	0° Skew Conc. C.Y. 1Bbl.	0° Skew Conc. C.Y. Δc	0° Skew Steel lbs. 1Bbl.	0° Skew Steel lbs. Δs	5° Skew Conc. C.Y. 1Bbl.	5° Skew Conc. C.Y. Δc	5° Skew Steel lbs. 1Bbl.	5° Skew Steel lbs. Δs	10° Skew Conc. C.Y. 1Bbl.	10° Skew Conc. C.Y. Δc	10° Skew Steel lbs. 1Bbl.	10° Skew Steel lbs. Δs	15° Skew Conc. C.Y. 1Bbl.	15° Skew Conc. C.Y. Δc	15° Skew Steel lbs. 1Bbl.	15° Skew Steel lbs. Δs	20° Skew Conc. C.Y. 1Bbl.	20° Skew Conc. C.Y. Δc	20° Skew Steel lbs. 1Bbl.	20° Skew Steel lbs. Δs
6'	3'	0.44	1.05	22	91	0.44	1.05	22	91	0.46	1.08	25	94	0.50	1.06	27	92	0.55	1.08	33	94
	4'	0.50	1.23	31	104	0.50	1.23	31	104	0.51	1.26	34	107	0.57	1.26	39	107	0.62	1.28	45	109
	5'	0.52	1.40	42	117	0.53	1.43	44	119	0.54	1.43	44	120	0.59	1.43	49	120	0.64	1.46	54	122
	6'	0.57	1.58	54	130	0.58	1.61	57	132	0.61	1.63	61	135	0.66	1.63	65	135	0.72	1.66	71	137
	7'	0.65	1.75	69	143	0.66	1.78	72	145	0.69	1.81	76	148	0.74	1.80	80	148	0.79	1.83	85	150
8'	3'	0.84	1.45	51	118	0.84	1.45	51	118	0.86	1.49	55	122	0.90	1.46	56	119	0.96	1.50	63	122
	4'	0.95	1.68	64	135	0.95	1.68	64	135	0.97	1.72	68	138	1.03	1.72	73	139	1.10	1.76	79	142
	5'	1.03	1.91	79	152	1.05	1.95	82	155	1.06	1.95	83	155	1.11	1.95	87	156	1.17	1.99	93	159
	6'	1.13	2.14	96	169	1.16	2.17	99	172	1.19	2.21	104	175	1.25	2.21	108	175	1.31	2.25	115	178
	7'	1.27	2.36	115	186	1.29	2.40	119	189	1.33	2.44	123	192	1.38	2.44	127	192	1.44	2.48	133	195
	8'	1.56	2.70	112	210	1.54	2.66	108	208	1.59	2.70	113	211	1.64	2.70	117	211	1.76	2.77	130	217
10'	3'	1.28	1.88	85	147	1.28	1.88	85	148	1.32	1.93	89	151	1.35	1.89	90	148	1.42	1.94	97	153
	4'	1.45	2.16	102	169	1.46	2.16	102	169	1.49	2.22	107	173	1.55	2.21	111	173	1.63	2.27	119	177
	5'	1.59	2.45	121	190	1.62	2.50	125	193	1.63	2.50	126	194	1.69	2.50	130	194	1.76	2.55	134	198
	6'	1.76	2.73	143	211	1.79	2.78	147	214	1.84	2.83	152	218	1.89	2.83	157	218	1.97	2.88	164	222
	7'	1.95	3.07	166	232	1.99	3.07	172	236	2.04	3.11	176	239	2.09	3.11	180	239	2.17	3.16	187	243
	8'	2.33	3.43	169	263	2.30	3.39	166	259	2.36	3.43	171	263	2.41	3.43	175	263	2.56	3.52	189	270
	9'	2.56	3.72	190	284	2.57	3.72	191	284	2.64	3.77	197	288	2.69	3.77	201	288	2.85	3.86	216	295
	10'	2.81	4.01	212	306	2.82	4.01	213	306	2.89	4.06	219	310	2.94	4.06	225	311	3.10	4.15	237	316
12'	8'	3.15	4.21	227	315	3.11	4.16	223	311	3.17	4.22	229	315	3.23	4.22	233	315	3.39	4.33	249	324
	9'	3.44	4.56	253	341	3.45	4.56	254	341	3.52	4.62	260	345	3.58	4.62	265	345	3.76	4.73	281	353
	10'	3.75	4.91	279	367	3.76	4.91	280	366	3.83	4.97	287	371	3.89	4.97	291	371	4.07	5.08	307	379
	11'	4.07	5.26	307	392	4.08	5.26	308	392	4.16	5.32	315	397	4.29	5.37	326	400	4.47	5.43	342	409
	12'	4.42	5.61	337	416	4.43	5.61	338	418	4.58	5.72	352	427	4.63	5.71	355	426	4.83	5.82	371	434

Span	Hgt.	25° Skew Conc. C.Y. 1Bbl.	25° Skew Conc. C.Y. Δc	25° Skew Steel lbs. 1Bbl.	25° Skew Steel lbs. Δs	30° Skew Conc. C.Y. 1Bbl.	30° Skew Conc. C.Y. Δc	30° Skew Steel lbs. 1Bbl.	30° Skew Steel lbs. Δs	35° Skew Conc. C.Y. 1Bbl.	35° Skew Conc. C.Y. Δc	35° Skew Steel lbs. 1Bbl.	35° Skew Steel lbs. Δs	40° Skew Conc. C.Y. 1Bbl.	40° Skew Conc. C.Y. Δc	40° Skew Steel lbs. 1Bbl.	40° Skew Steel lbs. Δs	45° Skew Conc. C.Y. 1Bbl.	45° Skew Conc. C.Y. Δc	45° Skew Steel lbs. 1Bbl.	45° Skew Steel lbs. Δs
6'	3'	0.77	1.13	52	98	1.03	1.13	73	99	1.27	1.38	95	104	1.58	1.22	123	108	1.84	1.28	147	113
	4'	0.89	1.32	67	113	1.20	1.33	92	114	1.50	1.34	116	116	1.84	1.42	147	123	2.25	1.47	185	128
	5'	0.98	1.46	81	123	1.37	1.50	113	126	1.75	1.57	146	132	2.15	1.60	180	136	2.60	1.65	220	141
	6'	1.11	1.66	101	138	1.55	1.69	137	141	2.00	1.73	173	144	2.50	1.78	216	150	3.02	1.88	260	158
	7'	1.28	1.86	124	153	1.78	1.89	164	156	2.24	1.93	204	159	2.91	2.00	251	166	3.46	2.06	302	171
8'	3'	1.19	1.55	83	127	1.46	1.57	105	129	1.72	1.64	128	134	2.05	1.69	157	139	2.33	1.77	183	146
	4'	1.38	1.81	103	146	1.69	1.83	128	148	2.00	1.85	153	150	2.37	1.95	186	155	2.81	2.03	226	166
	5'	1.51	2.00	120	160	1.91	2.04	154	164	2.32	2.14	189	172	2.74	2.19	223	176	3.21	2.27	265	183
	6'	1.71	2.26	145	179	2.17	2.30	182	183	2.62	2.35	220	188	3.14	2.43	264	194	3.71	2.56	311	205
	7'	1.95	2.52	173	199	2.46	2.56	214	203	2.98	2.61	254	207	3.63	2.72	311	216	4.21	2.80	357	223
	8'	2.35	2.81	175	220	2.93	2.81	220	221	3.58	2.89	273	228	4.24	2.91	326	235	5.12	3.16	396	250
10'	3'	1.67	2.01	119	158	1.94	2.03	141	160	2.22	2.12	166	167	2.57	2.19	197	173	2.88	2.30	224	182
	4'	1.93	2.34	144	182	2.25	2.36	169	184	2.56	2.39	195	187	2.97	2.52	230	198	3.43	2.63	272	206
	5'	2.11	2.57	165	199	2.52	2.63	199	204	2.96	2.75	236	214	3.40	2.82	273	220	3.90	2.92	316	228
	6'	2.38	2.89	195	224	2.85	2.95	233	228	3.32	3.02	272	234	3.87	3.12	318	241	4.47	3.23	364	255
	7'	2.68	3.22	228	248	3.21	3.28	270	253	3.74	3.34	312	258	4.43	3.48	370	269	5.03	3.58	419	277
	8'	3.16	3.58	236	275	3.74	3.59	281	276	4.42	3.69	336	284	5.10	3.80	390	293	6.03	4.04	465	312
	9'	3.52	3.91	264	299	4.16	3.92	317	300	4.91	4.03	376	309	5.75	4.17	444	320	6.69	4.35	518	334
	10'	3.80	4.15	291	317	4.62	4.25	355	325	5.48	4.34	426	332	6.38	4.48	497	343	7.37	4.65	574	357
12'	8'	4.01	4.40	297	329	4.60	4.42	342	330	5.31	4.55	399	340	6.02	4.69	455	351	7.01	4.99	534	373
	9'	4.44	4.80	334	359	5.09	4.82	383	360	5.87	4.95	445	370	6.75	5.13	514	384	7.73	5.35	592	400
	10'	4.78	5.08	361	380	5.63	5.21	427	389	6.50	5.32	499	398	7.44	5.50	572	411	8.48	5.72	652	427
	11'	5.26	5.48	402	409	6.12	5.54	469	414	7.13	5.72	549	427	8.26	5.95	638	441	9.39	6.17	722	461
	12'	5.77	5.88	445	439	6.71	5.94	517	444	7.72	6.05	598	452	8.91	6.27	690	468	10.36	6.57	800	491

NOTATIONS:

Δc = Apron concrete quantity per additional barrel.

Δs = Apron steel quantity per additional barrel.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

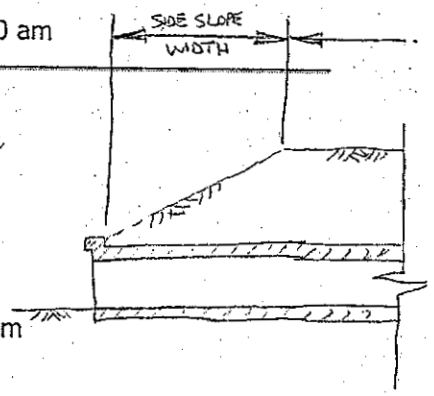
OUTLET APRON
DIMENSIONS & QUANTITIES
2 : 1 SLOPE

REVISION: 7-88

STANDARD NO. B-06.20

Jason Kelley - FW: North Inlet Channel Progress Meeting Monday, September 13th 9:30 am

From: Bobbie Ohler - FCDX <BAO@mail.maricopa.gov>
To: "'bling@kirkham.com'" <bling@kirkham.com>, "'jkelley@kirkham.com'" <jkelley@kirkham.com>
Date: 9/17/2004 11:37 AM
Subject: FW: North Inlet Channel Progress Meeting Monday, September 13th 9:30 am



-----Original Message-----
From: Richard Wallace - MCDOTX
Sent: Monday, September 13, 2004 12:57 PM
To: Bobbie Ohler - FCDX
Cc: Andrzej Wojakiewicz - MCDOTX
Subject: RE: North Inlet Channel Progress Meeting Monday, September 13th 9:30 am

DOESN'T TAKE INTO ACCOUNT SIDE SLOPE WIDTH

Bobbie:

We would recommend a culvert length of **116 feet, centered on the section line.** This should be sufficient length to allow for future roadway expansion to the ultimate section. We base this on a **principal arterial roadway with bike lanes** (per Figure 5.7 of MCDOT Roadway Design Manual), (51 feet to back of curb), a 6-foot sidewalk adjacent to curb as it crosses over the structure, and approx. a one-foot headwall thickness.

-----Original Message-----
From: Bobbie Ohler - FCDX
Sent: Monday, September 13, 2004 6:59 AM
To: Richard Wallace - MCDOTX
Subject: FW: North Inlet Channel Progress Meeting Monday, September 13th 9:30 am

NORTHERN WASH CULVERT

(SOUTH OF NORTHERN ONLY) L = 51' + 6' + 21.5' + 1' = 79'
SIDEWALK, SIDE SLOPE, HEADWALL CURB

WHERE 1236 = ROADWAY ELEV & 1225.29 IS FROM: 1217.75 INV + 6 HEIGHT + 12½" TOP SLAB + 6" HEADWALL CURB

APPROX. SIDE SLOPE WIDTH = (1236 - 1225.29) × 2 = 2:1

SAY, 80'

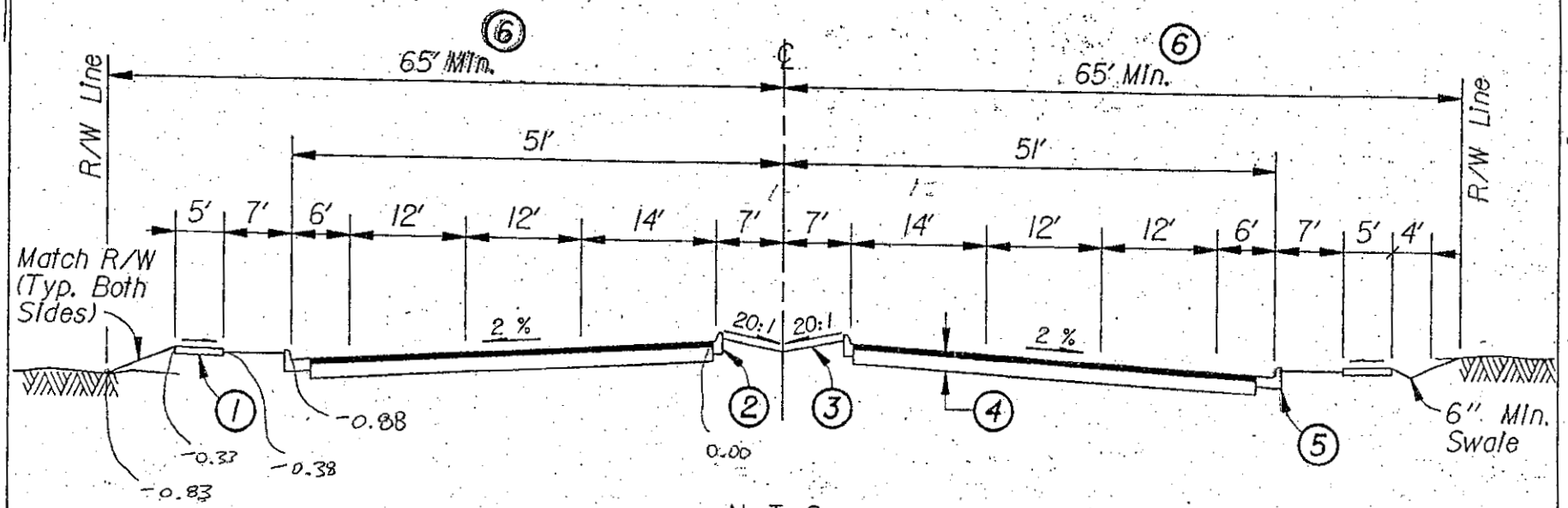
USE 84

-----Original Message-----
From: Jason Kelley [mailto:jkelley@kirkham.com]
Sent: Friday, September 10, 2004 10:18 AM
To: KEuge@aol.com; dmaguire@landsolutionsinc.com; BAO@mail.maricopa.gov; dwm@mail.maricopa.gov; gsm@mail.maricopa.gov; jmr@mail.maricopa.gov; jrr@mail.maricopa.gov; rbs@mail.maricopa.gov; glenv@mwdaz.com; snowaczyk@ninyoandmoore.com; nsanders@sagelandscape.com
Cc: Barry Ling
Subject: North Inlet Channel Progress Meeting Monday, September 13th 9:30 am

See attached agenda.

When: Monday, September 13, 2004 9:30 AM-11:30 AM (GMT-07:00) Arizona.
Where: FCD - White Tanks conference room

Jason K. Kelley, P.E.
Kirkham Michael & Associates, Inc.
9201 North 25th Avenue, Suite 195
Phoenix, Arizona 85021



1. Designer Shall Offset S/W Except at Street Intersections (Typ. Both Sides).
2. MCDOT Std. Detail 2030, Single Curb (Typ. Both Sides).
3. Under Certain Conditions, the Construction of Median Curb may be Waived by the Department.
4. 4" Min. A.C. Over 10" Min. A.B. or Approved Equivalent.
5. MAG Std. Detail 220, Type A or MCDOT Std. Detail 2030, Curb & Gutter (Typ. Both Sides).
6. Road of Regional Significance Alignment - 70' Typical Half-Width Min.

NOTE: Cross Section may be Flared at Intersections to Provide Dual Left Turn Lanes and/or Right Turn Lanes.

Maricopa Co. Dept. of Transportation Standard Typical Section	URBAN PRINCIPAL ARTERIAL ROAD WITH BIKE LANES	FIG. 5.7

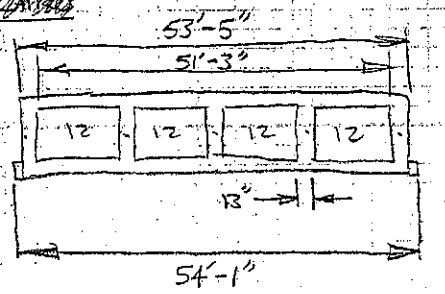
KIRKHAM MICHAEL
CONSULTING ENGINEERS
9201 North 25th Avenue • Suite 195 • Phoenix, AZ 85021

Job number: _____

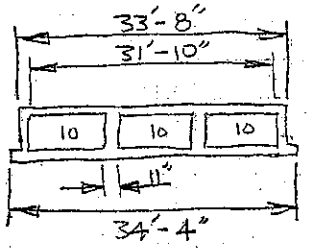
Sheet _____ of _____

Project: NORTH INLET CHANNEL Date: 10/05

Subject: WASH CULVERT & DIVERSION CULVERT AT NORTHERN Designed: JTK Checked: _____



NORTHERN WASH CULVERT



NORTHERN DIVERSION CULVERT

North Inlet Drop Structure Location, Analysis and Design

The drop structures were located, analyzed and designed using a set of methods and checks with HEC-RAS and hand calculations as follows:

1) Drop structures were located by evaluating the existing ground profile at proposed channel centerline and placing them such that the proposed channel would not be in a levee condition.
2) The drop structures include five 3.50' drops, two 4.50' drops, and one 6.25' drop.
3) An iterative HEC-RAS analysis was performed to determine that a 25' constriction was needed to eliminate draw down and increasing velocities upstream of each drop crest. The constriction is sudden enough (1:1 constriction into the main channel) to achieve the desired reduction in draw-down and velocities while also directing flow towards the drop.
4) The drop structure aprons and cutoff walls are configured to protect the structures from scour and seepage analysis done per Drainage design Manual.
5) A hydraulic jump analysis was performed to determine the bottom apron length of the drop structures. Each drop structure size was modeled in HEC-RAS using a range of flows from 400 to 1600 cfs. The location of the hydraulic jump was identified from the HEC-RAS flow profiles. The Froude number at the beginning of the jump and the downstream (sequent) flow depth were obtained from the HEC-RAS output for the worst case scenario (i.e. the values that produce the longest jump and therefore needing the longest apron length). The length of the jump was then obtained using three different methods .
    a. From Figure VI-11 "Length of Jump In Terms Of y1, Rectangular Channel" from USDOT, FHWA, HEC-14, 1983 (also Figure 7.7 in the new County (Draft) Hydraulics Manual).
    b. A HEC-RAS analysis using flows ranging from 400 cfs to 1600 cfs supplied the Froude number and water depth needed to obtain the maximum bottom apron length needed to prevent erosion.
    c. Using a graph from the Manual-the bottom apron lengths were determined: 30' apron for the 3.50' drop, 31' for the 4.50' drop, and 36' for the 6.25' drop.
6) Using the scour depth from the SS5-96, an upstream cutoff wall was set at 6'.
7) Seepage and uplift issues were checked using the methods set forth by the DDMMC and found to be within acceptable limits.
8) The boulder size analysis was calculated using a method used in the Colorado Flood Control District Manual.

Results:

- A 25' constriction, at a 1:1 constriction is needed at the crest of all drops.
- A total of five 3.50' drops, two 4.50' drops and one 6.25' drop are needed in the North Inlet Channel.
- 15' top aprons are needed on all drops and 30' bottom aprons are needed for the 3.50' drops, 31' bottom aprons are needed for the 4.50' drops, and a 36' bottom apron is needed for the 6.25' drop.
- Upstream cutoff walls need a minimum depth of 6'.
- Seepage and uplift on all structures are within limits.
- 24", 30" and 36" boulders are to be used in the structures .

6. The main stilling basin should be depressed 1 to 2 feet deep in order to stabilize the jump. A row of boulders should be located at the basin end to create a sill transition to the downstream invert elevation. It is advisable to bury riprap for a distance of 10 feet downstream of the sill to minimize any erosion that may occur due to secondary currents.

7. Do not use slopes steeper than 4:1. Slopes flatter than 4:1 improve appearance while steeper slopes will reduce structure stability. With high public usage, flatter slopes will help mitigate reverse roller formation from higher tailwater depths that can cause submerged hydraulic jump formation.

8. Simplified design criteria are provided in Table HS-4 for grouted sloping boulder drops. These criteria are valid only where the channel flow conditions meet criteria in the MAJOR DRAINAGE chapter.

TABLE HS-4

Grouted Sloping Boulder Drops: Minimum Design Criteria for Grass-Lined Channels Meeting the District's Maximum Depth and Velocity Criteria

Design Parameter	Drop Height (H_d) 5 Feet or Less	Drop Height (H_d) Greater Than 5 Feet
Maximum drop slope	4H to 1V	4H to 1V
Minimum boulder depth	Use V_c to size*	Use V_n to size**
Grout thickness—D_g	½ D_r	½ D_r
Basin depression	2 feet	Do sequential depth analysis
Grouted rock approach—L_a	8 feet	8 feet
Basin length—L_b**		
Erosive	25 feet	25 feet
Non-erosive	20 feet	20 feet
Basin width—B	Same as crest width	
Trickle and low-flow zone provisions	Install large boulders in center basin zone to break up high flow stream	
Trickle zone protection width below drop	$3b_1$ or b^2 (whichever is smaller; see Figure HS-7).	
Other provisions	A buried riprap zone should be installed for $2H_d$ (10 feet minimum) downstream of the basin	

* Use critical velocity in low-flow and main channels to size boulders.

** Use drawdown velocity at H_d to size low-flow and main channel section boulders.

Sizing of boulders for the simplified grouted sloping boulder procedure is based on the following:

1. This procedure can be used only for channels designed using the specified maximum velocities and depths for grass-lined channels in this *Manual* (see the MAJOR DRAINAGE chapter).

2. For drops of 5 feet or less in height, use the UD-Channels Spreadsheet to determine the 100-year critical velocities in the low-flow channel and the main channel to size boulders for each section.

3. For drops greater than 5 feet in height, determine the critical velocities using drawdown calculations to establish the 100-year flow depth at the toe of the drop.

4. For a composite channel, find critical velocity, V_c, for the channel cross-section segment outside the low-flow section.

5. For a composite channel, find critical velocity, V_{mc}, for the low-flow channel cross-section segment.

6. For a simple trapezoidal or wetland bottom channel, find critical velocity, V_c, for the channel cross section.

7. Calculate rock-sizing parameter, R_p, for the channel cross-section segment outside the low-flow section or for a simple trapezoidal channel section using the critical velocity estimated for this segment of the cross section:

$$R_p = \frac{V_c S^{0.17}}{(S_s - 1)^{0.66}}$$

V_c CALCULATED USING SPREADSHEET AND Y_c FROM HEC-RAS

in which:

S = longitudinal slope along direction of flow in ft/ft

S_s = Specific gravity of the rock. Assume 2.55 unless the quarry certifies higher specific gravity.

N/A 8. Calculate rock-sizing parameter, R_{pL}, for the channel cross-section segment within the low-flow section using the critical velocity estimated for this segment of the cross section:

$$R_{pL} = \frac{V_{mc} S^{0.17}}{(S_s - 1)^{0.66}} \qquad \text{(HS-9)}$$

9. Select minimum boulder sizes for the segments within and outside the low-flow channel segment of the channel cross section from Table HS-5. If the boulder sizes that result for the low-flow channel and the overbank segments of the cross section differ, decide to use only the larger sized boulders throughout the entire structure, or to specify two sizes, namely, one for the low-flow channel and the other for the overbank segments of the cross section. Consider the

complexity of specifying two different sizes on the design drawings and in the construction of the structure before deciding.

10. All boulders shall be grouted in accordance with the guidance in the MAJOR DRAINAGE chapter of this *Manual*.

11. All grouted boulders above the low-flow channel shall be buried with topsoil to a depth of 4 inches above the top of the highest boulder and the surface vegetated with native grasses on the overbank bench and native grasses and dry-land shrubs on the overbank channel's side slopes.

TABLE HS-5

Boulder Sizes for Various Rock Sizing Parameters

Rock Sizing Parameter, R_p	Minimum Dimensions of Boulder, D_B	Boulder Classification
Less than 4.50	18 inches	B18
4.50 to 4.99	24 inches	B24
5.00 to 5.59	30 inches	B30
5.60 to 6.39	36 inches	B36
6.40 to 6.99	42 inches	B42
7.00 to 7.50	48 inches	B48

2.4.4 Vertical Hard Basin Drops. The vertical hard basin drop is a generalized category that can include a wide variety of structure designs. However, the vertical hard basin drop is to be avoided where practical due to impingement energy, related maintenance, and turbulent hydraulic potential under some flow conditions (ASCE and WEF 1992). A variety of components can be used for both the hard basin and the crest wall. Various contraction effects can be implemented to reduce approach velocities, and different trickle or low-flow channel options can be selected. Maximum drop height across the structure is limited to 3 feet for safety considerations.

The hydraulic phenomenon provided by this type of drop is a jet of water that overflows the crest wall into the basin below. The jet hits the hard basin and is redirected horizontally. With sufficient tailwater, a hydraulic jump is initiated. Otherwise, the flow continues horizontally in a supercritical mode until the specific force of the tailwater is sufficient to force the jump. Energy is dissipated through the turbulence of the hydraulic jump; therefore, the basin is sized to contain the supercritical flow and the erosive turbulent zone.

Generally, a rough basin is advantageous since increased roughness will result in a shorter, more economical basin. Figure HS-9 shows a vertical drop with a grouted boulder basin. The rock-lined approach length ends abruptly at a structural retaining crest wall that has a nearly rectangular cross section and trickle channel section.

Boulder Sizing Calculations - Urban Storm Drainage Criteria Manual

Urban Drainage and Flood Control District (UDFCD)

Denver, Colorado

(See pages HS-23 through HS-25 of the Colorado Drainage Criteria Manual for procedure)

Drop Size	Width, b	Side Slopes (H:1)	Critical Depth, yc (from HEC-RAS)	Flow Area at Critical Depth, Ac	Water Surface Top Width, Tc	Calculated Critical Velocity, Vc	Rock-sizing Parameter, Rp	Table HS-5 Rock Size
3.50'	25.00	4.00	4.02	165.14	57.16	9.65	5.71	36
4.50'	25.00	4.00	4.02	165.14	57.16	9.65	5.71	36
6.25'	25.00	4.00	4.02	165.14	57.16	9.65	5.71	36

Critical Depth (from HEC-RAS)

3.50' Drop		4.50' Drop		6.25' Drop	
HEC-RAS xsecs	Tc	HEC-RAS xsecs	Tc	HEC-RAS xsecs	Tc
526 to 540	4.02	522 to 540	4.02	515 to 540	4.02

Critical Velocity for a trapezoidal channel:

$A_c/T_c = V_c^2/g$,where A_c = flow area

T_c = flow width

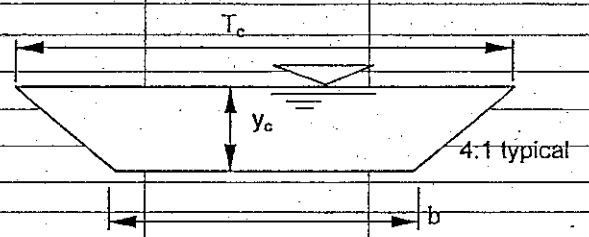
V_c = critical velocity

g = gravity

Solving for $V_c = [(A_c)(g)/T_c]^{0.5}$

where $A_c = (y_c)(b+4y_c)$

and $T_c = b+8y_c$



$R_p=(V_cS^{0.17})/(S_s-1)^{0.66}$

Where,

S=longitudinal slope along direction of flow (ft/ft) (see Note 1 at left)

S_s=Specific gravity of the rock. Assume 2.55 unless the quarry certifies higher.

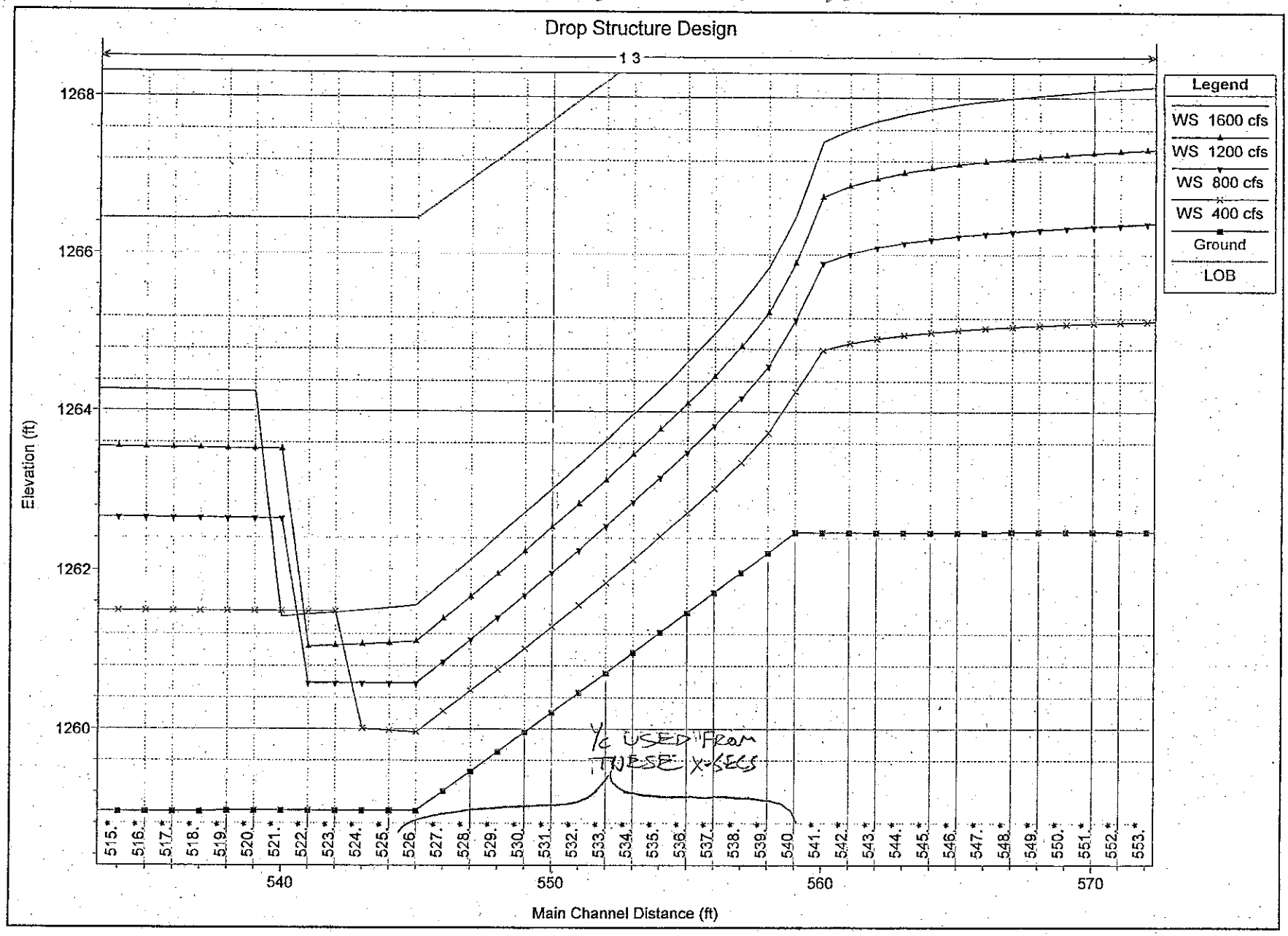
V_c=critical velocity

Notes:

1) Longitudinal slope along direction of flow (step 7, p. HS-24) used in rock-sizing parameter equation is the drop structure slope (4:1).

2) For Rock Size, see chart on page HS-25

3.50' BOULDER SIZING ANALYSIS



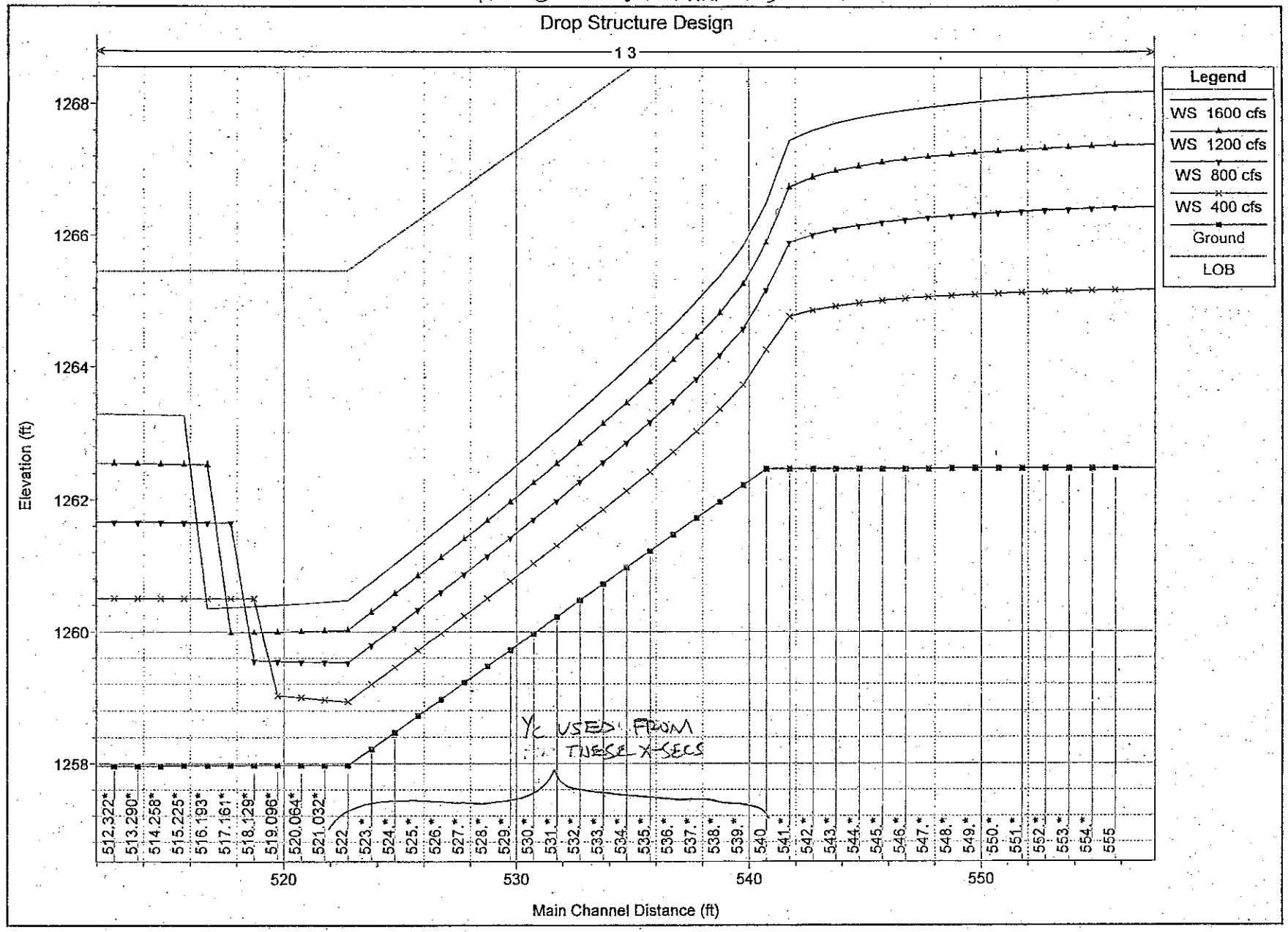
HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	545.*	400 cfs	400.00	1.00	0.040	1262.47	1265.02	2.55			1265.21	0.003327	3.47	115.36	55.41	0.42
3	544.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.79	5.32			1268.27	0.003802	5.54	288.97	75.58	0.50
3	544.*	1200 cfs	1200.00	1.00	0.040	1262.47	1267.05	4.58			1267.46	0.003812	5.11	235.03	69.64	0.49
3	544.*	800 cfs	800.00	1.00	0.040	1262.47	1266.16	3.69			1266.48	0.003835	4.54	176.03	62.49	0.48
3	544.*	400 cfs	400.00	1.00	0.040	1262.47	1264.99	2.52			1265.20	0.003880	3.69	108.34	53.13	0.46
3	543.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.71	5.24			1268.25	0.004422	5.88	272.29	72.92	0.54
3	543.*	1200 cfs	1200.00	1.00	0.040	1262.47	1266.98	4.51			1267.43	0.004458	5.43	220.92	67.05	0.53
3	543.*	800 cfs	800.00	1.00	0.040	1262.47	1266.09	3.62			1266.46	0.004518	4.85	164.90	60.00	0.52
3	543.*	400 cfs	400.00	1.00	0.040	1262.47	1264.94	2.47			1265.18	0.004619	3.96	100.97	50.76	0.50
3	542.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.60	5.13			1268.22	0.005273	6.29	254.20	70.06	0.58
3	542.*	1200 cfs	1200.00	1.00	0.040	1262.47	1266.88	4.41			1267.41	0.005353	5.84	205.64	64.27	0.57
3	542.*	800 cfs	800.00	1.00	0.040	1262.47	1266.01	3.54			1266.44	0.005476	5.23	152.87	57.33	0.56
3	542.*	400 cfs	400.00	1.00	0.040	1262.47	1264.88	2.41			1265.17	0.005674	4.30	93.04	48.27	0.55
3	541.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.45	4.98	3.90	1266.37	1268.18	0.006577	6.85	233.46	66.82	0.65
3	541.*	1200 cfs	1200.00	1.00	0.040	1262.47	1266.74	4.27	3.31	1265.78	1267.37	0.006740	6.38	188.13	61.15	0.64
3	541.*	800 cfs	800.00	1.00	0.040	1262.47	1265.89	3.42	2.62	1265.09	1266.40	0.006987	5.75	139.12	54.36	0.63
3	541.*	400 cfs	400.00	1.00	0.040	1262.47	1264.79	2.32			1265.14	0.007371	4.76	84.05	45.54	0.62
3	540	1600 cfs	1600.00	1.00	0.040	1262.47	1266.49	4.02	4.02	1266.49	1267.95	0.016990	9.70	164.88	57.12	1.01
3	540	1200 cfs	1200.00	1.00	0.040	1262.47	1265.89	3.42	3.42	1265.89	1267.17	0.017699	9.07	132.29	52.36	1.01
3	540	800 cfs	800.00	1.00	0.040	1262.47	1265.18	2.71	2.71	1265.18	1266.23	0.018859	8.24	97.13	46.68	1.01
3	540	400 cfs	400.00	1.00	0.040	1262.47	1264.27	1.80	1.80	1264.27	1265.01	0.021080	6.92	57.83	39.37	1.01
3	539.*	1600 cfs	1600.00	1.00	0.040	1262.22	1265.83	3.61	4.02	1266.24	1267.79	0.025496	11.22	142.59	53.91	1.22
3	539.*	1200 cfs	1200.00	1.00	0.040	1262.22	1265.27	3.05	3.42	1265.64	1267.01	0.027390	10.59	113.32	49.38	1.23
3	539.*	800 cfs	800.00	1.00	0.040	1262.22	1264.59	2.37	2.71	1264.93	1266.08	0.030861	9.78	81.78	43.97	1.26
3	539.*	400 cfs	400.00	1.00	0.040	1262.22	1263.73	1.51	1.80	1264.02	1264.86	0.039212	8.54	46.84	37.07	1.34
3	538.*	1600 cfs	1600.00	1.00	0.040	1261.97	1265.39	3.42	4.02	1265.99	1267.66	0.031362	12.08	132.45	52.38	1.34
3	538.*	1200 cfs	1200.00	1.00	0.040	1261.97	1264.84	2.87	3.42	1265.39	1266.88	0.034392	11.48	104.57	47.94	1.37
3	538.*	800 cfs	800.00	1.00	0.040	1261.97	1264.18	2.21	2.71	1264.68	1265.95	0.039676	10.67	74.95	42.71	1.42
3	538.*	400 cfs	400.00	1.00	0.040	1261.97	1263.36	1.39	1.80	1263.77	1264.74	0.052921	9.45	42.34	36.09	1.54
3	537.*	1600 cfs	1600.00	1.00	0.040	1261.72	1265.00	3.28	4.02	1265.74	1267.54	0.036694	12.77	125.26	51.28	1.44
3	537.*	1200 cfs	1200.00	1.00	0.040	1261.72	1264.46	2.74	3.42	1265.14	1266.77	0.040840	12.19	98.44	46.91	1.48
3	537.*	800 cfs	800.00	1.00	0.040	1261.72	1263.82	2.10	2.71	1264.43	1265.84	0.047900	11.39	70.22	41.82	1.55
3	537.*	400 cfs	400.00	1.00	0.040	1261.72	1263.03	1.31	1.80	1263.52	1264.62	0.065120	10.13	39.50	35.45	1.69
3	536.*	1600 cfs	1600.00	1.00	0.040	1261.47	1264.64	3.17	4.02	1265.49	1267.43	0.041914	13.39	119.49	50.37	1.53
3	536.*	1200 cfs	1200.00	1.00	0.040	1261.47	1264.11	2.64	3.42	1264.89	1266.65	0.046817	12.79	93.84	46.11	1.58
3	536.*	800 cfs	800.00	1.00	0.040	1261.47	1263.49	2.02	2.71	1264.18	1265.72	0.055816	11.99	66.70	41.14	1.66
3	536.*	400 cfs	400.00	1.00	0.040	1261.47	1262.72	1.25	1.80	1263.27	1264.49	0.076661	10.69	37.41	34.98	1.82
3	535.*	1600 cfs	1600.00	1.00	0.040	1261.22	1264.30	3.08	4.02	1265.24	1267.31	0.046959	13.94	114.78	49.61	1.62
3	535.*	1200 cfs	1200.00	1.00	0.040	1261.22	1263.78	2.56	3.42	1264.64	1266.54	0.052744	13.33	90.01	45.44	1.67
3	535.*	800 cfs	800.00	1.00	0.040	1261.22	1263.17	1.95	2.71	1263.93	1265.60	0.063043	12.52	63.88	40.59	1.76
3	535.*	400 cfs	400.00	1.00	0.040	1261.22	1262.42	1.20	1.80	1263.02	1264.36	0.087397	11.17	35.81	34.61	1.94
3	534.*	1600 cfs	1600.00	1.00	0.040	1260.97	1263.97	3.00	4.02	1264.99	1267.20	0.051699	14.42	110.95	46.99	1.69
3	534.*	1200 cfs	1200.00	1.00	0.040	1260.97	1263.46	2.49	3.42	1264.39	1266.42	0.058267	13.80	86.93	44.90	1.75

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	534.*	800 cfs	800.00	1.00	0.040	1260.97	1262.86	1.89	2.71	1263.68	1265.48	0.070202	12.99	61.57	40.13	1.85
3	534.*	400 cfs	400.00	1.00	0.040	1260.97	1262.13	1.16	1.80	1262.77	1264.22	0.097760	11.59	34.50	34.31	2.04
3	533.*	1600 cfs	1600.00	1.00	0.040	1260.71	1263.64	2.93	4.02	1264.73	1267.08	0.056619	14.89	107.44	48.42	1.76
3	533.*	1200 cfs	1200.00	1.00	0.040	1260.71	1263.13	2.42	3.42	1264.13	1266.30	0.064064	14.27	84.10	44.39	1.83
3	533.*	800 cfs	800.00	1.00	0.040	1260.71	1262.55	1.84	2.71	1263.42	1265.35	0.077471	13.44	59.53	39.72	1.93
3	533.*	400 cfs	400.00	1.00	0.040	1260.71	1261.84	1.13	1.80	1262.51	1264.07	0.108299	11.99	33.35	34.04	2.14
3	532.*	1600 cfs	1600.00	1.00	0.040	1260.46	1263.32	2.86	4.02	1264.48	1266.97	0.061395	15.32	104.42	47.91	1.83
3	532.*	1200 cfs	1200.00	1.00	0.040	1260.46	1262.83	2.37	3.42	1263.88	1266.18	0.069436	14.67	81.78	43.97	1.90
3	532.*	800 cfs	800.00	1.00	0.040	1260.46	1262.26	1.80	2.71	1263.17	1265.22	0.084093	13.62	57.88	39.38	2.01
3	532.*	400 cfs	400.00	1.00	0.040	1260.46	1261.56	1.10	1.80	1262.26	1263.92	0.117659	12.33	32.45	33.82	2.22
3	531.*	1600 cfs	1600.00	1.00	0.040	1260.21	1263.02	2.81	4.02	1264.23	1266.85	0.065960	15.71	101.82	47.48	1.89
3	531.*	1200 cfs	1200.00	1.00	0.040	1260.21	1262.53	2.32	3.42	1263.63	1266.06	0.074847	15.06	79.67	43.59	1.96
3	531.*	800 cfs	800.00	1.00	0.040	1260.21	1261.97	1.76	2.71	1262.92	1265.09	0.090568	14.18	56.43	39.09	2.08
3	531.*	400 cfs	400.00	1.00	0.040	1260.21	1261.29	1.08	1.80	1262.01	1263.77	0.126733	12.63	31.66	33.64	2.30
3	530.*	1600 cfs	1600.00	1.00	0.040	1259.96	1262.72	2.76	4.02	1263.98	1266.73	0.070375	16.08	99.53	47.09	1.95
3	530.*	1200 cfs	1200.00	1.00	0.040	1259.96	1262.24	2.28	3.42	1263.38	1265.93	0.080038	15.42	77.84	43.25	2.03
3	530.*	800 cfs	800.00	1.00	0.040	1259.96	1261.69	1.73	2.71	1262.67	1264.96	0.097114	14.52	55.11	38.82	2.15
3	530.*	400 cfs	400.00	1.00	0.040	1259.96	1261.02	1.06	1.80	1261.76	1263.61	0.135190	12.91	30.99	33.48	2.36
3	529.*	1600 cfs	1600.00	1.00	0.040	1259.71	1262.43	2.72	4.01	1263.72	1266.61	0.074761	16.42	97.44	46.73	2.00
3	529.*	1200 cfs	1200.00	1.00	0.040	1259.71	1261.95	2.24	3.42	1263.13	1265.80	0.085077	15.75	76.21	42.95	2.08
3	529.*	800 cfs	800.00	1.00	0.040	1259.71	1261.41	1.70	2.71	1262.42	1264.82	0.103362	14.83	53.95	38.58	2.21
3	529.*	400 cfs	400.00	1.00	0.040	1259.71	1260.75	1.04	1.80	1261.51	1263.44	0.143091	13.15	30.42	33.34	2.43
3	528.*	1600 cfs	1600.00	1.00	0.040	1259.46	1262.14	2.68	4.01	1263.47	1266.49	0.078995	16.74	95.57	46.41	2.06
3	528.*	1200 cfs	1200.00	1.00	0.040	1259.46	1261.67	2.21	3.42	1262.88	1265.67	0.089937	16.05	74.75	42.67	2.14
3	528.*	800 cfs	800.00	1.00	0.040	1259.46	1261.13	1.67	2.71	1262.17	1264.66	0.109323	15.11	52.93	38.37	2.27
3	528.*	400 cfs	400.00	1.00	0.040	1259.46	1260.49	1.03	1.80	1261.26	1263.27	0.150906	13.38	29.89	33.21	2.49
3	527.*	1600 cfs	1600.00	1.00	0.040	1259.21	1261.85	2.64	4.02	1263.23	1266.36	0.083132	17.04	93.88	46.12	2.11
3	527.*	1200 cfs	1200.00	1.00	0.040	1259.21	1261.39	2.18	3.42	1262.63	1265.54	0.094684	16.34	73.43	42.43	2.19
3	527.*	800 cfs	800.00	1.00	0.040	1259.21	1260.86	1.65	2.71	1261.92	1264.53	0.114903	15.37	52.04	38.18	2.32
3	527.*	400 cfs	400.00	1.00	0.040	1259.21	1260.22	1.01	1.80	1261.01	1263.09	0.158009	13.59	29.44	33.11	2.54
3	526	1600 cfs	1600.00	1.00	0.040	1258.96	1261.57	2.61	4.02	1262.98	1266.23	0.087193	17.33	92.32	45.85	2.15
3	526	1200 cfs	1200.00	1.00	0.040	1258.96	1261.11	2.15	3.42	1262.38	1265.40	0.099544	16.63	72.17	42.19	2.24
3	526	800 cfs	800.00	1.00	0.040	1258.96	1260.59	1.63	2.71	1261.67	1264.37	0.120301	15.61	51.24	38.01	2.37
3	526	400 cfs	400.00	1.00	0.040	1258.96	1259.96	1.00	1.80	1260.76	1262.91	0.164504	13.77	29.05	33.01	2.59
3	525.*	1600 cfs	1600.00	1.00	0.040	1258.96	1261.53	2.57	3.96	1262.92	1266.10	0.085930	17.15	93.29	46.57	2.14
3	525.*	1200 cfs	1200.00	1.00	0.040	1258.96	1261.09	2.13	3.36	1262.33	1265.23	0.096070	16.32	73.52	43.04	2.20
3	525.*	800 cfs	800.00	1.00	0.040	1258.96	1260.59	1.63	2.66	1261.62	1264.14	0.112180	15.13	52.87	39.01	2.29
3	525.*	400 cfs	400.00	1.00	0.040	1258.96	1259.98	1.02	1.76	1260.72	1262.60	0.141331	12.97	30.84	34.20	2.41
3	524.*	1600 cfs	1600.00	1.00	0.040	1258.96	1261.50	2.54	3.90	1262.86	1265.97	0.084528	16.96	94.34	47.31	2.12
3	524.*	1200 cfs	1200.00	1.00	0.040	1258.96	1261.07	2.11	3.31	1262.27	1265.06	0.092585	16.02	74.93	43.91	2.16
3	524.*	800 cfs	800.00	1.00	0.040	1258.96	1260.59	1.63	2.62	1261.58	1263.93	0.104848	14.68	54.49	40.01	2.22
3	524.*	400 cfs	400.00	1.00	0.040	1258.96	1260.01	1.05	1.73	1260.69	1262.32	0.120750	12.20	32.78	35.40	2.23
3	523.*	1600 cfs	1600.00	1.00	0.040	1258.96	1261.47	2.51	3.84	1262.80	1265.83	0.082980	16.76	95.46	48.08	2.10

4.50' BOULDER SIZING ANALYSIS



HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	546.*	400 cfs	400.00	1.00	0.040	1262.47	1265.05	2.58			1265.22	0.002897	3.27	122.16	57.65	0.40
3	545.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.86	5.39			1268.29	0.003325	5.25	304.76	78.11	0.47
3	545.*	1200 cfs	1200.00	1.00	0.040	1262.47	1267.11	4.64			1267.47	0.003317	4.83	248.46	72.11	0.46
3	545.*	800 cfs	800.00	1.00	0.040	1262.47	1266.21	3.74			1266.49	0.003319	4.29	186.61	64.89	0.45
3	545.*	400 cfs	400.00	1.00	0.040	1262.47	1265.02	2.55			1265.21	0.003326	3.47	115.37	55.42	0.42
3	544.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.79	5.32			1268.27	0.003802	5.54	288.97	75.58	0.50
3	544.*	1200 cfs	1200.00	1.00	0.040	1262.47	1267.05	4.58			1267.46	0.003810	5.10	235.08	69.64	0.49
3	544.*	800 cfs	800.00	1.00	0.040	1262.47	1266.16	3.69			1266.48	0.003836	4.54	176.02	62.49	0.48
3	544.*	400 cfs	400.00	1.00	0.040	1262.47	1264.99	2.52			1265.20	0.003879	3.69	108.34	53.13	0.46
3	543.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.71	5.24			1268.25	0.004422	5.86	272.29	72.92	0.54
3	543.*	1200 cfs	1200.00	1.00	0.040	1262.47	1266.98	4.51			1267.44	0.004455	5.43	220.97	67.05	0.53
3	543.*	800 cfs	800.00	1.00	0.040	1262.47	1266.09	3.62			1266.46	0.004518	4.85	164.89	59.99	0.52
3	543.*	400 cfs	400.00	1.00	0.040	1262.47	1264.94	2.47			1265.18	0.004618	3.96	100.97	50.76	0.49
3	542.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.60	5.13			1268.22	0.005273	6.29	254.20	70.06	0.58
3	542.*	1200 cfs	1200.00	1.00	0.040	1262.47	1266.88	4.41			1267.41	0.005348	5.83	205.70	64.28	0.57
3	542.*	800 cfs	800.00	1.00	0.040	1262.47	1266.01	3.54			1266.44	0.005477	5.23	152.87	57.33	0.56
3	542.*	400 cfs	400.00	1.00	0.040	1262.47	1264.88	2.41			1265.17	0.005673	4.30	93.05	48.27	0.55
3	541.*	1600 cfs	1600.00	1.00	0.040	1262.47	1267.45	4.98	3.90	1266.37	1268.18	0.006577	6.85	233.46	66.82	0.65
3	541.*	1200 cfs	1200.00	1.00	0.040	1262.47	1266.74	4.27	3.31	1265.78	1267.37	0.006733	6.38	188.20	61.16	0.64
3	541.*	800 cfs	800.00	1.00	0.040	1262.47	1265.89	3.42	2.62	1265.09	1266.40	0.006988	5.75	139.12	54.36	0.63
3	541.*	400 cfs	400.00	1.00	0.040	1262.47	1264.79	2.32			1265.14	0.007368	4.76	84.06	45.54	0.62
3	540	1600 cfs	1600.00	1.00	0.040	1262.47	1266.49	4.02	4.02	1266.49	1267.95	0.016990	9.70	164.88	57.12	1.01
3	540	1200 cfs	1200.00	1.00	0.040	1262.47	1265.89	3.42	3.42	1265.89	1267.17	0.017730	9.08	132.21	52.35	1.01
3	540	800 cfs	800.00	1.00	0.040	1262.47	1265.18	2.71	2.71	1265.18	1266.23	0.018856	8.24	97.14	46.68	1.01
3	540	400 cfs	400.00	1.00	0.040	1262.47	1264.27	1.80	1.80	1264.27	1265.01	0.021096	6.92	57.81	39.37	1.01
3	539.*	1600 cfs	1600.00	1.00	0.040	1262.22	1265.83	3.61	4.02	1266.24	1267.79	0.025496	11.22	142.59	53.91	1.22
3	539.*	1200 cfs	1200.00	1.00	0.040	1262.22	1265.27	3.05	3.42	1265.64	1267.01	0.027415	10.59	113.28	49.37	1.23
3	539.*	800 cfs	800.00	1.00	0.040	1262.22	1264.59	2.37	2.71	1264.93	1266.08	0.030855	9.78	81.78	43.97	1.26
3	539.*	400 cfs	400.00	1.00	0.040	1262.22	1263.73	1.51	1.80	1264.02	1264.86	0.039200	8.54	46.84	37.07	1.34
3	538.*	1600 cfs	1600.00	1.00	0.040	1261.97	1265.39	3.42	4.02	1265.99	1267.66	0.031362	12.08	132.45	52.38	1.34
3	538.*	1200 cfs	1200.00	1.00	0.040	1261.97	1264.84	2.87	3.42	1265.39	1266.88	0.034397	11.48	104.57	47.94	1.37
3	538.*	800 cfs	800.00	1.00	0.040	1261.97	1264.18	2.21	2.71	1264.68	1265.95	0.039668	10.67	74.95	42.71	1.42
3	538.*	400 cfs	400.00	1.00	0.040	1261.97	1263.36	1.39	1.80	1263.77	1264.74	0.052921	9.45	42.34	36.09	1.54
3	537.*	1600 cfs	1600.00	1.00	0.040	1261.72	1265.00	3.28	4.02	1265.74	1267.54	0.036894	12.77	125.26	51.28	1.44
3	537.*	1200 cfs	1200.00	1.00	0.040	1261.72	1264.46	2.74	3.42	1265.14	1266.77	0.040847	12.19	98.44	46.90	1.48
3	537.*	800 cfs	800.00	1.00	0.040	1261.72	1263.82	2.10	2.71	1264.43	1265.84	0.047890	11.39	70.23	41.82	1.55
3	537.*	400 cfs	400.00	1.00	0.040	1261.72	1263.03	1.31	1.80	1263.52	1264.62	0.065120	10.13	39.50	35.45	1.69
3	536.*	1600 cfs	1600.00	1.00	0.040	1261.47	1264.64	3.17	4.02	1265.49	1267.43	0.041914	13.39	119.49	50.37	1.53
3	536.*	1200 cfs	1200.00	1.00	0.040	1261.47	1264.11	2.64	3.42	1264.89	1266.65	0.046826	12.79	93.83	46.11	1.58
3	536.*	800 cfs	800.00	1.00	0.040	1261.47	1263.49	2.02	2.71	1264.18	1265.72	0.055616	11.99	66.70	41.14	1.66
3	536.*	400 cfs	400.00	1.00	0.040	1261.47	1262.72	1.25	1.80	1263.27	1264.49	0.076661	10.69	37.41	34.98	1.82
3	535.*	1600 cfs	1600.00	1.00	0.040	1261.22	1264.30	3.08	4.02	1265.24	1267.31	0.046959	13.94	114.78	49.61	1.62
3	535.*	1200 cfs	1200.00	1.00	0.040	1261.22	1263.78	2.56	3.42	1264.64	1266.54	0.052744	13.33	90.01	45.44	1.67

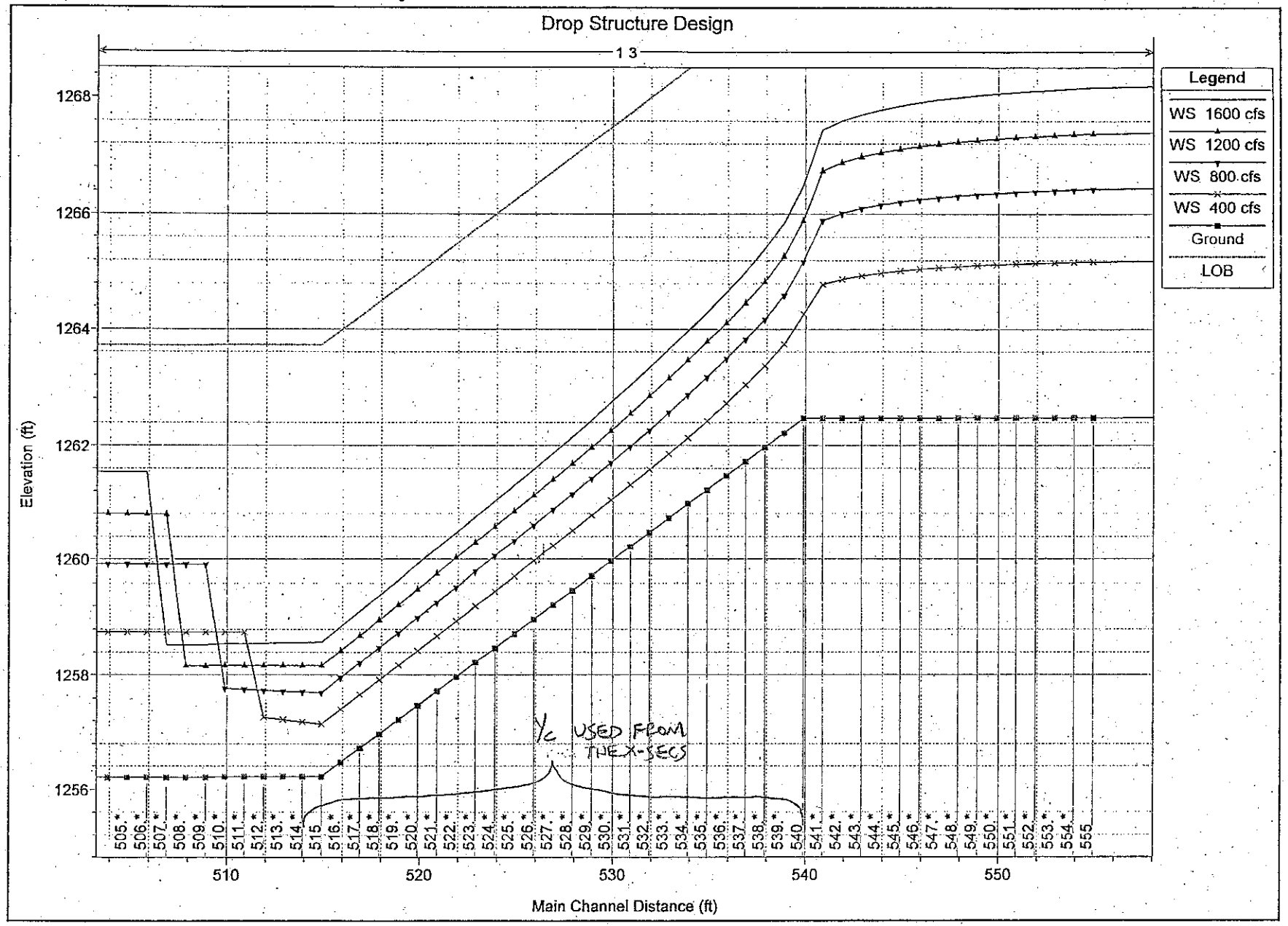
HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	535.*	800 cfs	800.00	1.00	0.040	1261.22	1263.17	1.95	2.71	1263.93	1265.60	0.063043	12.52	63.86	40.59	1.76
3	535.*	400 cfs	400.00	1.00	0.040	1261.22	1262.42	1.20	1.80	1263.02	1264.36	0.087397	11.17	35.81	34.61	1.94
3	534.*	1600 cfs	1600.00	1.00	0.040	1260.97	1263.97	3.00	4.02	1264.99	1267.20	0.051699	14.42	110.95	48.99	1.69
3	534.*	1200 cfs	1200.00	1.00	0.040	1260.97	1263.46	2.49	3.42	1264.39	1266.42	0.058267	13.80	86.93	44.90	1.75
3	534.*	800 cfs	800.00	1.00	0.040	1260.97	1262.86	1.89	2.71	1263.68	1265.48	0.070202	12.99	61.57	40.13	1.85
3	534.*	400 cfs	400.00	1.00	0.040	1260.97	1262.13	1.16	1.80	1262.77	1264.22	0.097760	11.59	34.50	34.31	2.04
3	533.*	1600 cfs	1600.00	1.00	0.040	1260.72	1263.65	2.93	4.02	1264.74	1267.08	0.056380	14.87	107.60	48.44	1.76
3	533.*	1200 cfs	1200.00	1.00	0.040	1260.72	1263.15	2.43	3.42	1264.14	1266.30	0.063770	14.25	84.24	44.42	1.82
3	533.*	800 cfs	800.00	1.00	0.040	1260.72	1262.56	1.84	2.71	1263.43	1265.35	0.076754	13.40	59.72	39.75	1.93
3	533.*	400 cfs	400.00	1.00	0.040	1260.72	1261.85	1.13	1.80	1262.52	1264.08	0.107527	11.97	33.43	34.06	2.13
3	532.*	1600 cfs	1600.00	1.00	0.040	1260.47	1263.34	2.87	4.02	1264.49	1266.97	0.061172	15.30	104.56	47.94	1.83
3	532.*	1200 cfs	1200.00	1.00	0.040	1260.47	1262.84	2.37	3.42	1263.89	1266.18	0.069149	14.65	81.89	43.99	1.89
3	532.*	800 cfs	800.00	1.00	0.040	1260.47	1262.27	1.80	2.71	1263.18	1265.22	0.083424	13.78	58.04	39.42	2.00
3	532.*	400 cfs	400.00	1.00	0.040	1260.47	1261.58	1.11	1.80	1262.27	1263.93	0.116937	12.30	32.51	33.84	2.21
3	531.*	1600 cfs	1600.00	1.00	0.040	1260.22	1263.03	2.81	4.02	1264.24	1266.86	0.065738	15.70	101.94	47.50	1.89
3	531.*	1200 cfs	1200.00	1.00	0.040	1260.22	1262.55	2.33	3.42	1263.64	1266.06	0.074574	15.04	79.77	43.61	1.96
3	531.*	800 cfs	800.00	1.00	0.040	1260.22	1261.99	1.76	2.71	1262.93	1265.09	0.089920	14.14	56.57	39.12	2.07
3	531.*	400 cfs	400.00	1.00	0.040	1260.22	1261.30	1.08	1.80	1262.02	1263.77	0.126039	12.61	31.72	33.65	2.29
3	530.*	1600 cfs	1600.00	1.00	0.040	1259.97	1262.73	2.76	4.02	1263.99	1266.74	0.070167	16.06	99.63	47.11	1.95
3	530.*	1200 cfs	1200.00	1.00	0.040	1259.97	1262.25	2.28	3.42	1263.39	1265.94	0.079773	15.40	77.93	43.27	2.02
3	530.*	800 cfs	800.00	1.00	0.040	1259.97	1261.70	1.73	2.71	1262.68	1264.96	0.096528	14.49	55.22	38.84	2.14
3	530.*	400 cfs	400.00	1.00	0.040	1259.97	1261.03	1.06	1.80	1261.77	1263.61	0.134488	12.88	31.05	33.49	2.36
3	529.*	1600 cfs	1600.00	1.00	0.040	1259.72	1262.44	2.72	4.02	1263.74	1266.62	0.074562	16.41	97.53	46.75	2.00
3	529.*	1200 cfs	1200.00	1.00	0.040	1259.72	1261.97	2.25	3.42	1263.14	1265.81	0.084807	15.73	76.29	42.96	2.08
3	529.*	800 cfs	800.00	1.00	0.040	1259.72	1261.42	1.70	2.71	1262.43	1264.82	0.102776	14.80	54.05	38.60	2.20
3	529.*	400 cfs	400.00	1.00	0.040	1259.72	1260.76	1.04	1.80	1261.52	1263.44	0.142448	13.13	30.46	33.35	2.42
3	528.*	1600 cfs	1600.00	1.00	0.040	1259.47	1262.15	2.68	4.02	1263.49	1266.49	0.078795	16.73	95.66	46.43	2.05
3	528.*	1200 cfs	1200.00	1.00	0.040	1259.47	1261.68	2.21	3.42	1262.89	1265.67	0.089663	16.04	74.83	42.69	2.13
3	528.*	800 cfs	800.00	1.00	0.040	1259.47	1261.14	1.67	2.71	1262.18	1264.68	0.108780	15.09	53.02	38.38	2.26
3	528.*	400 cfs	400.00	1.00	0.040	1259.47	1260.50	1.03	1.80	1261.27	1263.27	0.150286	13.36	29.93	33.22	2.48
3	527.*	1600 cfs	1600.00	1.00	0.040	1259.22	1261.86	2.64	4.02	1263.24	1266.37	0.082930	17.03	93.96	46.13	2.10
3	527.*	1200 cfs	1200.00	1.00	0.040	1259.22	1261.40	2.18	3.42	1262.64	1265.54	0.094415	16.33	73.51	42.44	2.19
3	527.*	800 cfs	800.00	1.00	0.040	1259.22	1260.87	1.65	2.71	1261.93	1264.53	0.114385	15.35	52.12	38.20	2.32
3	527.*	400 cfs	400.00	1.00	0.040	1259.22	1260.23	1.01	1.80	1261.02	1263.10	0.157482	13.57	29.47	33.11	2.54
3	526.*	1600 cfs	1600.00	1.00	0.040	1258.97	1261.58	2.61	4.02	1262.99	1266.23	0.086997	17.32	92.40	45.86	2.15
3	526.*	1200 cfs	1200.00	1.00	0.040	1258.97	1261.12	2.15	3.42	1262.39	1265.41	0.099298	16.61	72.24	42.20	2.24
3	526.*	800 cfs	800.00	1.00	0.040	1258.97	1260.60	1.63	2.71	1261.68	1264.37	0.119819	15.59	51.31	38.03	2.37
3	526.*	400 cfs	400.00	1.00	0.040	1258.97	1259.97	1.00	1.80	1260.77	1262.91	0.164026	13.75	29.08	33.02	2.58
3	525.*	1600 cfs	1600.00	1.00	0.040	1258.72	1261.30	2.58	4.01	1262.73	1266.09	0.090754	17.57	91.04	45.63	2.19
3	525.*	1200 cfs	1200.00	1.00	0.040	1258.72	1260.84	2.12	3.42	1262.14	1265.27	0.103979	16.88	71.10	41.98	2.29
3	525.*	800 cfs	800.00	1.00	0.040	1258.72	1260.33	1.61	2.71	1261.43	1264.22	0.125071	15.82	50.57	37.87	2.41
3	525.*	400 cfs	400.00	1.00	0.040	1258.72	1259.71	0.99	1.80	1260.52	1262.72	0.170180	13.92	28.73	32.93	2.63
3	524.*	1600 cfs	1600.00	1.00	0.040	1258.47	1261.02	2.55	4.01	1262.48	1265.95	0.094482	17.82	89.77	45.40	2.23

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	524.*	1200 cfs	1200.00	1.00	0.040	1258.47	1260.57	2.10	3.42	1261.89	1265.12	0.108461	17.13	70.06	41.79	2.33
3	524.*	800 cfs	800.00	1.00	0.040	1258.47	1260.06	1.59	2.71	1261.18	1264.05	0.130157	16.04	49.89	37.73	2.46
3	524.*	400 cfs	400.00	1.00	0.040	1258.47	1259.45	0.98	1.80	1260.27	1262.52	0.175362	14.06	28.45	32.87	2.66
3	523.*	1600 cfs	1600.00	1.00	0.040	1258.22	1260.74	2.52	4.02	1262.24	1265.81	0.098156	18.06	88.58	45.19	2.27
3	523.*	1200 cfs	1200.00	1.00	0.040	1258.22	1260.30	2.08	3.42	1261.64	1264.98	0.112844	17.36	69.12	41.60	2.37
3	523.*	800 cfs	800.00	1.00	0.040	1258.22	1259.79	1.57	2.71	1260.93	1263.89	0.135131	16.24	49.26	37.59	2.50
3	523.*	400 cfs	400.00	1.00	0.040	1258.22	1259.20	0.98	1.80	1260.02	1262.32	0.180415	14.19	28.18	32.80	2.70
3	522	1600 cfs	1600.00	1.00	0.040	1257.97	1260.47	2.50	4.02	1261.99	1265.67	0.101787	18.29	87.46	44.99	2.31
3	522	1200 cfs	1200.00	1.00	0.040	1257.97	1260.02	2.05	3.42	1261.39	1264.83	0.117076	17.58	68.24	41.44	2.41
3	522	800 cfs	800.00	1.00	0.040	1257.97	1259.53	1.56	2.71	1260.68	1263.73	0.140310	16.45	48.64	37.46	2.54
3	522	400 cfs	400.00	1.00	0.040	1257.97	1258.94	0.97	1.80	1259.77	1262.13	0.185754	14.33	27.92	32.74	2.73
3	521.032*	1600 cfs	1600.00	1.00	0.040	1257.97	1260.44	2.47	3.96	1261.93	1265.49	0.099184	18.03	88.73	45.76	2.28
3	521.032*	1200 cfs	1200.00	1.00	0.040	1257.97	1260.01	2.04	3.37	1261.34	1264.61	0.111839	17.20	69.76	42.31	2.36
3	521.032*	800 cfs	800.00	1.00	0.040	1257.97	1259.53	1.56	2.67	1260.64	1263.45	0.129519	15.89	50.34	38.46	2.45
3	521.032*	400 cfs	400.00	1.00	0.040	1257.97	1258.97	1.00	1.77	1259.74	1261.75	0.155044	13.38	29.90	33.95	2.51
3	520.064*	1600 cfs	1600.00	1.00	0.040	1257.97	1260.42	2.45	3.90	1261.87	1265.33	0.096688	17.78	90.00	46.54	2.25
3	520.064*	1200 cfs	1200.00	1.00	0.040	1257.97	1260.00	2.03	3.31	1261.28	1264.40	0.106908	16.83	71.29	43.20	2.31
3	520.064*	800 cfs	800.00	1.00	0.040	1257.97	1259.54	1.57	2.62	1260.59	1263.20	0.119617	15.36	52.10	39.49	2.36
3	520.064*	400 cfs	400.00	1.00	0.040	1257.97	1259.00	1.03	1.73	1259.70	1261.43	0.130394	12.52	31.95	35.17	2.32
3	519.096*	1600 cfs	1600.00	1.00	0.040	1257.97	1260.40	2.43	3.85	1261.82	1265.16	0.093995	17.51	91.37	47.33	2.22
3	519.096*	1200 cfs	1200.00	1.00	0.040	1257.97	1260.00	2.03	3.27	1261.24	1264.20	0.101946	16.46	72.91	44.10	2.26
3	519.096*	800 cfs	800.00	1.00	0.040	1257.97	1259.55	1.58	2.58	1260.55	1262.96	0.110240	14.83	53.94	40.52	2.27
3	519.096*	400 cfs	400.00	1.00	0.040	1257.97	1259.03	1.06	1.70	1259.67	1261.18	0.111068	11.78	33.97	36.36	2.15
3	518.129*	1600 cfs	1600.00	1.00	0.040	1257.97	1260.38	2.41	3.79	1261.77	1265.00	0.091416	17.25	92.76	48.15	2.19
3	518.129*	1200 cfs	1200.00	1.00	0.040	1257.97	1259.99	2.02	3.21	1261.18	1264.01	0.097227	16.09	74.56	45.02	2.20
3	518.129*	800 cfs	800.00	1.00	0.040	1257.97	1259.56	1.59	2.54	1260.51	1262.74	0.101655	14.33	55.83	41.56	2.18
3	518.129*	400 cfs	400.00	1.00	0.040	1257.97	1260.50	2.53	1.67	1259.64	1260.75	0.004793	4.06	98.57	49.10	0.50
3	517.161*	1600 cfs	1600.00	1.00	0.040	1257.97	1260.36	2.39	3.74	1261.71	1264.84	0.088639	16.98	94.25	48.97	2.16
3	517.161*	1200 cfs	1200.00	1.00	0.040	1257.97	1259.99	2.02	3.17	1261.14	1263.81	0.091781	15.69	76.49	45.98	2.14
3	517.161*	800 cfs	800.00	1.00	0.040	1257.97	1261.65	3.68	2.50	1260.47	1262.02	0.004538	4.88	163.90	59.27	0.52
3	517.161*	400 cfs	400.00	1.00	0.040	1257.97	1260.50	2.53			1260.74	0.004529	3.96	101.03	50.07	0.49
3	516.193*	1600 cfs	1600.00	1.00	0.040	1257.97	1260.35	2.38	3.69	1261.66	1264.68	0.085880	16.70	95.79	49.81	2.12
3	516.193*	1200 cfs	1200.00	1.00	0.040	1257.97	1262.53	4.56	3.13	1261.10	1262.98	0.004300	5.37	223.64	67.28	0.52
3	516.193*	800 cfs	800.00	1.00	0.040	1257.97	1261.65	3.68			1262.01	0.004305	4.77	167.61	60.25	0.50
3	516.193*	400 cfs	400.00	1.00	0.040	1257.97	1260.50	2.53			1260.73	0.004285	3.86	103.50	51.04	0.48
3	515.225*	1600 cfs	1600.00	1.00	0.040	1257.97	1263.27	5.30	3.64	1261.61	1263.77	0.004089	5.70	280.62	74.16	0.52
3	515.225*	1200 cfs	1200.00	1.00	0.040	1257.97	1262.53	4.56			1262.96	0.004089	5.25	228.37	68.29	0.51
3	515.225*	800 cfs	800.00	1.00	0.040	1257.97	1261.65	3.68			1261.99	0.004085	4.67	171.38	61.25	0.49
3	515.225*	400 cfs	400.00	1.00	0.040	1257.97	1260.50	2.53			1260.72	0.004057	3.77	106.01	52.02	0.47
3	514.258*	1600 cfs	1600.00	1.00	0.040	1257.96	1263.27	5.31			1263.76	0.003871	5.58	286.93	75.25	0.50
3	514.258*	1200 cfs	1200.00	1.00	0.040	1257.96	1262.54	4.58			1262.95	0.003860	5.13	233.81	69.38	0.49
3	514.258*	800 cfs	800.00	1.00	0.040	1257.96	1261.66	3.70			1261.98	0.003841	4.55	175.77	62.32	0.48
3	514.258*	400 cfs	400.00	1.00	0.040	1257.96	1260.50	2.54			1260.71	0.003790	3.67	109.07	53.07	0.45

6.25' BOULDER SIZING ANALYSIS



HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	546.*	PF 4	400.00	1.00	0.040	1262.47	1265.05	2.58			1265.22	0.002895	3.27	122.19	57.65	0.40
3	545.*	PF 1	1600.00	1.00	0.040	1262.47	1267.86	5.39			1268.29	0.003328	5.25	304.67	78.09	0.47
3	545.*	PF 2	1200.00	1.00	0.040	1262.47	1267.11	4.64			1267.47	0.003318	4.83	248.43	72.10	0.46
3	545.*	PF 3	800.00	1.00	0.040	1262.47	1266.21	3.74			1266.49	0.003320	4.29	186.57	64.88	0.45
3	545.*	PF 4	400.00	1.00	0.040	1262.47	1265.02	2.55			1265.21	0.003325	3.47	115.38	55.41	0.42
3	544.*	PF 1	1600.00	1.00	0.040	1262.47	1267.79	5.32			1268.27	0.003806	5.54	288.76	75.53	0.50
3	544.*	PF 2	1200.00	1.00	0.040	1262.47	1267.05	4.58			1267.46	0.003814	5.11	234.95	69.60	0.49
3	544.*	PF 3	800.00	1.00	0.040	1262.47	1266.16	3.69			1266.48	0.003839	4.55	175.94	62.46	0.48
3	544.*	PF 4	400.00	1.00	0.040	1262.47	1264.99	2.52			1265.20	0.003879	3.69	108.33	53.11	0.46
3	543.*	PF 1	1600.00	1.00	0.040	1262.47	1267.71	5.24			1268.25	0.004422	5.88	272.28	72.92	0.54
3	543.*	PF 2	1200.00	1.00	0.040	1262.47	1266.98	4.51			1267.44	0.004455	5.43	220.97	67.05	0.53
3	543.*	PF 3	800.00	1.00	0.040	1262.47	1266.09	3.62			1266.46	0.004518	4.85	164.89	59.99	0.52
3	543.*	PF 4	400.00	1.00	0.040	1262.47	1264.94	2.47			1265.18	0.004615	3.96	101.00	50.76	0.49
3	542.*	PF 1	1600.00	1.00	0.040	1262.47	1267.60	5.13			1268.22	0.005276	6.30	254.13	70.04	0.58
3	542.*	PF 2	1200.00	1.00	0.040	1262.47	1266.88	4.41			1267.41	0.005351	5.84	205.64	64.27	0.57
3	542.*	PF 3	800.00	1.00	0.040	1262.47	1266.01	3.54			1266.44	0.005479	5.23	152.83	57.32	0.56
3	542.*	PF 4	400.00	1.00	0.040	1262.47	1264.88	2.41			1265.17	0.005669	4.30	93.07	48.27	0.55
3	541.*	PF 1	1600.00	1.00	0.040	1262.47	1267.45	4.98	3.90	1266.37	1268.18	0.006573	6.85	233.53	66.83	0.65
3	541.*	PF 2	1200.00	1.00	0.040	1262.47	1266.74	4.27	3.31	1265.78	1267.37	0.006729	6.37	188.26	61.17	0.64
3	541.*	PF 3	800.00	1.00	0.040	1262.47	1265.89	3.42	2.62	1265.09	1266.40	0.006983	5.75	139.16	54.37	0.63
3	541.*	PF 4	400.00	1.00	0.040	1262.47	1264.79	2.32			1265.14	0.007359	4.76	84.10	45.55	0.62
3	540	PF 1	1600.00	1.00	0.040	1262.47	1266.49	4.02	4.02	1265.49	1267.95	0.016990	9.70	164.88	57.12	1.01
3	540	PF 2	1200.00	1.00	0.040	1262.47	1265.89	3.42	3.42	1265.89	1267.17	0.017730	9.08	132.21	52.35	1.01
3	540	PF 3	800.00	1.00	0.040	1262.47	1265.18	2.71	2.71	1265.18	1266.23	0.018856	8.24	97.14	46.68	1.01
3	540	PF 4	400.00	1.00	0.040	1262.47	1264.27	1.80	1.80	1264.27	1265.01	0.021137	6.92	57.77	39.36	1.01
3	539.*	PF 1	1600.00	1.00	0.040	1262.22	1265.83	3.61	4.02	1266.24	1267.79	0.025496	11.22	142.59	53.91	1.22
3	539.*	PF 2	1200.00	1.00	0.040	1262.22	1265.27	3.05	3.42	1265.64	1267.01	0.027415	10.59	113.28	49.37	1.23
3	539.*	PF 3	800.00	1.00	0.040	1262.22	1264.59	2.37	2.71	1264.93	1266.08	0.030855	9.78	81.78	43.97	1.26
3	539.*	PF 4	400.00	1.00	0.040	1262.22	1263.73	1.51	1.80	1264.02	1264.86	0.039222	8.54	46.83	37.07	1.34
3	538.*	PF 1	1600.00	1.00	0.040	1261.97	1265.39	3.42	4.02	1265.99	1267.66	0.031362	12.08	132.45	52.38	1.34
3	538.*	PF 2	1200.00	1.00	0.040	1261.97	1264.84	2.87	3.42	1265.39	1266.88	0.034441	11.48	104.52	47.93	1.37
3	538.*	PF 3	800.00	1.00	0.040	1261.97	1264.18	2.21	2.71	1264.68	1265.96	0.039940	10.70	74.77	42.68	1.42
3	538.*	PF 4	400.00	1.00	0.040	1261.97	1263.36	1.39	1.80	1263.77	1264.74	0.052511	9.42	42.45	36.11	1.53
3	537.*	PF 1	1600.00	1.00	0.040	1261.72	1265.00	3.28	4.02	1265.74	1267.54	0.036802	12.79	125.13	51.25	1.44
3	537.*	PF 2	1200.00	1.00	0.040	1261.72	1264.46	2.74	3.42	1265.14	1266.77	0.040820	12.19	98.46	46.91	1.48
3	537.*	PF 3	800.00	1.00	0.040	1261.72	1263.82	2.10	2.71	1264.43	1265.84	0.048011	11.40	70.16	41.80	1.55
3	537.*	PF 4	400.00	1.00	0.040	1261.72	1263.03	1.31	1.80	1263.52	1264.61	0.064441	10.09	39.64	35.48	1.68
3	536.*	PF 1	1600.00	1.00	0.040	1261.47	1264.64	3.17	4.02	1265.49	1267.43	0.041914	13.39	119.49	50.37	1.53
3	536.*	PF 2	1200.00	1.00	0.040	1261.47	1264.11	2.64	3.42	1264.89	1266.65	0.046826	12.79	93.83	46.11	1.58
3	536.*	PF 3	800.00	1.00	0.040	1261.47	1263.49	2.02	2.71	1264.18	1265.72	0.055653	12.00	66.68	41.13	1.66
3	536.*	PF 4	400.00	1.00	0.040	1261.47	1262.72	1.25	1.80	1263.27	1264.49	0.075962	10.66	37.52	35.00	1.81
3	535.*	PF 1	1600.00	1.00	0.040	1261.22	1264.30	3.08	4.02	1265.24	1267.31	0.046903	13.93	114.83	49.62	1.61
3	535.*	PF 2	1200.00	1.00	0.040	1261.22	1263.78	2.56	3.42	1264.64	1266.53	0.052540	13.31	90.13	45.46	1.67

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	535.*	PF 3	800.00	1.00	0.040	1261.22	1263.17	1.95	2.71	1263.93	1265.60	0.062955	12.52	63.91	40.59	1.76
3	535.*	PF 4	400.00	1.00	0.040	1261.22	1262.42	1.20	1.80	1263.02	1264.35	0.086964	11.15	35.87	34.63	1.93
3	534.*	PF 1	1600.00	1.00	0.040	1260.97	1263.97	3.00	4.02	1264.99	1267.20	0.051903	14.44	110.79	48.96	1.69
3	534.*	PF 2	1200.00	1.00	0.040	1260.97	1263.46	2.49	3.42	1264.39	1266.41	0.058183	13.80	86.97	44.91	1.75
3	534.*	PF 3	800.00	1.00	0.040	1260.97	1262.86	1.89	2.71	1263.68	1265.48	0.069960	12.98	61.64	40.14	1.85
3	534.*	PF 4	400.00	1.00	0.040	1260.97	1262.14	1.16	1.80	1262.77	1264.22	0.097366	11.58	34.55	34.32	2.03
3	533.*	PF 1	1600.00	1.00	0.040	1260.72	1263.65	2.92	4.02	1264.74	1267.10	0.056796	14.91	107.33	48.40	1.76
3	533.*	PF 2	1200.00	1.00	0.040	1260.72	1263.15	2.43	3.42	1264.14	1266.30	0.063733	14.24	84.25	44.42	1.82
3	533.*	PF 3	800.00	1.00	0.040	1260.72	1262.56	1.84	2.71	1263.43	1265.35	0.076866	13.40	59.69	39.75	1.93
3	533.*	PF 4	400.00	1.00	0.040	1260.72	1261.85	1.13	1.80	1262.52	1264.07	0.106884	11.94	33.49	34.07	2.12
3	532.*	PF 1	1600.00	1.00	0.040	1260.47	1263.33	2.86	4.02	1264.49	1266.99	0.061580	15.34	104.31	47.89	1.83
3	532.*	PF 2	1200.00	1.00	0.040	1260.47	1262.84	2.37	3.42	1263.89	1266.18	0.069123	14.65	81.91	43.99	1.89
3	532.*	PF 3	800.00	1.00	0.040	1260.47	1262.27	1.80	2.71	1263.18	1265.23	0.083789	13.80	57.95	39.40	2.01
3	532.*	PF 4	400.00	1.00	0.040	1260.47	1261.58	1.11	1.80	1262.27	1263.91	0.115783	12.26	32.62	33.87	2.20
3	531.*	PF 1	1600.00	1.00	0.040	1260.22	1263.03	2.81	4.02	1264.24	1266.86	0.065960	15.71	101.82	47.48	1.89
3	531.*	PF 2	1200.00	1.00	0.040	1260.22	1262.55	2.33	3.42	1263.64	1266.05	0.074359	15.03	79.85	43.62	1.96
3	531.*	PF 3	800.00	1.00	0.040	1260.22	1261.98	1.76	2.71	1262.93	1265.10	0.090411	14.17	56.47	39.10	2.08
3	531.*	PF 4	400.00	1.00	0.040	1260.22	1261.31	1.09	1.80	1262.02	1263.75	0.124178	12.55	31.87	33.69	2.27
3	530.*	PF 1	1600.00	1.00	0.040	1259.97	1262.73	2.76	4.02	1263.99	1266.74	0.070187	16.06	99.63	47.11	1.95
3	530.*	PF 2	1200.00	1.00	0.040	1259.97	1262.26	2.29	3.42	1263.39	1265.93	0.079477	15.38	78.03	43.28	2.02
3	530.*	PF 3	800.00	1.00	0.040	1259.97	1261.70	1.73	2.71	1262.68	1264.96	0.096526	14.49	55.22	38.84	2.14
3	530.*	PF 4	400.00	1.00	0.040	1259.97	1261.04	1.07	1.80	1261.77	1263.59	0.132362	12.82	31.21	33.53	2.34
3	529.*	PF 1	1600.00	1.00	0.040	1259.72	1262.44	2.72	4.02	1263.74	1266.62	0.074474	16.40	97.57	46.76	2.00
3	529.*	PF 2	1200.00	1.00	0.040	1259.72	1261.97	2.25	3.42	1263.14	1265.80	0.084452	15.71	76.40	42.98	2.08
3	529.*	PF 3	800.00	1.00	0.040	1259.72	1261.42	1.70	2.71	1262.43	1264.81	0.102356	14.78	54.13	38.61	2.20
3	529.*	PF 4	400.00	1.00	0.040	1259.72	1260.77	1.05	1.80	1261.52	1263.42	0.140614	13.08	30.59	33.38	2.41
3	528.*	PF 1	1600.00	1.00	0.040	1259.47	1262.15	2.68	4.02	1263.49	1266.49	0.078675	16.72	95.71	46.44	2.05
3	528.*	PF 2	1200.00	1.00	0.040	1259.47	1261.68	2.21	3.42	1262.89	1265.67	0.089271	16.01	74.95	42.71	2.13
3	528.*	PF 3	800.00	1.00	0.040	1259.47	1261.15	1.68	2.71	1262.18	1264.67	0.108165	15.06	53.12	38.41	2.26
3	528.*	PF 4	400.00	1.00	0.040	1259.47	1260.50	1.03	1.80	1261.27	1263.25	0.148264	13.31	30.06	33.26	2.47
3	527.*	PF 1	1600.00	1.00	0.040	1259.22	1261.86	2.64	4.02	1263.24	1266.36	0.082777	17.02	94.02	46.14	2.10
3	527.*	PF 2	1200.00	1.00	0.040	1259.22	1261.40	2.18	3.42	1262.64	1265.52	0.093840	16.29	73.66	42.47	2.18
3	527.*	PF 3	800.00	1.00	0.040	1259.22	1260.87	1.65	2.71	1261.93	1264.52	0.113904	15.33	52.20	38.21	2.31
3	527.*	PF 4	400.00	1.00	0.040	1259.22	1260.24	1.02	1.80	1261.02	1263.08	0.156054	13.53	29.56	33.14	2.52
3	526.*	PF 1	1600.00	1.00	0.040	1258.97	1261.58	2.61	4.02	1262.99	1266.23	0.086741	17.30	92.49	45.88	2.15
3	526.*	PF 2	1200.00	1.00	0.040	1258.97	1261.12	2.15	3.42	1262.39	1265.39	0.098747	16.58	72.38	42.23	2.23
3	526.*	PF 3	800.00	1.00	0.040	1258.97	1260.60	1.63	2.71	1261.68	1264.37	0.119755	15.59	51.32	38.03	2.36
3	526.*	PF 4	400.00	1.00	0.040	1258.97	1259.97	1.00	1.80	1260.77	1262.90	0.162994	13.73	29.14	33.04	2.58
3	525.*	PF 1	1600.00	1.00	0.040	1258.72	1261.30	2.58	4.02	1262.74	1266.10	0.090834	17.58	91.01	45.62	2.19
3	525.*	PF 2	1200.00	1.00	0.040	1258.72	1260.85	2.13	3.42	1262.14	1265.25	0.103439	16.85	71.22	42.01	2.28
3	525.*	PF 3	800.00	1.00	0.040	1258.72	1260.33	1.61	2.71	1261.43	1264.22	0.125274	15.83	50.54	37.86	2.41
3	525.*	PF 4	400.00	1.00	0.040	1258.72	1259.71	0.99	1.80	1260.52	1262.71	0.169313	13.90	28.78	32.95	2.62
3	524.*	PF 1	1600.00	1.00	0.040	1258.47	1261.02	2.55	4.02	1262.49	1265.96	0.094799	17.84	89.66	45.38	2.24

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Length Chnl	Mann Wtd Chnl	Min Ch El	W.S. Elev	Max Chl Dpth	Crit Depth	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	524.*	PF 2	1200.00	1.00	0.040	1258.47	1260.57	2.10	3.42	1261.89	1265.11	0.107957	17.10	70.18	41.81	2.33
3	524.*	PF 3	800.00	1.00	0.040	1258.47	1260.06	1.59	2.71	1261.18	1264.06	0.130547	16.05	49.84	37.71	2.46
3	524.*	PF 4	400.00	1.00	0.040	1258.47	1259.45	0.98	1.80	1260.27	1262.52	0.175202	14.06	28.46	32.87	2.66
3	523.*	PF 1	1600.00	1.00	0.040	1258.22	1260.74	2.52	4.02	1262.24	1265.83	0.098666	18.10	88.42	45.16	2.28
3	523.*	PF 2	1200.00	1.00	0.040	1258.22	1260.30	2.08	3.42	1261.64	1264.96	0.112341	17.34	69.22	41.63	2.37
3	523.*	PF 3	800.00	1.00	0.040	1258.22	1259.79	1.57	2.71	1260.93	1263.90	0.135578	16.26	49.20	37.58	2.50
3	523.*	PF 4	400.00	1.00	0.040	1258.22	1259.20	0.97	1.80	1260.02	1262.33	0.180657	14.20	28.17	32.80	2.70
3	522.*	PF 1	1600.00	1.00	0.040	1257.97	1260.47	2.49	4.02	1261.99	1265.69	0.102449	18.34	87.26	44.96	2.32
3	522.*	PF 2	1200.00	1.00	0.040	1257.97	1260.03	2.06	3.42	1261.39	1264.81	0.116595	17.56	68.34	41.45	2.41
3	522.*	PF 3	800.00	1.00	0.040	1257.97	1259.53	1.56	2.71	1260.68	1263.73	0.140429	16.45	48.62	37.46	2.54
3	522.*	PF 4	400.00	1.00	0.040	1257.97	1258.94	0.97	1.80	1259.77	1262.12	0.185592	14.32	27.92	32.74	2.73
3	521.*	PF 1	1600.00	1.00	0.040	1257.72	1260.19	2.47	4.02	1261.74	1265.54	0.106148	18.56	86.19	44.77	2.36
3	521.*	PF 2	1200.00	1.00	0.040	1257.72	1259.76	2.04	3.42	1261.14	1264.66	0.120747	17.77	67.52	41.30	2.45
3	521.*	PF 3	800.00	1.00	0.040	1257.72	1259.26	1.54	2.71	1260.43	1263.56	0.145090	16.64	48.09	37.34	2.58
3	521.*	PF 4	400.00	1.00	0.040	1257.72	1258.68	0.96	1.80	1259.52	1261.92	0.190285	14.44	27.70	32.68	2.76
3	520.*	PF 1	1600.00	1.00	0.040	1257.47	1259.92	2.45	4.02	1261.49	1265.40	0.109774	18.78	85.19	44.59	2.39
3	520.*	PF 2	1200.00	1.00	0.040	1257.47	1259.49	2.02	3.42	1260.89	1264.51	0.124781	17.97	66.76	41.15	2.49
3	520.*	PF 3	800.00	1.00	0.040	1257.47	1259.00	1.53	2.71	1260.18	1263.39	0.149569	16.81	47.60	37.24	2.62
3	520.*	PF 4	400.00	1.00	0.040	1257.47	1258.43	0.95	1.80	1259.27	1261.71	0.194264	14.54	27.51	32.64	2.79
3	519.*	PF 1	1600.00	1.00	0.040	1257.22	1259.65	2.43	4.02	1261.24	1265.25	0.113285	18.99	84.26	44.42	2.43
3	519.*	PF 2	1200.00	1.00	0.040	1257.22	1259.22	2.00	3.42	1260.64	1264.35	0.128641	18.16	66.07	41.01	2.52
3	519.*	PF 3	800.00	1.00	0.040	1257.22	1258.74	1.52	2.71	1259.93	1263.21	0.153831	16.97	47.15	37.14	2.65
3	519.*	PF 4	400.00	1.00	0.040	1257.22	1258.17	0.95	1.80	1259.02	1261.50	0.198345	14.64	27.32	32.59	2.82
3	518.*	PF 1	1600.00	1.00	0.040	1256.97	1259.38	2.41	4.01	1260.98	1265.10	0.116739	19.19	83.38	44.26	2.46
3	518.*	PF 2	1200.00	1.00	0.040	1256.97	1258.96	1.99	3.42	1260.39	1264.18	0.132450	18.35	65.41	40.88	2.56
3	518.*	PF 3	800.00	1.00	0.040	1256.97	1258.48	1.51	2.71	1259.68	1263.03	0.157929	17.12	46.73	37.05	2.69
3	518.*	PF 4	400.00	1.00	0.040	1256.97	1257.91	0.94	1.80	1258.77	1261.28	0.202191	14.73	27.15	32.55	2.84
3	517.*	PF 1	1600.00	1.00	0.040	1256.72	1259.11	2.39	4.02	1260.74	1264.94	0.120123	19.36	82.56	44.11	2.50
3	517.*	PF 2	1200.00	1.00	0.040	1256.72	1258.69	1.97	3.42	1260.14	1264.02	0.136159	18.52	64.79	40.76	2.59
3	517.*	PF 3	800.00	1.00	0.040	1256.72	1258.22	1.50	2.71	1259.43	1262.84	0.161930	17.26	46.34	36.96	2.72
3	517.*	PF 4	400.00	1.00	0.040	1256.72	1257.66	0.94	1.80	1258.52	1261.07	0.205757	14.82	27.00	32.51	2.87
3	516.*	PF 1	1600.00	1.00	0.040	1256.47	1258.84	2.37	4.02	1260.49	1264.78	0.123234	19.55	81.83	43.98	2.53
3	516.*	PF 2	1200.00	1.00	0.040	1256.47	1258.43	1.96	3.42	1259.89	1263.85	0.139783	18.69	64.21	40.65	2.62
3	516.*	PF 3	800.00	1.00	0.040	1256.47	1257.96	1.49	2.71	1259.18	1262.65	0.165389	17.39	46.01	36.89	2.74
3	516.*	PF 4	400.00	1.00	0.040	1256.47	1257.40	0.93	1.80	1258.27	1260.85	0.209117	14.90	26.85	32.48	2.89
3	515	PF 1	1600.00	1.00	0.040	1256.22	1258.58	2.36	4.02	1260.24	1264.62	0.126393	19.73	81.11	43.85	2.56
3	515	PF 2	1200.00	1.00	0.040	1256.22	1258.16	1.94	3.42	1259.64	1263.67	0.143037	18.84	63.70	40.55	2.65
3	515	PF 3	800.00	1.00	0.040	1256.22	1257.70	1.48	2.71	1258.93	1262.46	0.168983	17.51	45.68	36.82	2.77
3	515	PF 4	400.00	1.00	0.040	1256.22	1257.15	0.93	1.80	1258.02	1260.64	0.212835	14.98	26.70	32.44	2.91
3	514.*	PF 1	1600.00	1.00	0.040	1256.22	1258.57	2.35	3.97	1260.19	1264.38	0.121254	19.35	82.69	44.62	2.50
3	514.*	PF 2	1200.00	1.00	0.040	1256.22	1258.16	1.94	3.38	1259.60	1263.40	0.135068	18.37	65.33	41.39	2.58
3	514.*	PF 3	800.00	1.00	0.040	1256.22	1257.71	1.49	2.67	1258.89	1262.13	0.154170	16.87	47.43	37.77	2.65
3	514.*	PF 4	400.00	1.00	0.040	1256.22	1257.19	0.97	1.77	1257.99	1260.20	0.174730	13.93	28.72	33.57	2.65

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number 0406915

Sheet 1 of 3

Project NORTH INLET CHANNEL Date 1/20/05 (EDIT 2/23/05)

Subject DIVERSION CHANNEL DROP STRUCT. Designed ACC Checked

CUTOFF WALL

DEPTH OF CUTOFF WALL DETERMINED BY TOTAL DEGRADATION OF THE CHANNEL (SEE ATTACHED TABLE).

⇒ CUTOFF WALL DEPTH SET AT 6'

APRON – HYDRAULIC JUMP ANALYSIS

THE TOP APRON LENGTH IS SET BY THE CHANNEL CONSTRICTION LENGTH.

⇒ TOP APRON LENGTH SET AT 15'

THE BOTTOM APRON LENGTH IS SET BY THE LENGTH OF THE HYDRAULIC JUMP (AS ANALIZED IN ATTACHED HEC RAS PROFILE & FIGURE 7.7 DRAINAGE DESIGN MANUAL VOL II, FIGURE 15-21, CHOW & $L_j = 6y_2$ BY ROBERSON)

	3.5' DROP	4.5' DROP	6.25' DROP
COUNTY VOL II FIG 7.7	$L = 11.5(y_1)$ FOR $F_1 = 2.15$ $= 11.5(2.6')$ $= 30.0'$ USE 30'	$L = 12.25(y_1)$ $F_1 = 2.31$ $= 12.25(2.50')$ $= 30.6'$ USE 31'	$L = 15.25(y_1)$ $F_1 = 2.65$ $= 15.25(2.36')$ $= 36.0'$ USE 36'
CHOW FIG 15-26	$y_2 = 5.39$, $F_1 = 2.15$, $S_0 = 0$ (HORIZONTAL) $L/y_2 = 4.4 \Rightarrow L = 23.7'$	$y_2 = 5.42$ $F_1 = 2.31$ $S_0 = 0$ (HORIZONTAL) $L/y_2 = 4.8 \Rightarrow L = 26.0'$	$y_2 = 5.42$ $F_1 = 2.65$ $S_0 = 0$ (HORIZONTAL) $L/y_2 = 5.0 \Rightarrow L = 27.1'$
ROBERSON	$L_j = 6y_2 \Rightarrow L_j = (6)(5.39) = 32.3'$	$L_j = 6y_2 \Rightarrow L_j = (6)(5.42) = 32.5'$	$L_j = 6y_2 \Rightarrow L_j = (6)(5.42) = 32.5$

∴ ★ USE MIN APRON LENGTH OF 30.0' WITH 15' OF DUMPED RIP-RAP ★

SEEPAGE

THE METHOD USED TO CHECK CREED CAN BE FOUND IN DDMML VOL II Pg 7-24

L_H (HORZ. LENGTH OF CONTACT SURFACES < 45°) ⇒ (15'+14'+30') = 59'; (15'+18'+31') = 64'; (15'+25+36') = 76'

L_V (VERT. LENGTH OF CONTACT SURFACES > 45°) = (6'+5') + (6+5) = 22'

H_{DE} (HEAD, USE SAT. SOILS w/ NO FLOW) = 3.5'; 4.5'; 6.25'

C_W (WEIGHTED-CREED RATIO – MED. SAND) = 6.0

3.5' DROP ⇒ $C_W = (L_H + 3L_V)/3H_{DE}$
$= (59' + 3(22))/3(3.5)$
$= 11.52 > 6.0$ OK

4.5' DROP ⇒ $C_W = (L_H + 3L_V)/3H_{DE}$
$= (64' + 3(22))/3(4.5)$
$= 9.63 > 6.0$ OK

6.25' DROP ⇒ $C_W = (L_H + 3L_V)/3H_{DE}$
$= (76' + 3(22))/3(6.25')$
$= 7.57 > 6.0$ OK

KIRKHAM MICHAEL
CONSULTING ENGINEERS

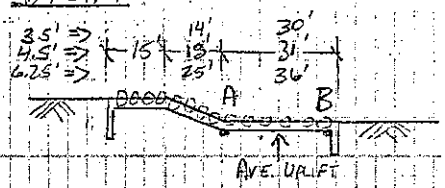
Job Number 0406915

Sheet 2 of 3

Project NORTH INLET CHANNEL Date 1/20/05 (EDIT 2/23/05)

Subject DIVERSION CHANNEL DROP STRUCT. Designed ACC Checked

UPLIFT -



UPLIFT CALCED BY AVERAGING HYDROSTATIC FORCE AT A & B. CHECK TO ENSURE SIZE/WEIGHT OF STRUCT. IS SUFFICIENT.

3.5' DROP

$L_W = L_H + 3L_V = 59' + 3(22') = 125'$

$L_{VA} = 6' + 5' = 11'$
$L_{HA} = 15' + 14' = 29'$
$L_{WA} = 29' + 3(11') = 62'$

UPLIFT @ A $= H_{Fd} - (L_{WA}/L_W)\,H_{Fd}$
$= 3.5' - (62'/125')\,3.5' = 1.76$

$L_{VB} = 6' + 5' = 11'$
$L_{HB} = 15' + 14' + 29' = 58'$
$L_{WB} = 58' + 3(11') = 91'$

UPLIFT @ B $= H_{Fd} - (L_{WB}/L_W)\,H_{Fd}$
$= 3.5' - (58'/125')\,3.5' = 0.95$

AVE. UPLIFT $= 1.76' + 0.95'/2$
$= 1.36'$

AVE. UPLIFT FORCE PER SQ FT.
$= (1.36')(62.4\ \text{lb/ft}^3)(1')(1')$
$= 84.86$

AVE. WEIGHT (DOWNWARD FORCE) PER SQ. FT.
$= 150\ \text{lb/ft}^3\ (1')(1')(1.5')$
$= 225 > 85$ lb OK

4.5' DROP

$L_W = 64' + 3(22') = 130$

$L_{VA} = 6 + 5 = 11'$
$L_{HA} = 15' + 18' = 33'$
$L_{WA} = 33' + 3(11) = 66'$

UPLIFT @ A $= H_{Fd} - (L_{WA}/L_W)\,H_{Fd}$
$= 4.5' - (66'/130')\,4.5'$
$= 2.22$

$L_{VB} = 6 + 5 = 11$
$L_{HB} = 15' + 18' + 30' = 63$
$L_{WB} = 63 + 3(11) = 99'$

UPLIFT @ B $= H_{Fd} - (L_{WA}/L_W)\,H_{Fd}$
$= 4.5' - (99'/130')\,4.5'$
$= 1.07$

AVE. UPLIFT $= 2.22' + 1.07'/2 = 1.65'$

AVE UPLIFT PER SQUARE FOOT
$= (1.65')(62.4\ \text{lb/ft}^3)(1')(1') = 102.96$

AVE WEIGHT (DOWNWARD FORCE) PER SQ FT
$= 150\ \text{lb/ft}^3\ (1')(1')(1.5') = 225$
$225 > 103$ OK

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number 0406915

Sheet 3 of 3

Project NORTH INLET CHANNEL Date 2/23/05

Subject DIVERSION CHANNEL DROP STRUCT Designed ACL Checked

6.25' DROP

$L_W = 76' + 3(22') = 142'$

$L_{VA} = 6+5 = 11'$

$L_{HA} = 15+25 = 40'$

$L_{WA} = 40 + 3(11) = 73'$

$L_{VB} = 6+5 = 11'$

$L_{HB} = 15+25+35 = 75'$

$L_{WB} = 75' + 3(11) = 108'$

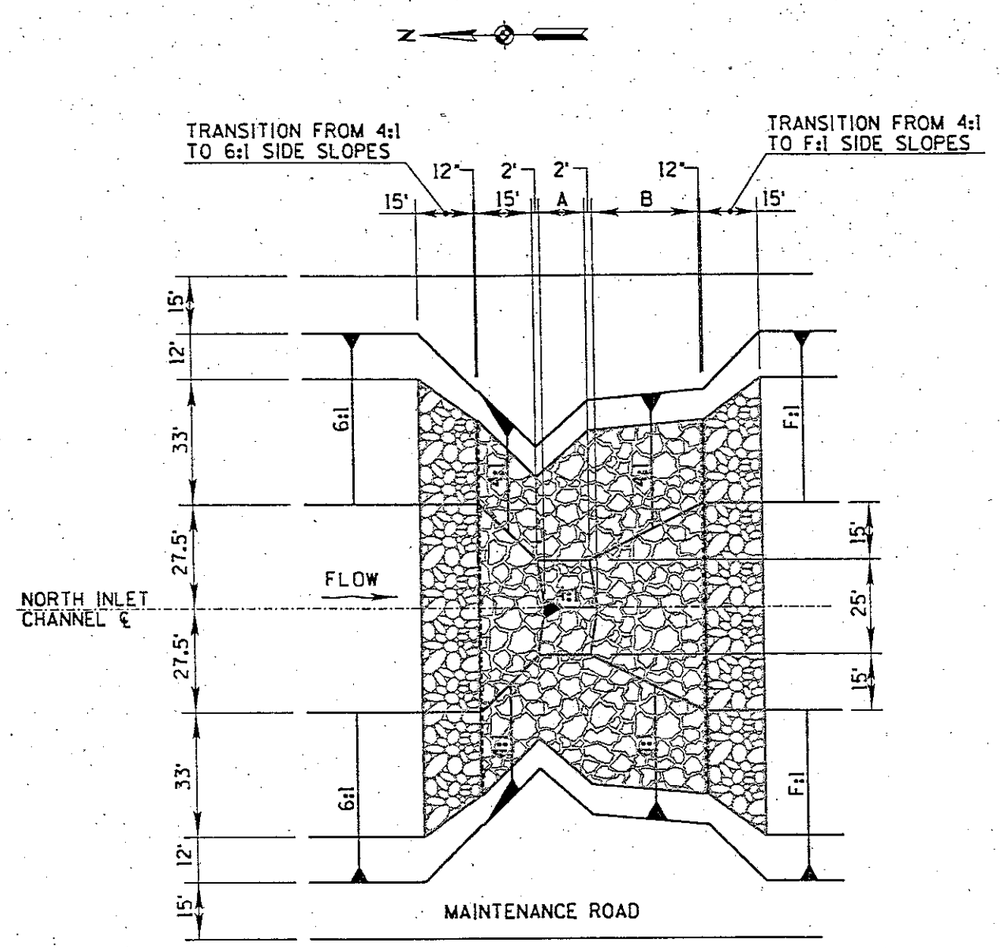
UPLIFT @ A = $H_{Fd} - (L_{WA}/L_W) H_{Fd}$
$= 6.25 - (73'/142) 6.25 = 3.04$

UPLIFT @ B = $H_{Fd} - (L_{WB}/L_W) H_{Fd}$
$= 6.25' - (108'/142') 6.25 = 1.50$

AVE UPLIFT = $3.04 + 1.50 / 2 = 2.27$

AVE UPLIFT PER SQ FT
$= (2.27')(62.4\ lb/ft^3)(1')(1')$
$= 141.65$

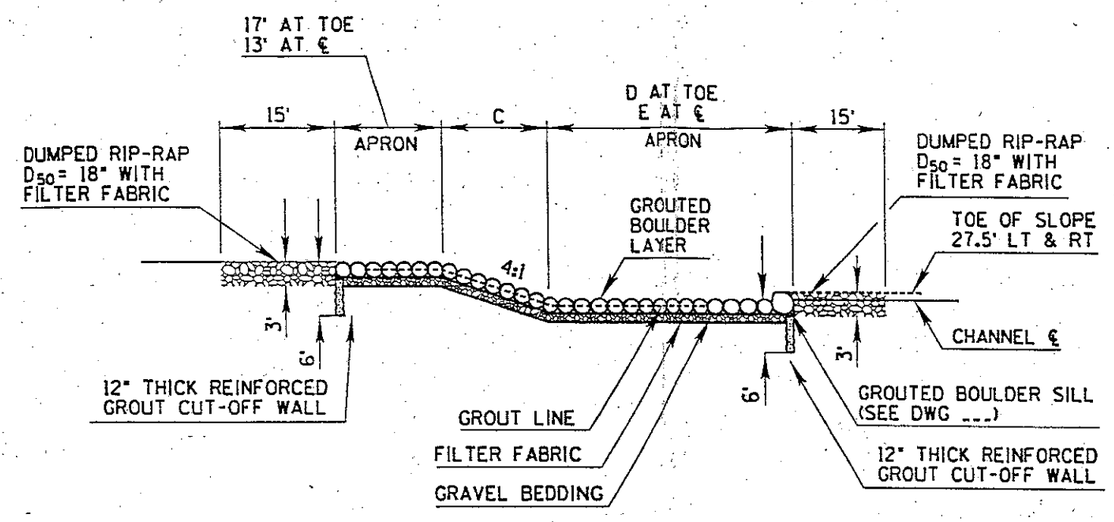
AVE WEIGHT (DOWNWARD FORCE) PER SQ FT
$= 150\ lb/ft^3\ (1')(1')(1.5')$
$= 225 > 142\ lb$ OK



DROP STRUCTURE PLAN
NTS

PLAN/PROFILE DIMENSIONS PER DROP STRUCTURE HEIGHT

HEIGHT OF STRUCTURE	A	B	C	D	E	F
3.50' DROP STRUCTURE	12'	28'	14'	30'	28'	6
4.50' DROP STRUCTURE	16'	29'	18'	31'	29'	6
6.25' DROP STRUCTURE	23'	34'	23'	36'	34'	5



DROP STRUCTURE PROFILE
NTS

NOTE:

1. SEE DWG. NO. C30 FOR DROP STRUCTURE #5 PLAN.
2. THERE IS NO DROP STRUCTURE #4 IN PROJECT
3. SEE DWG. NO. DS2 FOR GENERAL DETAIL AND NOTES
4. BOULDER SIZE FOR DROP STRUCTURE:
   6.25' DROP: 36"-ON SLOPES & APRONS/48" ON SILL
   4.50' DROP: 30"-ON SLOPES & APRONS/42" ON SILL
   3.50' DROP: 24"-ON SLOPES & APRONS/36" ON SILL
5. BOULDER SIZE MAY VARY A MAXIMUM OF 6# OF THE NOMINAL BOULDER SIZE (SEE SPECIAL PROVISIONS SEC _____)

NO.	REVISION	BY.	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

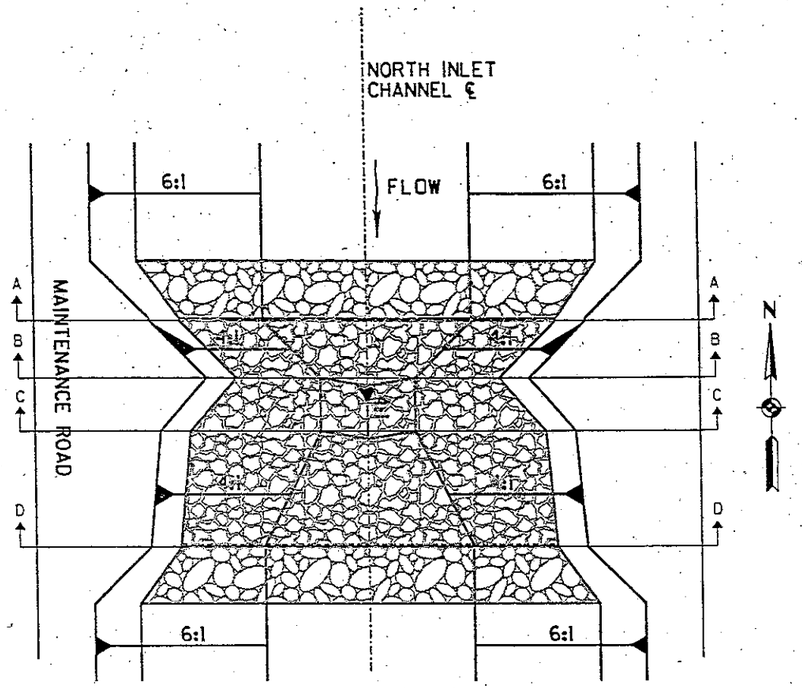
WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

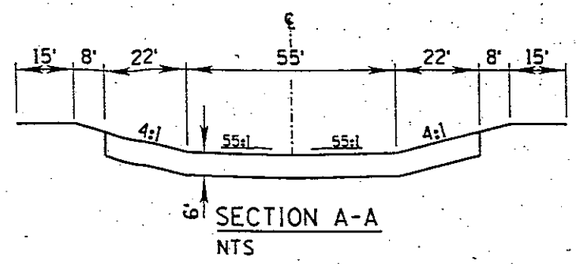
	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

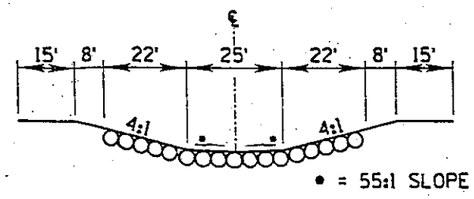
DRAWING NO. DS2 | NORTH INLET CHANNEL DROP STRUCTURE #X | SHEET 101 OF XXX



DROP STRUCTURE PLAN
NTS



SECTION A-A
NTS



SECTION B-B
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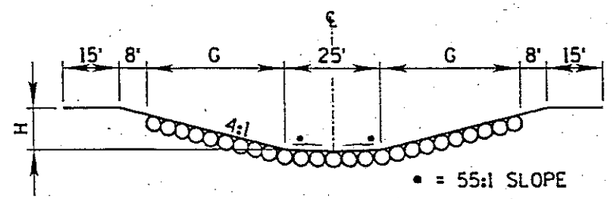
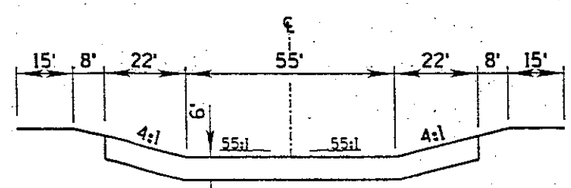


SECTION C-C
NTS



SECTION D-D
NTS

CROSS-SECTION DIMENSIONS PER DROP STRUCTURE HEIGHT

HEIGHT OF STRUCTURE	G	H
3.50' DROP STRUCTURE	36'	9.88'
4.50' DROP STRUCTURE	40'	10.33'
6.25' DROP STRUCTURE	47'	11.75'

NO.	REVISION	BY	DATE
3			
2			
1.			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

DRAWING NO.

SHEET OF XXX

State Standard 5-96 Watercourse System Sediment Balance				
Beardsley Canal Wash and North Inlet Channel Estimated Channel Degradation				
Location on	100-yr Peak	Degradation (ft)		
Channel	Discharge (cfs)	General	Long Term	Total
Olive Ave. (u/s)	2655	3.7	2.3	6.0
Olive Ave. (d/s)	1055	2.5	1.3	3.8
Cholla Wash (before confl.)	4868	4.7	3.3	8.0
Cholla Wash (at BCW)	5539	4.9	3.5	8.4
Northern Ave. (d/s)	7139	5.5	4.1	9.6
1200' d/s of Northern Ave.	7776	5.7	4.3	10.0
North Inlet Channel (div.1)	1600	3.0	1.7	4.7
North Inlet Channel (div.2)	1200	2.7	1.4	4.1

USE 6'

GROUTED BOULDER DROP STRUCTURE
NORTH INLET CHANNEL

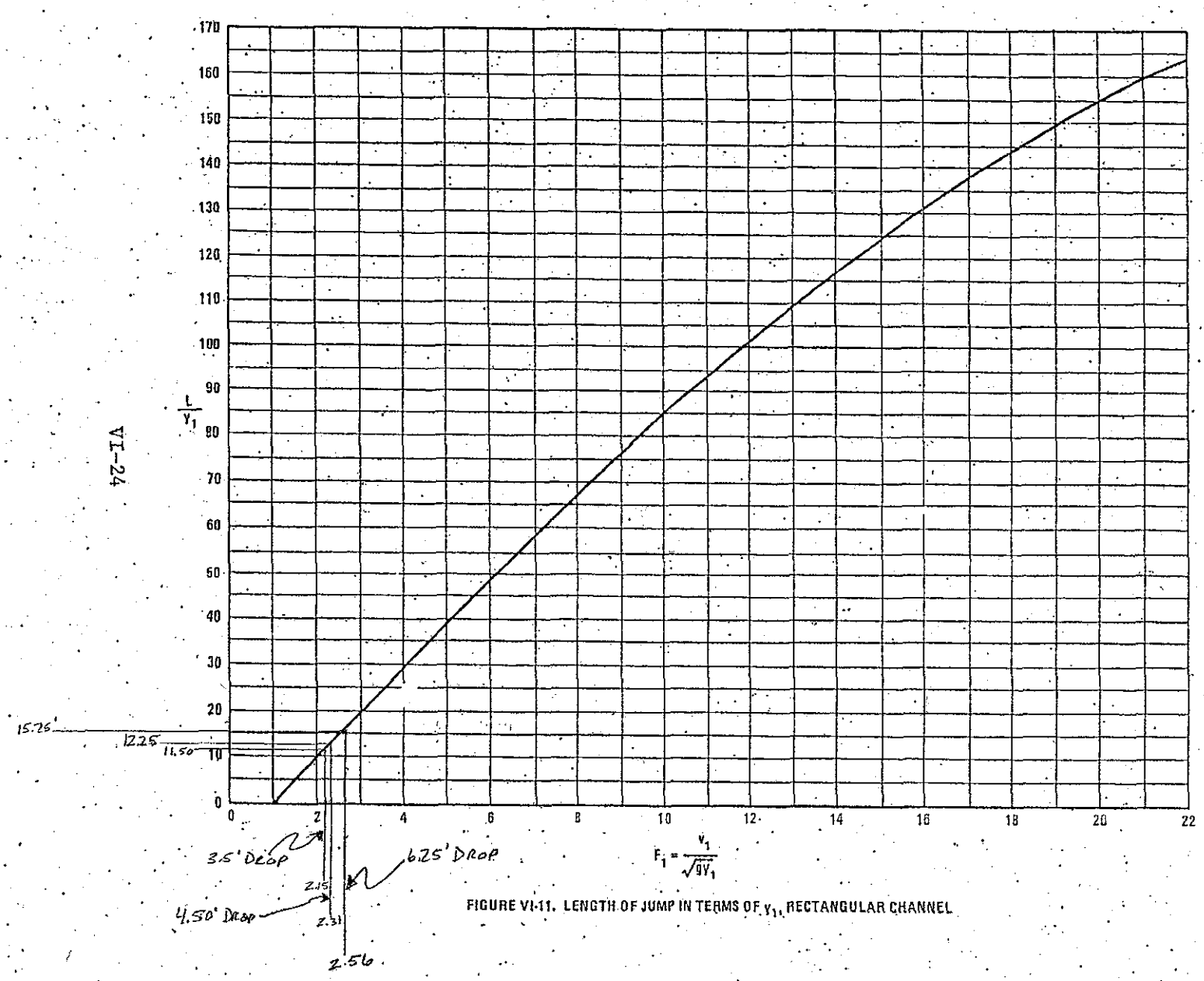


FIGURE VI-11. LENGTH OF JUMP IN TERMS OF y_1, RECTANGULAR CHANNEL

OPEN-CHANNEL HYDRAULICS

VEN TE CHOW, Ph.D.

Professor of Hydraulic Engineering
University of Illinois

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y_2, the [illegible] jump will recede downstream. On the other hand, if the tailwater depth is greater than y_2, the jump will be submerged. As the tailwater level rises, the spillway crest may be finally submerged. The spillway will still be effective if the submergence does not reach the control depth on the spillway crest. The upper surface of the submerged nappe may be assumed as a straight line tangent to the upper surface of the free nappe at the point where the nappe plunges into the tailwater. The upper surface of the free nappe may be represented by the general equation given in Art. 14-1.

In the above discussion it is assumed that the length of the spillway crest is the same as the width of the approach channel. If the crest length is less than the width of the approach channel, the contraction at the ends of the spillway notch will be so great that the ends of the nappe may land beyond the stilling-basin sidewalls and the concentration of high velocities at the center of the outlet may cause additional scour in the downstream channel. It is, therefore, important to design the approach end properly by shaping the approach channel to reduce the effect of end contractions.

The straight drop spillway is commonly installed in small drainage structures by the U.S. Soil Conservation Service. The simplest form of such a structure, known as the *box inlet drop spillway*, is simply a rectangular box open at the top and at the downstream end [67–69]. Storm runoff is directed to the box by dikes and headwalls, enters over the upstream end and two sides, and leaves through the open downstream end leading to a channel outlet. A generalized design has also been developed by the Service as a result of tests and analyses at the St. Anthony Falls Hydraulic Laboratory [70,71].

By placing a gridiron or grate on top of the straight drop spillway, the overfalling jet can be separated into a number of long thin sheets of water which fall nearly vertically into the channel below. Thus the energy in the jet can be dissipated without resort to the use of hydraulic jump, and hence wave action can be reduced if $F_1 = 2.5$ to 4.5. This scheme has been adopted by the U.S. Bureau of Reclamation [34,35] for developing a so-called *drop energy dissipator* as a substitute design for USBR basin IV (Art. 15-14). In this design, the grate may be composed of a series of beams, such as steel rails, channel irons, or timbers, which form slots parallel to the direction of flow. The width of the slots is equal to two-thirds the width of the beams. If the rails are tilted downward at an angle of 3° or more, the grate is self-cleaning. On the other hand, if the grate is tilted upward, it can check the upstream water level but may pose a cleaning problem. The length of the grate slots can be computed by

$$L_G = \frac{4.1Q}{WN\sqrt{2gy_1}} \tag{15-14}$$

where Q is the total discharge in cfs, W is the width of a space in ft, N is the number of spaces, g is the gravitational acceleration, and y_1 is the depth of flow in the canal upstream.

15-16. Jump in Sloping Channels. In the analysis of hydraulic jumps in sloping channels or channels having appreciable slope, it is essential to consider the weight of water in the jump; in horizontal channels the effect of this weight is negligible. Thus, the momentum formulas for jumps on horizontal floor cannot be applied straightforwardly to jumps on sloping floor. As will be shown in this article, however, the momentum principle can be used to derive an equation analogous to Eq. (3-21), which will contain an empirical function that has to be determined experimentally.

Early studies on hydraulic jumps in sloping channels were made by Riegal and Beebe [9] and by Ellms [72,73]. Later investigations were made by Bakhmeteff and Matzke [74] and also by Yarnell[1] and Kindsvater [75].

Hydraulic jump in sloping channels may occur in various forms, as shown in Fig. 15-19. Case 1 is a typical form, but it is not common in practical problems. Cases 2 to 4, known as *drowned-out jumps*, are common forms and usually appear simply as jets of water plunging into a downstream pool below the steep slope. For practical purposes, it is believed that the solutions for the typical form of case 1 and for the drowned-out jumps are mutually applicable. Case 5 shows the jump on an adverse slope. This is a rare type of jump, and no adequate experimental data are available at the present moment.

For the analysis of the jump of case 1, a rectangular channel of unit width is assumed. Considering all effective forces parallel to the channel bottom, the momentum equation may be written

$$\frac{Qw}{g}(\beta_2 V_2 - \beta_1 V_1) = P_1 - P_2 + W\sin\theta - F_f \tag{3-14}$$

where $Q = V_1 d_1$, $V_2 = V_1 d_1/d_2$, $P_1 = 0.5wd_1^2\cos\theta$, $P_2 = 0.5wd_2^2\cos\theta$, F_f is negligible, and β_1 and β_2 may be taken as unity. If the surface profile of the jump is a straight line, the weight of water in the jump can be computed. The discrepancy between the straight-line and actual profiles and the effect of slope may be corrected by a factor K. Thus,

$$W = \tfrac{1}{2}K\gamma wL(d_1 + d_2) \tag{15-15}$$

Substituting Eq. (15-15) in Eq. (3-14), letting $F_1 = V_1/\sqrt{gd_1}$, and

[1] The work started in 1936 by David L. Yarnell at the Iowa Institute of Hydraulic Research, Iowa City, Iowa, was interrupted by his death in 1937. The Yarnell data were lent to the Tennessee Valley Authority in 1939 for an extensive investigation by Kindsvater.

simplifying,

$$\left(\frac{d_2}{d_1}\right)^3 - (2G^2 + 1)\frac{d_2}{d_1} + 2G^2 = 0 \qquad (15\text{-}16)$$

where

$$G = \frac{F_1}{\sqrt{\cos\theta - \dfrac{KL\sin\theta}{d_2 - d_1}}} \qquad (15\text{-}17)$$

There is a general belief [76] that K and $L/(d_2 - d_1)$ vary primarily with F_1 and, hence, that G is a function of F_1 and θ, or $G = f(F_1,\theta)$.

If Eq. (15-16) is compared with Eq. (3-20) for level-floor jump, a similarity between the two equations is evident. Following the solution for Eq. (3-20), the solution of Eq. (15-16) is apparently

$$\frac{d_2}{d_1} = \tfrac{1}{2}(\sqrt{1 + 8G^2} - 1) \qquad (15\text{-}18)$$

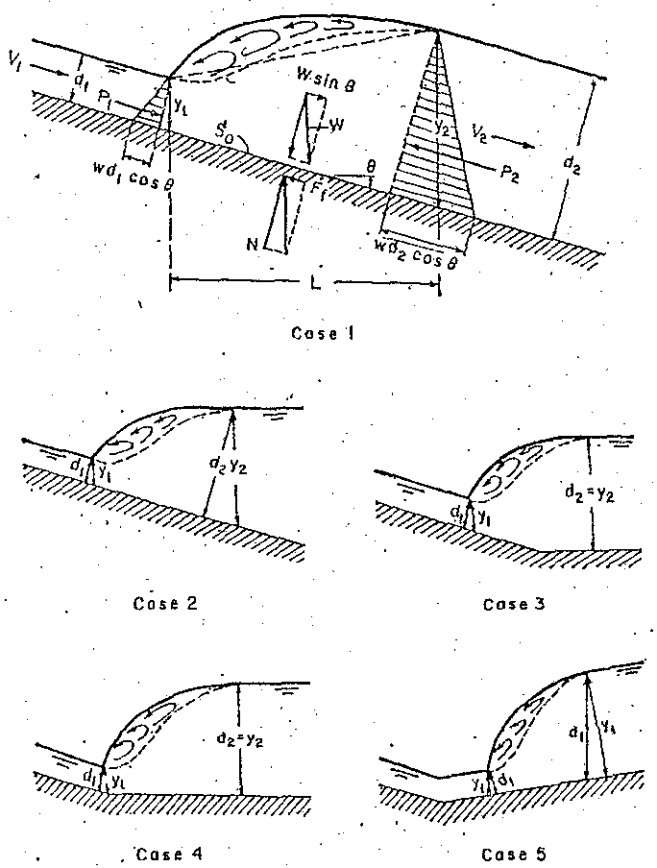

FIG. 15-19. Hydraulic jumps in sloping channels.

Since $d_1 = y_1 \cos\theta$ and $d_2 = y_2 \cos\theta$, Eq. (15-18) may also be written

$$\frac{y_2}{y_1} = \tfrac{1}{2}(\sqrt{1 + 8G^2} - 1) \qquad (15\text{-}19)$$

The above two equations are analogous to Eq. (3-21). Since $G = f(F_1,\theta)$, these equations indicate that d_2/d_1 and y_2/y_1 are functions of F_1 and θ.

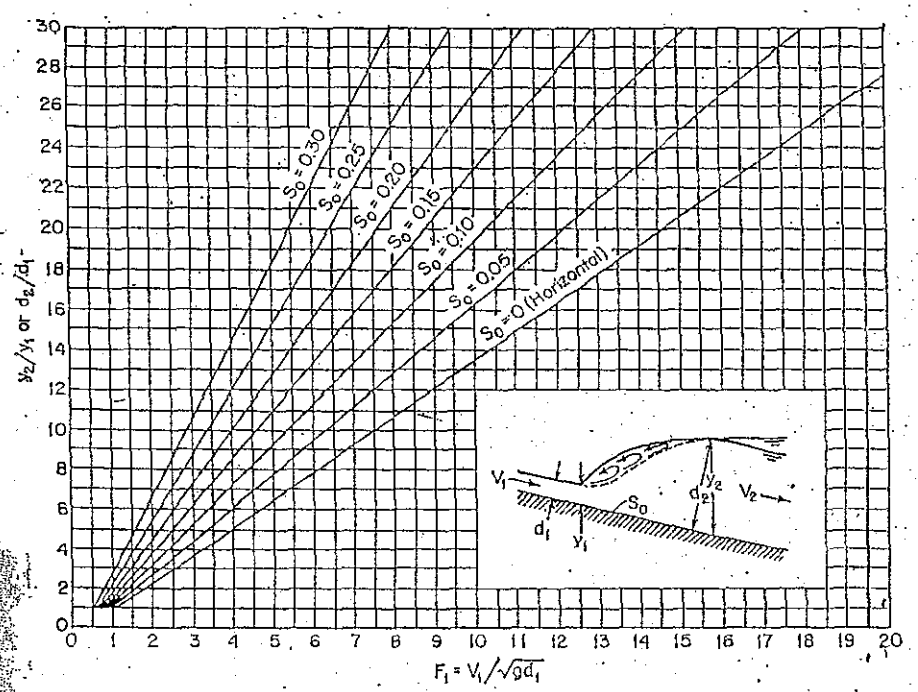

FIG. 15-20. Experimental relations between F_1 and y_2/y_1 or d_2/d_1 for jumps in sloping channels.

The depth ratio y_2/y_1 or d_2/d_1 can be shown as a function of F_1 and S_0 (i.e. $\sin\theta$) by the chart in Fig. 15-20, which is based on the experimental data of Hickox [77], Kindsvater [75], Bakhmeteff and Matzke [74], and the U.S. Bureau of Reclamation [34,35]. Similarly, the relative length of jump L/y_2 may also be shown as a function of F_1 and S_0 and represented by curves based on the experimental data of the Bureau of Reclamation (Fig. 15-21). The dashed lines indicate the parts where the curves are not well defined by the available data. The diagrams in Figs. 15-20 and 15-21 are based on limited experimental data with considerable interpolation; nevertheless they provide useful information for practical purposes.

The following rules for designing a stilling basin with sloping apron

(USBR basin V) are extracted from recommendations made by the U.S. Bureau of Reclamation [34,35]:

1. Determine an apron arrangement that will give the greatest economy for the maximum discharge condition. This is the governing factor and the only justification for using a sloping apron.

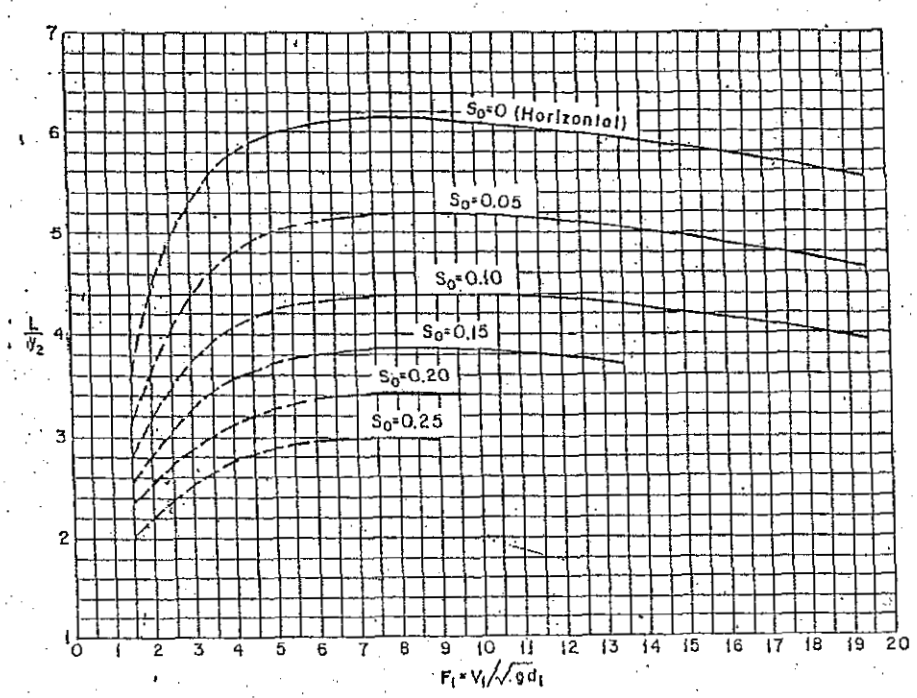

FIG. 15-21. Length in terms of sequent depth of jumps in sloping channels. (*U.S. Bureau of Reclamation* [34].)

2. Position the apron so that the front of the jump will form at the upstream end of the slope for the maximum discharge and tailwater condition.

3. The portion of the jump to be confined on the stilling basin is a decision for the designer, depending on the quality of the material in the river bed and other conditions. The average over-all apron is about 60% of the length of jump for the maximum discharge condition.

4. With the apron designed properly for the maximum discharge condition, the next step is to be certain that the tailwater depth and basin length available for energy dissipation are sufficient for, say, one-quarter, one-half, and three-quarters of capacity.

5. A horizontal apron will perform on par with the sloping apron for high Froude numbers, if proper tailwater is provided.

6. The slope of the chute upstream from a stilling basin has little effect on the jump as long as the distribution of velocity and depth of flow are reasonably uniform on entering the jump.

7. A small solid triangular sill with a sloping upstream surface, placed at the end of the apron, is the only appurtenance needed. This serves to lift the flow as it leaves the apron and thus acts to control scour. Its dimensions are not critical; the most effective height is between 0.05 and 0.10 of the vertical distance of the sequent tailwater elevation above the bottom of the toe of the jump, and the surface slope can be 3:1 to 2:1.

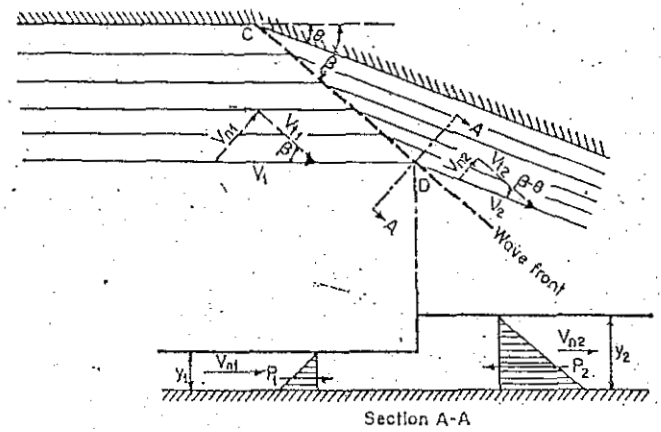

FIG. 15-22. Oblique hydraulic jump.

15-17. The Oblique Jump. When a supercritical flow is deflected inward to the course of the flow by a vertical boundary (Fig. 15-22), the depth of flow y_1 will increase abruptly to a depth y_2 along a wavefront CD which extends out from the point of boundary discontinuity at a *wave angle* β that depends in magnitude on the angle of deflection θ of the boundary. This phenomenon resembles a normal hydraulic jump but with the change in depth occurring along an oblique front; hence it may be called an *oblique hydraulic jump.*[1] When $\theta = 0$, oblique jump becomes the familiar hydraulic jump in which the wavefront is normal to the direction of flow, or $\beta = 90°$.

Referring to the relationship of velocity vectors before the jump in Fig. 15-22, the velocity normal to the wavefront is $V_{n1} = V_1 \sin \beta$ where V_1 is the velocity of flow before the jump. The Froude number normal to

[1] For original information see [78] and [79]. The oblique hydraulic jump or oblique standing wave is also known as the *shock wave,* by analogy to the case in supersonic flow of gases. The basic development of this subject was accomplished by Rouse and White [80].

Hydraulic Engineering

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To our wives:
Amy, Alice, and Shamim

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Art by Boston Graphics, Inc.

Printed in the U.S.A.
Library of Congress Catalog Card Number: 87-81367
ISBN: 0-395-38123-1

DEFGHIJ-H-95432

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Preface

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2-5 Pre
2-6 Sur
2-7 Str
2-8 Ob
2-9 Co

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3-1 Ge
3-2 Oc

rate of 300 cfs.
of 1 to 1. If a hydraulic
00 ft, what will be the

is equal to 11 ft². The
refore, the pressure at
r $V = Q/A_1 = 27.3$ ft/s.
gnificant digits):

olution gives

ecause of the intense tur-
ead loss due to the jump
n determine the head loss
ation across the jump and

VEL If a jump occurs in a
a formula for y_2 as a func-
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(4-27)

with the hydraulic jump, see Sec.

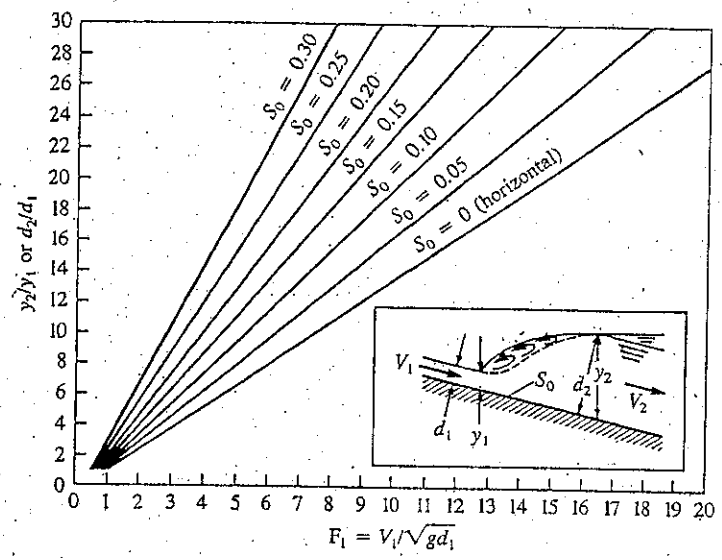

Figure 4-24 Experimental relations between F_1 and y_2/y_1 or d_2/d_1 for jumps in sloping channels [Adapted from *Open Channel Hydraulics* by Chow (4) Copyright 1959, McGraw-Hill Book Company, New York; used with permission of McGraw-Hill Book Company.]

A graph of Eq. (4-27) is shown in Fig. 4-24 (the case for $S_0 = 0$). Figure 4-24 also shows the relations between depth and Froude numbers for hydraulic jumps in channels that are not horizontal.

LENGTH OF THE HYDRAULIC JUMP The length of the hydraulic jump is the distance measured from the front face of the jump to a point on the surface immediately downstream of the roller, as shown in Fig. 4-22. No general theoretical solution exists for this length. However, experiments in rectangular channels (4) show that $L = 6y_2$ for $4 < \mathrm{Fr}_1 < 20$. For Froude numbers outside this range, the length is somewhat less than $6y_2$.

STILLING BASINS We have already shown that the transition from supercritical to subcritical flow produces a hydraulic jump, and that the relative height of the jump (y_2/y_1) is a function of Fr_1. Because flow over the spillway of a dam invariably results in supercritical flow at the lower end of the spillway, and because flow in the channel downstream of a spillway is usually subcritical, it is obvious that a hydraulic jump must form near the base of the spillway (see Fig. 4-25). The downstream portion of the spillway must be designed so that the hydraulic jump always forms on the concrete structure itself. If the hydraulic

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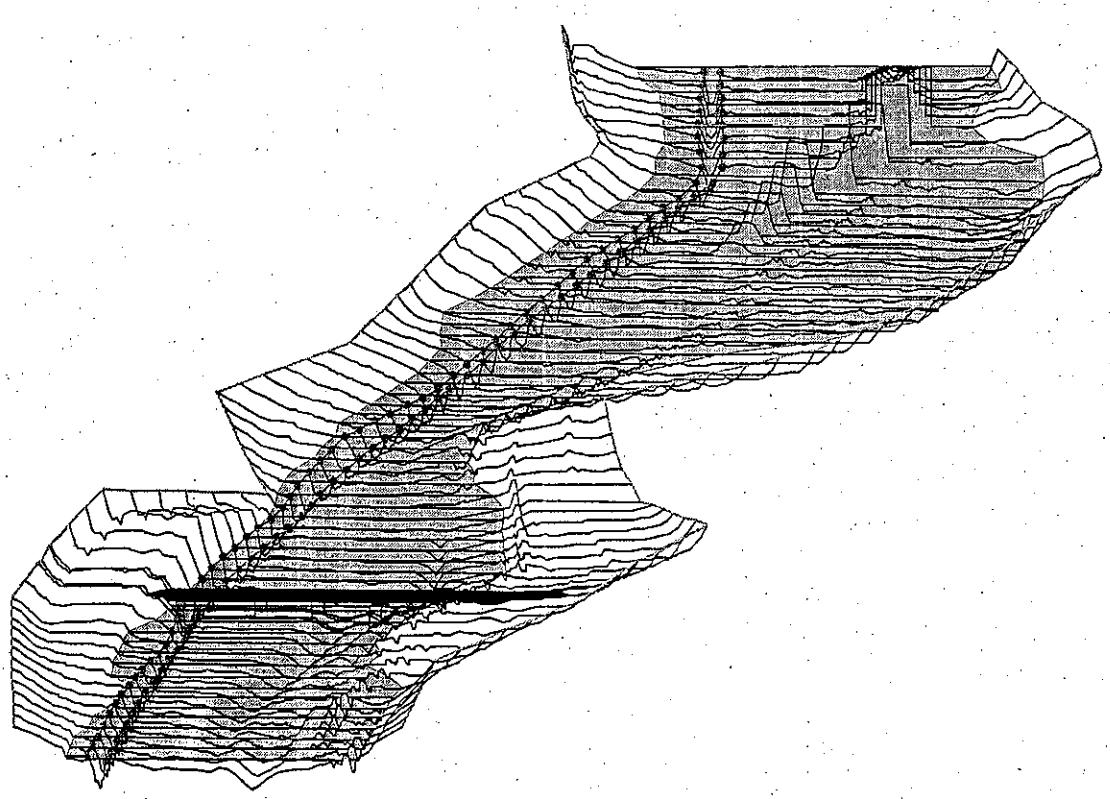
HEC-RAS
River Analysis System



Hydraulic Reference Manual

Version 3.1
November 2002

Approved for Public Release. Distribution Unlimited

CPD-69

CHAPTER 8

Modeling Gated Spillways, Weirs and Drop Structures

This version of HEC-RAS allows the user to model inline structures, such as gated spillways, overflow weirs, drop structures, as well as lateral structures. HEC-RAS has the ability to model radial gates (often called tainter gates) or vertical lift gates (sluice gates). The spillway crest of the gates can be modeled as either an ogee shape or a broad crested weir shape. In addition to the gate openings, the user can also define a separate uncontrolled overflow weir.

This chapter describes the general modeling guidelines for using the gated spillway and weir capability within HEC-RAS, as well as the hydraulic equations used. Information on modeling drop structures with HEC-RAS is also provided. For information on how to enter gated spillway and weir data, as well as viewing gated spillway and weir results, see Chapter 6 and Chapter 8 of the HEC-RAS User's Manual, respectively.

Contents

- General Modeling Guidelines
- Hydraulic Computations Through Gated Spillways
- Uncontrolled Overflow Weirs
- Modeling Lateral Structures
- Drop Structures

Drop Structures

Drop structures can be modeled with the inline weir option or as a series of cross sections. If you are just interested in getting the water surface upstream and downstream of the drop structure, then the inline weir option would probably be the most appropriate (as described in a previous section of this chapter). However, if you want to compute a more detailed profile upstream of and through the drop, then you will need to model it as a series of cross sections.

When modeling a drop structure as a series of cross sections, the most important thing is to have enough cross sections at the correct locations. Cross sections need to be closely spaced where the water surface and velocity is changing rapidly (i.e. just upstream and downstream of the drop). An example of a drop structure is shown in Figure 8.13.

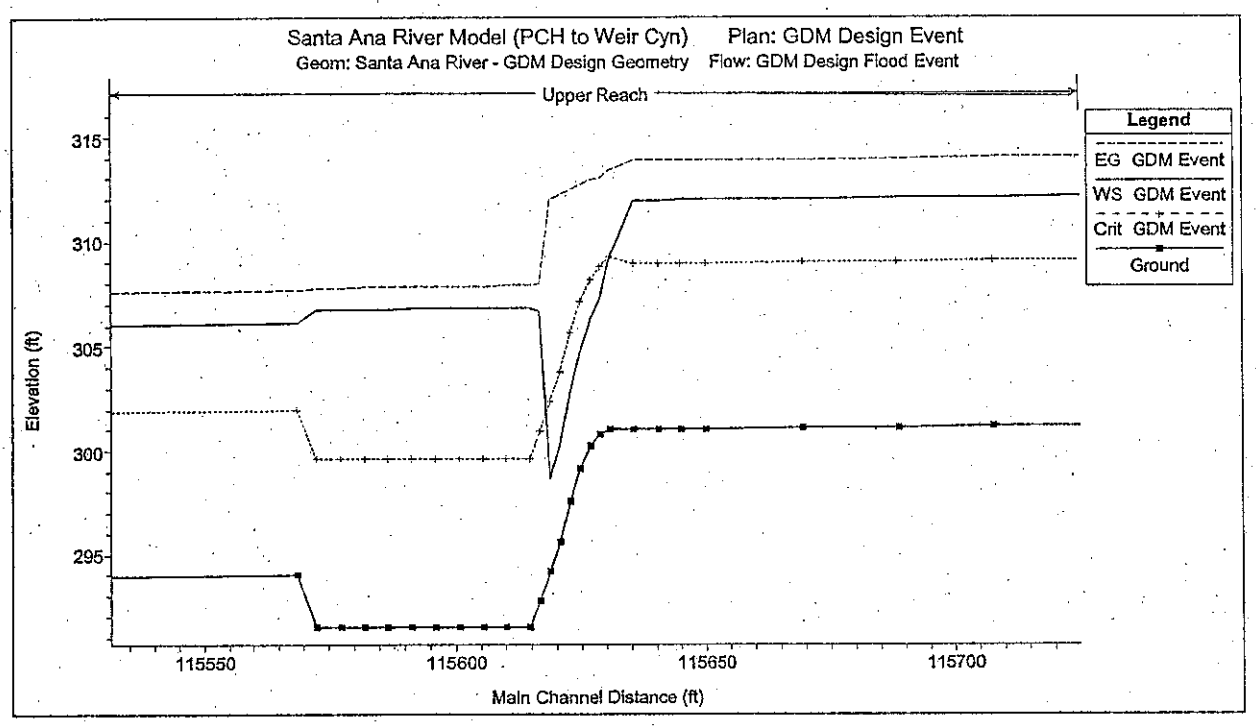


Figure 8.13 Drop Structure Modeled With Cross Sections

As shown in Figure 8.13, the spacing between cross sections should decrease as you get closer to the drop structure (cross sections are located at each square shown on the ground profile). Additionally, if the drop itself is on a slope, then additional cross sections should be placed along the sloping drop in order to model the transition from subcritical to supercritical flow. Several cross sections should also be placed in the stilling basin (location of energy dissipaters) in order to correctly locate where the hydraulic jump will occur

(i.e. the hydraulic jump could occur on the slope of the drop, or it may occur inside of the stilling basin). Manning's n values should be increased inside of the stilling basin to represent the increased roughness do to the energy dissipater blocks.

In order to evaluate this method of modeling drop structures, a comparison was made between a physical model study and an HEC-RAS model of the drop structure. During the design phase of improvements to the Santa Ana river, the Waterways Experiment Station (WES) was contracted to study the drop structures and make recommendations. The results of this study were reported in General Design for Replacement of or Modifications to the Lower Santa Ana River Drop Structures, Orange County, California (Technical Report HL-94-4, April 1994, USACE). Over 50 different designs were tested in 1:25 scale flume models and 1:40 scale full width models. The designs evaluated existing structures, modifying original structures and replacing them with entirely new designs. The drop structure design used in the Santa Ana River is similar to one referred to as Type 10 in the report. A HEC-RAS model was developed to model the Type 10 drop structure and the model results were compared to the flume results.

The geometry for the HEC-RAS model was developed from the following design diagram in the WES report.

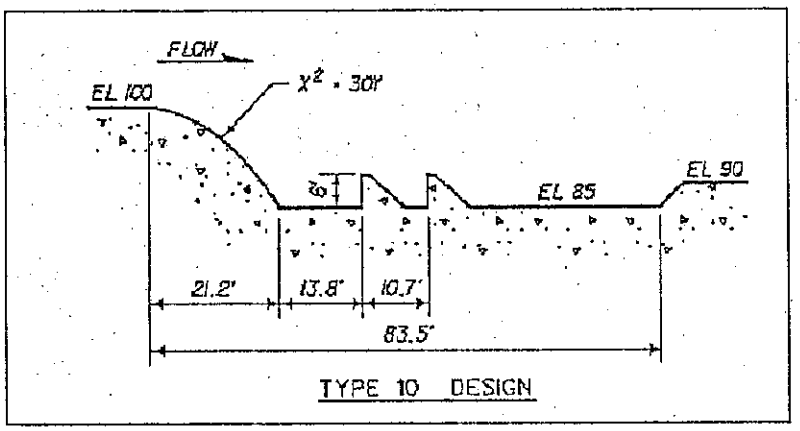


Figure 8.14 WES Report Plate 13.

The total reach in the model was 350 feet, 150 upstream of the crest of the drop structure and 200 feet below the crest. The cross sections were rectangular, with the following spacing used in the HEC-RAS model:

Location	Reach Lengths
Upstream of Drop structure:	10 feet
Over the drop:	2 feet
Inside the stilling basin:	10 feet
Downstream of Structure:	10 feet

The expansion and contraction coefficients were set to 0.3 and 0.1 respectively. Two Manning's n values were used in the HEC-RAS model of the flume. Inside the stilling basin where the bottom elevation was 85 feet, the Manning's n values were set to 0.05. In all other cross sections the Manning's n values were set to 0.03. The higher n value was used in the stilling basin to account for the additional energy loss due to the rows of baffles that exist in the flume but were not added into the cross sections data of HEC-RAS.

The original data from the flume experiments were obtained from the Waterways Experiment Station, and entered in HEC-RAS as observed data. The results of the HEC-RAS model are compared in profile to the observed water surface elevations in the flume study in Figure 8.15. These results show that HEC-RAS was able to adequately model the drop structures, both upstream and downstream of the crest.

Some differences occur right at the crest and through the hydraulic jump. The differences at the crest are due to the fact that the energy equation will always show the flow passing through critical depth at the top of the crest. Whereas, in the field it has been shown that the flow passes through critical depth at a distance upstream of 3-4 times critical depth. However, as shown in Figure 8.15, a short distance upstream of the crest the HEC-RAS program converges to the same depth as the observed data. Correctly obtaining the maximum upstream water surface in the most important part of modeling the drop structure.

Downstream of the drop, the flow is supercritical and then goes through a hydraulic jump. The flume data shows the jump occurring over a distance of 50 to 60 feet with a lot of turbulence. The HEC-RAS model cannot predict how long of a distance it will take for the jump to occur, but it can predict where the jump will begin. The HEC-RAS model will always show the jump occurring between two adjacent cross sections. The HEC-RAS model shows the higher water surface inside of the stilling basin and then going down below the stilling basin. The model shows all of this as a fairly smooth transition, whereas it is actually a turbulent transition with the water surface bouncing up and down. In general, the results from the HEC-RAS model are very good at predicting the stages upstream, inside, and downstream of the drop structure.

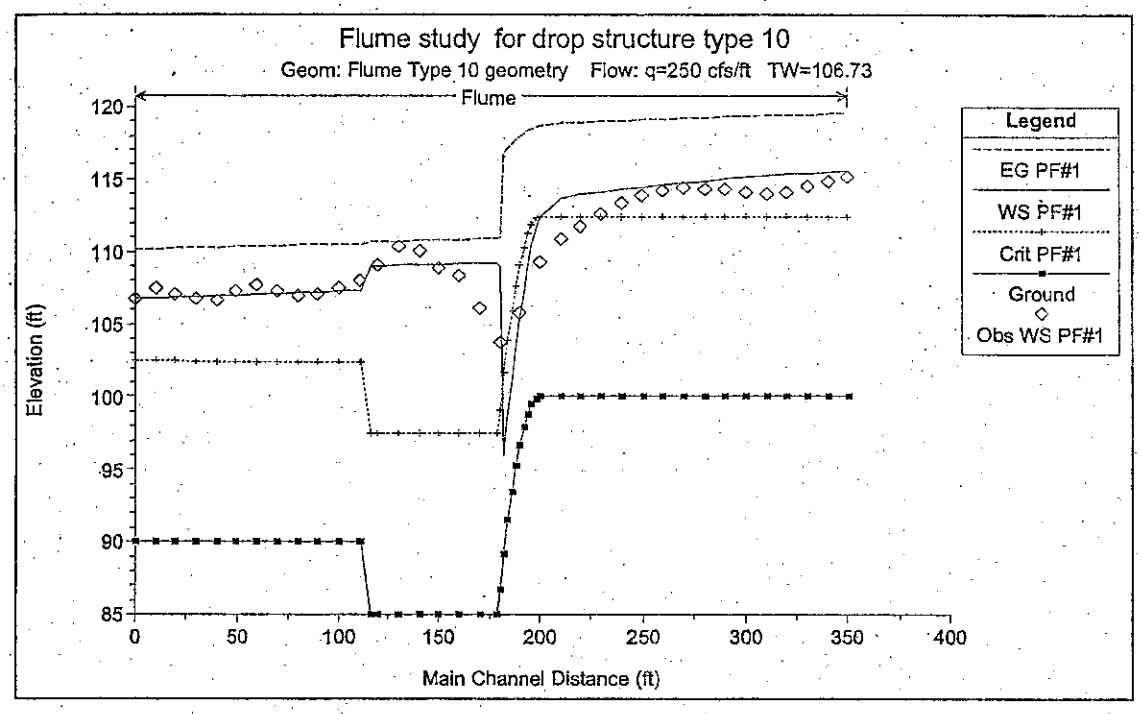
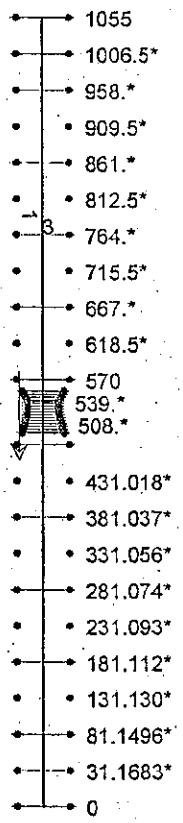
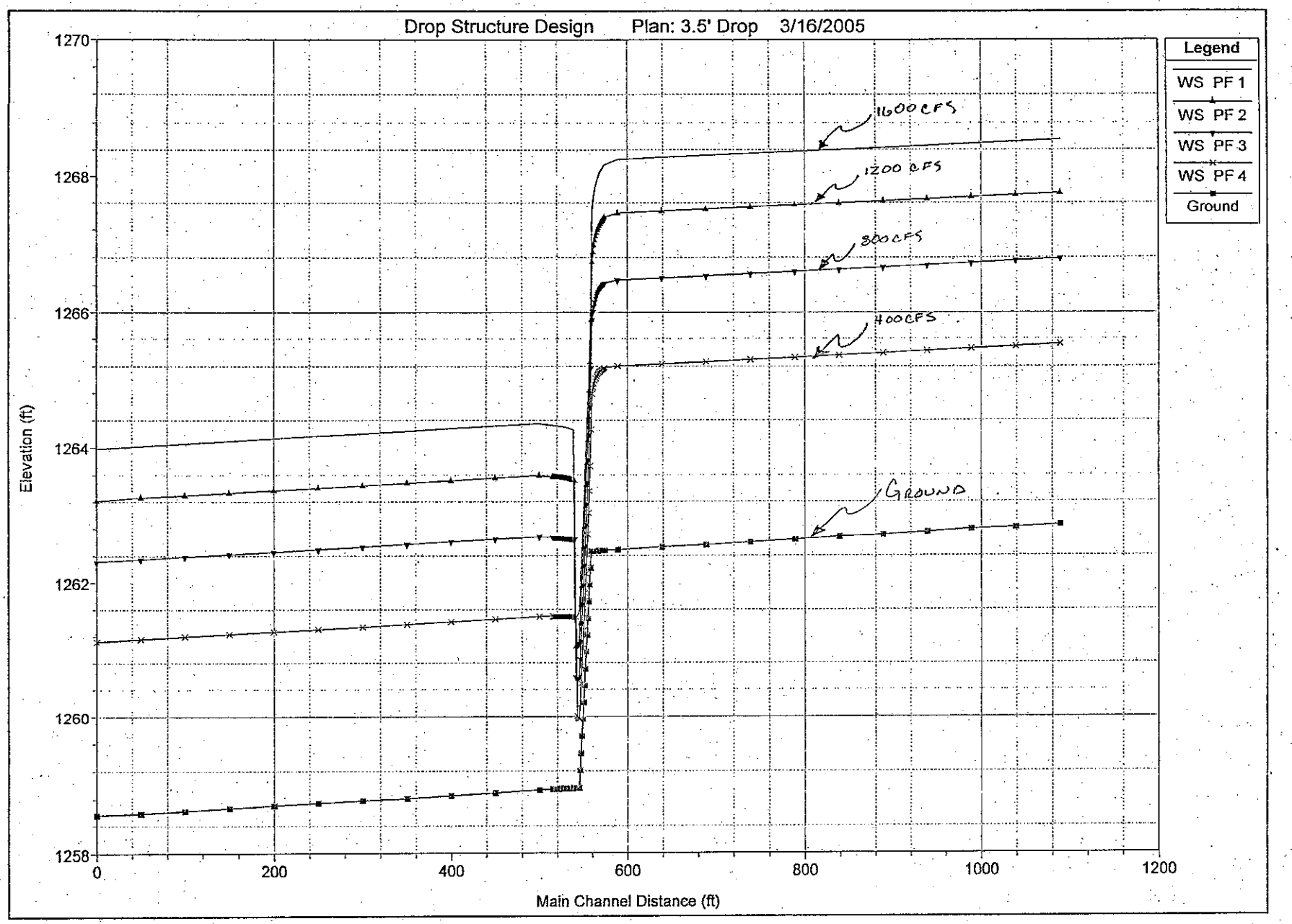
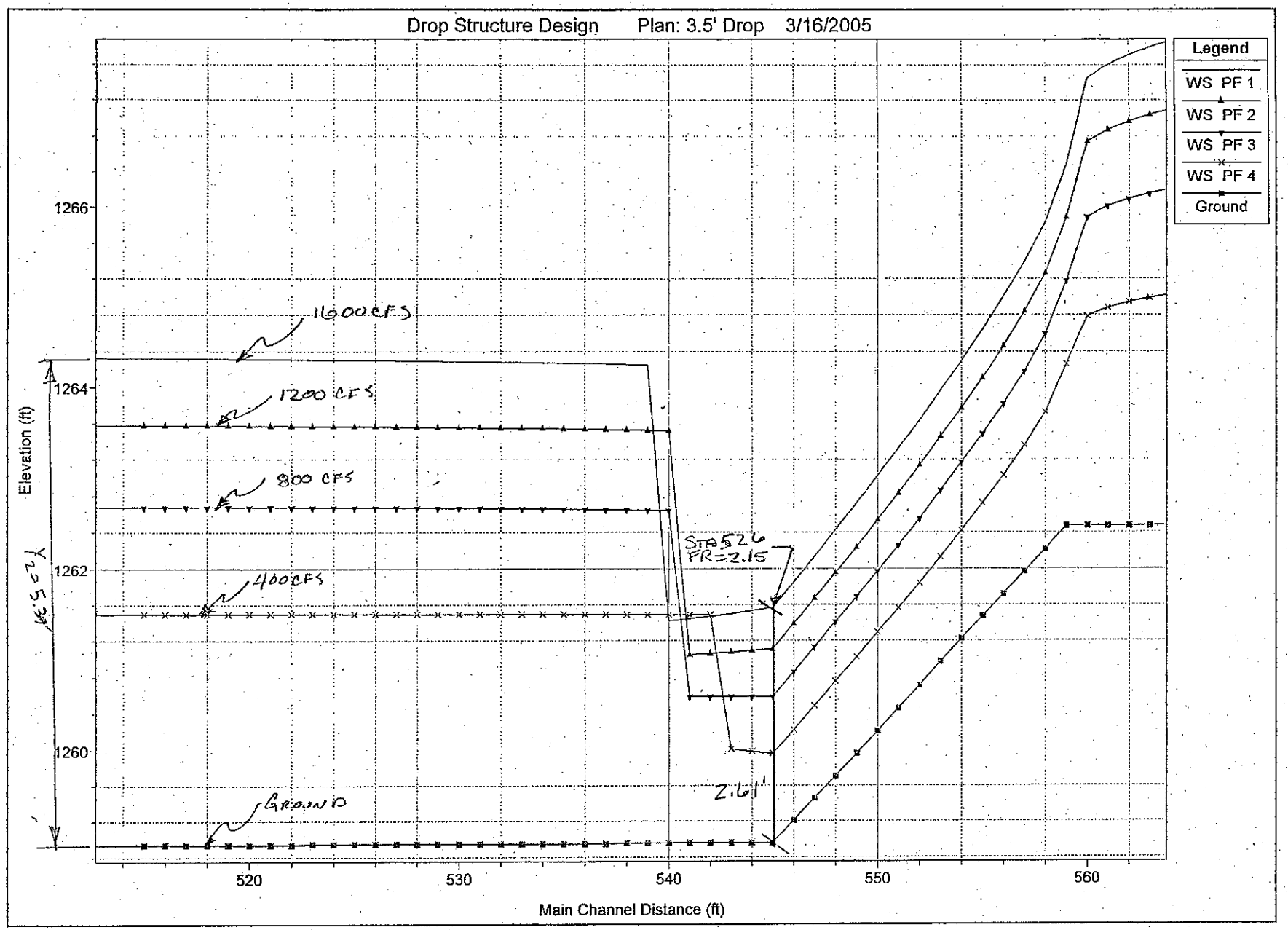


Figure 8.15 Comparison Between Flume Data and HEC-RAS For a Drop Structure

3.50' Drop Structure Analysis




Drop Structure Design Plan: 3.5' Drop 3/16/2005
Legend
WS PF 1
WS PF 2
WS PF 3
WS PF 4
Ground
1600 CFS
1200 CFS
800 CFS
400 CFS
GROUND
Elevation (ft)
1270
1268
1266
1264
1262
1260
1258
0
200
400
600
800
1000
1200
Main Channel Distance (ft)


Drop Structure Design Plan: 3.5' Drop 3/16/2005
Legend
WS PF 1
WS PF 2
WS PF 3
WS PF 4
Ground
1266
1264
1262
1260
Elevation (ft)
520
530
540
550
560
Main Channel Distance (ft)
1600CFS
1200 CFS
800 CFS
400CFS
GROUND
STA 526
FR=2.15
2.61'
Y=5.39'

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	1055	PF 1	1600.00	1262.86	1268.55	1265.53	1268.71	0.000620	3.15	507.74	123.33	0.27
3	1055	PF 2	1200.00	1262.86	1267.75	1265.10	1267.88	0.000625	2.91	412.34	113.67	0.27
3	1055	PF 3	800.00	1262.86	1266.78	1264.61	1266.89	0.000634	2.60	308.25	102.09	0.26
3	1055	PF 4	400.00	1262.86	1265.52	1263.99	1265.59	0.000654	2.12	188.92	86.94	0.25
3	1006.5*	PF 1	1600.00	1262.82	1268.52		1268.68	0.000616	3.14	508.89	123.44	0.27
3	1006.5*	PF 2	1200.00	1262.82	1267.72		1267.85	0.000621	2.90	413.37	113.78	0.27
3	1006.5*	PF 3	800.00	1262.82	1266.75		1266.86	0.000629	2.59	309.12	102.20	0.26
3	1006.5*	PF 4	400.00	1262.82	1265.49		1265.56	0.000647	2.11	189.59	87.04	0.25
3	958.*	PF 1	1600.00	1262.79	1268.49		1268.65	0.000616	3.14	508.77	123.43	0.27
3	958.*	PF 2	1200.00	1262.79	1267.69		1267.82	0.000621	2.90	413.23	113.77	0.27
3	958.*	PF 3	800.00	1262.79	1266.72		1266.83	0.000630	2.59	308.95	102.18	0.26
3	958.*	PF 4	400.00	1262.79	1265.46		1265.53	0.000649	2.11	189.35	87.00	0.25
3	909.5*	PF 1	1600.00	1262.75	1268.46		1268.62	0.000612	3.14	509.93	123.54	0.27
3	909.5*	PF 2	1200.00	1262.75	1267.66		1267.79	0.000617	2.90	414.27	113.88	0.27
3	909.5*	PF 3	800.00	1262.75	1266.69		1266.79	0.000625	2.58	309.85	102.28	0.26
3	909.5*	PF 4	400.00	1262.75	1265.43		1265.49	0.000642	2.10	190.04	87.10	0.25
3	861.*	PF 1	1600.00	1262.71	1268.43		1268.58	0.000608	3.13	511.12	123.66	0.27
3	861.*	PF 2	1200.00	1262.71	1267.63		1267.76	0.000613	2.89	415.34	113.99	0.27
3	861.*	PF 3	800.00	1262.71	1266.66		1266.76	0.000620	2.57	310.77	102.39	0.26
3	861.*	PF 4	400.00	1262.71	1265.39		1265.46	0.000635	2.10	190.77	87.20	0.25
3	812.5*	PF 1	1600.00	1262.68	1268.40		1268.55	0.000609	3.13	511.04	123.65	0.27
3	812.5*	PF 2	1200.00	1262.68	1267.60		1267.73	0.000613	2.89	415.26	113.98	0.27
3	812.5*	PF 3	800.00	1262.68	1266.63		1266.73	0.000621	2.58	310.65	102.38	0.26
3	812.5*	PF 4	400.00	1262.68	1265.36		1265.43	0.000637	2.10	190.58	87.17	0.25
3	764.*	PF 1	1600.00	1262.64	1268.37		1268.52	0.000605	3.12	512.25	123.77	0.27
3	764.*	PF 2	1200.00	1262.64	1267.57		1267.69	0.000608	2.88	416.36	114.09	0.27
3	764.*	PF 3	800.00	1262.64	1266.60		1266.70	0.000615	2.57	311.60	102.49	0.26
3	764.*	PF 4	400.00	1262.64	1265.33		1265.40	0.000630	2.09	191.33	87.28	0.25
3	715.5*	PF 1	1600.00	1262.60	1268.34		1268.49	0.000600	3.12	513.52	123.89	0.27
3	715.5*	PF 2	1200.00	1262.60	1267.53		1267.66	0.000604	2.87	417.49	114.21	0.26
3	715.5*	PF 3	800.00	1262.60	1266.57		1266.67	0.000610	2.56	312.57	102.60	0.26

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq.ft)	(ft)	
3	715.5*	PF 4	400.00	1262.60	1265.30		1265.37	0.000622	2.08	192.11	87.38	0.25
3	667.*	PF 1	1600.00	1262.56	1268.31		1268.46	0.000596	3.11	514.81	124.02	0.27
3	667.*	PF 2	1200.00	1262.56	1267.51		1267.63	0.000599	2.87	418.66	114.34	0.26
3	667.*	PF 3	800.00	1262.56	1266.54		1266.64	0.000604	2.55	313.57	102.71	0.26
3	667.*	PF 4	400.00	1262.56	1265.27		1265.33	0.000615	2.07	192.91	87.49	0.25
3	618.5*	PF 1	1600.00	1262.53	1268.28		1268.43	0.000596	3.11	514.84	124.02	0.27
3	618.5*	PF 2	1200.00	1262.53	1267.48		1267.60	0.000599	2.87	418.67	114.34	0.26
3	618.5*	PF 3	800.00	1262.53	1266.51		1266.61	0.000604	2.55	313.54	102.71	0.26
3	618.5*	PF 4	400.00	1262.53	1265.24		1265.30	0.000615	2.07	192.84	87.48	0.25
3	570	PF 1	1600.00	1262.49	1268.25		1268.40	0.000592	3.10	516.17	124.15	0.27
3	570	PF 2	1200.00	1262.49	1267.45		1267.57	0.000594	2.86	419.89	114.46	0.26
3	570	PF 3	800.00	1262.49	1266.48		1266.58	0.000599	2.54	314.61	102.84	0.26
3	570	PF 4	400.00	1262.49	1265.21		1265.27	0.000608	2.07	193.70	87.60	0.24
3	555	PF 1	1600.00	1262.48	1268.17		1268.37	0.001338	3.62	442.41	100.52	0.30
3	555	PF 2	1200.00	1262.48	1267.38		1267.55	0.001302	3.28	365.55	94.20	0.29
3	555	PF 3	800.00	1262.48	1266.43		1266.56	0.001261	2.86	279.66	86.60	0.28
3	555	PF 4	400.00	1262.48	1265.18		1265.26	0.001213	2.25	177.54	76.59	0.26
3	554.*	PF 1	1600.00	1262.48	1268.15		1268.37	0.001438	3.73	429.31	98.38	0.31
3	554.*	PF 2	1200.00	1262.48	1267.37		1267.54	0.001402	3.39	354.36	92.08	0.30
3	554.*	PF 3	800.00	1262.48	1266.42		1266.55	0.001360	2.95	270.74	84.50	0.29
3	554.*	PF 4	400.00	1262.48	1265.17		1265.26	0.001312	2.33	171.52	74.52	0.27
3	553.*	PF 1	1600.00	1262.48	1268.13		1268.36	0.001550	3.85	416.11	96.22	0.33
3	553.*	PF 2	1200.00	1262.48	1267.35		1267.54	0.001514	3.50	343.08	89.95	0.32
3	553.*	PF 3	800.00	1262.48	1266.40		1266.55	0.001472	3.06	261.75	82.39	0.30
3	553.*	PF 4	400.00	1262.48	1265.16		1265.25	0.001425	2.42	165.47	72.45	0.28
3	552.*	PF 1	1600.00	1262.48	1268.11		1268.36	0.001677	3.97	402.76	94.05	0.34
3	552.*	PF 2	1200.00	1262.48	1267.33		1267.53	0.001641	3.62	331.73	87.80	0.33
3	552.*	PF 3	800.00	1262.48	1266.39		1266.55	0.001600	3.17	252.69	80.27	0.31
3	552.*	PF 4	400.00	1262.48	1265.15		1265.25	0.001554	2.51	159.37	70.36	0.29
3	551.*	PF 1	1600.00	1262.48	1268.09		1268.35	0.001821	4.11	389.28	91.86	0.35

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	551.*	PF 2	1200.00	1262.48	1267.31		1267.53	0.001785	3.75	320.26	85.63	0.34
3	551.*	PF 3	800.00	1262.48	1266.37		1266.54	0.001745	3.28	243.55	78.14	0.33
3	551.*	PF 4	400.00	1262.48	1265.14		1265.25	0.001701	2.61	153.24	68.27	0.31
3	550.*	PF 1	1600.00	1262.48	1268.06		1268.34	0.001986	4.26	375.63	89.64	0.37
3	550.*	PF 2	1200.00	1262.48	1267.29		1267.52	0.001952	3.89	308.62	83.45	0.36
3	550.*	PF 3	800.00	1262.48	1266.35		1266.53	0.001914	3.41	234.32	75.99	0.34
3	550.*	PF 4	400.00	1262.48	1265.13		1265.24	0.001873	2.72	147.06	66.17	0.32
3	549.*	PF 1	1600.00	1262.48	1268.03		1268.33	0.002177	4.42	361.79	87.39	0.38
3	549.*	PF 2	1200.00	1262.48	1267.26		1267.51	0.002145	4.04	296.84	81.23	0.37
3	549.*	PF 3	800.00	1262.48	1266.33		1266.53	0.002110	3.56	224.95	73.81	0.36
3	549.*	PF 4	400.00	1262.48	1265.11		1265.24	0.002073	2.84	140.81	64.05	0.34
3	548.*	PF 1	1600.00	1262.48	1267.99		1268.32	0.002399	4.60	347.71	85.11	0.40
3	548.*	PF 2	1200.00	1262.48	1267.23		1267.50	0.002371	4.21	284.86	78.98	0.39
3	548.*	PF 3	800.00	1262.48	1266.31		1266.52	0.002341	3.71	215.43	71.61	0.38
3	548.*	PF 4	400.00	1262.48	1265.09		1265.23	0.002310	2.97	134.49	61.91	0.36
3	547.*	PF 1	1600.00	1262.47	1267.96		1268.32	0.002634	4.78	334.65	82.92	0.42
3	547.*	PF 2	1200.00	1262.47	1267.20		1267.50	0.002609	4.38	273.78	76.82	0.41
3	547.*	PF 3	800.00	1262.47	1266.28		1266.51	0.002583	3.87	206.71	69.49	0.40
3	547.*	PF 4	400.00	1262.47	1265.08		1265.23	0.002553	3.11	128.77	59.84	0.37
3	546.*	PF 1	1600.00	1262.47	1267.91		1268.30	0.002945	5.00	319.93	80.55	0.44
3	546.*	PF 2	1200.00	1262.47	1267.16		1267.48	0.002928	4.59	261.28	74.50	0.43
3	546.*	PF 3	800.00	1262.47	1266.25		1266.50	0.002912	4.06	196.80	67.21	0.42
3	546.*	PF 4	400.00	1262.47	1265.05		1265.22	0.002897	3.27	122.15	57.65	0.40
3	545.*	PF 1	1600.00	1262.47	1267.86		1268.29	0.003325	5.25	304.76	78.11	0.47
3	545.*	PF 2	1200.00	1262.47	1267.11		1267.47	0.003319	4.83	248.41	72.11	0.46
3	545.*	PF 3	800.00	1262.47	1266.21		1266.49	0.003318	4.29	186.61	64.89	0.45
3	545.*	PF 4	400.00	1262.47	1265.02		1265.21	0.003327	3.47	115.36	55.41	0.42
3	544.*	PF 1	1600.00	1262.47	1267.79		1268.27	0.003802	5.54	288.97	75.58	0.50
3	544.*	PF 2	1200.00	1262.47	1267.05		1267.46	0.003812	5.11	235.03	69.64	0.49
3	544.*	PF 3	800.00	1262.47	1266.16		1266.48	0.003835	4.54	176.03	62.49	0.48
3	544.*	PF 4	400.00	1262.47	1264.99		1265.20	0.003880	3.69	108.34	53.13	0.46

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	543.*	PF 1	1600.00	1262.47	1267.71		1268.25	0.004422	5.88	272.29	72.92	0.54
3	543.*	PF 2	1200.00	1262.47	1266.98		1267.43	0.004458	5.43	220.92	67.05	0.53
3	543.*	PF 3	800.00	1262.47	1266.09		1266.46	0.004518	4.85	164.90	60.00	0.52
3	543.*	PF 4	400.00	1262.47	1264.94		1265.18	0.004619	3.96	100.97	50.76	0.50
3	542.*	PF 1	1600.00	1262.47	1267.60		1268.22	0.005273	6.29	254.20	70.06	0.58
3	542.*	PF 2	1200.00	1262.47	1266.88		1267.41	0.005353	5.84	205.64	64.27	0.57
3	542.*	PF 3	800.00	1262.47	1266.01		1266.44	0.005476	5.23	152.87	57.33	0.56
3	542.*	PF 4	400.00	1262.47	1264.88		1265.17	0.005674	4.30	93.04	48.27	0.55
3	541.*	PF 1	1600.00	1262.47	1267.45	1266.37	1268.18	0.006577	6.85	233.46	66.82	0.65
3	541.*	PF 2	1200.00	1262.47	1266.74	1265.78	1267.37	0.006740	6.38	188.13	61.15	0.64
3	541.*	PF 3	800.00	1262.47	1265.89	1265.09	1266.40	0.006987	5.75	139.12	54.36	0.63
3	541.*	PF 4	400.00	1262.47	1264.79		1265.14	0.007371	4.76	84.05	45.54	0.62
3	540	PF 1	1600.00	1262.47	1266.49	1266.49	1267.95	0.016990	9.70	164.88	57.12	1.01
3	540	PF 2	1200.00	1262.47	1265.89	1265.89	1267.17	0.017699	9.07	132.29	52.36	1.01
3	540	PF 3	800.00	1262.47	1265.18	1265.18	1266.23	0.018859	8.24	97.13	46.68	1.01
3	540	PF 4	400.00	1262.47	1264.27	1264.27	1265.01	0.021080	6.92	57.83	39.37	1.01
3	539.*	PF 1	1600.00	1262.22	1265.83	1266.24	1267.79	0.025496	11.22	142.59	53.91	1.22
3	539.*	PF 2	1200.00	1262.22	1265.27	1265.64	1267.01	0.027390	10.59	113.32	49.38	1.23
3	539.*	PF 3	800.00	1262.22	1264.59	1264.93	1266.08	0.030861	9.78	81.78	43.97	1.26
3	539.*	PF 4	400.00	1262.22	1263.73	1264.02	1264.86	0.039212	8.54	46.84	37.07	1.34
3	538.*	PF 1	1600.00	1261.97	1265.39	1265.99	1267.66	0.031362	12.08	132.45	52.38	1.34
3	538.*	PF 2	1200.00	1261.97	1264.84	1265.39	1266.88	0.034392	11.48	104.57	47.94	1.37
3	538.*	PF 3	800.00	1261.97	1264.18	1264.68	1265.95	0.039676	10.67	74.95	42.71	1.42
3	538.*	PF 4	400.00	1261.97	1263.36	1263.77	1264.74	0.052921	9.45	42.34	36.09	1.54
3	537.*	PF 1	1600.00	1261.72	1265.00	1265.74	1267.54	0.036694	12.77	125.26	51.28	1.44
3	537.*	PF 2	1200.00	1261.72	1264.46	1265.14	1266.77	0.040840	12.19	98.44	46.91	1.48
3	537.*	PF 3	800.00	1261.72	1263.82	1264.43	1265.84	0.047900	11.39	70.22	41.82	1.55
3	537.*	PF 4	400.00	1261.72	1263.03	1263.52	1264.62	0.065120	10.13	39.50	35.45	1.69
3	536.*	PF 1	1600.00	1261.47	1264.64	1265.49	1267.43	0.041914	13.39	119.49	50.37	1.53
3	536.*	PF 2	1200.00	1261.47	1264.11	1264.89	1266.65	0.046817	12.79	93.84	46.11	1.58

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	536.*	PF 3	800.00	1261.47	1263.49	1264.18	1265.72	0.055616	11.99	66.70	41.14	1.66
3	536.*	PF 4	400.00	1261.47	1262.72	1263.27	1264.49	0.076661	10.69	37.41	34.98	1.82
3	535.*	PF 1	1600.00	1261.22	1264.30	1265.24	1267.31	0.046959	13.94	114.78	49.61	1.62
3	535.*	PF 2	1200.00	1261.22	1263.78	1264.64	1266.54	0.052744	13.33	90.01	45.44	1.67
3	535.*	PF 3	800.00	1261.22	1263.17	1263.93	1265.60	0.063043	12.52	63.88	40.59	1.76
3	535.*	PF 4	400.00	1261.22	1262.42	1263.02	1264.36	0.087397	11.17	35.81	34.61	1.94
3	534.*	PF 1	1600.00	1260.97	1263.97	1264.99	1267.20	0.051699	14.42	110.95	48.99	1.69
3	534.*	PF 2	1200.00	1260.97	1263.46	1264.39	1266.42	0.058267	13.80	86.93	44.90	1.75
3	534.*	PF 3	800.00	1260.97	1262.86	1263.68	1265.48	0.070202	12.99	61.57	40.13	1.85
3	534.*	PF 4	400.00	1260.97	1262.13	1262.77	1264.22	0.097760	11.59	34.50	34.31	2.04
3	533.*	PF 1	1600.00	1260.71	1263.64	1264.73	1267.08	0.056619	14.89	107.44	48.42	1.76
3	533.*	PF 2	1200.00	1260.71	1263.13	1264.13	1266.30	0.064064	14.27	84.10	44.39	1.83
3	533.*	PF 3	800.00	1260.71	1262.55	1263.42	1265.35	0.077471	13.44	59.53	39.72	1.93
3	533.*	PF 4	400.00	1260.71	1261.84	1262.51	1264.07	0.108299	11.99	33.35	34.04	2.14
3	532.*	PF 1	1600.00	1260.46	1263.32	1264.48	1266.97	0.061395	15.32	104.42	47.91	1.83
3	532.*	PF 2	1200.00	1260.46	1262.83	1263.88	1266.18	0.069436	14.67	81.78	43.97	1.90
3	532.*	PF 3	800.00	1260.46	1262.26	1263.17	1265.22	0.084093	13.82	57.88	39.38	2.01
3	532.*	PF 4	400.00	1260.46	1261.56	1262.26	1263.92	0.117659	12.33	32.45	33.82	2.22
3	531.*	PF 1	1600.00	1260.21	1263.02	1264.23	1266.85	0.065960	15.71	101.82	47.48	1.89
3	531.*	PF 2	1200.00	1260.21	1262.53	1263.63	1266.06	0.074847	15.06	79.67	43.59	1.96
3	531.*	PF 3	800.00	1260.21	1261.97	1262.92	1265.09	0.090568	14.18	56.43	39.09	2.08
3	531.*	PF 4	400.00	1260.21	1261.29	1262.01	1263.77	0.126733	12.63	31.66	33.64	2.30
3	530.*	PF 1	1600.00	1259.96	1262.72	1263.98	1266.73	0.070375	16.08	99.53	47.09	1.95
3	530.*	PF 2	1200.00	1259.96	1262.24	1263.38	1265.93	0.080038	15.42	77.84	43.25	2.03
3	530.*	PF 3	800.00	1259.96	1261.69	1262.67	1264.96	0.097114	14.52	55.11	38.82	2.15
3	530.*	PF 4	400.00	1259.96	1261.02	1261.76	1263.61	0.135190	12.91	30.99	33.48	2.36
3	529.*	PF 1	1600.00	1259.71	1262.43	1263.72	1266.61	0.074761	16.42	97.44	46.73	2.00
3	529.*	PF 2	1200.00	1259.71	1261.95	1263.13	1265.80	0.085077	15.75	76.21	42.95	2.08
3	529.*	PF 3	800.00	1259.71	1261.41	1262.42	1264.82	0.103362	14.83	53.95	38.58	2.21
3	529.*	PF 4	400.00	1259.71	1260.75	1261.51	1263.44	0.143091	13.15	30.42	33.34	2.43

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	528.*	PF 1	1600.00	1259.46	1262.14	1263.47	1266.49	0.078995	16.74	95.57	46.41	2.06
3	528.*	PF 2	1200.00	1259.46	1261.67	1262.88	1265.67	0.089937	16.05	74.75	42.67	2.14
3	528.*	PF 3	800.00	1259.46	1261.13	1262.17	1264.68	0.109323	15.11	52.93	38.37	2.27
3	528.*	PF 4	400.00	1259.46	1260.49	1261.26	1263.27	0.150906	13.38	29.89	33.21	2.49
3	527.*	PF 1	1600.00	1259.21	1261.85	1263.23	1266.36	0.083132	17.04	93.88	46.12	2.11
3	527.*	PF 2	1200.00	1259.21	1261.39	1262.63	1265.54	0.094684	16.34	73.43	42.43	2.19
3	527.*	PF 3	800.00	1259.21	1260.86	1261.92	1264.53	0.114903	15.37	52.04	38.18	2.32
3	527.*	PF 4	400.00	1259.21	1260.22	1261.01	1263.09	0.158009	13.59	29.44	33.11	2.54
3	526	PF 1	1600.00	1258.96	1261.57	1262.98	1266.23	0.087193	17.33	92.32	45.85	2.15 ← USED FOR APRON LENGTH
3	526	PF 2	1200.00	1258.96	1261.11	1262.38	1265.40	0.099544	16.63	72.17	42.19	2.24
3	526	PF 3	800.00	1258.96	1260.59	1261.67	1264.37	0.120301	15.61	51.24	38.01	2.37
3	526	PF 4	400.00	1258.96	1259.96	1260.76	1262.91	0.164504	13.77	29.05	33.01	2.59
3	525.*	PF 1	1600.00	1258.96	1261.53	1262.92	1266.10	0.085930	17.15	93.29	46.57	2.14
3	525.*	PF 2	1200.00	1258.96	1261.09	1262.33	1265.23	0.096070	16.32	73.52	43.04	2.20
3	525.*	PF 3	800.00	1258.96	1260.59	1261.62	1264.14	0.112180	15.13	52.87	39.01	2.29
3	525.*	PF 4	400.00	1258.96	1259.98	1260.72	1262.60	0.141331	12.97	30.84	34.20	2.41
3	524.*	PF 1	1600.00	1258.96	1261.50	1262.86	1265.97	0.084528	16.96	94.34	47.31	2.12
3	524.*	PF 2	1200.00	1258.96	1261.07	1262.27	1265.06	0.092585	16.02	74.93	43.91	2.16
3	524.*	PF 3	800.00	1258.96	1260.59	1261.58	1263.93	0.104848	14.68	54.49	40.01	2.22
3	524.*	PF 4	400.00	1258.96	1260.01	1260.69	1262.32	0.120750	12.20	32.78	35.40	2.23
3	523.*	PF 1	1600.00	1258.96	1261.47	1262.80	1265.83	0.082980	16.76	95.46	48.08	2.10
3	523.*	PF 2	1200.00	1258.96	1261.06	1262.22	1264.89	0.089095	15.71	76.40	44.79	2.12
3	523.*	PF 3	800.00	1258.96	1260.59	1261.54	1263.74	0.098207	14.26	56.12	41.01	2.15
3	523.*	PF 4	400.00	1258.96	1261.49	1260.66	1261.76	0.005054	4.15	96.32	48.22	0.52
3	522.*	PF 1	1600.00	1258.96	1261.44	1262.74	1265.70	0.081324	16.56	96.65	48.86	2.07
3	522.*	PF 2	1200.00	1258.96	1261.05	1262.17	1264.73	0.085604	15.40	77.92	45.69	2.08
3	522.*	PF 3	800.00	1258.96	1260.59	1261.49	1263.57	0.092172	13.85	57.74	42.01	2.08
3	522.*	PF 4	400.00	1258.96	1261.49		1261.74	0.004755	4.04	98.90	49.23	0.50
3	521.*	PF 1	1600.00	1258.96	1261.42	1262.69	1265.57	0.079579	16.34	97.90	49.66	2.05
3	521.*	PF 2	1200.00	1258.96	1263.52	1262.12	1263.98	0.004475	5.46	219.92	66.47	0.53
3	521.*	PF 3	800.00	1258.96	1262.64	1261.45	1263.01	0.004488	4.86	164.65	59.45	0.51

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	521 *	PF 4	400.00	1258.96	1261.49		1261.73	0.004481	3.94	101.49	50.24	0.49
3	520 *	PF 1	1600.00	1258.96	1264.26	1262.64	1264.78	0.004241	5.79	276.41	73.37	0.53
3	520 *	PF 2	1200.00	1258.96	1263.52		1263.97	0.004246	5.34	224.78	67.51	0.52
3	520 *	PF 3	800.00	1258.96	1262.64		1262.99	0.004249	4.75	168.51	60.47	0.50
3	520 *	PF 4	400.00	1258.96	1261.49		1261.72	0.004231	3.84	104.07	51.25	0.48
3	519 *	PF 1	1600.00	1258.96	1264.26		1264.76	0.004037	5.67	282.08	74.41	0.51
3	519 *	PF 2	1200.00	1258.96	1263.53		1263.95	0.004035	5.23	229.62	68.54	0.50
3	519 *	PF 3	800.00	1258.96	1262.65		1262.98	0.004028	4.64	172.37	61.50	0.49
3	519 *	PF 4	400.00	1258.96	1261.49		1261.71	0.004001	3.75	106.64	52.25	0.46
3	518 *	PF 1	1600.00	1258.95	1264.27		1264.75	0.003815	5.54	288.63	75.54	0.50
3	518 *	PF 2	1200.00	1258.95	1263.53		1263.94	0.003802	5.10	235.26	69.66	0.49
3	518 *	PF 3	800.00	1258.95	1262.65		1262.97	0.003780	4.52	176.93	62.61	0.47
3	518 *	PF 4	400.00	1258.95	1261.49		1261.70	0.003730	3.64	109.81	53.35	0.45
3	517 *	PF 1	1600.00	1258.95	1264.27		1264.73	0.003640	5.44	294.28	76.58	0.49
3	517 *	PF 2	1200.00	1258.95	1263.54		1263.93	0.003621	5.00	240.10	70.69	0.48
3	517 *	PF 3	800.00	1258.95	1262.65		1262.96	0.003594	4.43	180.78	63.63	0.46
3	517 *	PF 4	400.00	1258.95	1261.49		1261.69	0.003538	3.56	112.39	54.35	0.44
3	516 *	PF 1	1600.00	1258.95	1264.28		1264.72	0.003478	5.33	299.93	77.61	0.48
3	516 *	PF 2	1200.00	1258.95	1263.54		1263.91	0.003454	4.90	244.92	71.72	0.47
3	516 *	PF 3	800.00	1258.95	1262.66		1262.95	0.003421	4.33	184.63	64.64	0.45
3	516 *	PF 4	400.00	1258.95	1261.50		1261.68	0.003361	3.48	114.97	55.36	0.43
3	515 *	PF 1	1600.00	1258.95	1264.28		1264.71	0.003325	5.24	305.56	78.64	0.47
3	515 *	PF 2	1200.00	1258.95	1263.54		1263.90	0.003298	4.81	249.73	72.74	0.46
3	515 *	PF 3	800.00	1258.95	1262.66		1262.94	0.003260	4.24	188.47	65.66	0.44
3	515 *	PF 4	400.00	1258.95	1261.50		1261.68	0.003197	3.40	117.54	56.36	0.42
3	514 *	PF 1	1600.00	1258.95	1264.28		1264.70	0.003183	5.14	311.18	79.67	0.46
3	514 *	PF 2	1200.00	1258.95	1263.55		1263.89	0.003152	4.71	254.54	73.77	0.45
3	514 *	PF 3	800.00	1258.95	1262.66		1262.93	0.003111	4.16	192.30	66.68	0.43
3	514 *	PF 4	400.00	1258.95	1261.50		1261.67	0.003045	3.33	120.10	57.36	0.41
3	513 *	PF 1	1600.00	1258.95	1264.29		1264.68	0.003050	5.05	316.79	80.70	0.45

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	513.*	PF 2	1200.00	1258.95	1263.55		1263.88	0.003016	4.63	259.34	74.79	0.44
3	513.*	PF 3	800.00	1258.95	1262.66		1262.92	0.002972	4.08	196.13	67.69	0.42
3	513.*	PF 4	400.00	1258.95	1261.50		1261.66	0.002903	3.26	122.67	58.37	0.40
3	512.*	PF 1	1600.00	1258.95	1264.29		1264.67	0.002925	4.96	322.39	81.73	0.44
3	512.*	PF 2	1200.00	1258.95	1263.55		1263.87	0.002888	4.54	264.13	75.81	0.43
3	512.*	PF 3	800.00	1258.95	1262.66		1262.91	0.002842	4.00	199.94	68.70	0.41
3	512.*	PF 4	400.00	1258.95	1261.50		1261.66	0.002771	3.19	125.23	59.37	0.39
3	511.*	PF 1	1600.00	1258.95	1264.29		1264.66	0.002808	4.88	327.98	82.75	0.43
3	511.*	PF 2	1200.00	1258.95	1263.55		1263.86	0.002769	4.46	268.91	76.83	0.42
3	511.*	PF 3	800.00	1258.95	1262.66		1262.90	0.002720	3.93	203.76	69.71	0.40
3	511.*	PF 4	400.00	1258.95	1261.50		1261.65	0.002648	3.13	127.79	60.37	0.38
3	510.*	PF 1	1600.00	1258.95	1264.30		1264.65	0.002697	4.80	333.57	83.77	0.42
3	510.*	PF 2	1200.00	1258.95	1263.56		1263.85	0.002657	4.38	273.68	77.85	0.41
3	510.*	PF 3	800.00	1258.95	1262.67		1262.90	0.002606	3.85	207.57	70.73	0.40
3	510.*	PF 4	400.00	1258.95	1261.50		1261.64	0.002534	3.07	130.35	61.37	0.37
3	509.*	PF 1	1600.00	1258.95	1264.30		1264.65	0.002593	4.72	339.15	84.80	0.42
3	509.*	PF 2	1200.00	1258.95	1263.56		1263.85	0.002551	4.31	278.46	78.86	0.40
3	509.*	PF 3	800.00	1258.95	1262.67		1262.89	0.002499	3.78	211.37	71.73	0.39
3	509.*	PF 4	400.00	1258.95	1261.50		1261.64	0.002426	3.01	132.90	62.37	0.36
3	508.*	PF 1	1600.00	1258.95	1264.30		1264.64	0.002495	4.64	344.72	85.82	0.41
3	508.*	PF 2	1200.00	1258.95	1263.56		1263.84	0.002452	4.24	283.22	79.88	0.40
3	508.*	PF 3	800.00	1258.95	1262.67		1262.88	0.002399	3.72	215.18	72.75	0.38
3	508.*	PF 4	400.00	1258.95	1261.50		1261.63	0.002326	2.95	135.45	63.38	0.36
3	507.*	PF 1	1600.00	1258.95	1264.30		1264.63	0.002402	4.57	350.28	86.84	0.40
3	507.*	PF 2	1200.00	1258.95	1263.56		1263.83	0.002358	4.17	287.98	80.89	0.39
3	507.*	PF 3	800.00	1258.95	1262.67		1262.88	0.002304	3.65	218.98	73.75	0.37
3	507.*	PF 4	400.00	1258.95	1261.50		1261.63	0.002231	2.90	138.01	64.38	0.35
3	506.*	PF 1	1600.00	1258.95	1264.31		1264.62	0.002315	4.50	355.84	87.86	0.39
3	506.*	PF 2	1200.00	1258.95	1263.56		1263.82	0.002270	4.10	292.73	81.91	0.38
3	506.*	PF 3	800.00	1258.95	1262.67		1262.87	0.002215	3.59	222.77	74.76	0.37
3	506.*	PF 4	400.00	1258.95	1261.50		1261.62	0.002142	2.85	140.56	65.38	0.34

HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	505 *	PF 1	1600.00	1258.95	1264.31		1264.61	0.002232	4.43	361.39	88.87	0.39
3	505 *	PF 2	1200.00	1258.95	1263.57		1263.82	0.002187	4.03	297.47	82.92	0.38
3	505 *	PF 3	800.00	1258.95	1262.67		1262.87	0.002131	3.53	226.56	75.77	0.36
3	505 *	PF 4	400.00	1258.95	1261.50		1261.62	0.002058	2.80	143.10	66.38	0.34
3	504 *	PF 1	1600.00	1258.95	1264.31		1264.61	0.002153	4.36	366.94	89.89	0.38
3	504 *	PF 2	1200.00	1258.95	1263.57		1263.81	0.002108	3.97	302.22	83.93	0.37
3	504 *	PF 3	800.00	1258.95	1262.67		1262.86	0.002052	3.47	230.35	76.78	0.35
3	504 *	PF 4	400.00	1258.95	1261.50		1261.61	0.001980	2.75	145.65	67.38	0.33
3	503 *	PF 1	1600.00	1258.94	1264.31		1264.60	0.002064	4.28	373.45	90.99	0.37
3	503 *	PF 2	1200.00	1258.94	1263.57		1263.80	0.002016	3.90	307.86	85.03	0.36
3	503 *	PF 3	800.00	1258.94	1262.67		1262.85	0.001957	3.40	234.97	77.87	0.35
3	503 *	PF 4	400.00	1258.94	1261.50		1261.61	0.001878	2.69	148.91	68.46	0.32
3	502 *	PF 1	1600.00	1258.94	1264.32		1264.59	0.001993	4.22	378.99	92.00	0.37
3	502 *	PF 2	1200.00	1258.94	1263.57		1263.80	0.001946	3.84	312.61	86.04	0.35
3	502 *	PF 3	800.00	1258.94	1262.67		1262.85	0.001887	3.35	238.76	78.88	0.34
3	502 *	PF 4	400.00	1258.94	1261.50		1261.61	0.001809	2.64	151.46	69.46	0.32
3	501 *	PF 1	1600.00	1258.94	1264.32		1264.59	0.001927	4.16	384.53	93.02	0.36
3	501 *	PF 2	1200.00	1258.94	1263.57		1263.79	0.001879	3.78	317.36	87.05	0.35
3	501 *	PF 3	800.00	1258.94	1262.68		1262.84	0.001820	3.30	242.55	79.88	0.33
3	501 *	PF 4	400.00	1258.94	1261.50		1261.60	0.001744	2.60	154.01	70.46	0.31
3	500 *	PF 1	1600.00	1258.94	1264.32		1264.58	0.001864	4.10	390.07	94.03	0.35
3	500 *	PF 2	1200.00	1258.94	1263.57		1263.79	0.001816	3.73	322.09	88.06	0.34
3	500 *	PF 3	800.00	1258.94	1262.68		1262.84	0.001758	3.25	246.33	80.88	0.33
3	500 *	PF 4	400.00	1258.94	1261.50		1261.60	0.001682	2.55	156.56	71.46	0.30
3	499 *	PF 1	1600.00	1258.94	1264.32		1264.58	0.001804	4.04	395.60	95.04	0.35
3	499 *	PF 2	1200.00	1258.94	1263.57		1263.78	0.001756	3.67	326.82	89.07	0.34
3	499 *	PF 3	800.00	1258.94	1262.68		1262.84	0.001698	3.20	250.12	81.89	0.32
3	499 *	PF 4	400.00	1258.94	1261.50		1261.60	0.001623	2.51	159.11	72.46	0.30
3	498 *	PF 1	1600.00	1258.94	1264.32		1264.57	0.001746	3.99	401.12	96.06	0.34
3	498 *	PF 2	1200.00	1258.94	1263.58		1263.78	0.001699	3.62	331.56	90.08	0.33

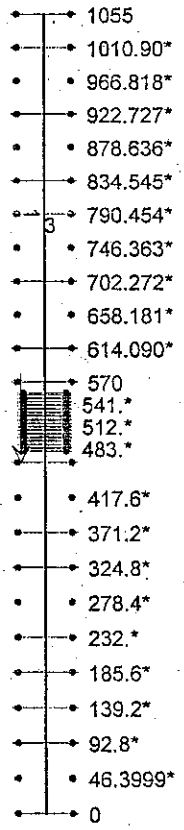
HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

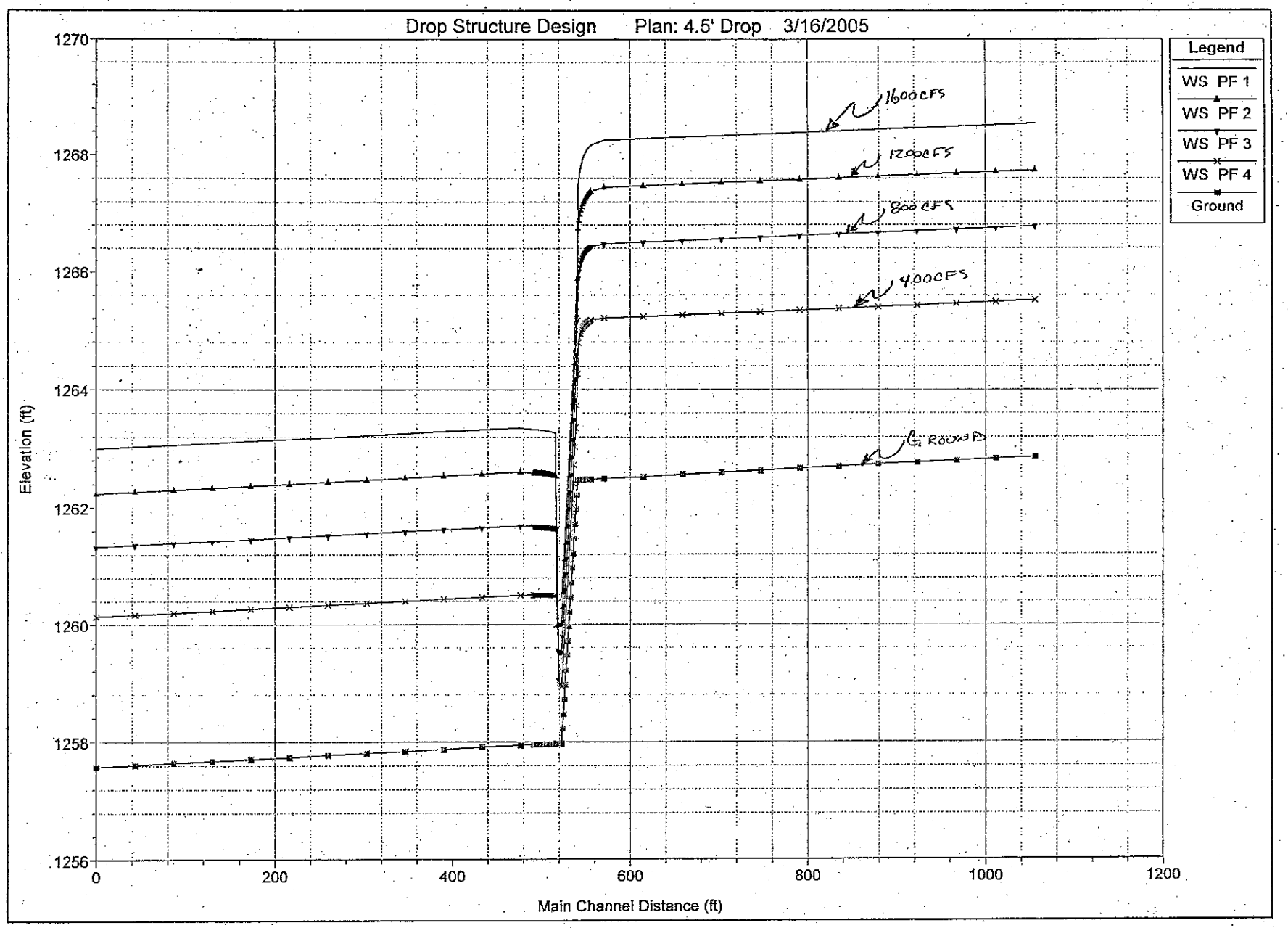
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	498.*	PF 3	800.00	1258.94	1262.68		1262.83	0.001641	3.15	253.91	82.89	0.32
3	498.*	PF 4	400.00	1258.94	1261.50		1261.59	0.001568	2.47	161.66	73.45	0.29
3	497.*	PF 1	1600.00	1258.94	1264.32		1264.56	0.001692	3.93	406.64	97.07	0.34
3	497.*	PF 2	1200.00	1258.94	1263.58		1263.77	0.001644	3.57	336.29	91.09	0.33
3	497.*	PF 3	800.00	1258.94	1262.68		1262.83	0.001587	3.10	257.68	83.90	0.31
3	497.*	PF 4	400.00	1258.94	1261.50		1261.59	0.001515	2.44	164.20	74.45	0.29
3	496	PF 1	1600.00	1258.94	1264.33		1264.56	0.001049	3.88	412.19	98.08	0.33
3	496	PF 2	1200.00	1258.94	1263.58		1263.77	0.001019	3.52	341.05	92.10	0.32
3	496	PF 3	800.00	1258.94	1262.68		1262.82	0.000983	3.06	261.50	84.91	0.31
3	496	PF 4	400.00	1258.94	1261.50		1261.59	0.000937	2.40	166.78	75.46	0.28
3	481	PF 1	1600.00	1258.93	1264.35		1264.53	0.000749	3.37	474.63	120.07	0.30
3	481	PF 2	1200.00	1258.93	1263.59		1263.74	0.000748	3.10	386.96	110.96	0.29
3	481	PF 3	800.00	1258.93	1262.69		1262.80	0.000748	2.75	291.08	100.05	0.28
3	481	PF 4	400.00	1258.93	1261.49		1261.57	0.000749	2.22	180.38	85.76	0.27
3	431.018*	PF 1	1600.00	1258.89	1264.32		1264.49	0.000747	3.37	474.95	120.10	0.30
3	431.018*	PF 2	1200.00	1258.89	1263.56		1263.71	0.000746	3.10	387.26	110.99	0.29
3	431.018*	PF 3	800.00	1258.89	1262.65		1262.76	0.000745	2.75	291.36	100.09	0.28
3	431.018*	PF 4	400.00	1258.89	1261.46		1261.53	0.000746	2.21	180.62	85.79	0.27
3	381.037*	PF 1	1600.00	1258.85	1264.28		1264.45	0.000746	3.37	475.29	120.13	0.30
3	381.037*	PF 2	1200.00	1258.85	1263.52		1263.67	0.000745	3.10	387.57	111.03	0.29
3	381.037*	PF 3	800.00	1258.85	1262.61		1262.73	0.000743	2.74	291.64	100.12	0.28
3	381.037*	PF 4	400.00	1258.85	1261.42		1261.50	0.000743	2.21	180.87	85.82	0.27
3	331.056*	PF 1	1600.00	1258.81	1264.24		1264.42	0.000744	3.36	475.61	120.16	0.30
3	331.056*	PF 2	1200.00	1258.81	1263.48		1263.63	0.000743	3.09	387.89	111.06	0.29
3	331.056*	PF 3	800.00	1258.81	1262.57		1262.69	0.000741	2.74	291.92	100.16	0.28
3	331.056*	PF 4	400.00	1258.81	1261.38		1261.46	0.000740	2.21	181.12	85.86	0.27
3	281.074*	PF 1	1600.00	1258.78	1264.20		1264.38	0.000748	3.37	474.64	120.07	0.30
3	281.074*	PF 2	1200.00	1258.78	1263.44		1263.59	0.000748	3.10	387.00	110.96	0.29
3	281.074*	PF 3	800.00	1258.78	1262.54		1262.65	0.000747	2.75	291.14	100.06	0.28
3	281.074*	PF 4	400.00	1258.78	1261.34		1261.42	0.000748	2.22	180.45	85.77	0.27

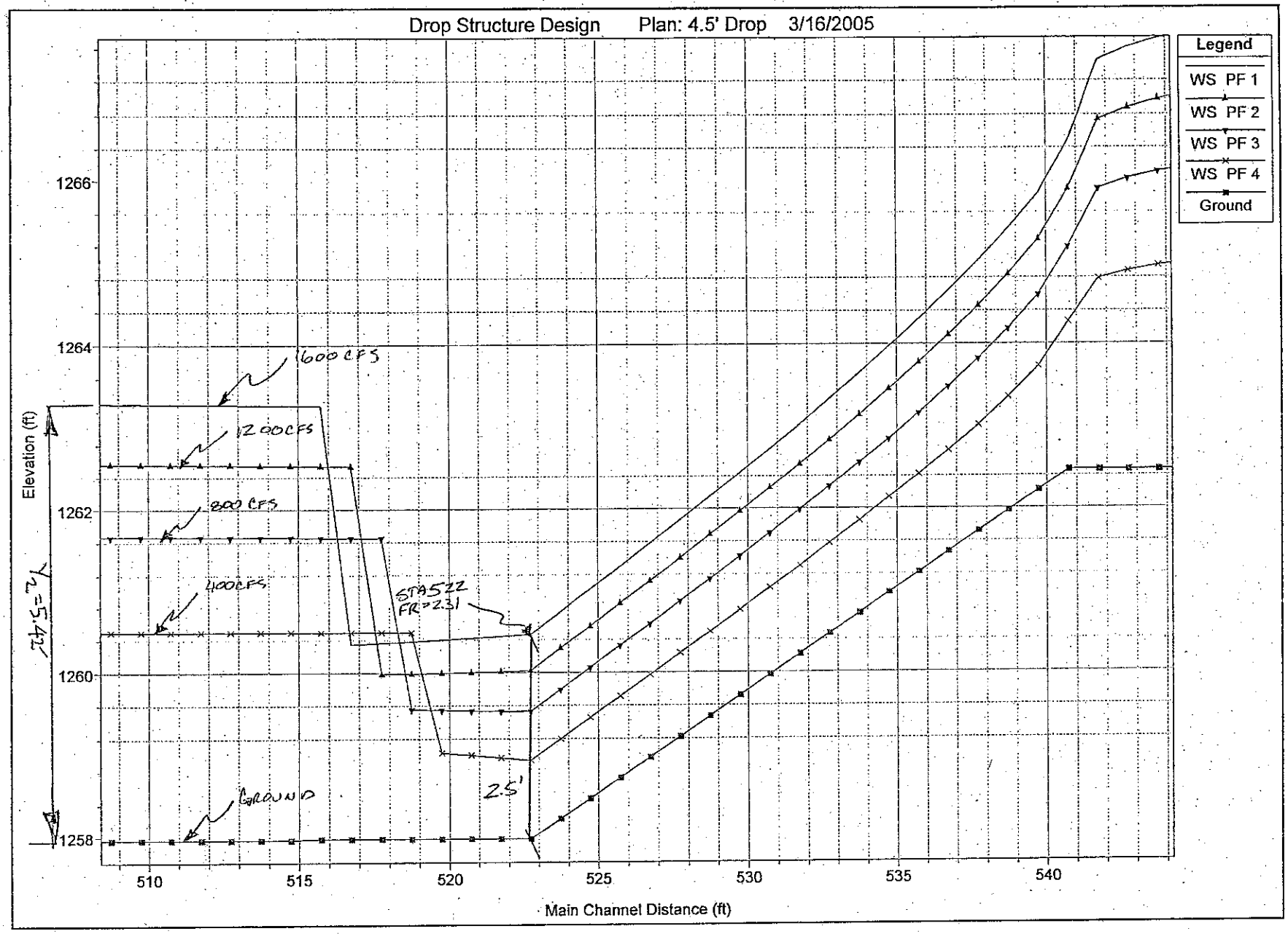
HEC-RAS Plan: 3.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	231.093*	PF 1	1600.00	1258.74	1264.17		1264.34	0.000747	3.37	474.97	120.10	0.30
3	231.093*	PF 2	1200.00	1258.74	1263.41		1263.56	0.000746	3.10	387.30	111.00	0.29
3	231.093*	PF 3	800.00	1258.74	1262.50		1262.62	0.000745	2.75	291.42	100.10	0.28
3	231.093*	PF 4	400.00	1258.74	1261.31		1261.38	0.000745	2.21	180.69	85.80	0.27
3	181.112*	PF 1	1600.00	1258.70	1264.13		1264.30	0.000746	3.37	475.30	120.13	0.30
3	181.112*	PF 2	1200.00	1258.70	1263.37		1263.52	0.000745	3.10	387.61	111.03	0.29
3	181.112*	PF 3	800.00	1258.70	1262.46		1262.58	0.000743	2.74	291.71	100.13	0.28
3	181.112*	PF 4	400.00	1258.70	1261.27		1261.35	0.000742	2.21	180.94	85.84	0.27
3	131.130*	PF 1	1600.00	1258.66	1264.09		1264.27	0.000744	3.36	475.62	120.17	0.30
3	131.130*	PF 2	1200.00	1258.66	1263.33		1263.48	0.000743	3.09	387.93	111.06	0.29
3	131.130*	PF 3	800.00	1258.66	1262.42		1262.54	0.000741	2.74	292.01	100.17	0.28
3	131.130*	PF 4	400.00	1258.66	1261.23		1261.31	0.000739	2.21	181.20	85.87	0.27
3	81.1496*	PF 1	1600.00	1258.62	1264.05		1264.23	0.000743	3.36	475.98	120.20	0.30
3	81.1496*	PF 2	1200.00	1258.62	1263.30		1263.44	0.000741	3.09	388.25	111.10	0.29
3	81.1496*	PF 3	800.00	1258.62	1262.39		1262.50	0.000738	2.74	292.32	100.20	0.28
3	81.1496*	PF 4	400.00	1258.62	1261.20		1261.27	0.000735	2.20	181.48	85.91	0.27
3	31.1683*	PF 1	1600.00	1258.58	1264.02		1264.19	0.000741	3.36	476.33	120.24	0.30
3	31.1683*	PF 2	1200.00	1258.58	1263.26		1263.41	0.000739	3.09	388.59	111.14	0.29
3	31.1683*	PF 3	800.00	1258.58	1262.35		1262.47	0.000736	2.73	292.65	100.24	0.28
3	31.1683*	PF 4	400.00	1258.58	1261.16		1261.23	0.000732	2.20	181.77	85.95	0.27
3	0	PF 1	1600.00	1258.56	1263.98	1261.23	1264.16	0.000751	3.37	474.09	120.01	0.30
3	0	PF 2	1200.00	1258.56	1263.22	1260.80	1263.37	0.000751	3.11	386.45	110.90	0.29
3	0	PF 3	800.00	1258.56	1262.31	1260.31	1262.43	0.000750	2.75	290.72	100.01	0.28
3	0	PF 4	400.00	1258.56	1261.12	1259.69	1261.20	0.000751	2.22	180.17	85.73	0.27

4.50' Drop Structure Analysis




Drop Structure Design Plan: 4.5' Drop 3/16/2005
Legend
WS PF 1
WS PF 2
WS PF 3
WS PF 4
Ground
1600CFS
1200CFS
800CFS
400CFS
GROUND
Elevation (ft)
1270
1268
1266
1264
1262
1260
1258
1256
0
200
400
600
800
1000
1200
Main Channel Distance (ft)


Drop Structure Design Plan: 4.5' Drop 3/16/2005
Legend
WS PF 1
WS PF 2
WS PF 3
WS PF 4
Ground
Elevation (ft)
1266
1264
1262
1260
1258
510
515
520
525
530
535
540
Main Channel Distance (ft)
1600 CFS
1200 CFS
800 CFS
400 CFS
GROUND
STA 522
FR=2.31
2.5'
Y2=5.42'

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	1055	PF 1	1600.00	1262.86	1268.55	1265.53	1268.70	0.000623	3.16	506.90	123.25	0.27
3	1055	PF 2	1200.00	1262.86	1267.74	1265.10	1267.88	0.000628	2.92	411.62	113.60	0.27
3	1055	PF 3	800.00	1262.86	1266.78	1264.61	1266.88	0.000639	2.60	307.52	102.01	0.26
3	1055	PF 4	400.00	1262.86	1265.52	1263.99	1265.59	0.000659	2.12	188.36	86.87	0.25
3	1010.90*	PF 1	1600.00	1262.83	1268.52		1268.68	0.000621	3.15	507.23	123.28	0.27
3	1010.90*	PF 2	1200.00	1262.83	1267.72		1267.85	0.000627	2.91	411.88	113.62	0.27
3	1010.90*	PF 3	800.00	1262.83	1266.75		1266.85	0.000638	2.60	307.72	102.03	0.26
3	1010.90*	PF 4	400.00	1262.83	1265.49		1265.56	0.000658	2.12	188.45	86.88	0.25
3	966.818*	PF 1	1600.00	1262.79	1268.49		1268.65	0.000616	3.14	508.86	123.44	0.27
3	966.818*	PF 2	1200.00	1262.79	1267.69		1267.82	0.000621	2.90	413.36	113.78	0.27
3	966.818*	PF 3	800.00	1262.79	1266.72		1266.83	0.000630	2.59	308.99	102.18	0.26
3	966.818*	PF 4	400.00	1262.79	1265.46		1265.53	0.000648	2.11	189.45	87.02	0.25
3	922.727*	PF 1	1600.00	1262.76	1268.47		1268.62	0.000615	3.14	509.22	123.48	0.27
3	922.727*	PF 2	1200.00	1262.76	1267.66		1267.79	0.000620	2.90	413.66	113.81	0.27
3	922.727*	PF 3	800.00	1262.76	1266.69		1266.80	0.000629	2.59	309.22	102.21	0.26
3	922.727*	PF 4	400.00	1262.76	1265.43		1265.50	0.000647	2.11	189.57	87.03	0.25
3	878.636*	PF 1	1600.00	1262.73	1268.44		1268.59	0.000613	3.14	509.58	123.51	0.27
3	878.636*	PF 2	1200.00	1262.73	1267.63		1267.76	0.000618	2.90	413.98	113.84	0.27
3	878.636*	PF 3	800.00	1262.73	1266.67		1266.77	0.000627	2.59	309.46	102.23	0.26
3	878.636*	PF 4	400.00	1262.73	1265.40		1265.47	0.000646	2.11	189.71	87.05	0.25
3	834.545*	PF 1	1600.00	1262.69	1268.41		1268.57	0.000608	3.13	511.27	123.68	0.27
3	834.545*	PF 2	1200.00	1262.69	1267.61		1267.74	0.000612	2.89	415.51	114.01	0.27
3	834.545*	PF 3	800.00	1262.69	1266.64		1266.74	0.000620	2.57	310.80	102.39	0.26
3	834.545*	PF 4	400.00	1262.69	1265.37		1265.44	0.000635	2.10	190.78	87.20	0.25
3	790.454*	PF 1	1600.00	1262.66	1268.39		1268.54	0.000607	3.13	511.66	123.71	0.27
3	790.454*	PF 2	1200.00	1262.66	1267.58		1267.71	0.000610	2.89	415.86	114.04	0.27
3	790.454*	PF 3	800.00	1262.66	1266.61		1266.72	0.000618	2.57	311.07	102.42	0.26
3	790.454*	PF 4	400.00	1262.66	1265.35		1265.41	0.000634	2.09	190.95	87.22	0.25
3	746.363*	PF 1	1600.00	1262.62	1268.36		1268.51	0.000601	3.12	513.39	123.88	0.27
3	746.363*	PF 2	1200.00	1262.62	1267.55		1267.68	0.000604	2.87	417.43	114.21	0.26
3	746.363*	PF 3	800.00	1262.62	1266.59		1266.69	0.000610	2.56	312.45	102.59	0.26

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	746.363*	PF 4	400.00	1262.62	1265.32		1265.39	0.000623	2.08	192.07	87.38	0.25
3	702.272*	PF 1	1600.00	1262.59	1268.33		1268.48	0.000599	3.11	513.84	123.92	0.27
3	702.272*	PF 2	1200.00	1262.59	1267.53		1267.66	0.000602	2.87	417.82	114.25	0.26
3	702.272*	PF 3	800.00	1262.59	1266.56		1266.66	0.000609	2.56	312.77	102.62	0.26
3	702.272*	PF 4	400.00	1262.59	1265.29		1265.36	0.000621	2.08	192.30	87.41	0.25
3	658.181*	PF 1	1600.00	1262.56	1268.31		1268.46	0.000598	3.11	514.28	123.97	0.27
3	658.181*	PF 2	1200.00	1262.56	1267.50		1267.63	0.000601	2.87	418.21	114.29	0.26
3	658.181*	PF 3	800.00	1262.56	1266.53		1266.63	0.000607	2.56	313.10	102.66	0.26
3	658.181*	PF 4	400.00	1262.56	1265.26		1265.33	0.000618	2.08	192.53	87.44	0.25
3	614.090*	PF 1	1600.00	1262.52	1268.28		1268.43	0.000592	3.10	516.05	124.14	0.27
3	614.090*	PF 2	1200.00	1262.52	1267.48		1267.60	0.000594	2.86	419.83	114.46	0.26
3	614.090*	PF 3	800.00	1262.52	1266.51		1266.61	0.000599	2.54	314.53	102.83	0.26
3	614.090*	PF 4	400.00	1262.52	1265.24		1265.30	0.000607	2.06	193.71	87.60	0.24
3	570	PF 1	1600.00	1262.49	1268.25		1268.40	0.000673	3.10	516.30	124.16	0.27
3	570	PF 2	1200.00	1262.49	1267.45		1267.57	0.000675	2.86	420.07	114.48	0.26
3	570	PF 3	800.00	1262.49	1266.48		1266.58	0.000680	2.54	314.72	102.85	0.26
3	570	PF 4	400.00	1262.49	1265.21		1265.27	0.000690	2.06	193.84	87.62	0.24
3	555	PF 1	1600.00	1262.48	1268.17		1268.37	0.001338	3.62	442.41	100.52	0.30
3	555	PF 2	1200.00	1262.48	1267.38		1267.55	0.001302	3.28	365.60	94.21	0.29
3	555	PF 3	800.00	1262.48	1266.43		1266.56	0.001261	2.86	279.66	86.60	0.28
3	555	PF 4	400.00	1262.48	1265.18		1265.26	0.001213	2.25	177.55	76.59	0.26
3	554*	PF 1	1600.00	1262.48	1268.15		1268.37	0.001438	3.73	429.31	98.38	0.31
3	554*	PF 2	1200.00	1262.48	1267.37		1267.54	0.001401	3.39	354.40	92.08	0.30
3	554*	PF 3	800.00	1262.48	1266.42		1266.55	0.001360	2.95	270.74	84.50	0.29
3	554*	PF 4	400.00	1262.48	1265.17		1265.26	0.001312	2.33	171.53	74.52	0.27
3	553*	PF 1	1600.00	1262.48	1268.13		1268.36	0.001550	3.85	416.11	96.22	0.33
3	553*	PF 2	1200.00	1262.48	1267.35		1267.54	0.001513	3.50	343.13	89.95	0.32
3	553*	PF 3	800.00	1262.48	1266.40		1266.55	0.001472	3.06	261.75	82.39	0.30
3	553*	PF 4	400.00	1262.48	1265.16		1265.25	0.001425	2.42	165.48	72.45	0.28
3	552*	PF 1	1600.00	1262.48	1268.11		1268.36	0.001677	3.97	402.76	94.05	0.34

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	552.*	PF 2	1200.00	1262.48	1267.33		1267.53	0.001640	3.62	331.77	87.80	0.33
3	552.*	PF 3	800.00	1262.48	1266.39		1266.55	0.001600	3.17	252.69	80.27	0.31
3	552.*	PF 4	400.00	1262.48	1265.15		1265.25	0.001553	2.51	159.38	70.36	0.29
3	551.*	PF 1	1600.00	1262.48	1268.09		1268.35	0.001821	4.11	389.28	91.86	0.35
3	551.*	PF 2	1200.00	1262.48	1267.31		1267.53	0.001784	3.75	320.30	85.64	0.34
3	551.*	PF 3	800.00	1262.48	1266.37		1266.54	0.001745	3.28	243.55	78.14	0.33
3	551.*	PF 4	400.00	1262.48	1265.14		1265.25	0.001701	2.61	153.25	68.27	0.31
3	550.*	PF 1	1600.00	1262.48	1268.06		1268.34	0.001986	4.26	375.63	89.64	0.37
3	550.*	PF 2	1200.00	1262.48	1267.29		1267.52	0.001951	3.89	308.66	83.45	0.36
3	550.*	PF 3	800.00	1262.48	1266.35		1266.53	0.001914	3.41	234.32	75.99	0.34
3	550.*	PF 4	400.00	1262.48	1265.13		1265.24	0.001872	2.72	147.07	66.17	0.32
3	549.*	PF 1	1600.00	1262.48	1268.03		1268.33	0.002177	4.42	361.79	87.39	0.38
3	549.*	PF 2	1200.00	1262.48	1267.26		1267.51	0.002144	4.04	296.88	81.23	0.37
3	549.*	PF 3	800.00	1262.48	1266.33		1266.53	0.002110	3.56	224.94	73.81	0.36
3	549.*	PF 4	400.00	1262.48	1265.11		1265.24	0.002073	2.84	140.82	64.05	0.34
3	548.*	PF 1	1600.00	1262.48	1267.99		1268.32	0.002399	4.60	347.71	85.11	0.40
3	548.*	PF 2	1200.00	1262.48	1267.23		1267.50	0.002370	4.21	284.90	78.99	0.39
3	548.*	PF 3	800.00	1262.48	1266.31		1266.52	0.002342	3.71	215.42	71.61	0.38
3	548.*	PF 4	400.00	1262.48	1265.09		1265.23	0.002310	2.97	134.50	61.91	0.36
3	547.*	PF 1	1600.00	1262.47	1267.96		1268.32	0.002634	4.78	334.65	82.92	0.42
3	547.*	PF 2	1200.00	1262.47	1267.20		1267.50	0.002608	4.38	273.83	76.83	0.41
3	547.*	PF 3	800.00	1262.47	1266.28		1266.51	0.002583	3.87	206.70	69.48	0.40
3	547.*	PF 4	400.00	1262.47	1265.08		1265.23	0.002552	3.11	128.78	59.85	0.37
3	546.*	PF 1	1600.00	1262.47	1267.91		1268.30	0.002945	5.00	319.93	80.55	0.44
3	546.*	PF 2	1200.00	1262.47	1267.16		1267.49	0.002926	4.59	261.33	74.50	0.43
3	546.*	PF 3	800.00	1262.47	1266.25		1266.50	0.002912	4.07	196.79	67.21	0.42
3	546.*	PF 4	400.00	1262.47	1265.05		1265.22	0.002897	3.27	122.16	57.65	0.40
3	545.*	PF 1	1600.00	1262.47	1267.86		1268.29	0.003325	5.25	304.76	78.11	0.47
3	545.*	PF 2	1200.00	1262.47	1267.11		1267.47	0.003317	4.83	248.46	72.11	0.46
3	545.*	PF 3	800.00	1262.47	1266.21		1266.49	0.003319	4.29	186.61	64.89	0.45
3	545.*	PF 4	400.00	1262.47	1265.02		1265.21	0.003326	3.47	115.37	55.42	0.42

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	544.*	PF 1	1600.00	1262.47	1267.79		1268.27	0.003802	5.54	288.97	75.58	0.50
3	544.*	PF 2	1200.00	1262.47	1267.05		1267.46	0.003810	5.10	235.08	69.64	0.49
3	544.*	PF 3	800.00	1262.47	1266.16		1266.48	0.003836	4.54	176.02	62.49	0.48
3	544.*	PF 4	400.00	1262.47	1264.99		1265.20	0.003879	3.69	108.34	53.13	0.46
3	543.*	PF 1	1600.00	1262.47	1267.71		1268.25	0.004422	5.88	272.29	72.92	0.54
3	543.*	PF 2	1200.00	1262.47	1266.98		1267.44	0.004455	5.43	220.97	67.05	0.53
3	543.*	PF 3	800.00	1262.47	1266.09		1266.46	0.004518	4.85	164.89	59.99	0.52
3	543.*	PF 4	400.00	1262.47	1264.94		1265.18	0.004618	3.96	100.97	50.76	0.49
3	542.*	PF 1	1600.00	1262.47	1267.60		1268.22	0.005273	6.29	254.20	70.06	0.58
3	542.*	PF 2	1200.00	1262.47	1266.88		1267.41	0.005348	5.83	205.70	64.28	0.57
3	542.*	PF 3	800.00	1262.47	1266.01		1266.44	0.005477	5.23	152.87	57.33	0.56
3	542.*	PF 4	400.00	1262.47	1264.88		1265.17	0.005673	4.30	93.05	48.27	0.55
3	541.*	PF 1	1600.00	1262.47	1267.45	1266.37	1268.18	0.006577	6.85	233.46	66.82	0.65
3	541.*	PF 2	1200.00	1262.47	1266.74	1265.78	1267.37	0.006733	6.38	188.20	61.16	0.64
3	541.*	PF 3	800.00	1262.47	1265.89	1265.09	1266.40	0.006988	5.75	139.12	54.36	0.63
3	541.*	PF 4	400.00	1262.47	1264.79		1265.14	0.007368	4.76	84.06	45.54	0.62
3	540	PF 1	1600.00	1262.47	1266.49	1266.49	1267.95	0.016990	9.70	164.88	57.12	1.01
3	540	PF 2	1200.00	1262.47	1265.89	1265.89	1267.17	0.017730	9.08	132.21	52.35	1.01
3	540	PF 3	800.00	1262.47	1265.18	1265.18	1266.23	0.018856	8.24	97.14	46.68	1.01
3	540	PF 4	400.00	1262.47	1264.27	1264.27	1265.01	0.021096	6.92	57.81	39.37	1.01
3	539.*	PF 1	1600.00	1262.22	1265.83	1266.24	1267.79	0.025496	11.22	142.59	53.91	1.22
3	539.*	PF 2	1200.00	1262.22	1265.27	1265.64	1267.01	0.027415	10.59	113.28	49.37	1.23
3	539.*	PF 3	800.00	1262.22	1264.59	1264.93	1266.08	0.030855	9.78	81.78	43.97	1.26
3	539.*	PF 4	400.00	1262.22	1263.73	1264.02	1264.86	0.039200	8.54	46.84	37.07	1.34
3	538.*	PF 1	1600.00	1261.97	1265.39	1265.99	1267.66	0.031362	12.08	132.45	52.38	1.34
3	538.*	PF 2	1200.00	1261.97	1264.84	1265.39	1266.88	0.034397	11.48	104.57	47.94	1.37
3	538.*	PF 3	800.00	1261.97	1264.18	1264.68	1265.95	0.039668	10.67	74.95	42.71	1.42
3	538.*	PF 4	400.00	1261.97	1263.36	1263.77	1264.74	0.052921	9.45	42.34	36.09	1.54
3	537.*	PF 1	1600.00	1261.72	1265.00	1265.74	1267.54	0.036694	12.77	125.26	51.28	1.44
3	537.*	PF 2	1200.00	1261.72	1264.46	1265.14	1266.77	0.040847	12.19	98.44	46.90	1.48

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	537.*	PF 3	800.00	1261.72	1263.82	1264.43	1265.84	0.047890	11.39	70.23	41.82	1.55
3	537.*	PF 4	400.00	1261.72	1263.03	1263.52	1264.62	0.065120	10.13	39.50	35.45	1.69
3	536.*	PF 1	1600.00	1261.47	1264.64	1265.49	1267.43	0.041914	13.39	119.49	50.37	1.53
3	536.*	PF 2	1200.00	1261.47	1264.11	1264.89	1266.65	0.046826	12.79	93.83	46.11	1.58
3	536.*	PF 3	800.00	1261.47	1263.49	1264.18	1265.72	0.055616	11.99	66.70	41.14	1.66
3	536.*	PF 4	400.00	1261.47	1262.72	1263.27	1264.49	0.076661	10.69	37.41	34.98	1.82
3	535.*	PF 1	1600.00	1261.22	1264.30	1265.24	1267.31	0.046959	13.94	114.78	49.61	1.62
3	535.*	PF 2	1200.00	1261.22	1263.78	1264.64	1266.54	0.052744	13.33	90.01	45.44	1.67
3	535.*	PF 3	800.00	1261.22	1263.17	1263.93	1265.60	0.063043	12.52	63.88	40.59	1.76
3	535.*	PF 4	400.00	1261.22	1262.42	1263.02	1264.36	0.087397	11.17	35.81	34.61	1.94
3	534.*	PF 1	1600.00	1260.97	1263.97	1264.99	1267.20	0.051699	14.42	110.95	48.99	1.69
3	534.*	PF 2	1200.00	1260.97	1263.46	1264.39	1266.42	0.058267	13.80	86.93	44.90	1.75
3	534.*	PF 3	800.00	1260.97	1262.86	1263.68	1265.48	0.070202	12.99	61.57	40.13	1.85
3	534.*	PF 4	400.00	1260.97	1262.13	1262.77	1264.22	0.097760	11.59	34.50	34.31	2.04
3	533.*	PF 1	1600.00	1260.72	1263.65	1264.74	1267.08	0.056380	14.87	107.60	48.44	1.76
3	533.*	PF 2	1200.00	1260.72	1263.15	1264.14	1266.30	0.063770	14.25	84.24	44.42	1.82
3	533.*	PF 3	800.00	1260.72	1262.56	1263.43	1265.35	0.076754	13.40	59.72	39.75	1.93
3	533.*	PF 4	400.00	1260.72	1261.85	1262.52	1264.08	0.107527	11.97	33.43	34.06	2.13
3	532.*	PF 1	1600.00	1260.47	1263.34	1264.49	1266.97	0.061172	15.30	104.56	47.94	1.83
3	532.*	PF 2	1200.00	1260.47	1262.84	1263.89	1266.18	0.069149	14.65	81.89	43.99	1.89
3	532.*	PF 3	800.00	1260.47	1262.27	1263.18	1265.22	0.083424	13.78	58.04	39.42	2.00
3	532.*	PF 4	400.00	1260.47	1261.58	1262.27	1263.93	0.116937	12.30	32.51	33.84	2.21
3	531.*	PF 1	1600.00	1260.22	1263.03	1264.24	1266.86	0.065738	15.70	101.94	47.50	1.89
3	531.*	PF 2	1200.00	1260.22	1262.55	1263.64	1266.06	0.074574	15.04	79.77	43.61	1.96
3	531.*	PF 3	800.00	1260.22	1261.99	1262.93	1265.09	0.089920	14.14	56.57	39.12	2.07
3	531.*	PF 4	400.00	1260.22	1261.30	1262.02	1263.77	0.126039	12.61	31.72	33.65	2.29
3	530.*	PF 1	1600.00	1259.97	1262.73	1263.99	1266.74	0.070167	16.06	99.63	47.11	1.95
3	530.*	PF 2	1200.00	1259.97	1262.25	1263.39	1265.94	0.079773	15.40	77.93	43.27	2.02
3	530.*	PF 3	800.00	1259.97	1261.70	1262.68	1264.96	0.096528	14.49	55.22	38.84	2.14
3	530.*	PF 4	400.00	1259.97	1261.03	1261.77	1263.61	0.134488	12.88	31.05	33.49	2.36

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	529.*	PF 1	1600.00	1259.72	1262.44	1263.74	1266.62	0.074562	16.41	97.53	46.75	2.00
3	529.*	PF 2	1200.00	1259.72	1261.97	1263.14	1265.81	0.084807	15.73	76.29	42.96	2.08
3	529.*	PF 3	800.00	1259.72	1261.42	1262.43	1264.82	0.102776	14.80	54.05	38.60	2.20
3	529.*	PF 4	400.00	1259.72	1260.76	1261.52	1263.44	0.142448	13.13	30.46	33.35	2.42
3	528.*	PF 1	1600.00	1259.47	1262.15	1263.49	1266.49	0.078795	16.73	95.66	46.43	2.05
3	528.*	PF 2	1200.00	1259.47	1261.68	1262.89	1265.67	0.089663	16.04	74.83	42.69	2.13
3	528.*	PF 3	800.00	1259.47	1261.14	1262.18	1264.68	0.108780	15.09	53.02	38.38	2.26
3	528.*	PF 4	400.00	1259.47	1260.50	1261.27	1263.27	0.150286	13.36	29.93	33.22	2.48
3	527.*	PF 1	1600.00	1259.22	1261.86	1263.24	1266.37	0.082930	17.03	93.96	46.13	2.10
3	527.*	PF 2	1200.00	1259.22	1261.40	1262.64	1265.54	0.094415	16.33	73.51	42.44	2.19
3	527.*	PF 3	800.00	1259.22	1260.87	1261.93	1264.53	0.114385	15.35	52.12	38.20	2.32
3	527.*	PF 4	400.00	1259.22	1260.23	1261.02	1263.10	0.157482	13.57	29.47	33.11	2.54
3	526.*	PF 1	1600.00	1258.97	1261.58	1262.99	1266.23	0.086997	17.32	92.40	45.86	2.15
3	526.*	PF 2	1200.00	1258.97	1261.12	1262.39	1265.41	0.099298	16.61	72.24	42.20	2.24
3	526.*	PF 3	800.00	1258.97	1260.60	1261.68	1264.37	0.119819	15.59	51.31	38.03	2.37
3	526.*	PF 4	400.00	1258.97	1259.97	1260.77	1262.91	0.164026	13.75	29.08	33.02	2.58
3	525.*	PF 1	1600.00	1258.72	1261.30	1262.73	1266.09	0.090754	17.57	91.04	45.63	2.19
3	525.*	PF 2	1200.00	1258.72	1260.84	1262.14	1265.27	0.103979	16.88	71.10	41.98	2.29
3	525.*	PF 3	800.00	1258.72	1260.33	1261.43	1264.22	0.125071	15.82	50.57	37.87	2.41
3	525.*	PF 4	400.00	1258.72	1259.71	1260.52	1262.72	0.170180	13.92	28.73	32.93	2.63
3	524.*	PF 1	1600.00	1258.47	1261.02	1262.48	1265.95	0.094482	17.82	89.77	45.40	2.23
3	524.*	PF 2	1200.00	1258.47	1260.57	1261.89	1265.12	0.108481	17.13	70.06	41.79	2.33
3	524.*	PF 3	800.00	1258.47	1260.06	1261.18	1264.05	0.130157	16.04	49.89	37.73	2.46
3	524.*	PF 4	400.00	1258.47	1259.45	1260.27	1262.52	0.175362	14.06	28.45	32.87	2.66
3	523.*	PF 1	1600.00	1258.22	1260.74	1262.24	1265.81	0.098156	18.06	88.58	45.19	2.27
3	523.*	PF 2	1200.00	1258.22	1260.30	1261.64	1264.98	0.112844	17.36	69.12	41.60	2.37
3	523.*	PF 3	800.00	1258.22	1259.79	1260.93	1263.89	0.135131	16.24	49.26	37.59	2.50
3	523.*	PF 4	400.00	1258.22	1259.20	1260.02	1262.32	0.180415	14.19	28.18	32.80	2.70
3	522	PF 1	1600.00	1257.97	1260.47	1261.99	1265.67	0.101787	18.29	87.46	44.99	2.31 ← USED FOR APRON LENGTH
3	522	PF 2	1200.00	1257.97	1260.02	1261.39	1264.83	0.117076	17.58	68.24	41.44	2.41
3	522	PF 3	800.00	1257.97	1259.53	1260.68	1263.73	0.140310	16.45	48.64	37.46	2.54

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	522	PF 4	400.00	1257.97	1258.94	1259.77	1262.13	0.185754	14.33	27.92	32.74	2.73
3	521.032*	PF 1	1600.00	1257.97	1260.44	1261.93	1265.49	0.099184	18.03	88.73	45.76	2.28
3	521.032*	PF 2	1200.00	1257.97	1260.01	1261.34	1264.61	0.111839	17.20	69.76	42.31	2.36
3	521.032*	PF 3	800.00	1257.97	1259.53	1260.64	1263.45	0.129519	15.89	50.34	38.46	2.45
3	521.032*	PF 4	400.00	1257.97	1258.97	1259.74	1261.75	0.155044	13.38	29.90	33.95	2.51
3	520.064*	PF 1	1600.00	1257.97	1260.42	1261.87	1265.33	0.096688	17.78	90.00	46.54	2.25
3	520.064*	PF 2	1200.00	1257.97	1260.00	1261.28	1264.40	0.106908	16.83	71.29	43.20	2.31
3	520.064*	PF 3	800.00	1257.97	1259.54	1260.59	1263.20	0.119617	15.36	52.10	39.49	2.36
3	520.064*	PF 4	400.00	1257.97	1259.00	1259.70	1261.43	0.130394	12.52	31.95	35.17	2.32
3	519.096*	PF 1	1600.00	1257.97	1260.40	1261.82	1265.16	0.093995	17.51	91.37	47.33	2.22
3	519.096*	PF 2	1200.00	1257.97	1260.00	1261.24	1264.20	0.101946	16.46	72.91	44.10	2.26
3	519.096*	PF 3	800.00	1257.97	1259.55	1260.55	1262.96	0.110240	14.83	53.94	40.52	2.27
3	519.096*	PF 4	400.00	1257.97	1259.03	1259.67	1261.18	0.111068	11.78	33.97	36.36	2.15
3	518.129*	PF 1	1600.00	1257.97	1260.38	1261.77	1265.00	0.091416	17.25	92.76	48.15	2.19
3	518.129*	PF 2	1200.00	1257.97	1259.99	1261.18	1264.01	0.097227	16.09	74.56	45.02	2.20
3	518.129*	PF 3	800.00	1257.97	1259.56	1260.51	1262.74	0.101655	14.33	55.83	41.56	2.18
3	518.129*	PF 4	400.00	1257.97	1260.50	1259.64	1260.75	0.004793	4.06	98.57	49.10	0.50
3	517.161*	PF 1	1600.00	1257.97	1260.36	1261.71	1264.84	0.088639	16.98	94.25	48.97	2.16
3	517.161*	PF 2	1200.00	1257.97	1259.99	1261.14	1263.81	0.091781	15.69	76.49	45.98	2.14
3	517.161*	PF 3	800.00	1257.97	1261.65	1260.47	1262.02	0.004538	4.88	163.90	59.27	0.52
3	517.161*	PF 4	400.00	1257.97	1260.50		1260.74	0.004529	3.96	101.03	50.07	0.49
3	516.193*	PF 1	1600.00	1257.97	1260.35	1261.66	1264.68	0.085880	16.70	95.79	49.81	2.12
3	516.193*	PF 2	1200.00	1257.97	1262.53	1261.10	1262.98	0.004300	5.37	223.64	67.28	0.52
3	516.193*	PF 3	800.00	1257.97	1261.65		1262.01	0.004305	4.77	167.61	60.25	0.50
3	516.193*	PF 4	400.00	1257.97	1260.50		1260.73	0.004285	3.86	103.50	51.04	0.48
3	515.225*	PF 1	1600.00	1257.97	1263.27	1261.61	1263.77	0.004089	5.70	280.62	74.16	0.52
3	515.225*	PF 2	1200.00	1257.97	1262.53		1262.96	0.004089	5.25	228.37	68.29	0.51
3	515.225*	PF 3	800.00	1257.97	1261.65		1261.99	0.004085	4.67	171.38	61.25	0.49
3	515.225*	PF 4	400.00	1257.97	1260.50		1260.72	0.004057	3.77	106.01	52.02	0.47
3	514.258*	PF 1	1600.00	1257.96	1263.27		1263.76	0.003871	5.58	286.93	75.25	0.50

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	514.258*	PF 2	1200.00	1257.96	1262.54		1262.95	0.003860	5.13	233.81	69.38	0.49
3	514.258*	PF 3	800.00	1257.96	1261.66		1261.98	0.003841	4.55	175.77	62.32	0.48
3	514.258*	PF 4	400.00	1257.96	1260.50		1260.71	0.003790	3.67	109.07	53.07	0.45
3	513.290*	PF 1	1600.00	1257.96	1263.28		1263.74	0.003700	5.47	292.35	76.24	0.49
3	513.290*	PF 2	1200.00	1257.96	1262.54		1262.94	0.003683	5.03	238.43	70.36	0.48
3	513.290*	PF 3	800.00	1257.96	1261.66		1261.97	0.003658	4.46	179.46	63.30	0.47
3	513.290*	PF 4	400.00	1257.96	1260.50		1260.70	0.003602	3.59	111.53	54.04	0.44
3	512.322*	PF 1	1600.00	1257.96	1263.28		1263.73	0.003537	5.37	297.87	77.26	0.48
3	512.322*	PF 2	1200.00	1257.96	1262.55		1262.92	0.003515	4.94	243.15	71.37	0.47
3	512.322*	PF 3	800.00	1257.96	1261.66		1261.96	0.003484	4.37	183.22	64.30	0.46
3	512.322*	PF 4	400.00	1257.96	1260.50		1260.69	0.003424	3.51	114.05	55.02	0.43
3	511.354*	PF 1	1600.00	1257.96	1263.29		1263.72	0.003387	5.28	303.27	78.25	0.47
3	511.354*	PF 2	1200.00	1257.96	1262.55		1262.91	0.003362	4.84	247.76	72.35	0.46
3	511.354*	PF 3	800.00	1257.96	1261.66		1261.95	0.003326	4.28	186.90	65.27	0.45
3	511.354*	PF 4	400.00	1257.96	1260.50		1260.69	0.003262	3.43	116.51	55.99	0.42
3	510.387*	PF 1	1600.00	1257.96	1263.29		1263.71	0.003245	5.18	308.76	79.25	0.46
3	510.387*	PF 2	1200.00	1257.96	1262.55		1262.90	0.003216	4.75	252.46	73.35	0.45
3	510.387*	PF 3	800.00	1257.96	1261.67		1261.94	0.003176	4.20	190.64	66.27	0.44
3	510.387*	PF 4	400.00	1257.96	1260.50		1260.68	0.003109	3.36	119.02	56.97	0.41
3	509.419*	PF 1	1600.00	1257.96	1263.29		1263.70	0.003113	5.09	314.15	80.24	0.45
3	509.419*	PF 2	1200.00	1257.96	1262.55		1262.89	0.003081	4.67	257.06	74.33	0.44
3	509.419*	PF 3	800.00	1257.96	1261.67		1261.93	0.003038	4.12	194.31	67.24	0.43
3	509.419*	PF 4	400.00	1257.96	1260.50		1260.67	0.002969	3.29	121.48	57.93	0.40
3	508.451*	PF 1	1600.00	1257.96	1263.30		1263.69	0.002990	5.01	319.51	81.22	0.44
3	508.451*	PF 2	1200.00	1257.96	1262.56		1262.88	0.002955	4.59	261.64	75.31	0.43
3	508.451*	PF 3	800.00	1257.96	1261.67		1261.92	0.002910	4.04	197.97	68.21	0.42
3	508.451*	PF 4	400.00	1257.96	1260.50		1260.67	0.002839	3.23	123.93	58.89	0.39
3	507.483*	PF 1	1600.00	1257.96	1263.30		1263.68	0.002871	4.92	324.99	82.23	0.44
3	507.483*	PF 2	1200.00	1257.96	1262.56		1262.87	0.002834	4.51	266.33	76.31	0.43
3	507.483*	PF 3	800.00	1257.96	1261.67		1261.92	0.002786	3.97	201.70	69.20	0.41
3	507.483*	PF 4	400.00	1257.96	1260.50		1260.66	0.002714	3.16	126.44	59.87	0.38

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	506.516*	PF 1	1600.00	1257.96	1263.30		1263.67	0.002761	4.84	330.35	83.21	0.43
3	506.516*	PF 2	1200.00	1257.96	1262.56		1262.87	0.002723	4.43	270.90	77.29	0.42
3	506.516*	PF 3	800.00	1257.96	1261.67		1261.91	0.002673	3.90	205.36	70.17	0.40
3	506.516*	PF 4	400.00	1257.96	1260.50		1260.65	0.002600	3.10	128.89	60.84	0.38
3	505.548*	PF 1	1600.00	1257.96	1263.30		1263.66	0.002656	4.76	335.81	84.21	0.42
3	505.548*	PF 2	1200.00	1257.96	1262.56		1262.86	0.002616	4.35	275.58	78.28	0.41
3	505.548*	PF 3	800.00	1257.96	1261.67		1261.90	0.002564	3.83	209.08	71.16	0.39
3	505.548*	PF 4	400.00	1257.96	1260.50		1260.65	0.002491	3.04	131.39	61.82	0.37
3	504.580*	PF 1	1600.00	1257.96	1263.31		1263.65	0.002559	4.69	341.14	85.19	0.41
3	504.580*	PF 2	1200.00	1257.96	1262.57		1262.85	0.002517	4.28	280.14	79.26	0.40
3	504.580*	PF 3	800.00	1257.96	1261.67		1261.89	0.002465	3.76	212.72	72.13	0.39
3	504.580*	PF 4	400.00	1257.96	1260.50		1260.64	0.002391	2.99	133.83	62.78	0.36
3	503.612*	PF 1	1600.00	1257.96	1263.31		1263.64	0.002466	4.62	346.48	86.17	0.41
3	503.612*	PF 2	1200.00	1257.96	1262.57		1262.84	0.002424	4.21	284.70	80.23	0.39
3	503.612*	PF 3	800.00	1257.96	1261.68		1261.89	0.002370	3.70	216.36	73.10	0.38
3	503.612*	PF 4	400.00	1257.96	1260.50		1260.64	0.002296	2.94	136.28	63.74	0.35
3	502.645*	PF 1	1600.00	1257.96	1263.31		1263.63	0.002377	4.55	351.92	87.17	0.40
3	502.645*	PF 2	1200.00	1257.96	1262.57		1262.84	0.002334	4.15	289.35	81.22	0.39
3	502.645*	PF 3	800.00	1257.96	1261.68		1261.88	0.002280	3.64	220.07	74.09	0.37
3	502.645*	PF 4	400.00	1257.96	1260.50		1260.63	0.002206	2.88	138.77	64.71	0.35
3	501.677*	PF 1	1600.00	1257.96	1263.31		1263.63	0.002295	4.48	357.24	88.15	0.39
3	501.677*	PF 2	1200.00	1257.96	1262.57		1262.83	0.002250	4.08	293.90	82.20	0.38
3	501.677*	PF 3	800.00	1257.96	1261.68		1261.88	0.002196	3.58	223.70	75.05	0.37
3	501.677*	PF 4	400.00	1257.96	1260.50		1260.63	0.002122	2.83	141.20	65.68	0.34
3	500.709*	PF 1	1600.00	1257.96	1263.32		1263.62	0.002214	4.41	362.68	89.14	0.39
3	500.709*	PF 2	1200.00	1257.96	1262.57		1262.82	0.002169	4.02	298.56	83.19	0.37
3	500.709*	PF 3	800.00	1257.96	1261.68		1261.87	0.002115	3.52	227.41	76.04	0.36
3	500.709*	PF 4	400.00	1257.96	1260.50		1260.63	0.002041	2.78	143.70	66.66	0.33
3	499.741*	PF 1	1600.00	1257.96	1263.32		1263.61	0.002140	4.35	367.98	90.12	0.38
3	499.741*	PF 2	1200.00	1257.96	1262.57		1262.82	0.002095	3.96	303.09	84.16	0.37

HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	499.741*	PF 3	800.00	1257.96	1261.68		1261.87	0.002040	3.46	231.04	77.01	0.35
3	499.741*	PF 4	400.00	1257.96	1260.50		1260.62	0.001967	2.74	146.13	67.61	0.33
3	498.774*	PF 1	1600.00	1257.95	1263.32		1263.60	0.002054	4.27	374.27	91.18	0.37
3	498.774*	PF 2	1200.00	1257.95	1262.57		1262.81	0.002007	3.89	308.54	85.22	0.36
3	498.774*	PF 3	800.00	1257.95	1261.68		1261.86	0.001949	3.40	235.49	78.06	0.34
3	498.774*	PF 4	400.00	1257.95	1260.51		1260.62	0.001869	2.68	149.29	68.66	0.32
3	497.806*	PF 1	1600.00	1257.95	1263.32		1263.60	0.001986	4.21	379.68	92.17	0.37
3	497.806*	PF 2	1200.00	1257.95	1262.58		1262.80	0.001939	3.83	313.17	86.21	0.35
3	497.806*	PF 3	800.00	1257.95	1261.68		1261.85	0.001881	3.34	239.19	79.04	0.34
3	497.806*	PF 4	400.00	1257.95	1260.50		1260.61	0.001802	2.64	151.78	69.63	0.31
3	496.838*	PF 1	1600.00	1257.95	1263.32		1263.59	0.001923	4.16	384.99	93.14	0.36
3	496.838*	PF 2	1200.00	1257.95	1262.58		1262.80	0.001875	3.78	317.71	87.18	0.35
3	496.838*	PF 3	800.00	1257.95	1261.68		1261.85	0.001817	3.29	242.83	80.01	0.33
3	496.838*	PF 4	400.00	1257.95	1260.50		1260.61	0.001740	2.59	154.22	70.59	0.31
3	495.871*	PF 1	1600.00	1257.95	1263.32		1263.59	0.001862	4.10	390.28	94.12	0.35
3	495.871*	PF 2	1200.00	1257.95	1262.58		1262.79	0.001815	3.72	322.25	88.14	0.34
3	495.871*	PF 3	800.00	1257.95	1261.68		1261.85	0.001757	3.25	246.44	80.97	0.33
3	495.871*	PF 4	400.00	1257.95	1260.50		1260.61	0.001681	2.55	156.66	71.55	0.30
3	494.903*	PF 1	1600.00	1257.95	1263.33		1263.58	0.001804	4.04	395.69	95.11	0.35
3	494.903*	PF 2	1200.00	1257.95	1262.58		1262.79	0.001756	3.67	326.88	89.13	0.34
3	494.903*	PF 3	800.00	1257.95	1261.68		1261.84	0.001699	3.20	250.15	81.96	0.32
3	494.903*	PF 4	400.00	1257.95	1260.50		1260.60	0.001624	2.51	159.16	72.53	0.30
3	493.935*	PF 1	1600.00	1257.95	1263.33		1263.57	0.001749	3.99	400.99	96.08	0.34
3	493.935*	PF 2	1200.00	1257.95	1262.58		1262.78	0.001701	3.62	331.42	90.10	0.33
3	493.935*	PF 3	800.00	1257.95	1261.68		1261.84	0.001645	3.15	253.78	82.92	0.32
3	493.935*	PF 4	400.00	1257.95	1260.50		1260.60	0.001571	2.48	161.60	73.49	0.29
3	492.967*	PF 1	1600.00	1257.95	1263.33		1263.57	0.001695	3.94	406.38	97.07	0.34
3	492.967*	PF 2	1200.00	1257.95	1262.58		1262.78	0.001648	3.57	336.04	91.09	0.33
3	492.967*	PF 3	800.00	1257.95	1261.68		1261.83	0.001592	3.11	257.47	83.90	0.31
3	492.967*	PF 4	400.00	1257.95	1260.50		1260.60	0.001519	2.44	164.09	74.47	0.29

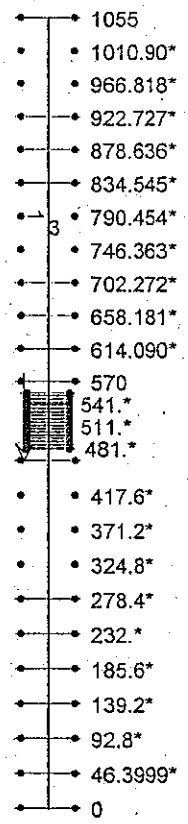
HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

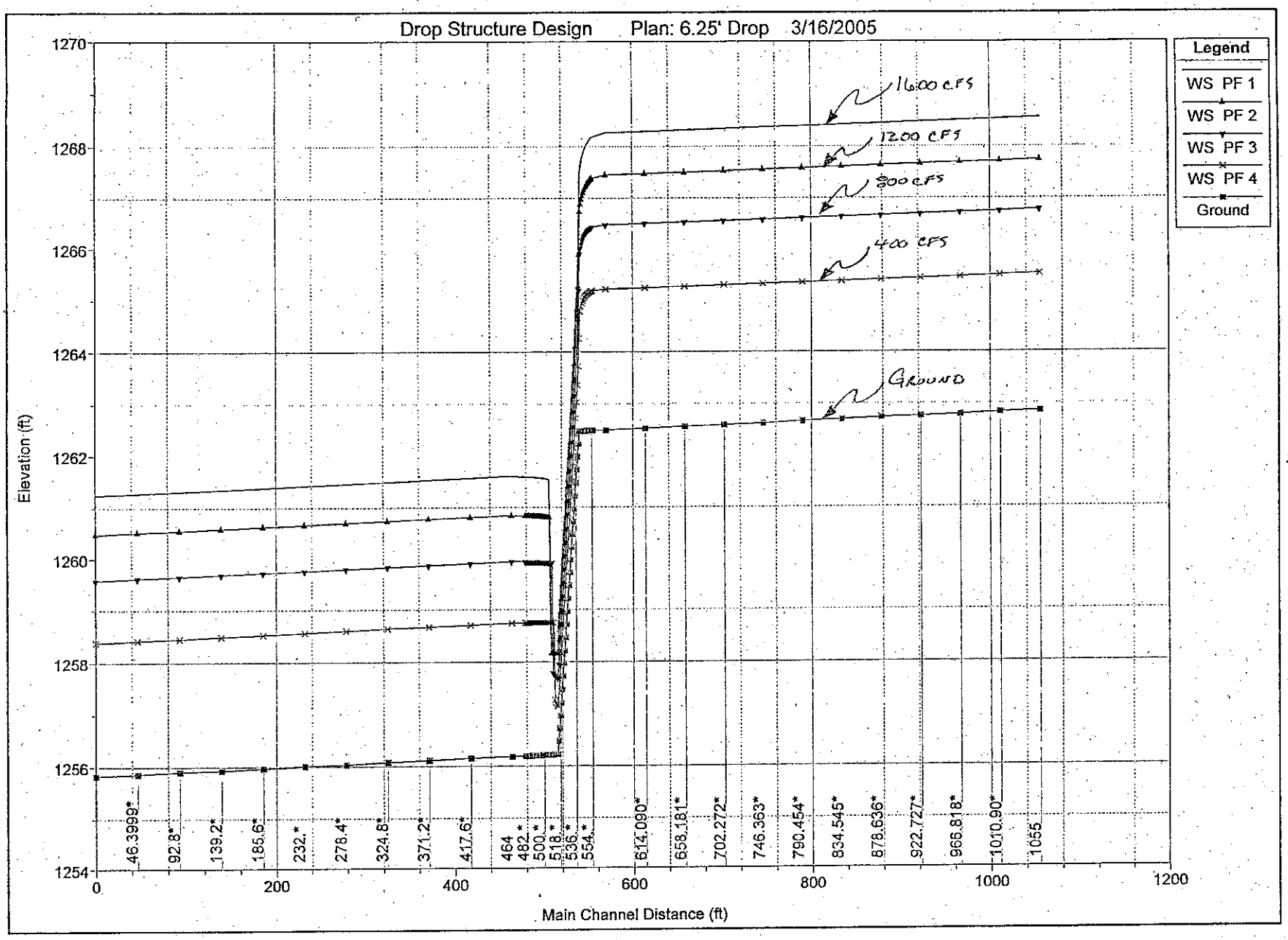
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	492	PF 1	1600.00	1257.95	1263.33		1263.57	0.001053	3.89	411.70	98.04	0.33
3	492	PF 2	1200.00	1257.95	1262.58		1262.78	0.001023	3.52	340.60	92.06	0.32
3	492	PF 3	800.00	1257.95	1261.68		1261.83	0.000987	3.06	261.12	84.87	0.31
3	492	PF 4	400.00	1257.95	1260.50		1260.59	0.000941	2.40	166.55	75.43	0.28
3 END APRON	477	PF 1	1600.00	1257.94	1263.36		1263.53	0.000751	3.38	474.04	120.01	0.30
3	477	PF 2	1200.00	1257.94	1262.60		1262.75	0.000751	3.11	386.43	110.90	0.29
3	477	PF 3	800.00	1257.94	1261.69		1261.81	0.000751	2.75	290.65	100.00	0.28
3	477	PF 4	400.00	1257.94	1260.50		1260.58	0.000752	2.22	180.12	85.72	0.27
3	433.636*	PF 1	1600.00	1257.91	1263.32		1263.50	0.000753	3.38	473.69	119.97	0.30
3	433.636*	PF 2	1200.00	1257.91	1262.57		1262.72	0.000753	3.11	386.11	110.87	0.29
3	433.636*	PF 3	800.00	1257.91	1261.66		1261.78	0.000753	2.76	290.36	99.97	0.28
3	433.636*	PF 4	400.00	1257.91	1260.47		1260.54	0.000755	2.22	179.86	85.68	0.27
3	390.272*	PF 1	1600.00	1257.87	1263.29		1263.47	0.000749	3.37	474.60	120.06	0.30
3	390.272*	PF 2	1200.00	1257.87	1262.53		1262.68	0.000748	3.10	386.95	110.96	0.29
3	390.272*	PF 3	800.00	1257.87	1261.63		1261.74	0.000747	2.75	291.13	100.06	0.28
3	390.272*	PF 4	400.00	1257.87	1260.44		1260.51	0.000747	2.22	180.52	85.78	0.27
3	346.909*	PF 1	1600.00	1257.84	1263.26		1263.44	0.000750	3.37	474.27	120.03	0.30
3	346.909*	PF 2	1200.00	1257.84	1262.50		1262.65	0.000750	3.10	386.65	110.93	0.29
3	346.909*	PF 3	800.00	1257.84	1261.59		1261.71	0.000749	2.75	290.87	100.03	0.28
3	346.909*	PF 4	400.00	1257.84	1260.40		1260.48	0.000750	2.22	180.31	85.75	0.27
3	303.545*	PF 1	1600.00	1257.81	1263.23		1263.40	0.000752	3.38	473.92	120.00	0.30
3	303.545*	PF 2	1200.00	1257.81	1262.47		1262.62	0.000752	3.11	386.33	110.89	0.29
3	303.545*	PF 3	800.00	1257.81	1261.56		1261.68	0.000751	2.75	290.59	100.00	0.28
3	303.545*	PF 4	400.00	1257.81	1260.37		1260.45	0.000753	2.22	180.05	85.71	0.27
3	260.181*	PF 1	1600.00	1257.78	1263.19		1263.37	0.000753	3.38	473.59	119.96	0.30
3	260.181*	PF 2	1200.00	1257.78	1262.44		1262.59	0.000753	3.11	386.02	110.86	0.29
3	260.181*	PF 3	800.00	1257.78	1261.53		1261.65	0.000753	2.76	290.31	99.96	0.28
3	260.181*	PF 4	400.00	1257.78	1260.34		1260.41	0.000756	2.22	179.81	85.68	0.27
3	216.818*	PF 1	1600.00	1257.74	1263.16		1263.34	0.000749	3.37	474.50	120.05	0.30
3	216.818*	PF 2	1200.00	1257.74	1262.40		1262.55	0.000749	3.10	386.86	110.95	0.29
3	216.818*	PF 3	800.00	1257.74	1261.50		1261.61	0.000748	2.75	291.08	100.05	0.28

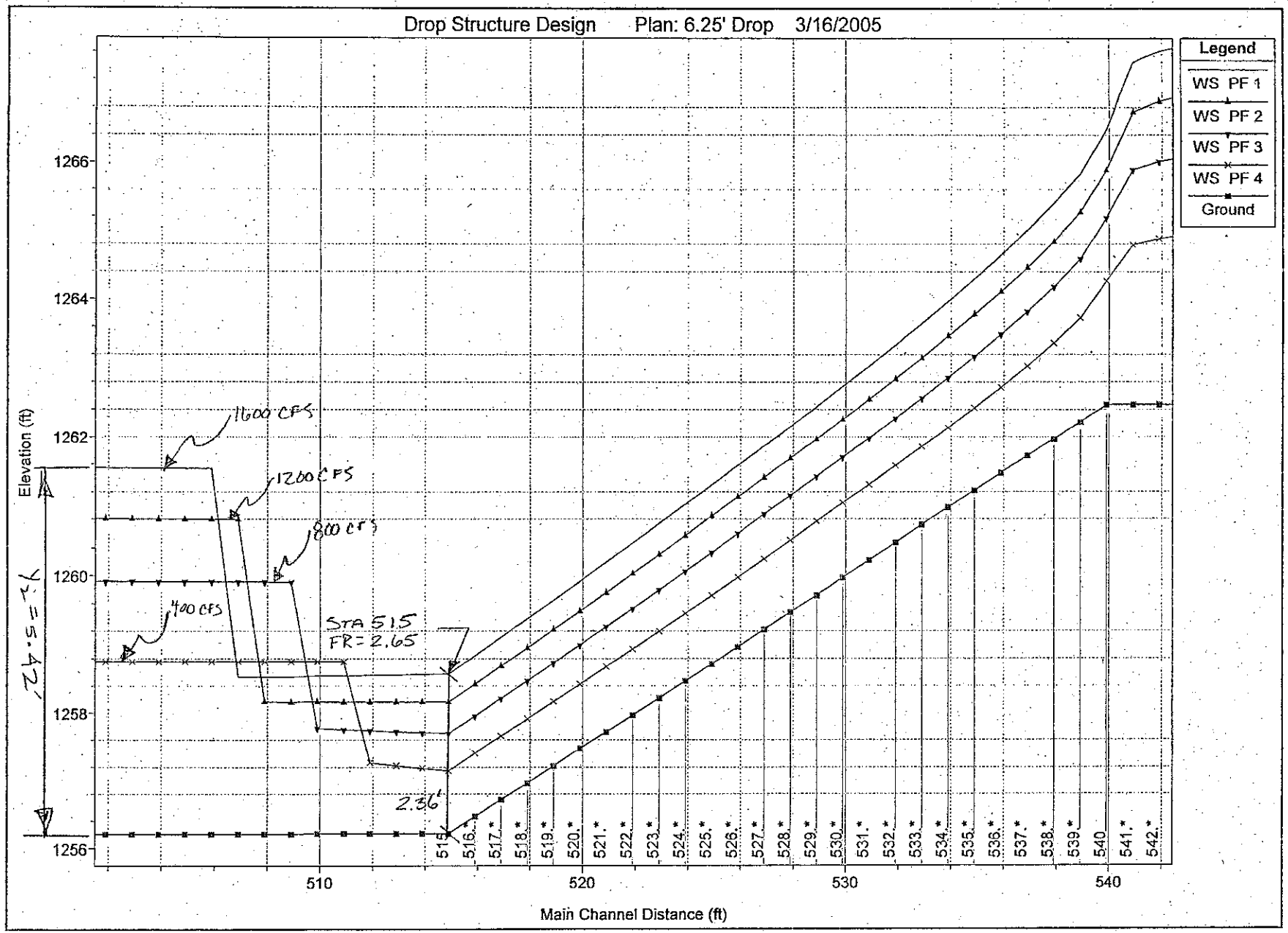
HEC-RAS Plan: 4.5' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	216.818*	PF 4	400.00	1257.74	1260.30		1260.38	0.000748	2.22	180.47	85.77	0.27
3	173.454*	PF 1	1600.00	1257.71	1263.13		1263.31	0.000751	3.37	474.17	120.02	0.30
3	173.454*	PF 2	1200.00	1257.71	1262.37		1262.52	0.000750	3.10	386.56	110.92	0.29
3	173.454*	PF 3	800.00	1257.71	1261.46		1261.58	0.000750	2.75	290.81	100.02	0.28
3	173.454*	PF 4	400.00	1257.71	1260.27		1260.35	0.000750	2.22	180.24	85.74	0.27
3	130.090*	PF 1	1600.00	1257.68	1263.10		1263.27	0.000752	3.38	473.82	119.99	0.30
3	130.090*	PF 2	1200.00	1257.68	1262.34		1262.49	0.000752	3.11	386.23	110.88	0.29
3	130.090*	PF 3	800.00	1257.68	1261.43		1261.55	0.000752	2.75	290.53	99.99	0.28
3	130.090*	PF 4	400.00	1257.68	1260.24		1260.32	0.000753	2.22	179.99	85.70	0.27
3	86.7272*	PF 1	1600.00	1257.65	1263.06		1263.24	0.000754	3.38	473.49	119.95	0.30
3	86.7272*	PF 2	1200.00	1257.65	1262.30		1262.45	0.000754	3.11	385.92	110.85	0.29
3	86.7272*	PF 3	800.00	1257.65	1261.40		1261.51	0.000754	2.76	290.25	99.96	0.29
3	86.7272*	PF 4	400.00	1257.65	1260.21		1260.28	0.000757	2.23	179.74	85.67	0.27
3	43.3636*	PF 1	1600.00	1257.61	1263.03		1263.21	0.000750	3.37	474.39	120.04	0.30
3	43.3636*	PF 2	1200.00	1257.61	1262.27		1262.42	0.000749	3.10	386.76	110.94	0.29
3	43.3636*	PF 3	800.00	1257.61	1261.36		1261.48	0.000748	2.75	291.00	100.04	0.28
3	43.3636*	PF 4	400.00	1257.61	1260.17		1260.25	0.000749	2.22	180.39	85.76	0.27
3	0	PF 1	1600.00	1257.58	1263.00	1260.25	1263.18	0.000751	3.37	474.09	120.01	0.30
3	0	PF 2	1200.00	1257.58	1262.24	1259.82	1262.39	0.000751	3.11	386.45	110.90	0.29
3	0	PF 3	800.00	1257.58	1261.33	1259.33	1261.45	0.000750	2.75	290.72	100.01	0.28
3	0	PF 4	400.00	1257.58	1260.14	1258.71	1260.22	0.000751	2.22	180.16	85.72	0.27

6.25' Drop Structure Analysis




Drop Structure Design Plan: 6.25' Drop 3/16/2005
Legend
WS PF 1
WS PF 2
WS PF 3
WS PF 4
Ground
1600 CFS
1200 CFS
800 CFS
400 CFS
GROUND
Elevation (ft)
Main Channel Distance (ft)
1270
1268
1266
1264
1262
1260
1258
1256
1254
0
200
400
600
800
1000
1200
46.3999*
92.8*
139.2*
185.6*
232.*
278.4*
324.8*
371.2*
417.6*
464
482.*
500.*
518.*
536.*
554.*
614.090*
658.181*
702.272*
746.363*
790.454*
834.545*
878.636*
922.727*
966.818*
1010.90*
1055


Drop Structure Design Plan: 6.25' Drop 3/16/2005
Legend
WS PF 1
WS PF 2
WS PF 3
WS PF 4
Ground
Elevation (ft)
Main Channel Distance (ft)
1266
1264
1262
1260
1258
1256
510
520
530
540
1600 CFS
1200 CFS
800 CFS
400 CFS
STA 515
FR = 2.65
2.36'
Y2 = 5.42'

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	1055	PF 1	1600.00	1262.86	1268.55	1265.54	1268.70	0.000624	3.16	506.58	123.22	0.27
3	1055	PF 2	1200.00	1262.86	1267.74	1265.10	1267.87	0.000629	2.92	411.38	113.57	0.27
3	1055	PF 3	800.00	1262.86	1266.78	1264.61	1266.88	0.000640	2.60	307.27	101.98	0.26
3	1055	PF 4	400.00	1262.86	1265.51	1263.99	1265.58	0.000661	2.13	188.17	86.84	0.25
3	1010.90*	PF 1	1600.00	1262.83	1268.52		1268.67	0.000623	3.16	506.90	123.25	0.27
3	1010.90*	PF 2	1200.00	1262.83	1267.71		1267.85	0.000628	2.92	411.65	113.60	0.27
3	1010.90*	PF 3	800.00	1262.83	1266.75		1266.85	0.000639	2.60	307.46	102.00	0.26
3	1010.90*	PF 4	400.00	1262.83	1265.48		1265.55	0.000661	2.12	188.25	86.85	0.25
3	966.818*	PF 1	1600.00	1262.79	1268.49		1268.64	0.000617	3.15	508.51	123.41	0.27
3	966.818*	PF 2	1200.00	1262.79	1267.69		1267.82	0.000622	2.90	413.10	113.75	0.27
3	966.818*	PF 3	800.00	1262.79	1266.72		1266.82	0.000632	2.59	308.71	102.15	0.26
3	966.818*	PF 4	400.00	1262.79	1265.46		1265.53	0.000650	2.11	189.25	86.99	0.25
3	922.727*	PF 1	1600.00	1262.76	1268.46		1268.62	0.000616	3.14	508.86	123.44	0.27
3	922.727*	PF 2	1200.00	1262.76	1267.66		1267.79	0.000621	2.90	413.41	113.79	0.27
3	922.727*	PF 3	800.00	1262.76	1266.69		1266.80	0.000630	2.59	308.94	102.17	0.26
3	922.727*	PF 4	400.00	1262.76	1265.43		1265.50	0.000649	2.11	189.37	87.01	0.25
3	878.636*	PF 1	1600.00	1262.73	1268.44		1268.59	0.000615	3.14	509.22	123.48	0.27
3	878.636*	PF 2	1200.00	1262.73	1267.63		1267.76	0.000619	2.90	413.72	113.82	0.27
3	878.636*	PF 3	800.00	1262.73	1266.66		1266.77	0.000629	2.59	309.17	102.20	0.26
3	878.636*	PF 4	400.00	1262.73	1265.40		1265.47	0.000648	2.11	189.50	87.02	0.25
3	834.545*	PF 1	1600.00	1262.69	1268.41		1268.56	0.000609	3.13	510.89	123.64	0.27
3	834.545*	PF 2	1200.00	1262.69	1267.61		1267.73	0.000613	2.89	415.23	113.98	0.27
3	834.545*	PF 3	800.00	1262.69	1266.64		1266.74	0.000621	2.58	310.50	102.36	0.26
3	834.545*	PF 4	400.00	1262.69	1265.37		1265.44	0.000637	2.10	190.55	87.17	0.25
3	790.454*	PF 1	1600.00	1262.66	1268.38		1268.54	0.000608	3.13	511.27	123.68	0.27
3	790.454*	PF 2	1200.00	1262.66	1267.58		1267.71	0.000612	2.89	415.57	114.01	0.27
3	790.454*	PF 3	800.00	1262.66	1266.61		1266.71	0.000620	2.57	310.76	102.39	0.26
3	790.454*	PF 4	400.00	1262.66	1265.34		1265.41	0.000636	2.10	190.71	87.19	0.25
3	746.363*	PF 1	1600.00	1262.62	1268.36		1268.51	0.000602	3.12	512.99	123.84	0.27
3	746.363*	PF 2	1200.00	1262.62	1267.55		1267.68	0.000605	2.88	417.13	114.18	0.27
3	746.363*	PF 3	800.00	1262.62	1266.58		1266.68	0.000612	2.56	312.12	102.55	0.26

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	746.363*	PF 4	400.00	1262.62	1265.32		1265.38	0.000625	2.09	191.82	87.34	0.25
3	702.272*	PF 1	1600.00	1262.59	1268.33		1268.48	0.000601	3.12	513.43	123.88	0.27
3	702.272*	PF 2	1200.00	1262.59	1267.53		1267.65	0.000604	2.87	417.52	114.22	0.26
3	702.272*	PF 3	800.00	1262.59	1266.56		1266.66	0.000611	2.56	312.44	102.58	0.26
3	702.272*	PF 4	400.00	1262.59	1265.29		1265.36	0.000623	2.08	192.04	87.37	0.25
3	658.181*	PF 1	1600.00	1262.56	1268.30		1268.45	0.000599	3.11	513.87	123.93	0.27
3	658.181*	PF 2	1200.00	1262.56	1267.50		1267.63	0.000602	2.87	417.89	114.26	0.26
3	658.181*	PF 3	800.00	1262.56	1266.53		1266.63	0.000609	2.56	312.75	102.62	0.26
3	658.181*	PF 4	400.00	1262.56	1265.26		1265.33	0.000621	2.08	192.27	87.40	0.25
3	614.090*	PF 1	1600.00	1262.52	1268.28		1268.43	0.000594	3.10	515.64	124.10	0.27
3	614.090*	PF 2	1200.00	1262.52	1267.47		1267.60	0.000596	2.86	419.51	114.43	0.26
3	614.090*	PF 3	800.00	1262.52	1266.50		1266.60	0.000601	2.55	314.18	102.79	0.26
3	614.090*	PF 4	400.00	1262.52	1265.23		1265.30	0.000610	2.07	193.43	87.56	0.25
3	570	PF 1	1600.00	1262.49	1268.25		1268.40	0.000592	3.10	516.12	124.14	0.27
3	570	PF 2	1200.00	1262.49	1267.45		1267.57	0.000594	2.86	419.96	114.47	0.26
3	570	PF 3	800.00	1262.49	1266.48		1266.58	0.000599	2.54	314.56	102.83	0.26
3	570	PF 4	400.00	1262.49	1265.21		1265.27	0.000608	2.07	193.69	87.60	0.24
3	555	PF 1	1600.00	1262.48	1268.17		1268.37	0.001339	3.62	442.37	100.51	0.30
3	555	PF 2	1200.00	1262.48	1267.38		1267.55	0.001302	3.28	365.61	94.21	0.29
3	555	PF 3	800.00	1262.48	1266.43		1266.56	0.001262	2.86	279.61	86.60	0.28
3	555	PF 4	400.00	1262.48	1265.18		1265.26	0.001213	2.25	177.53	76.59	0.26
3	554.*	PF 1	1600.00	1262.48	1268.15		1268.37	0.001446	3.73	429.32	98.79	0.32
3	554.*	PF 2	1200.00	1262.48	1267.37		1267.54	0.001402	3.39	354.37	92.07	0.30
3	554.*	PF 3	800.00	1262.48	1266.42		1266.55	0.001361	2.96	270.66	84.48	0.29
3	554.*	PF 4	400.00	1262.48	1265.17		1265.25	0.001313	2.33	171.50	74.51	0.27
3	553.*	PF 1	1600.00	1262.48	1268.13		1268.36	0.001561	3.84	416.25	96.83	0.33
3	553.*	PF 2	1200.00	1262.48	1267.35		1267.54	0.001513	3.50	343.20	89.97	0.32
3	553.*	PF 3	800.00	1262.48	1266.40		1266.55	0.001472	3.06	261.76	82.41	0.30
3	553.*	PF 4	400.00	1262.48	1265.16		1265.25	0.001425	2.42	165.47	72.46	0.28
3	552.*	PF 1	1600.00	1262.48	1268.11		1268.36	0.001686	3.97	402.75	94.44	0.34

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	552.*	PF 2	1200.00	1262.48	1267.33		1267.53	0.001640	3.62	331.79	87.80	0.33
3	552.*	PF 3	800.00	1262.48	1266.39		1266.55	0.001600	3.17	252.67	80.27	0.31
3	552.*	PF 4	400.00	1262.48	1265.15		1265.25	0.001554	2.51	159.37	70.36	0.29
3	551.*	PF 1	1600.00	1262.48	1268.09		1268.35	0.001820	4.11	389.43	91.91	0.35
3	551.*	PF 2	1200.00	1262.48	1267.31		1267.53	0.001783	3.74	320.47	85.69	0.34
3	551.*	PF 3	800.00	1262.48	1266.37		1266.54	0.001745	3.28	243.62	78.18	0.33
3	551.*	PF 4	400.00	1262.48	1265.14		1265.24	0.001701	2.61	153.27	68.30	0.31
3	550.*	PF 1	1600.00	1262.48	1268.06		1268.34	0.001986	4.26	375.65	89.65	0.37
3	550.*	PF 2	1200.00	1262.48	1267.29		1267.52	0.001950	3.89	308.73	83.47	0.36
3	550.*	PF 3	800.00	1262.48	1266.35		1266.53	0.001914	3.41	234.33	76.00	0.34
3	550.*	PF 4	400.00	1262.48	1265.13		1265.24	0.001873	2.72	147.06	66.17	0.32
3	549.*	PF 1	1600.00	1262.48	1268.03		1268.33	0.002177	4.42	361.75	87.39	0.38
3	549.*	PF 2	1200.00	1262.48	1267.26		1267.51	0.002144	4.04	296.90	81.24	0.37
3	549.*	PF 3	800.00	1262.48	1266.33		1266.53	0.002110	3.56	224.93	73.81	0.36
3	549.*	PF 4	400.00	1262.48	1265.11		1265.24	0.002074	2.84	140.80	64.04	0.34
3	548.*	PF 1	1600.00	1262.48	1267.99		1268.32	0.002398	4.60	347.86	85.17	0.40
3	548.*	PF 2	1200.00	1262.48	1267.23		1267.50	0.002368	4.21	285.05	79.04	0.39
3	548.*	PF 3	800.00	1262.48	1266.31		1266.52	0.002340	3.71	215.50	71.65	0.38
3	548.*	PF 4	400.00	1262.48	1265.09		1265.23	0.002310	2.97	134.52	61.93	0.36
3	547.*	PF 1	1600.00	1262.47	1267.96		1268.31	0.002637	4.78	334.44	82.86	0.42
3	547.*	PF 2	1200.00	1262.47	1267.20		1267.50	0.002609	4.38	273.71	76.78	0.41
3	547.*	PF 3	800.00	1262.47	1266.28		1266.51	0.002585	3.87	206.62	69.45	0.40
3	547.*	PF 4	400.00	1262.47	1265.08		1265.23	0.002554	3.11	128.73	59.82	0.37
3	546.*	PF 1	1600.00	1262.47	1267.91		1268.30	0.002946	5.00	319.91	80.54	0.44
3	546.*	PF 2	1200.00	1262.47	1267.16		1267.49	0.002926	4.59	261.35	74.50	0.43
3	546.*	PF 3	800.00	1262.47	1266.25		1266.50	0.002912	4.07	196.79	67.21	0.42
3	546.*	PF 4	400.00	1262.47	1265.05		1265.22	0.002895	3.27	122.19	57.65	0.40
3	545.*	PF 1	1600.00	1262.47	1267.86		1268.29	0.003328	5.25	304.67	78.09	0.47
3	545.*	PF 2	1200.00	1262.47	1267.11		1267.47	0.003318	4.83	248.43	72.10	0.46
3	545.*	PF 3	800.00	1262.47	1266.21		1266.49	0.003320	4.29	186.57	64.88	0.45
3	545.*	PF 4	400.00	1262.47	1265.02		1265.21	0.003325	3.47	115.38	55.41	0.42

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	544.*	PF 1	1600.00	1262.47	1267.79		1268.27	0.003808	5.54	288.76	75.53	0.50
3	544.*	PF 2	1200.00	1262.47	1267.05		1267.46	0.003814	5.11	234.95	69.60	0.49
3	544.*	PF 3	800.00	1262.47	1266.16		1266.48	0.003839	4.55	175.94	62.46	0.48
3	544.*	PF 4	400.00	1262.47	1264.99		1265.20	0.003879	3.69	108.33	53.11	0.46
3	543.*	PF 1	1600.00	1262.47	1267.71		1268.25	0.004422	5.88	272.28	72.92	0.54
3	543.*	PF 2	1200.00	1262.47	1266.98		1267.44	0.004455	5.43	220.97	67.05	0.53
3	543.*	PF 3	800.00	1262.47	1266.09		1266.46	0.004518	4.85	164.89	59.99	0.52
3	543.*	PF 4	400.00	1262.47	1264.94		1265.18	0.004615	3.96	101.00	50.76	0.49
3	542.*	PF 1	1600.00	1262.47	1267.60		1268.22	0.005276	6.30	254.13	70.04	0.58
3	542.*	PF 2	1200.00	1262.47	1266.88		1267.41	0.005351	5.84	205.64	64.27	0.57
3	542.*	PF 3	800.00	1262.47	1266.01		1266.44	0.005479	5.23	152.83	57.32	0.56
3	542.*	PF 4	400.00	1262.47	1264.88		1265.17	0.005669	4.30	93.07	48.27	0.55
3	541.*	PF 1	1600.00	1262.47	1267.45	1266.37	1268.18	0.006573	6.85	233.53	66.83	0.65
3	541.*	PF 2	1200.00	1262.47	1266.74	1265.78	1267.37	0.006729	6.37	188.26	61.17	0.64
3	541.*	PF 3	800.00	1262.47	1265.89	1265.09	1266.40	0.006983	5.75	139.16	54.37	0.63
3	541.*	PF 4	400.00	1262.47	1264.79		1265.14	0.007359	4.76	84.10	45.55	0.62
3	540	PF 1	1600.00	1262.47	1266.49	1266.49	1267.95	0.016990	9.70	164.88	57.12	1.01
3	540	PF 2	1200.00	1262.47	1265.89	1265.89	1267.17	0.017730	9.08	132.21	52.35	1.01
3	540	PF 3	800.00	1262.47	1265.18	1265.18	1266.23	0.018856	8.24	97.14	46.68	1.01
3	540	PF 4	400.00	1262.47	1264.27	1264.27	1265.01	0.021137	6.92	57.77	39.36	1.01
3	539.*	PF 1	1600.00	1262.22	1265.83	1266.24	1267.79	0.025496	11.22	142.59	53.91	1.22
3	539.*	PF 2	1200.00	1262.22	1265.27	1265.64	1267.01	0.027415	10.59	113.28	49.37	1.23
3	539.*	PF 3	800.00	1262.22	1264.59	1264.93	1266.08	0.030855	9.78	81.78	43.97	1.26
3	539.*	PF 4	400.00	1262.22	1263.73	1264.02	1264.86	0.039222	8.54	46.83	37.07	1.34
3	538.*	PF 1	1600.00	1261.97	1265.39	1265.99	1267.66	0.031362	12.08	132.45	52.38	1.34
3	538.*	PF 2	1200.00	1261.97	1264.84	1265.39	1266.88	0.034441	11.48	104.52	47.93	1.37
3	538.*	PF 3	800.00	1261.97	1264.18	1264.68	1265.96	0.039940	10.70	74.77	42.68	1.42
3	538.*	PF 4	400.00	1261.97	1263.36	1263.77	1264.74	0.052511	9.42	42.45	36.11	1.53
3	537.*	PF 1	1600.00	1261.72	1265.00	1265.74	1267.54	0.036802	12.79	125.13	51.25	1.44
3	537.*	PF 2	1200.00	1261.72	1264.46	1265.14	1266.77	0.040820	12.19	98.46	46.91	1.48

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	537.*	PF 3	800.00	1261.72	1263.82	1264.43	1265.84	0.048011	11.40	70.16	41.80	1.55
3	537.*	PF 4	400.00	1261.72	1263.03	1263.52	1264.61	0.064441	10.09	39.64	35.48	1.68
3	536.*	PF 1	1600.00	1261.47	1264.64	1265.49	1267.43	0.041914	13.39	119.49	50.37	1.53
3	536.*	PF 2	1200.00	1261.47	1264.11	1264.89	1266.65	0.046826	12.79	93.83	46.11	1.58
3	536.*	PF 3	800.00	1261.47	1263.49	1264.18	1265.72	0.055653	12.00	66.68	41.13	1.66
3	536.*	PF 4	400.00	1261.47	1262.72	1263.27	1264.49	0.075982	10.66	37.52	35.00	1.81
3	535.*	PF 1	1600.00	1261.22	1264.30	1265.24	1267.31	0.046903	13.93	114.83	49.62	1.61
3	535.*	PF 2	1200.00	1261.22	1263.78	1264.64	1266.53	0.052540	13.31	90.13	45.46	1.67
3	535.*	PF 3	800.00	1261.22	1263.17	1263.93	1265.60	0.062955	12.52	63.91	40.59	1.76
3	535.*	PF 4	400.00	1261.22	1262.42	1263.02	1264.35	0.086964	11.15	35.87	34.63	1.93
3	534.*	PF 1	1600.00	1260.97	1263.97	1264.99	1267.20	0.051903	14.44	110.79	48.96	1.69
3	534.*	PF 2	1200.00	1260.97	1263.46	1264.39	1266.41	0.058183	13.80	86.97	44.91	1.75
3	534.*	PF 3	800.00	1260.97	1262.86	1263.68	1265.48	0.069960	12.98	61.64	40.14	1.85
3	534.*	PF 4	400.00	1260.97	1262.14	1262.77	1264.22	0.097366	11.58	34.55	34.32	2.03
3	533.*	PF 1	1600.00	1260.72	1263.65	1264.74	1267.10	0.056796	14.91	107.33	48.40	1.76
3	533.*	PF 2	1200.00	1260.72	1263.15	1264.14	1266.30	0.063733	14.24	84.25	44.42	1.82
3	533.*	PF 3	800.00	1260.72	1262.56	1263.43	1265.35	0.076866	13.40	59.69	39.75	1.93
3	533.*	PF 4	400.00	1260.72	1261.85	1262.52	1264.07	0.106884	11.94	33.49	34.07	2.12
3	532.*	PF 1	1600.00	1260.47	1263.33	1264.49	1266.99	0.061580	15.34	104.31	47.89	1.83
3	532.*	PF 2	1200.00	1260.47	1262.84	1263.89	1266.18	0.069123	14.65	81.91	43.99	1.89
3	532.*	PF 3	800.00	1260.47	1262.27	1263.18	1265.23	0.083789	13.80	57.95	39.40	2.01
3	532.*	PF 4	400.00	1260.47	1261.58	1262.27	1263.91	0.115783	12.26	32.62	33.87	2.20
3	531.*	PF 1	1600.00	1260.22	1263.03	1264.24	1266.86	0.065960	15.71	101.82	47.48	1.89
3	531.*	PF 2	1200.00	1260.22	1262.55	1263.64	1266.05	0.074359	15.03	79.85	43.62	1.96
3	531.*	PF 3	800.00	1260.22	1261.98	1262.93	1265.10	0.090411	14.17	56.47	39.10	2.08
3	531.*	PF 4	400.00	1260.22	1261.31	1262.02	1263.75	0.124178	12.55	31.87	33.69	2.27
3	530.*	PF 1	1600.00	1259.97	1262.73	1263.99	1266.74	0.070167	16.06	99.63	47.11	1.95
3	530.*	PF 2	1200.00	1259.97	1262.26	1263.39	1265.93	0.079477	15.38	78.03	43.28	2.02
3	530.*	PF 3	800.00	1259.97	1261.70	1262.68	1264.96	0.096528	14.49	55.22	38.84	2.14
3	530.*	PF 4	400.00	1259.97	1261.04	1261.77	1263.59	0.132362	12.82	31.21	33.53	2.34

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	529.*	PF 1	1600.00	1259.72	1262.44	1263.74	1266.62	0.074474	16.40	97.57	46.76	2.00
3	529.*	PF 2	1200.00	1259.72	1261.97	1263.14	1265.80	0.084452	15.71	76.40	42.98	2.08
3	529.*	PF 3	800.00	1259.72	1261.42	1262.43	1264.81	0.102356	14.78	54.13	38.61	2.20
3	529.*	PF 4	400.00	1259.72	1260.77	1261.52	1263.42	0.140614	13.08	30.59	33.38	2.41
3	528.*	PF 1	1600.00	1259.47	1262.15	1263.49	1266.49	0.078675	16.72	95.71	46.44	2.05
3	528.*	PF 2	1200.00	1259.47	1261.68	1262.89	1265.67	0.089271	16.01	74.95	42.71	2.13
3	528.*	PF 3	800.00	1259.47	1261.15	1262.18	1264.67	0.108165	15.06	53.12	38.41	2.26
3	528.*	PF 4	400.00	1259.47	1260.50	1261.27	1263.25	0.148264	13.31	30.06	33.26	2.47
3	527.*	PF 1	1600.00	1259.22	1261.86	1263.24	1266.36	0.082777	17.02	94.02	46.14	2.10
3	527.*	PF 2	1200.00	1259.22	1261.40	1262.64	1265.52	0.093840	16.29	73.66	42.47	2.18
3	527.*	PF 3	800.00	1259.22	1260.87	1261.93	1264.52	0.113904	15.33	52.20	38.21	2.31
3	527.*	PF 4	400.00	1259.22	1260.24	1261.02	1263.08	0.156054	13.53	29.56	33.14	2.52
3	526.*	PF 1	1600.00	1258.97	1261.58	1262.99	1266.23	0.086741	17.30	92.49	45.88	2.15
3	526.*	PF 2	1200.00	1258.97	1261.12	1262.39	1265.39	0.098747	16.58	72.38	42.23	2.23
3	526.*	PF 3	800.00	1258.97	1260.60	1261.68	1264.37	0.119755	15.59	51.32	38.03	2.36
3	526.*	PF 4	400.00	1258.97	1259.97	1260.77	1262.90	0.162994	13.73	29.14	33.04	2.58
3	525.*	PF 1	1600.00	1258.72	1261.30	1262.74	1266.10	0.090834	17.58	91.01	45.62	2.19
3	525.*	PF 2	1200.00	1258.72	1260.85	1262.14	1265.25	0.103439	16.85	71.22	42.01	2.28
3	525.*	PF 3	800.00	1258.72	1260.33	1261.43	1264.22	0.125274	15.83	50.54	37.86	2.41
3	525.*	PF 4	400.00	1258.72	1259.71	1260.52	1262.71	0.169313	13.90	28.78	32.95	2.62
3	524.*	PF 1	1600.00	1258.47	1261.02	1262.49	1265.96	0.094799	17.84	89.66	45.38	2.24
3	524.*	PF 2	1200.00	1258.47	1260.57	1261.89	1265.11	0.107957	17.10	70.18	41.81	2.33
3	524.*	PF 3	800.00	1258.47	1260.06	1261.18	1264.06	0.130547	16.05	49.84	37.71	2.46
3	524.*	PF 4	400.00	1258.47	1259.45	1260.27	1262.52	0.175202	14.06	28.46	32.87	2.66
3	523.*	PF 1	1600.00	1258.22	1260.74	1262.24	1265.83	0.098666	18.10	88.42	45.16	2.28
3	523.*	PF 2	1200.00	1258.22	1260.30	1261.64	1264.96	0.112341	17.34	69.22	41.63	2.37
3	523.*	PF 3	800.00	1258.22	1259.79	1260.93	1263.90	0.135578	16.26	49.20	37.58	2.50
3	523.*	PF 4	400.00	1258.22	1259.20	1260.02	1262.33	0.180657	14.20	28.17	32.80	2.70
3	522.*	PF 1	1600.00	1257.97	1260.47	1261.99	1265.69	0.102449	18.34	87.26	44.96	2.32
3	522.*	PF 2	1200.00	1257.97	1260.03	1261.39	1264.81	0.116595	17.56	68.34	41.45	2.41
3	522.*	PF 3	800.00	1257.97	1259.53	1260.68	1263.73	0.140429	16.45	48.62	37.46	2.54

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	522.*	PF 4	400.00	1257.97	1258.94	1259.77	1262.12	0.185592	14.32	27.92	32.74	2.73
3	521.*	PF 1	1600.00	1257.72	1260.19	1261.74	1265.54	0.106148	18.56	86.19	44.77	2.36
3	521.*	PF 2	1200.00	1257.72	1259.76	1261.14	1264.66	0.120747	17.77	67.52	41.30	2.45
3	521.*	PF 3	800.00	1257.72	1259.26	1260.43	1263.56	0.145090	16.64	48.09	37.34	2.58
3	521.*	PF 4	400.00	1257.72	1258.68	1259.52	1261.92	0.190285	14.44	27.70	32.68	2.76
3	520.*	PF 1	1600.00	1257.47	1259.92	1261.49	1265.40	0.109774	18.78	85.19	44.59	2.39
3	520.*	PF 2	1200.00	1257.47	1259.49	1260.89	1264.51	0.124781	17.97	66.76	41.15	2.49
3	520.*	PF 3	800.00	1257.47	1259.00	1260.18	1263.39	0.149569	16.81	47.60	37.24	2.62
3	520.*	PF 4	400.00	1257.47	1258.43	1259.27	1261.71	0.194264	14.54	27.51	32.64	2.79
3	519.*	PF 1	1600.00	1257.22	1259.65	1261.24	1265.25	0.113285	18.99	84.26	44.42	2.43
3	519.*	PF 2	1200.00	1257.22	1259.22	1260.64	1264.35	0.128641	18.16	66.07	41.01	2.52
3	519.*	PF 3	800.00	1257.22	1258.74	1259.93	1263.21	0.153831	16.97	47.15	37.14	2.65
3	519.*	PF 4	400.00	1257.22	1258.17	1259.02	1261.50	0.198345	14.64	27.32	32.59	2.82
3	518.*	PF 1	1600.00	1256.97	1259.38	1260.98	1265.10	0.116739	19.19	83.38	44.26	2.46
3	518.*	PF 2	1200.00	1256.97	1258.96	1260.39	1264.18	0.132450	18.35	65.41	40.88	2.56
3	518.*	PF 3	800.00	1256.97	1258.48	1259.68	1263.03	0.157929	17.12	46.73	37.05	2.69
3	518.*	PF 4	400.00	1256.97	1257.91	1258.77	1261.28	0.202191	14.73	27.15	32.55	2.84
3	517.*	PF 1	1600.00	1256.72	1259.11	1260.74	1264.94	0.120123	19.38	82.56	44.11	2.50
3	517.*	PF 2	1200.00	1256.72	1258.69	1260.14	1264.02	0.136159	18.52	64.79	40.76	2.59
3	517.*	PF 3	800.00	1256.72	1258.22	1259.43	1262.84	0.161930	17.26	46.34	36.96	2.72
3	517.*	PF 4	400.00	1256.72	1257.66	1258.52	1261.07	0.205757	14.82	27.00	32.51	2.87
3	516.*	PF 1	1600.00	1256.47	1258.84	1260.49	1264.78	0.123234	19.55	81.83	43.98	2.53
3	516.*	PF 2	1200.00	1256.47	1258.43	1259.89	1263.85	0.139783	18.69	64.21	40.65	2.62
3	516.*	PF 3	800.00	1256.47	1257.96	1259.18	1262.65	0.165389	17.39	46.01	36.89	2.74
3	516.*	PF 4	400.00	1256.47	1257.40	1258.27	1260.85	0.209117	14.90	26.85	32.48	2.89
3	515	PF 1	1600.00	1256.22	1258.58	1260.24	1264.62	0.126393	19.73	81.11	43.85	2.56
3	515	PF 2	1200.00	1256.22	1258.16	1259.64	1263.67	0.143037	18.84	63.70	40.55	2.65
3	515	PF 3	800.00	1256.22	1257.70	1258.93	1262.46	0.168983	17.51	45.68	36.82	2.77
3	515	PF 4	400.00	1256.22	1257.15	1258.02	1260.64	0.212835	14.98	26.70	32.44	2.91
3	514.*	PF 1	1600.00	1256.22	1258.57	1260.19	1264.38	0.121254	19.35	82.69	44.62	2.50

← USED TO OBTAIN APRON LENGTH

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	514.*	PF 2	1200.00	1256.22	1258.16	1259.60	1263.40	0.135068	18.37	65.33	41.39	2.58
3	514.*	PF 3	800.00	1256.22	1257.71	1258.89	1262.13	0.154170	16.87	47.43	37.77	2.65
3	514.*	PF 4	400.00	1256.22	1257.19	1257.99	1260.20	0.174730	13.93	28.72	33.57	2.65
3	513.*	PF 1	1600.00	1256.22	1258.56	1260.14	1264.15	0.116171	18.97	84.33	45.39	2.45
3	513.*	PF 2	1200.00	1256.22	1258.16	1259.55	1263.16	0.127891	17.93	66.93	42.21	2.51
3	513.*	PF 3	800.00	1256.22	1257.73	1258.85	1261.83	0.140558	16.25	49.24	38.72	2.54
3	513.*	PF 4	400.00	1256.22	1257.22	1257.96	1259.84	0.144409	12.98	30.81	34.70	2.43
3	512.*	PF 1	1600.00	1256.22	1258.55	1260.09	1263.93	0.111347	18.61	85.99	46.18	2.40
3	512.*	PF 2	1200.00	1256.22	1258.16	1259.51	1262.92	0.121129	17.50	68.56	43.05	2.44
3	512.*	PF 3	800.00	1256.22	1257.74	1258.82	1261.55	0.128209	15.65	51.12	39.68	2.43
3	512.*	PF 4	400.00	1256.22	1257.27	1257.93	1259.52	0.117836	12.05	33.20	35.88	2.21
3	511.*	PF 1	1600.00	1256.22	1258.55	1260.04	1263.72	0.106674	18.25	87.69	46.97	2.35
3	511.*	PF 2	1200.00	1256.22	1258.16	1259.46	1262.70	0.114883	17.09	70.20	43.89	2.38
3	511.*	PF 3	800.00	1256.22	1257.76	1258.78	1261.29	0.116914	15.08	53.06	40.65	2.33
3	511.*	PF 4	400.00	1256.22	1258.75	1257.90	1259.01	0.004914	4.10	97.44	48.61	0.51
3	510.*	PF 1	1600.00	1256.22	1258.55	1260.00	1263.50	0.101566	17.86	89.60	47.79	2.30
3	510.*	PF 2	1200.00	1256.22	1258.17	1259.42	1262.47	0.107892	16.65	72.09	44.77	2.31
3	510.*	PF 3	800.00	1256.22	1257.78	1258.75	1261.05	0.106417	14.52	55.09	41.62	2.22
3	510.*	PF 4	400.00	1256.22	1258.75		1259.00	0.004682	4.02	99.52	49.43	0.50
3	509.*	PF 1	1600.00	1256.21	1258.53	1259.94	1263.32	0.098078	17.56	91.10	48.54	2.26
3	509.*	PF 2	1200.00	1256.21	1258.16	1259.37	1262.28	0.102633	16.28	73.71	45.59	2.26
3	509.*	PF 3	800.00	1256.21	1259.91	1258.70	1260.27	0.004415	4.83	165.58	59.55	0.51
3	509.*	PF 4	400.00	1256.21	1258.75		1258.99	0.004391	3.91	102.19	50.33	0.48
3	508.*	PF 1	1600.00	1256.21	1258.53	1259.90	1263.12	0.093488	17.20	93.05	49.38	2.21
3	508.*	PF 2	1200.00	1256.21	1258.17	1259.33	1262.07	0.096393	15.85	75.69	46.48	2.19
3	508.*	PF 3	800.00	1256.21	1259.91		1260.26	0.004220	4.74	168.79	60.41	0.50
3	508.*	PF 4	400.00	1256.21	1258.75		1258.98	0.004187	3.83	104.33	51.17	0.47
3	507.*	PF 1	1600.00	1256.21	1258.53	1259.86	1262.94	0.089298	16.85	94.96	50.21	2.16
3	507.*	PF 2	1200.00	1256.21	1260.80	1259.30	1261.22	0.004044	5.24	229.17	68.31	0.50
3	507.*	PF 3	800.00	1256.21	1259.91		1260.25	0.004040	4.65	171.94	61.25	0.49
3	507.*	PF 4	400.00	1256.21	1258.75		1258.97	0.004003	3.76	106.42	52.00	0.46

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	506.*	PF 1	1600.00	1256.21	1261.54	1259.82	1262.02	0.003882	5.59	286.42	75.07	0.50
3	506.*	PF 2	1200.00	1256.21	1260.80		1261.21	0.003879	5.15	233.20	69.17	0.49
3	506.*	PF 3	800.00	1256.21	1259.91		1260.24	0.003869	4.57	175.14	62.10	0.48
3	506.*	PF 4	400.00	1256.21	1258.75		1258.97	0.003826	3.68	108.56	52.84	0.45
3	505.*	PF 1	1600.00	1256.21	1261.54		1262.01	0.003732	5.50	291.12	75.93	0.49
3	505.*	PF 2	1200.00	1256.21	1260.80		1261.20	0.003724	5.06	237.21	70.03	0.48
3	505.*	PF 3	800.00	1256.21	1259.91		1260.23	0.003708	4.49	178.33	62.95	0.47
3	505.*	PF 4	400.00	1256.21	1258.75		1258.96	0.003662	3.61	110.69	53.68	0.44
3	504.*	PF 1	1600.00	1256.21	1261.54		1262.00	0.003594	5.41	295.75	76.79	0.49
3	504.*	PF 2	1200.00	1256.21	1260.80		1261.19	0.003581	4.98	241.16	70.88	0.48
3	504.*	PF 3	800.00	1256.21	1259.92		1260.22	0.003561	4.41	181.47	63.79	0.46
3	504.*	PF 4	400.00	1256.21	1258.75		1258.95	0.003510	3.55	112.78	54.50	0.43
3	503.*	PF 1	1600.00	1256.21	1261.54		1261.98	0.003460	5.33	300.44	77.65	0.48
3	503.*	PF 2	1200.00	1256.21	1260.80		1261.18	0.003443	4.89	245.17	71.74	0.47
3	503.*	PF 3	800.00	1256.21	1259.92		1260.21	0.003419	4.33	184.66	64.64	0.45
3	503.*	PF 4	400.00	1256.21	1258.75		1258.94	0.003365	3.48	114.91	55.34	0.43
3	502.*	PF 1	1600.00	1256.21	1261.55		1261.97	0.003334	5.24	305.13	78.52	0.47
3	502.*	PF 2	1200.00	1256.21	1260.81		1261.17	0.003314	4.82	249.17	72.59	0.46
3	502.*	PF 3	800.00	1256.21	1259.92		1260.20	0.003285	4.26	187.85	65.49	0.44
3	502.*	PF 4	400.00	1256.21	1258.75		1258.94	0.003229	3.42	117.04	56.18	0.42
3	501.*	PF 1	1600.00	1256.21	1261.55		1261.96	0.003218	5.17	309.70	79.36	0.46
3	501.*	PF 2	1200.00	1256.21	1260.81		1261.16	0.003194	4.74	253.06	73.43	0.45
3	501.*	PF 3	800.00	1256.21	1259.92		1260.19	0.003162	4.19	190.95	66.32	0.44
3	501.*	PF 4	400.00	1256.21	1258.75		1258.93	0.003104	3.36	119.11	57.00	0.41
3	500.*	PF 1	1600.00	1256.21	1261.55		1261.95	0.003104	5.09	314.37	80.21	0.45
3	500.*	PF 2	1200.00	1256.21	1260.81		1261.15	0.003079	4.67	257.05	74.28	0.44
3	500.*	PF 3	800.00	1256.21	1259.92		1260.18	0.003043	4.12	194.13	67.16	0.43
3	500.*	PF 4	400.00	1256.21	1258.75		1258.92	0.002983	3.30	121.23	57.84	0.40
3	499.*	PF 1	1600.00	1256.21	1261.55		1261.94	0.002997	5.01	319.05	81.07	0.45
3	499.*	PF 2	1200.00	1256.21	1260.81		1261.14	0.002969	4.60	261.04	75.13	0.43

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	499.*	PF 3	800.00	1256.21	1259.92		1260.18	0.002931	4.05	197.31	68.01	0.42
3	499.*	PF 4	400.00	1256.21	1258.75		1258.92	0.002870	3.24	123.35	58.68	0.39
3	498.*	PF 1	1600.00	1256.21	1261.56		1261.94	0.002897	4.94	323.64	81.93	0.44
3	498.*	PF 2	1200.00	1256.21	1260.81		1261.13	0.002867	4.53	264.96	75.98	0.43
3	498.*	PF 3	800.00	1256.21	1259.92		1260.17	0.002827	3.99	200.42	68.85	0.41
3	498.*	PF 4	400.00	1256.21	1258.75		1258.91	0.002765	3.19	125.43	59.50	0.39
3	497.*	PF 1	1600.00	1256.20	1261.56		1261.93	0.002778	4.86	329.23	82.87	0.43
3	497.*	PF 2	1200.00	1256.20	1260.82		1261.12	0.002744	4.45	269.78	76.92	0.42
3	497.*	PF 3	800.00	1256.20	1259.92		1260.16	0.002697	3.91	204.35	69.78	0.40
3	497.*	PF 4	400.00	1256.20	1258.75		1258.90	0.002624	3.12	128.19	60.42	0.38
3	496.*	PF 1	1600.00	1256.20	1261.56		1261.92	0.002687	4.79	333.89	83.73	0.42
3	496.*	PF 2	1200.00	1256.20	1260.82		1261.12	0.002651	4.38	273.76	77.77	0.41
3	496.*	PF 3	800.00	1256.20	1259.92		1260.15	0.002603	3.85	207.52	70.63	0.40
3	496.*	PF 4	400.00	1256.20	1258.75		1258.90	0.002530	3.07	130.32	61.26	0.37
3	495.*	PF 1	1600.00	1256.20	1261.56		1261.91	0.002601	4.73	338.49	84.58	0.42
3	495.*	PF 2	1200.00	1256.20	1260.82		1261.11	0.002564	4.32	277.68	78.62	0.41
3	495.*	PF 3	800.00	1256.20	1259.92		1260.15	0.002516	3.80	210.65	71.46	0.39
3	495.*	PF 4	400.00	1256.20	1258.75		1258.89	0.002442	3.02	132.40	62.09	0.36
3	494.*	PF 1	1600.00	1256.20	1261.56		1261.90	0.002519	4.66	343.14	85.43	0.41
3	494.*	PF 2	1200.00	1256.20	1260.82		1261.10	0.002481	4.26	281.66	79.46	0.40
3	494.*	PF 3	800.00	1256.20	1259.93		1260.14	0.002431	3.74	213.82	72.31	0.38
3	494.*	PF 4	400.00	1256.20	1258.75		1258.89	0.002358	2.97	134.52	62.92	0.36
3	493.*	PF 1	1600.00	1256.20	1261.57		1261.90	0.002440	4.60	347.79	86.29	0.40
3	493.*	PF 2	1200.00	1256.20	1260.82		1261.09	0.002401	4.20	285.63	80.31	0.39
3	493.*	PF 3	800.00	1256.20	1259.93		1260.14	0.002350	3.69	216.99	73.15	0.38
3	493.*	PF 4	400.00	1256.20	1258.75		1258.89	0.002277	2.93	136.64	63.76	0.35
3	492.*	PF 1	1600.00	1256.20	1261.57		1261.89	0.002366	4.54	352.32	87.12	0.40
3	492.*	PF 2	1200.00	1256.20	1260.82		1261.09	0.002327	4.15	289.50	81.14	0.39
3	492.*	PF 3	800.00	1256.20	1259.93		1260.13	0.002275	3.63	220.09	73.98	0.37
3	492.*	PF 4	400.00	1256.20	1258.75		1258.88	0.002203	2.88	138.71	64.58	0.35

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	491.*	PF 1	1600.00	1256.20	1261.57		1261.88	0.002295	4.48	356.96	87.97	0.39
3	491.*	PF 2	1200.00	1256.20	1260.82		1261.08	0.002254	4.09	293.47	81.99	0.38
3	491.*	PF 3	800.00	1256.20	1259.93		1260.13	0.002202	3.58	223.25	74.82	0.37
3	491.*	PF 4	400.00	1256.20	1258.75		1258.88	0.002130	2.84	140.83	65.42	0.34
3	490.*	PF 1	1600.00	1256.20	1261.57		1261.87	0.002226	4.42	361.60	88.82	0.39
3	490.*	PF 2	1200.00	1256.20	1260.82		1261.08	0.002185	4.03	297.44	82.84	0.38
3	490.*	PF 3	800.00	1256.20	1259.93		1260.12	0.002132	3.53	226.42	75.67	0.36
3	490.*	PF 4	400.00	1256.20	1258.75		1258.87	0.002061	2.80	142.95	66.25	0.34
3	489.*	PF 1	1600.00	1256.20	1261.57		1261.87	0.002161	4.37	366.18	89.67	0.38
3	489.*	PF 2	1200.00	1256.20	1260.82		1261.07	0.002120	3.98	301.34	83.68	0.37
3	489.*	PF 3	800.00	1256.20	1259.93		1260.12	0.002067	3.49	229.53	76.50	0.35
3	489.*	PF 4	400.00	1256.20	1258.75		1258.87	0.001996	2.76	145.03	67.08	0.33
3	488.*	PF 1	1600.00	1256.20	1261.57		1261.86	0.002099	4.31	370.81	90.52	0.38
3	488.*	PF 2	1200.00	1256.20	1260.83		1261.06	0.002057	3.93	305.30	84.53	0.36
3	488.*	PF 3	800.00	1256.20	1259.93		1260.11	0.002004	3.44	232.69	77.35	0.35
3	488.*	PF 4	400.00	1256.20	1258.75		1258.87	0.001934	2.72	147.15	67.92	0.33
3	487.*	PF 1	1600.00	1256.20	1261.57		1261.86	0.002039	4.26	375.44	91.37	0.37
3	487.*	PF 2	1200.00	1256.20	1260.83		1261.06	0.001996	3.88	309.25	85.38	0.36
3	487.*	PF 3	800.00	1256.20	1259.93		1260.11	0.001943	3.39	235.84	78.19	0.34
3	487.*	PF 4	400.00	1256.20	1258.75		1258.86	0.001874	2.68	149.26	68.75	0.32
3	486.*	PF 1	1600.00	1256.20	1261.58		1261.85	0.001982	4.21	380.00	92.22	0.37
3	486.*	PF 2	1200.00	1256.20	1260.83		1261.05	0.001940	3.83	313.15	86.22	0.35
3	486.*	PF 3	800.00	1256.20	1259.93		1260.10	0.001887	3.35	238.95	79.03	0.34
3	486.*	PF 4	400.00	1256.20	1258.75		1258.86	0.001818	2.64	151.34	69.58	0.32
3	485.*	PF 1	1600.00	1256.19	1261.58		1261.85	0.001914	4.15	385.38	93.08	0.36
3	485.*	PF 2	1200.00	1256.19	1260.83		1261.05	0.001870	3.78	317.86	87.08	0.35
3	485.*	PF 3	800.00	1256.19	1259.93		1260.10	0.001814	3.29	242.84	79.90	0.33
3	485.*	PF 4	400.00	1256.19	1258.75		1258.85	0.001739	2.60	154.14	70.46	0.31
3	484.*	PF 1	1600.00	1256.19	1261.58		1261.84	0.001864	4.10	390.01	94.00	0.35
3	484.*	PF 2	1200.00	1256.19	1260.83		1261.04	0.001817	3.73	321.81	87.93	0.34
3	484.*	PF 3	800.00	1256.19	1259.93		1260.09	0.001762	3.25	245.99	80.74	0.33

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	484 *	PF 4	400.00	1256.19	1258.75		1258.85	0.001688	2.56	156.26	71.30	0.30
3	483 *	PF 1	1600.00	1256.19	1261.58		1261.83	0.001817	4.06	394.53	94.92	0.35
3	483 *	PF 2	1200.00	1256.19	1260.83		1261.04	0.001768	3.68	325.67	88.75	0.34
3	483 *	PF 3	800.00	1256.19	1259.93		1260.09	0.001713	3.21	249.08	81.56	0.32
3	483 *	PF 4	400.00	1256.19	1258.75		1258.85	0.001640	2.53	158.33	72.12	0.30
3	482 *	PF 1	1600.00	1256.19	1261.58		1261.83	0.001769	4.01	399.16	95.80	0.35
3	482 *	PF 2	1200.00	1256.19	1260.83		1261.04	0.001720	3.64	329.62	89.60	0.33
3	482 *	PF 3	800.00	1256.19	1259.93		1260.09	0.001664	3.17	252.24	82.40	0.32
3	482 *	PF 4	400.00	1256.19	1258.75		1258.84	0.001593	2.49	160.45	72.95	0.30
3	481 *	PF 1	1600.00	1256.19	1261.58		1261.83	0.001721	3.96	403.78	96.63	0.34
3	481 *	PF 2	1200.00	1256.19	1260.83		1261.03	0.001673	3.60	333.57	90.44	0.33
3	481 *	PF 3	800.00	1256.19	1259.93		1260.08	0.001618	3.13	255.40	83.24	0.32
3	481 *	PF 4	400.00	1256.19	1258.75		1258.84	0.001548	2.46	162.58	73.79	0.29
3	480 *	PF 1	1600.00	1256.19	1261.58		1261.82	0.001676	3.92	408.34	97.41	0.34
3	480 *	PF 2	1200.00	1256.19	1260.83		1261.03	0.001630	3.56	337.48	91.29	0.33
3	480 *	PF 3	800.00	1256.19	1259.93		1260.08	0.001575	3.09	258.51	84.08	0.31
3	480 *	PF 4	400.00	1256.19	1258.75		1258.84	0.001505	2.43	164.66	74.62	0.29
3 ENDS	479	PF 1	1600.00	1256.19	1261.58		1261.82	0.001043	3.87	412.97	98.14	0.33
3 APRON	479	PF 2	1200.00	1256.19	1260.83		1261.02	0.001015	3.51	341.46	92.13	0.32
3	479	PF 3	800.00	1256.19	1259.93		1260.08	0.000981	3.06	261.69	84.92	0.31
3	479	PF 4	400.00	1256.19	1258.75		1258.84	0.000936	2.40	166.81	75.46	0.28
3	464	PF 1	1600.00	1256.18	1261.60		1261.78	0.000751	3.38	474.07	120.01	0.30
3	464	PF 2	1200.00	1256.18	1260.84		1260.99	0.000751	3.10	386.49	110.91	0.29
3	464	PF 3	800.00	1256.18	1259.93		1260.05	0.000750	2.75	290.75	100.02	0.28
3	464	PF 4	400.00	1256.18	1258.74		1258.82	0.000751	2.22	180.19	85.73	0.27
3	417.6*	PF 1	1600.00	1256.15	1261.56		1261.74	0.000754	3.38	473.43	119.95	0.30
3	417.6*	PF 2	1200.00	1256.15	1260.80		1260.95	0.000754	3.11	385.89	110.84	0.29
3	417.6*	PF 3	800.00	1256.15	1259.90		1260.01	0.000754	2.76	290.22	99.95	0.29
3	417.6*	PF 4	400.00	1256.15	1258.71		1258.78	0.000757	2.23	179.73	85.66	0.27
3	371.2*	PF 1	1600.00	1256.11	1261.53		1261.70	0.000751	3.38	474.06	120.01	0.30

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	371.2*	PF 2	1200.00	1256.11	1260.77		1260.92	0.000751	3.10	386.48	110.91	0.29
3	371.2*	PF 3	800.00	1256.11	1259.86		1259.98	0.000750	2.75	290.75	100.02	0.28
3	371.2*	PF 4	400.00	1256.11	1258.67		1258.75	0.000751	2.22	180.18	85.73	0.27
3	324.8*	PF 1	1600.00	1256.08	1261.49		1261.67	0.000754	3.38	473.41	119.95	0.30
3	324.8*	PF 2	1200.00	1256.08	1260.73		1260.88	0.000754	3.11	385.88	110.84	0.29
3	324.8*	PF 3	800.00	1256.08	1259.83		1259.94	0.000754	2.76	290.22	99.95	0.29
3	324.8*	PF 4	400.00	1256.08	1258.64		1258.71	0.000757	2.23	179.72	85.66	0.27
3	278.4*	PF 1	1600.00	1256.04	1261.46		1261.63	0.000751	3.38	474.03	120.01	0.30
3	278.4*	PF 2	1200.00	1256.04	1260.70		1260.85	0.000751	3.11	386.45	110.90	0.29
3	278.4*	PF 3	800.00	1256.04	1259.79		1259.91	0.000750	2.75	290.74	100.01	0.28
3	278.4*	PF 4	400.00	1256.04	1258.60		1258.68	0.000751	2.22	180.15	85.72	0.27
3	232.*	PF 1	1600.00	1256.01	1261.42		1261.60	0.000754	3.38	473.38	119.94	0.30
3	232.*	PF 2	1200.00	1256.01	1260.66		1260.81	0.000754	3.11	385.85	110.84	0.29
3	232.*	PF 3	800.00	1256.01	1259.76		1259.87	0.000754	2.76	290.21	99.95	0.29
3	232.*	PF 4	400.00	1256.01	1258.57		1258.64	0.000757	2.23	179.69	85.66	0.27
3	185.6*	PF 1	1600.00	1255.97	1261.39		1261.56	0.000751	3.38	474.01	120.01	0.30
3	185.6*	PF 2	1200.00	1255.97	1260.63		1260.78	0.000751	3.11	386.43	110.90	0.29
3	185.6*	PF 3	800.00	1255.97	1259.72		1259.84	0.000750	2.75	290.74	100.01	0.28
3	185.6*	PF 4	400.00	1255.97	1258.53		1258.61	0.000752	2.22	180.13	85.72	0.27
3	139.2*	PF 1	1600.00	1255.93	1261.35		1261.53	0.000748	3.37	474.64	120.07	0.30
3	139.2*	PF 2	1200.00	1255.93	1260.59		1260.74	0.000748	3.10	387.02	110.96	0.29
3	139.2*	PF 3	800.00	1255.93	1259.69		1259.80	0.000746	2.75	291.26	100.08	0.28
3	139.2*	PF 4	400.00	1255.93	1258.50		1258.57	0.000746	2.22	180.58	85.78	0.27
3	92.8*	PF 1	1600.00	1255.90	1261.32		1261.49	0.000751	3.38	474.01	120.01	0.30
3	92.8*	PF 2	1200.00	1255.90	1260.56		1260.71	0.000751	3.11	386.45	110.90	0.29
3	92.8*	PF 3	800.00	1255.90	1259.65		1259.77	0.000750	2.75	290.75	100.02	0.28
3	92.8*	PF 4	400.00	1255.90	1258.46		1258.54	0.000752	2.22	180.14	85.72	0.27
3	46.3999*	PF 1	1600.00	1255.86	1261.28		1261.46	0.000748	3.37	474.66	120.07	0.30
3	46.3999*	PF 2	1200.00	1255.86	1260.52		1260.67	0.000748	3.10	387.04	110.97	0.29
3	46.3999*	PF 3	800.00	1255.86	1259.62		1259.73	0.000746	2.75	291.30	100.08	0.28
3	46.3999*	PF 4	400.00	1255.86	1258.43		1258.50	0.000746	2.21	180.60	85.79	0.27

HEC-RAS Plan: 6.25' Drop River: 1 Reach: 3 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
3	0	PF 1	1600.00	1255.83	1261.25	1258.50	1261.43	0.000751	3.37	474.09	120.01	0.30
3	0	PF 2	1200.00	1255.83	1260.49	1258.07	1260.64	0.000751	3.11	386.45	110.90	0.29
3	0	PF 3	800.00	1255.83	1259.58	1257.58	1259.70	0.000750	2.75	290.72	100.01	0.28
3	0	PF 4	400.00	1255.83	1258.39	1256.96	1258.47	0.000751	2.22	180.16	85.72	0.27

KIRKHAM MICHAEL

Client: FCDMC
Project: North Inlet Channel
Calculated By: BJL, JKK
Checked By: BJL

100% Construction Cost Estimate - 10/26/2005

Item No.			Description	Unit	Quantity	Unit Cost	Amount
105	-	1	Partnering Allowance	LS	1	$20,000	$20,000
107	-	1	AZPDES/SWPPP Permits	LS	1	$20,000	$20,000
107	-	2	Public Information and Notification Allowance	LS	1	$20,000	$20,000
107	-	3	Project Signs Allowance	LS	1	$4,000	$4,000
107	-	4	Water Management	LS	1	$50,000	$50,000
201	-	1	Clearing & Grubbing	AC	26	$250	$6,500
202	-	1	Mobilization	LS	1	$75,000	$75,000
215	-	1	NIC South Interim Channel Excavation	CY	14,624	$6	$87,744
215	-	2	North Inlet Channel Excavation	CY	238,000	$6.0	$1,428,000
215	-	3	Beardsley Canal Wash Excavation	CY	7,073	$6.0	$42,438
220	-	1	Plain Dumped Rip Rap (D_{50} = 18")	CY	1,690	$50	$84,500
221	-	1	9" Reno Mattress	SY	10,001	$20	$200,020
222	-	1	Soil Cement Bank Protection at Cholla Wash	CY	4,367	$62	$270,754
310	-	1	ABC (4") (O&M Access Roads & Ramps)	SY	18,385	$3	$55,155
336	-	1	Asphalt Pavement Replacement	SY	318	$20	$6,360
336	-	2	New Survey Marker	EA	4	$250	$1,000
344	-	1	Decomposed Granite Road Surface	SY	18,385	$4	$73,540
350	-	1	Removal of Beardsley Canal at Northern Avenue	LF	226	$25	$5,650
350	-	2	Removal of Beardsley Canal at Olive Avenue	LF	194	$25	$4,850
350	-	3	Removal of Beardsley Turnout Canal at Olive Avenue	LF	240	$10	$2,400
350	-	4	Remove 2-60" CMP's at Northern Avenue	LSUM	1	$300	$300
350	-	5	Removal of Asphalt Pavement at Olive Avenue	SY	318	$5	$1,590
350	-	6	Remove Canal Maintenance Road Gates	EA	3	$750	$2,250
350	-	7	Remove/Replace FRS#3 Channel Gate	EA	1	$1,000	$1,000
350	-	9	Removal and Disposal of Inert Material Allowance	TON	250	$45	$11,250
350	-	10	Removal and Disposal of Non-Inert Material Allowance	TON	350	$80	$28,000
401	-	1	Detour at Northern Avenue	LSUM	1	$40,000	$40,000
401	-	2	Detour at Olive Avenue	LSUM	1	$80,000	$80,000
415	-	1	Guardrail (MAG STD. DET. 135)	LF	313	$25	$7,825
430	-	1	Native Seeding	AC	17	$3,000	$51,000
430	-	2	Soil Amendment Allowance	LS	1	$10,000	$10,000
505	-	1	Sideweir Inlet to Diversion Culvert at Olive Ave	LSUM	1	$191,572	$191,572
505	-	2	Diversion Culvert, Outlet Headwall, Wingwalls & Apron at Olive Avenue	LSUM	1	$481,433	$481,433
505	-	3	Diversion Culvert, Inlet & Outlet Headwalls, Wingwalls & Outlet Apron at Northern Avenue	LSUM	1	$783,762	$783,762
505	-	4	Wash Culvert, Outlet Headwall, Wingwalls & Apron at Northern Avenue	LSUM	1	$316,930	$316,930
505	-	5	Inlet Structure to Wash Culvert at Northern Avenue	LSUM	1	$107,260	$107,260
505	-	6	Pre-Cast Slab Crossing over Turnout Canal at Olive Avenue	LSUM	1	$10,000	$10,000
505	-	7	Beardsley Canal Lining at Olive Avenue	LF	240	$200	$48,000
505	-	8	Turnout Canal Lining At Olive Avenue	LF	194	$75	$14,550
505	-	9	Beardsley Canal Lining at Northern Avenue	LF	226	$200	$45,200
507	-	1	Drop Structure (H=6.25')	LSUM	1	$209,458	$209,458
507	-	2	Drop Structure (H=4.50')	LSUM	2	$111,200	$222,400
507	-	3	Drop Structure (H=3.50')	LSUM	5	$87,869	$439,345
520	-	1	Handrail	LF	1,438	$30	$43,140
520	-	2	Canal Security Gate	EA	2	$2,500	$5,000

Total Construction Cost **$5,609,176**

	NIC South Interim Channel End-Area Quantity Calculation				
	See "k:\0406915-nic\CADD\Plans\Xsec\FRS3_South.dgn"				
		CUT VOLUME			
	STA	CY			
	55000	2167			
	54900	4007			
	54800	3119	sheet C6 total =	9293	cy
	54700	2069			
	54600	1074			
	54500	580			
	54400	564			
	54300	460			
	54200	324	sheet C5 total =	5071	cy
	54100	196			
	54000	64			
	53900	0	sheet C4 total =	260	cy
			Total Exc.	14624	cy

KIRKHAM MICHAEL
CONSULTING ENGINEERS
9201 North 25th Avenue • Suite 195 • Phoenix, AZ 85021

Job number:

Sheet ____ of ____

Project: NIC-North

Date: 10/24/05

Subject:

Designed: BOC

Checked:

NIC South Interim Channel

Native Seeding -

STA	WIDTH	AREA (Ac)	SHEET QTY
539	0'	0.05	
540	40'	0.10	0.15
541	50'	0.11	
542	50'	0.13	
543	60'	0.14	
544	60'	0.14	0.96
545	60'	0.18	
546	100'	0.26	
547	130'	0.30	
548	130'	0.35	0.65
549+04	160'		

KIRKHAM MICHAEL

Client: FCDMC
Project: North Inlet Channel
Calculated By: ACC, JKK
Checked By: BJL
10/26/05

Roadway Crossing Structures

OLIVE AVE. DIVERSION STRUCTURE

2- 10' x 5' x 320' at 40° Skew and 2:1 Side Slope

Item No.			Description	Unit	Quantity	Unit Cost	Amount
215	-	1	Excavation	CY	11300.0	$8.00	$90,400
206	-	2	Backfill	CY	1235.0	$15.00	$18,525
505	-	2	Culvert Reinforced Concrete	CY	811.9	$400.00	$324,760
505	-	2	Outlet Wings/Apron Reinforced Concrete	CY	23.3	$400.00	$9,332
						Total Cost	$443,017

100% Modification to Concrete CY +97.8 +39,416

$481,433

NORTHERN AVE. DIVERSION STRUCTURE

4- 10' x 5' x 319' at 35° Skew and 2:1 Side Slope

Item No.			Description	Unit	Quantity	Unit Cost	Amount
215	-	1	Excavation	CY	12064.0	$8.00	$96,512
206	-	2	Backfill	CY	1254.0	$15.00	$18,810
505	-	3	Culvert Reinforced Concrete	CY	1556.0	$400.00	$622,400
505	-	3	Outlet Wings/Apron Reinforced Concrete	CY	45.2	$400.00	$18,064
505	-	3	Inlet Wing Reinforced Concrete	CY	13.7	$400.00	$5,496
						Total Cost	$761,282

100% Modification to Concrete CY +56.2 +22,480

$783,762

NORTHERN AVE. WASH CROSSING STRUCTURE

4- 12' x 6' x 67' at 0° Skew and 2:1 Side Slope

Item No.			Description	Unit	Quantity	Unit Cost	Amount
215	-	1	Excavation	CY	2962.0	$8.00	$23,696
206	-	2	Backfill	CY	315.3	$15.00	$4,730
505	-	4	Culvert Reinforced Concrete	CY	384.0	$400.00	$153,600
505	-	4	Outlet Wings/Apron Reinforced Concrete	CY	41.9	$400.00	$16,744
						Total Cost	$198,770

100% Modification to Concrete CY +295.4 +118,160

$316,930

KIRKHAM MICHAEL

Client: FCDMC
Project: North Inlet Channel
Calculated By: ACC, JKK
Checked By: BJL

NIC Drop Structures

3.50' DROP STRUCTURE

Grouted Boulders with Grout Cutoff Walls						
Item No.			Description	Unit	Quantity	Unit Cost	Amount
	-		Excavation	CY	547.0	$8.00	$4,376
	-		Grouted Boulders	CY	258.5	$250.00	$64,625
	-		Grout Cutoff Wall	CY	29.7	$275.00	$8,168
	-		Dumped Riprap Bank Protection	CY	214.0	$50.00	$10,700
						Total Cost	$87,869

4.50' DROP STRUCTURE

Grouted Boulders with Grout Cutoff Walls						
Item No.			Description	Unit	Quantity	Unit Cost	Amount
	-		Excavation	CY	700.0	$8.00	$5,600
	-		Grouted Boulders	CY	351.0	$250.00	$87,750
	-		Grout Cutoff Wall	CY	26.0	$275.00	$7,150
	-		Dumped Riprap Bank Protection	CY	214.0	$50.00	$10,700
						Total Cost	$111,200

6.25' DROP STRUCTURE

Grouted Boulders with Grout Cutoff Walls						
Item No.			Description	Unit	Quantity	Unit Cost	Amount
	-		Excavation	CY	1270.0	$8.00	$10,160
	-		Grouted Boulders	CY	718.9	$250.00	$179,725
	-		Grout Cutoff Wall	CY	23.9	$275.00	$6,573
	-		Dumped Riprap Bank Protection	CY	260.0	$50.00	$13,000
						Total Cost	$209,458

KIRKHAM MICHAEL

Client: FCDMC
Project: North Inlet Channel
Calculated By: ACC, JKK
Checked By: BJL

Other Structures

OLIVE AVE. SIDE WEIR

Concrete Side Weir with 150' Length							
Item No.			Description	Unit	Quantity	Unit Cost	Amount
	-		Structural Excavation	CY	2457.0	$8.00	$19,656
	-		Structural Backfill	CY	400.0	$15.00	$6,000
505	-	1	Reinforced Concrete	CY	414.8	$400.00	$165,916
						Total Cost	$191,572

NORTHERN AVE. WASH CROSSING DROP INLET

Concrete Drop							
Item No.			Description	Unit	Quantity	Unit Cost	Amount
	-		Structural Excavation	CY	977.0	$8.00	$7,816
	-		Structural Backfill	CY	268.0	$15.00	$4,020
505	-	5	Reinforced Concrete	CY	238.6	$400.00	$95,424
						Total Cost	$107,260

BEARDSLEY WASH SOIL CEMENT BANK PROTECTION

900' Length							
Item No.			Description	Unit	Quantity	Unit Cost	Amount
	-		Excavation	CY	5022	$8.00	$40,176
	-		Backfill	CY	655	$15.00	$9,826
222	-	1	Soil Cement	CY	4367	$50.00	$218,350
						Total Cost	$268,352

KIRKHAM MICHAEL
CONSULTING ENGINEERS
9201 North 25th Avenue • Suite 195 • Phoenix, AZ 85021

Job number: _____

Sheet _____ of _____

Project: NIC-North Date: 10/26/05

Subject: _____ Designed: BOL Checked: NM

Revisions to 90% Lump Sum Items

505-3 RCBC Diversion Culvert at Northern

Formerly 4-10'x5' x 336'

① Now 3-10'x5' x 392.5'

INCREASE OF 56.5'

Decrease of One Barrel

② Increase Top Slab 1/2"

Added Conjoined Headwall & Apron

① Barrel Concrete - 90% - 4.631 x 336' = 1556.0 CY

- 100% 4.067 x 392.5' = 1596.3 CY

+40.3 CY

② 1/2" Increase - $3(0.04)\frac{(392.5)}{27}$ = +17.4 CY

③ Wingwall at 90% - $\frac{9.5(0.75)(2.03+5.92)/2}{27}$ = -10.9 CY

- 6(1)95/27 -2.1 CY.

Conjoined WW @100% 4.92(1.17)(7)/27 = +1.5 CY.

Net Increase = +56.2 CY.

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CONSULTING ENGINEERS
9201 North 25th Avenue • Suite 195 • Phoenix, AZ 85021

Job number:

Sheet ____ of ____

Project: NIC - North

Date: 10/26/05

Subject:

Designed: BJ

Checked: NM

Revisions to 90% Lump Sum Items

505-4 RCBC Wash Culvert at Northern

① Formerly 4 - 12' x 6' x 66.5'

Now 4 - 12' x 6' x 117'

INCREASE OF 50.5'

③ Added Conjoined Headwall & Apron

② Increase Top Slab 1/2"

$- 48(0.04)(117)/27 = +8.3$ CY.

① Barrel Increase

$154.49\#/27 = 5.72$ CY/1 $\times 50.5 \Rightarrow +288.9$ CY.

Less Wingwall $\frac{11(1)(2+7)/2}{27} = -1.8$ CY.

Net Change $+295.4$ CY

505-2 Diversion Culvert at Olive Ave

2 - 10' x 5' x 331' RCBC

Increase Top Slab 1/2" = $20(0.04)(331)/27 = +9.8$ CY.

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CONSULTING ENGINEERS

Job Number

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 6/29/05

Subject INLET WEIR QUANTITIES Designed ACC Checked

SEE DETAIL SHEETS OF STRUCTURE
AREAS FROM CADD DRAWING

CONCRETE

BASE

AREA = 82.15 SQ FT + 49.36 SQ FT + 13.04 SQ FT = 144.55 SQ FT
LENGTH = 35.5'
VOLUME CONC = 144.55 SQ FT (35.5') = 5,131.53 CFT

WING

MIN AREA = 38.12 SQ FT
MAX AREA = 59.57 SQ FT
AVERAGE AREA = 48.85 SQ FT
LENGTH = 106.88
VOLUME = 48.85 SQ FT (106.88) = 5,220.55 CFT

END WALLS

WING AREA = 44.50 SQ FT
BASE AREA = 802.73 SQ FT
TOTAL AREA = 847.23 SQ FT
VOLUME = 847.23 SQ FT (1') = 847.23 CF

TOTAL CONC. VOLUME = 847.23 + 5,220.55 + 5,131.53 CF = 11,199.31 CF
≈ 414.79 CY

EXCAVATION

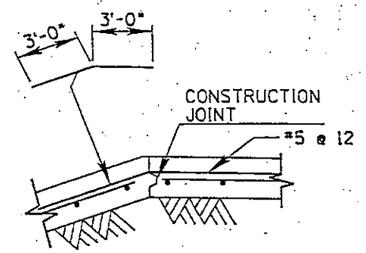
BASE

AREA = 802.73 SQ FT
LENGTH = 35.5'
VOLUME = 802.73 SQ FT (35.5') = 28,496.92 CFT

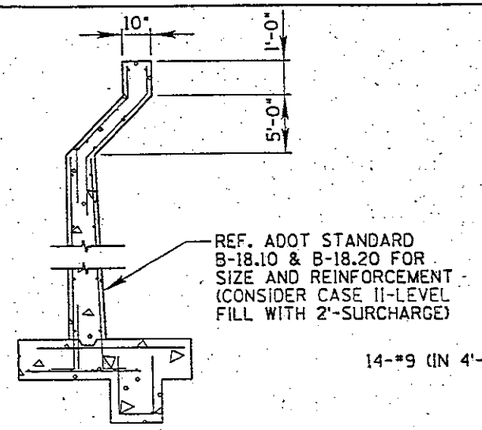
WING

MIN AREA = 81.30 SQ FT
MAX AREA = 272.69 SQ FT } AVE = 353.99 SQ FT
LENGTH = 106.88'
VOLUME 353.99 SQ FT (106.88') = 37,834.45 CFT

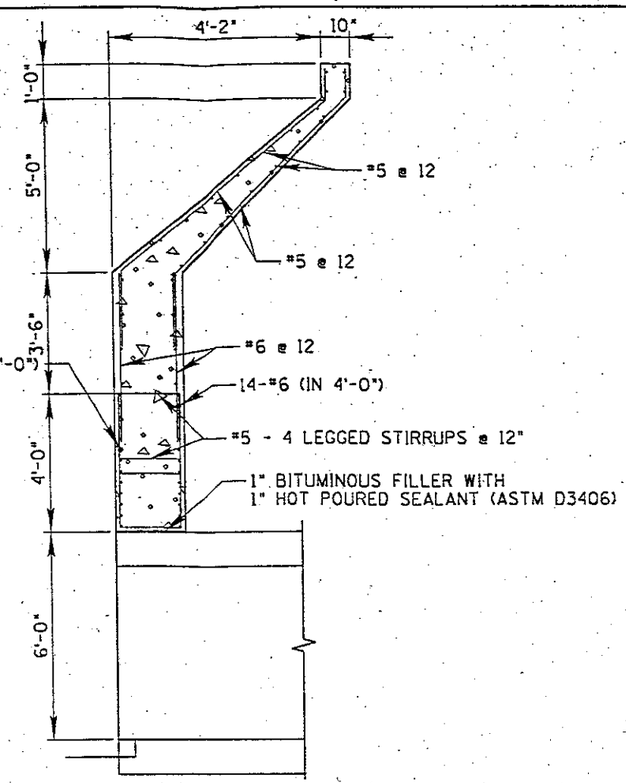
TOTAL VOLUME = 37,834.45 + 28,496.92 CFT = 66,331.37 CFT ≈ 2456.72 CY



DETAIL 2/ST2
NTS



SECTION H/ST2
NTS



SECTION G/ST2
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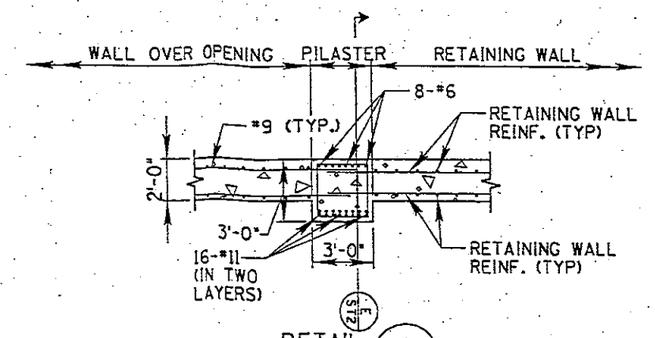

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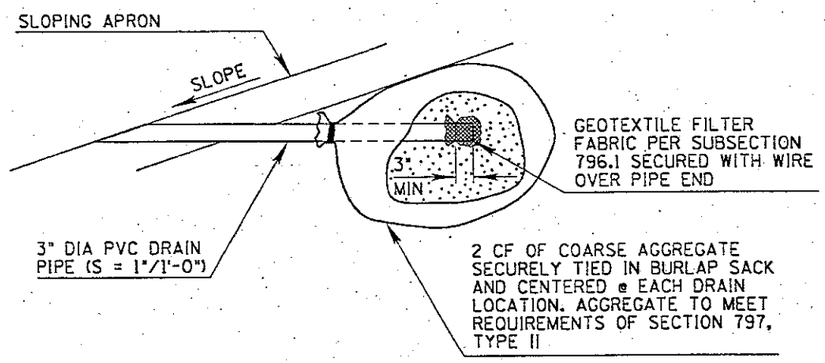
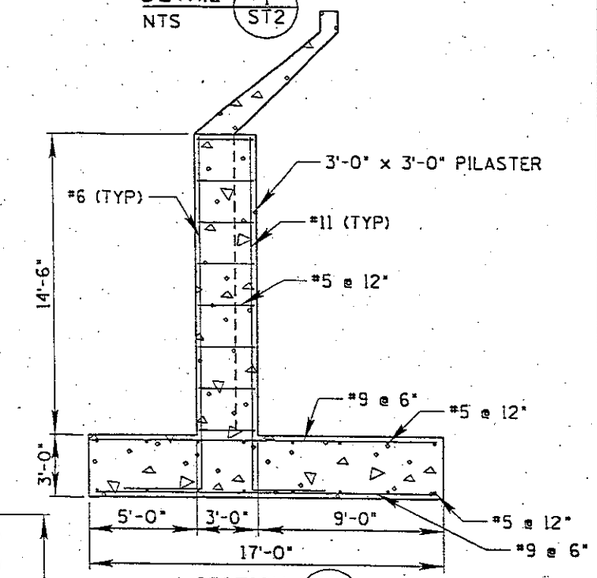
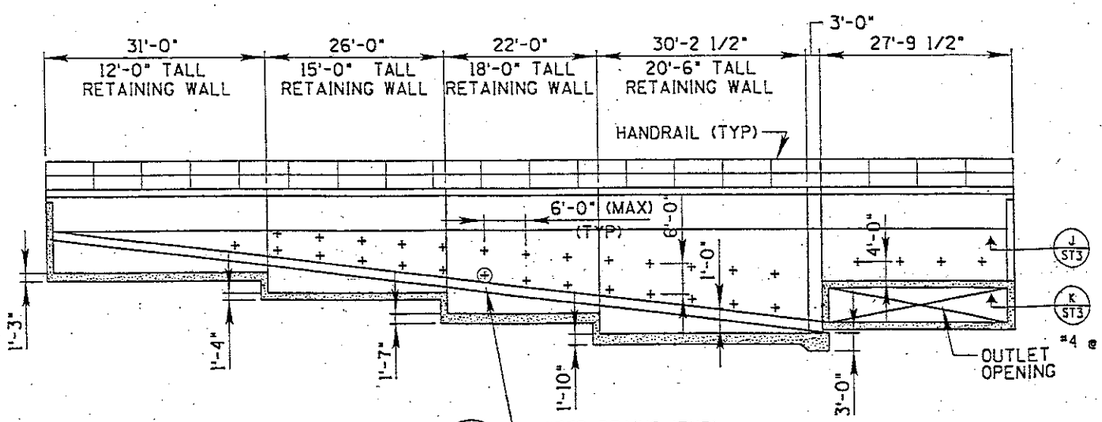


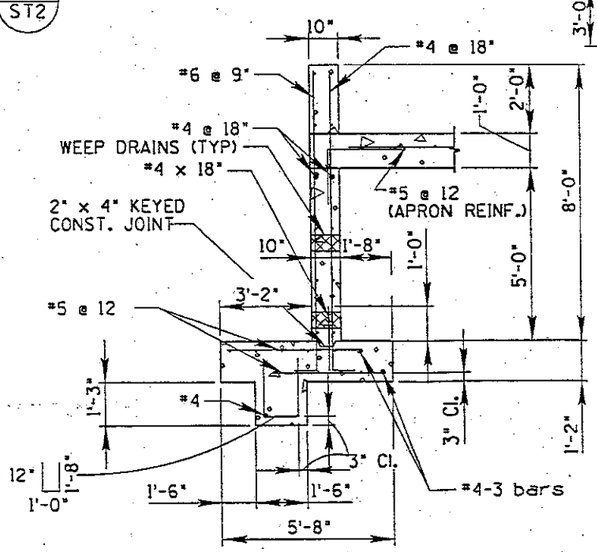
WEEP DRAIN DETAIL
NTS



SECTION E/ST2
NTS



SECTION F/ST2
NTS



SECTION D/ST2
NTS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

90%
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	ACC/JKK	06/05
DRAWN	JB/JP	06/05
CHECKED	BJL	06/05

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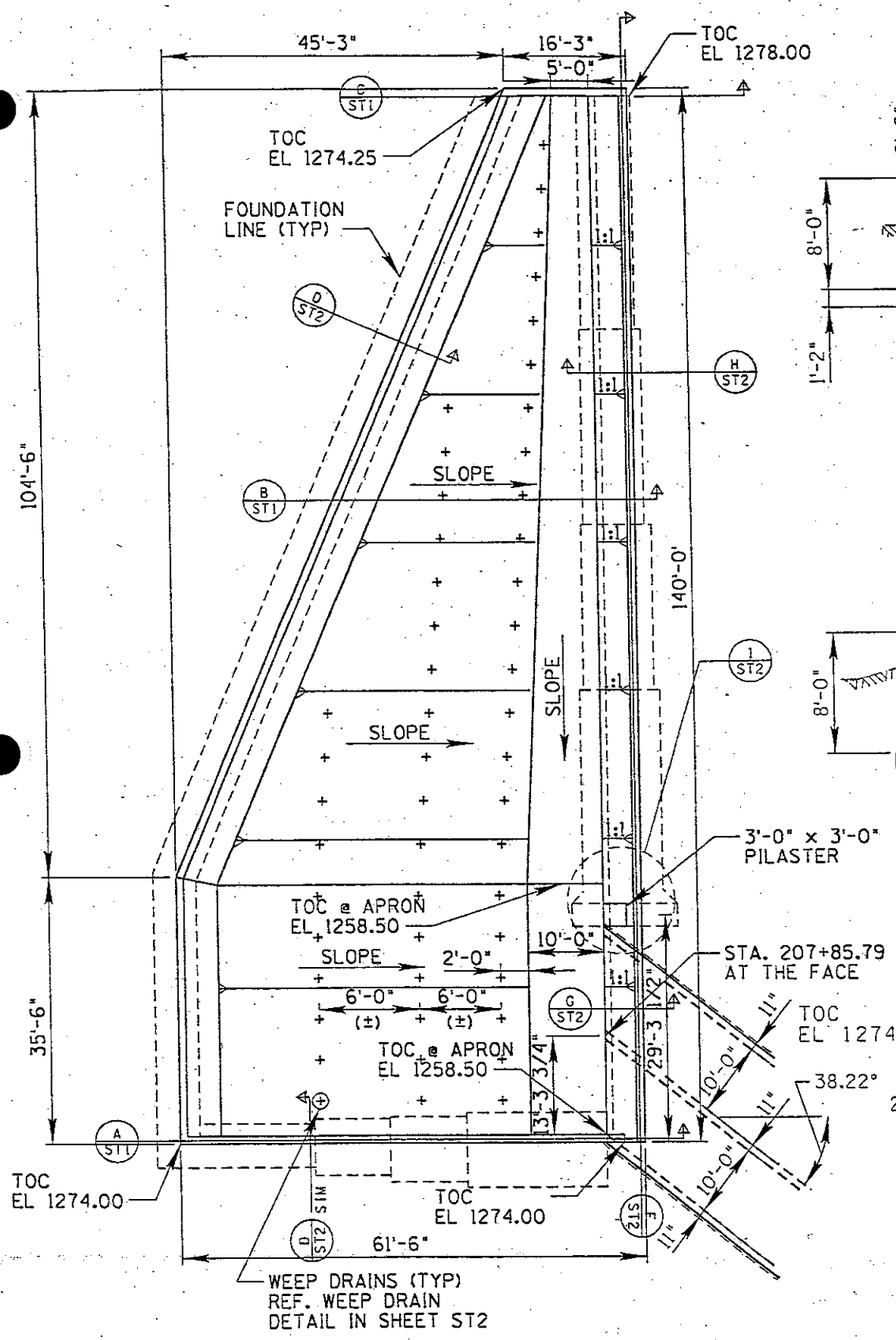
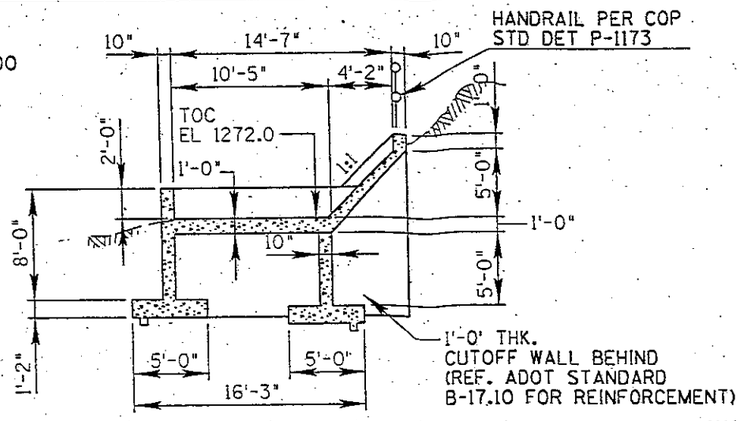
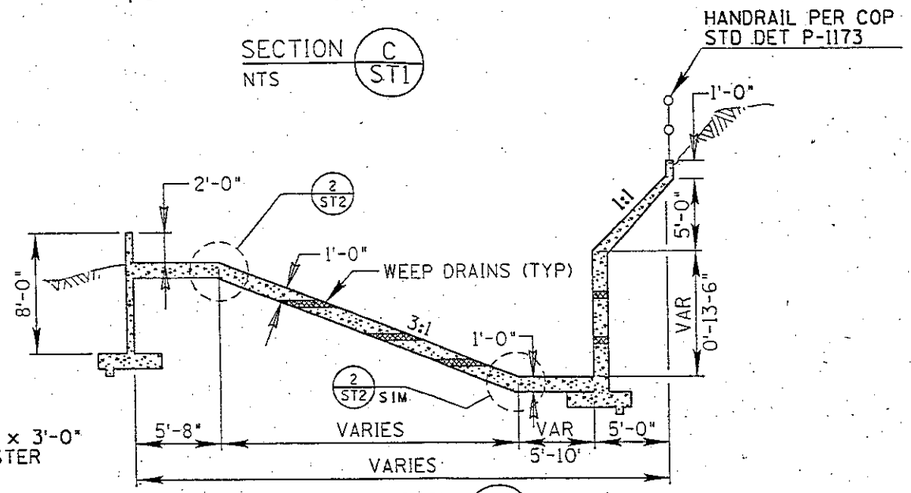
DRAWING NO. ST2 | SIDE WEIR STRUCTURE DETAILS | SHEET OF 30 62



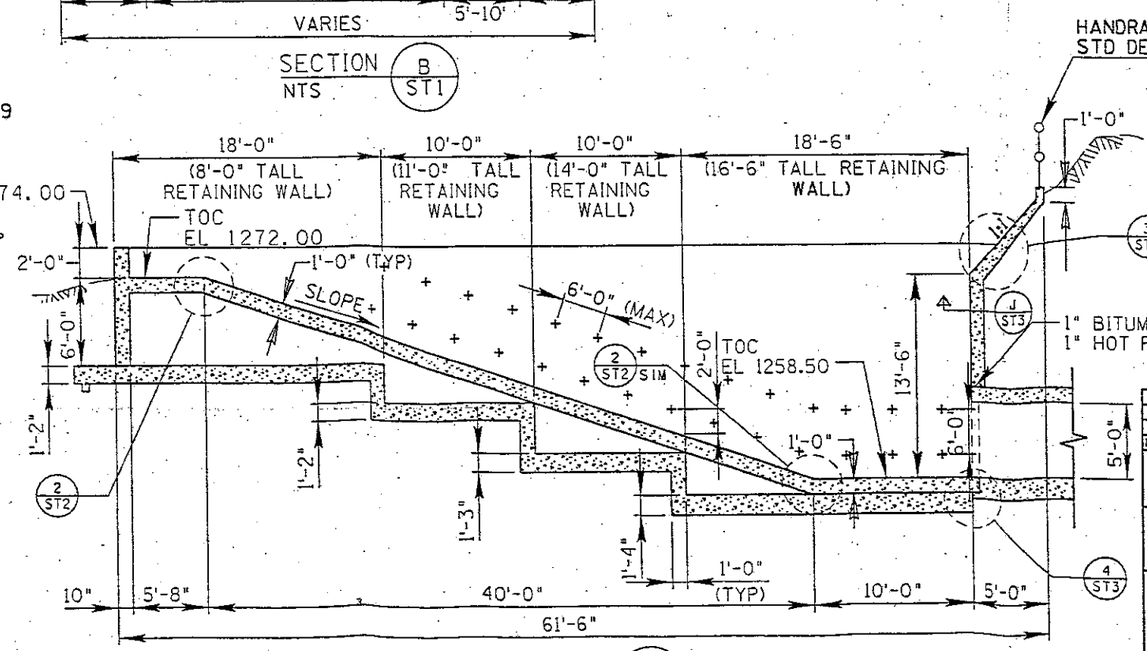
WEIR STRUCTURE DETAIL
NTS



SECTION C/ST1
NTS



SECTION B/ST1
NTS



SECTION A/ST1
NTS

GENERAL NOTES:

1. ALL GENERAL NOTES IN ADOT STANDARD B-18.10 ARE APPLICABLE FOR THESE SHEETS.

2. ALL EXPOSED VERTICAL SURFACES TO BE FORMED USING OREGON BASALT FORM LINER #175 BY SCOTT SYSTEMS OR EQUIVALENT.

3. BEFORE POURING CONCRETE FOR RETAINING WALLS OVER THE CULVERT OPENING, CULVERT ROOF SHALL BE SUPPORTED WITH TEMPORARY SUPPORTS.

4. REFER TO ADOT STANDARD B-06.20, B-06.30 AND B-06.40 FOR APRON REINFORCEMENT.

5. FOR FOOTING STEP DETAIL REFER TO ADOT STANDARD DETAIL IN B-18.50.

6. ALL REINFORCING STEEL HAVE 2 INCH CLEAR COVER UNLESS NOTED OTHERWISE.

STRESS
CLASS 'S' CONCRETE.....f'c = 3000 psi
GRADE 40 REINFORCING STEEL.....fs = 20000 psi
GRADE 60 REINFORCING STEEL.....fs = 24000 psi

7. SEE SECTION D/ST2 FOR APRON REINFORCING.

LEGEND

TOC = TOP OF CONCRETE
SIM = SIMILAR

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	ACC/JKK	06/05
DRAWN	JB/JP	06/05
CHECKED	BJL	06/05

KIRKHAM MICHAEL

DRAWING NO. ST1 | SIDE WEIR STRUCTURE DETAIL | SHEET OF 29 52

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 6/29/05

Subject DROP INLET QUANTITIES Designed ACL Checked

SEE DETAIL SHEETS OF STRUCTURE
AREAS FROM CADD DRAWING.

CONCRETE

BASE
AREA = 60.17 SQFT
LENGTH = 73.25'
VOLUME = 60.17 SQFT (73.25') = 4,407.45 CFT.

SIDEWALLS
AREA = (2) 360.17 SQFT = 720.34 SQ FT
WIDTH = 1'
VOLUME = 720.34 CFT

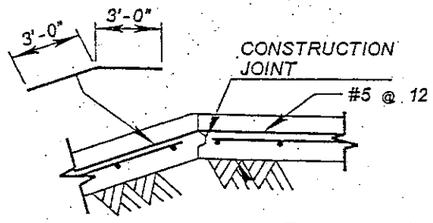
FRONT WALL
AREA = 270.63 SQ FT
WIDTH = 1'
VOLUME = 270.63 CFT

FOOTERS
AREA = 27.62 SQFT
LENGTH = 37.75'
VOLUME = 27.62 SQFT (37.75') = 1,042.66 CFT

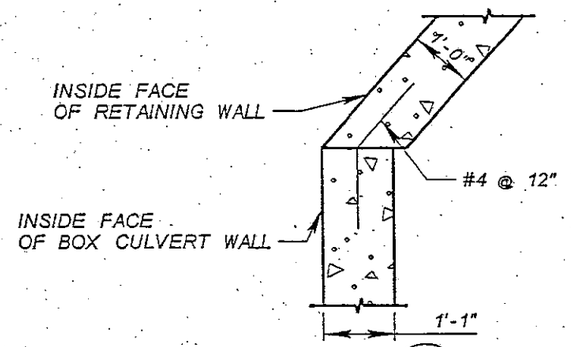
TOTAL VOLUME = 6,441.08 CF ≈ 238.56 CY

EXCAVATION

SIDE AREA = 360.17 SQ FT
LENGTH = 73.25'
VOLUME = 360.17 SQFT (73.25') = 26,382.45 CFT ≈ 977.13 CY.



DETAIL 1/ST5
NTS



DETAIL 2/ST5
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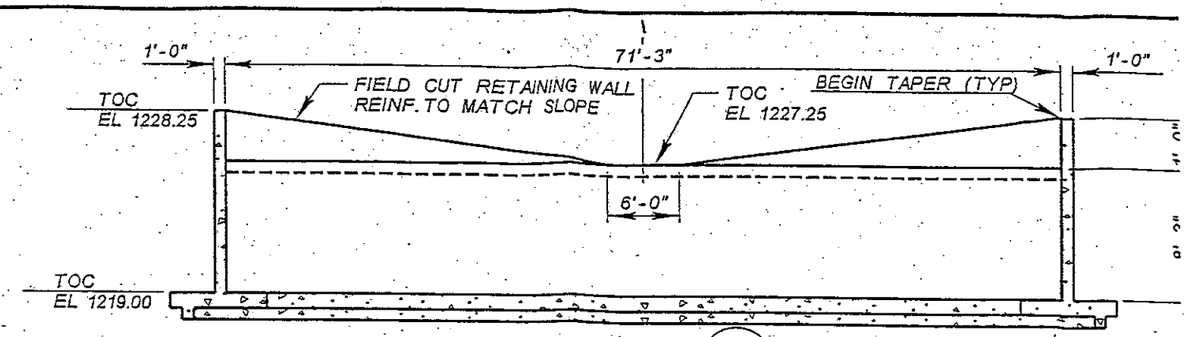
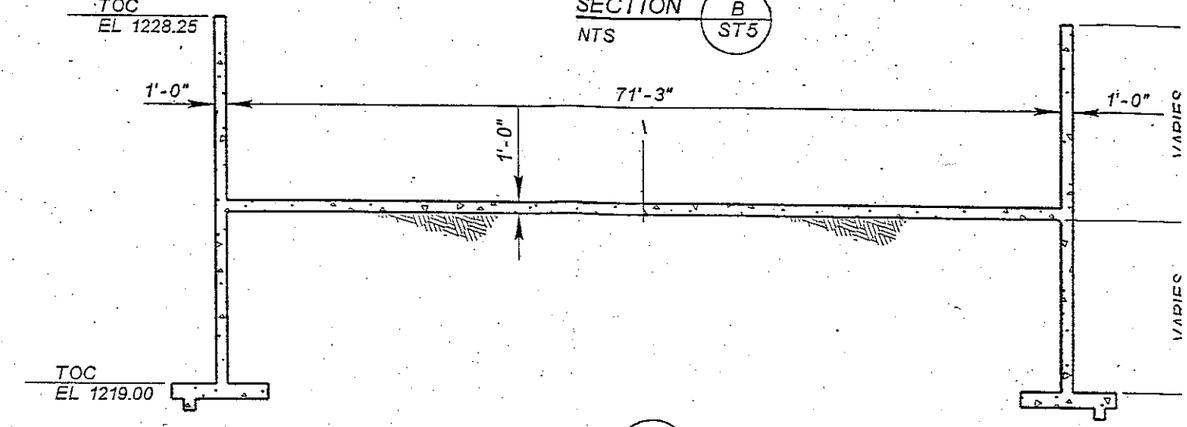
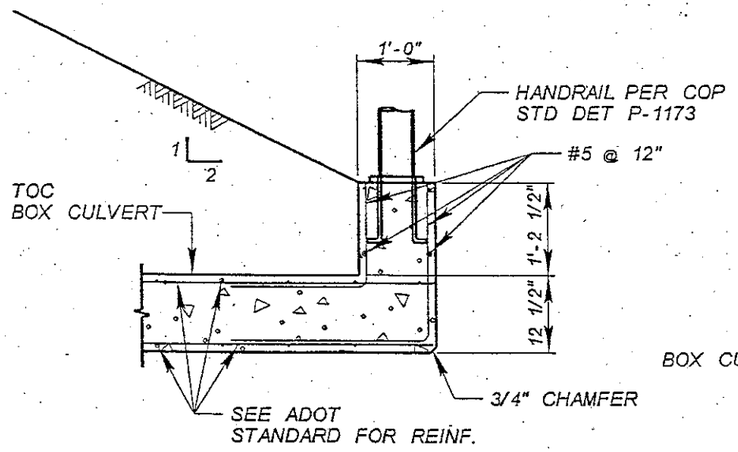


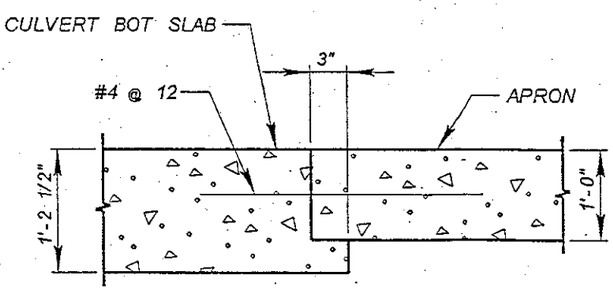
SECTION B/ST5
NTS



SECTION C/ST5
NTS



SECTION 3/ST5
NTS



SECTION 4/ST5
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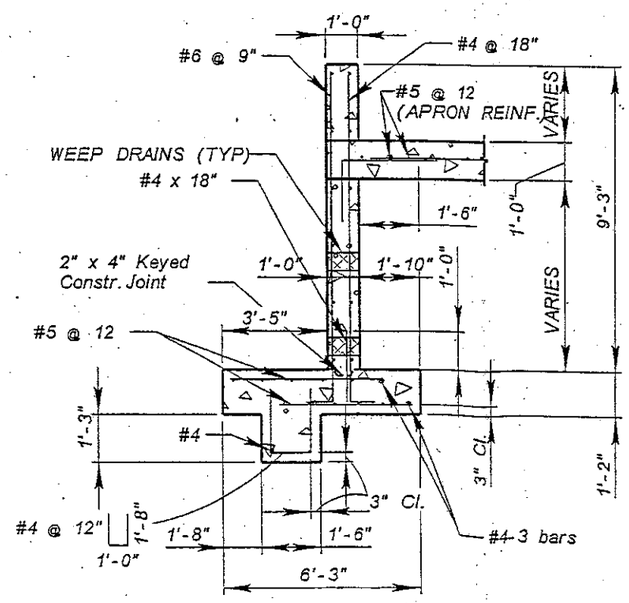
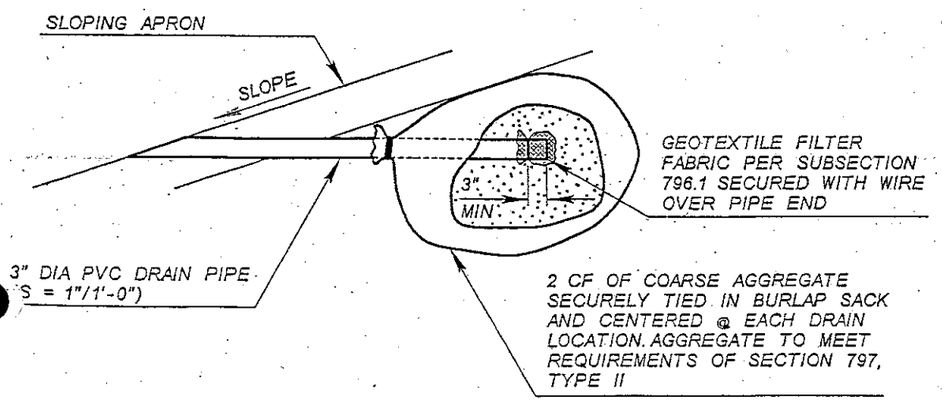


SECTION D/ST5
NTS



WEEP DRAIN DETAIL
NTS

LEGEND

TOC = TOP OF CONCRETE

NO.	REVISION	BY	DA
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

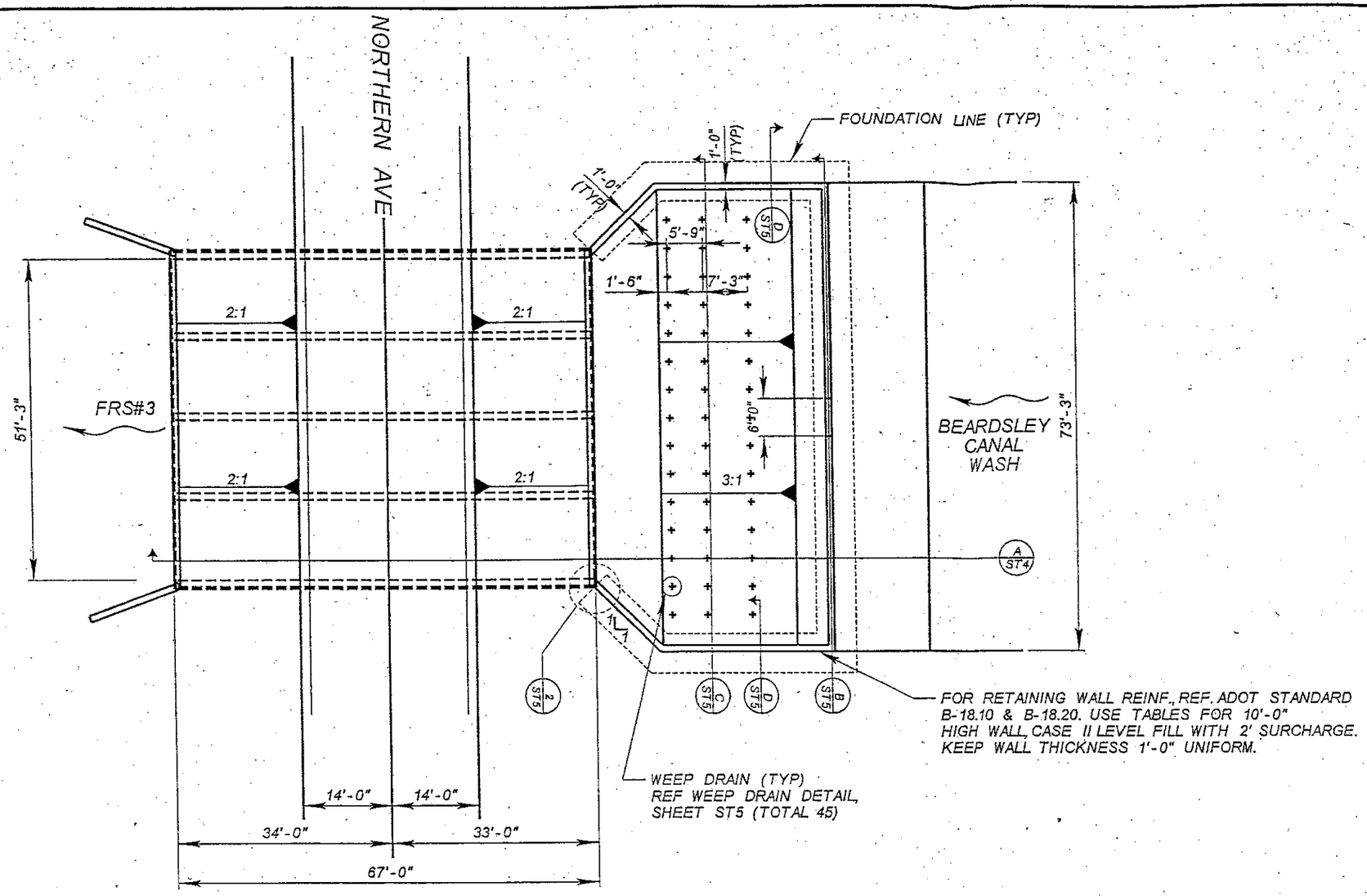
WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

90%
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	ACC/JKK	06/05
DRAWN	JB/JP	06/05
CHECKED	BJL	06/05

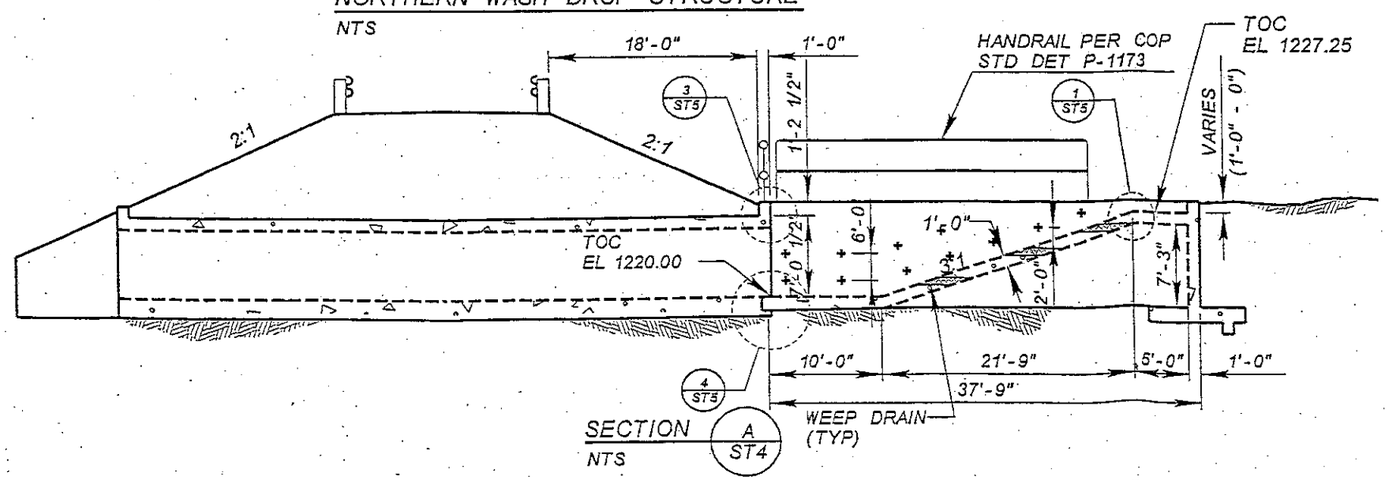
KIRKHAM MICHAEL

DRAWING NO. ST5 — BCW CULVERT — SHEET



NORTHERN WASH DROP STRUCTURE

NTS



SECTION A ST4

NTS

GENERAL NOTES:

1. ALL GENERAL NOTES IN ADOT STANDARD B-18.10. ARE APPLICABLE FOR THESE SHEETS.

2. ALL EXPOSED VERTICAL SURFACES TO BE FORMED USING CHISELED LIMESTONE A FORM LINER #166A BY SCOTT SYSTEMS OR EQUIVALENT.

3. FOR FOOTING STEP DETAIL REFER TO ADOT STANDARD DETAIL IN B-18.50.

4. ALL REINFORCING STEEL HAVE 2 INCH CLEAR COVER UNLESS NOTED OTHERWISE.

STRESS
CLASS 'S' CONCRETE.....f'c = 3000 psi
GRADE 40 REINFORCING STEEL.....fs = 20000 psi
GRADE 60 REINFORCING STEEL.....fs = 24000 psi

5. SEE SECTION D/ST5 FOR APRON REINFORCING.

LEGEND

TOC = TOP OF CONCRETE

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

90%
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	BY	DATE
DESIGNED	ACC/JKK	06/05
DRAWN	JB/JP	06/05
CHECKED	BJL	06/05

KIRKHAM MICHAEL

DRAWING NO. ST4

BCW CULVERT INLET DETAIL

SHEET 32

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/4/05

Subject CULVERT QUANTITIES Designed ACL Checked JHK

DETAILS & DIMENSIONS ON FOLLOWING SHEETS

QUANTITIES OBTAINED FROM ADOT STD. NO. B-02.70

○ OLIVE AVE DIVERSION CULVERT

(2) 10'x5' BOX CULVERT = (~~2.168~~ 2.453 CY/L.F.)(~~320~~ 331') = ~~693.76~~ 811.94 CY OF REINF CONC

TABLE II

CULVERT LENGTH

□ NORTHERN AVE. DIVERSION CULVERT

(4) 10'x5' BOX CULVERT = (~~4.076~~ 4.63 CY/LF)(~~336~~ 336') = ~~1300.27~~ 1556.01 CY OF REINF. CONC

TABLE II

CULVERT LENGTH

☆ NORTHERN AVE. WASH CULVERT

(4) 12'x6' BOX CULVERT => NO STANDARD EXISTS FOR A 12'x6' BOX CULVERT. THE STD. FOR 12'x8' WILL BE MODIFIED TO HAVE 6' HEIGHT.

AREA OF FACE

FOOTING AREA = (14.5'/12)[(12'·4) + (13"/12 · 5) + 8"/12] =	65.35	SQ FT.
WALL AREA = 5 (6')(13"/12) =	32.50	SQ FT.
CHAMFER AREA = 8 (1/2 (6"/12)(6"/12)) =	1.00	SQ FT.
TOP SLAB AREA = (12.5'/12)[(12'·4) + (13"/12 · 5)] =	55.64	SQ FT
	154.49	SQ FT
	≈ 17.17	SQ YD.

QUANTITY OF CONCRETE = 17.17 SQ YD · 67 FT / 3/YD

CULVERT LENGTH

= 383.37 CU YD OF CONCRETE

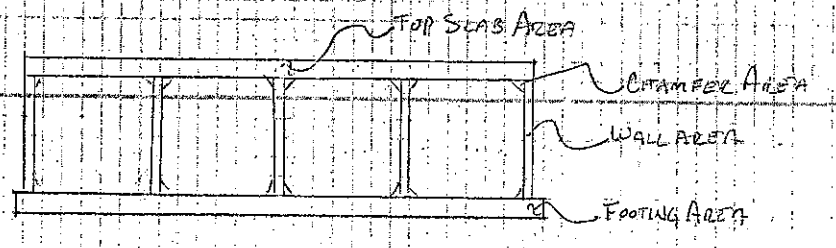
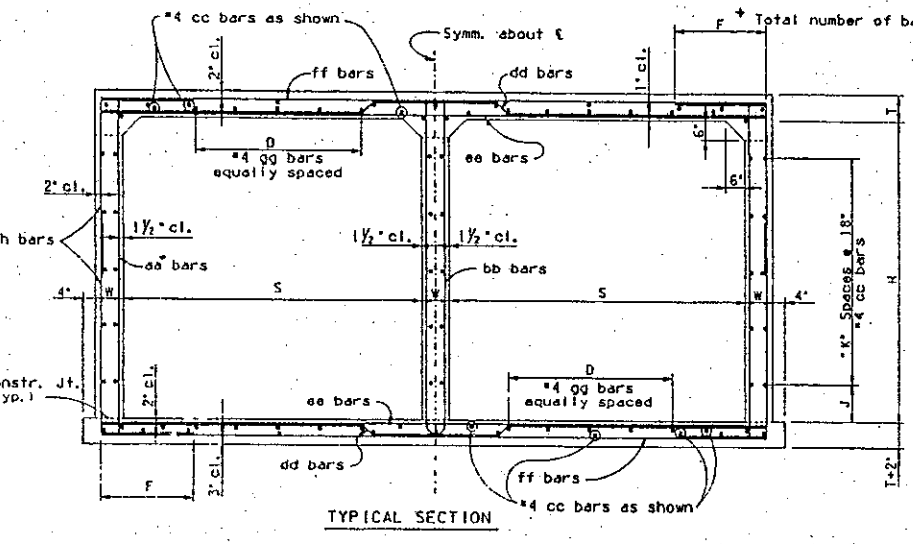


TABLE I
0'-10' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Bar Size	aa Spacing	aa Length	bb Bar Size	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	D	hh Bar Size	hh Spacing	hh Length	F
6'	3'	9½"	8"	5	12"	4'-4	5	12"	8'-9	48	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	5'-1	2'-5
	4'	9½"	8"	5	12"	5'-4	5	12"	10'-9	54	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	5'-1	2'-5
	5'	9½"	8"	5	12"	6'-4	5	12"	12'-9	54	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	6'-1	2'-5
	6'	9½"	8"	5	12"	7'-4	5	12"	14'-9	60	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	6'-1	2'-5
	7'	9½"	8"	5	12"	8'-4	5	12"	16'-9	66	5	13"	13'-2	4'-7	2'-7	6½"	5	13"	13'-7	5	13"	13'-7	20	3'-0	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	5	12"	4'-4	5	12"	8'-9	48	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	5'-6	2'-6
	4'	9½"	9"	5	12"	5'-4	5	12"	10'-9	54	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	6'-0	2'-6
	5'	9½"	9"	5	12"	6'-4	5	12"	12'-9	54	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	6'-6	2'-6
	6'	9½"	9"	5	12"	7'-4	5	12"	14'-9	60	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	7'-0	2'-6
	7'	9½"	9"	5	12"	8'-4	5	12"	16'-9	66	6	13"	17'-2	6'-1	3'-8	6½"	6	13"	17'-10	6	13"	17'-10	28	4'-0	5	6½"	7'-5	2'-6
	8'	9½"	9"	5	12"	9'-4	5	12"	18'-9	66	6	13"	17'-2	6'-1	3'-8	6½"	6	13"	17'-10	6	13"	17'-10	28	4'-0	6	6½"	8'-0	2'-6
10'	3'	10½"	11"	5	12"	4'-6	5	12"	9'-2	48	7	17"	21'-5	7'-7	4'-8	7½"	6	17"	22'-4	7	17"	22'-4	32	5'-0	6	8½"	6'-7	3'-0
	4'	10½"	11"	5	12"	5'-6	5	12"	11'-2	54	7	17"	21'-5	7'-7	4'-8	7½"	6	17"	22'-4	7	17"	22'-4	32	5'-0	6	8½"	6'-7	3'-0
	5'	10½"	11"	5	12"	6'-6	5	12"	13'-2	54	6	12"	21'-5	7'-7	4'-8	7½"	5	12"	22'-4	6	12"	22'-4	32	5'-0	5	6"	6'-8	2'-8
	6'	10½"	11"	5	12"	7'-6	5	12"	15'-2	60	6	12"	21'-5	7'-7	4'-8	7½"	5	12"	22'-4	6	12"	22'-4	32	5'-0	5	6"	7'-2	2'-8
	7'	10½"	11"	5	12"	8'-6	5	12"	17'-2	66	7	15"	21'-5	7'-7	4'-8	7½"	5	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	7'-9	2'-8
	8'	10½"	11"	5	12"	9'-6	5	12"	19'-2	66	7	15"	21'-5	7'-7	4'-8	7½"	5	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	8'-3	2'-8
	9'	10½"	11"	5	12"	10'-6	5	12"	21'-2	72	7	15"	21'-5	7'-7	4'-8	7½"	6	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	8'-9	2'-8
	10'	10½"	11"	5	12"	11'-6	5	12"	23'-2	78	7	14"	21'-5	7'-7	4'-8	7½"	5	14"	22'-4	7	14"	22'-4	32	5'-0	6	7"	9'-3	2'-8
12'	8'	12½"	13"	5	12"	9'-10	5	12"	20'-0	66	7	13"	25'-8	9'-1	5'-6	9½"	5	13"	26'-10	7	13"	26'-10	40	6'-0	6	6½"	8'-6	2'-10
	9'	12½"	13"	5	12"	10'-10	5	12"	22'-0	72	8	16"	25'-8	9'-1	5'-6	9½"	5	16"	26'-10	8	16"	26'-10	40	6'-0	6	6"	9'-0	2'-10
	10'	12½"	13"	5	12"	11'-10	5	12"	24'-0	78	8	16"	25'-8	9'-1	5'-6	9½"	5	16"	26'-10	8	16"	26'-10	40	6'-0	6	6"	9'-6	2'-10
	11'	12½"	13"	5	12"	12'-10	5	12"	26'-0	78	7	12"	25'-8	9'-1	5'-6	9½"	4	12"	26'-10	7	12"	26'-10	40	6'-0	6	6"	10'-0	2'-10
	12'	12½"	13"	5	12"	13'-10	5	12"	28'-0	84	7	12"	25'-8	9'-1	5'-6	9½"	5	12"	26'-10	7	12"	26'-10	40	6'-0	6	6"	10'-6	2'-10

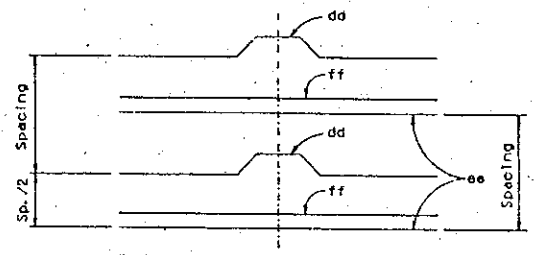
TABLE NO. II
10'-15' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Bar Size	aa Spacing	aa Length	bb Bar Size	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	D	hh Bar Size	hh Spacing	hh Length	F
6'	3'	8"	8"	5	12"	4'-1	5	12"	8'-3	48	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	5'-0	2'-5
	4'	8"	8"	5	12"	5'-1	5	12"	10'-3	54	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	5'-6	2'-5
	5'	8"	8"	5	12"	6'-1	5	12"	12'-3	54	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	6'-0	2'-5
	6'	8"	8"	5	12"	7'-1	5	12"	14'-3	60	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	6'-6	2'-5
	7'	8"	8"	5	12"	8'-1	5	12"	16'-3	66	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	7'-0	2'-5
8'	3'	10½"	9"	5	12"	4'-6	5	12"	9'-2	48	6	13"	17'-3	6'-1	3'-6	7½"	5	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	5'-3	2'-6
	4'	10½"	9"	5	12"	5'-6	5	12"	11'-2	54	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	5'-9	2'-6
	5'	10½"	9"	5	12"	6'-6	5	12"	13'-2	54	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	6'-3	2'-6
	6'	10½"	9"	5	12"	7'-6	5	12"	15'-2	60	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	6'-9	2'-6
	7'	10½"	9"	5	12"	8'-6	5	12"	17'-2	66	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	7'-3	2'-6
	8'	10½"	9"	5	12"	9'-6	5	12"	19'-2	66	6	12"	17'-3	6'-1	3'-6	7½"	4	12"	17'-10	6	12"	17'-10	20	4'-0	4	6"	7'-9	2'-6
10'	3'	12½"	11"	5	12"	4'-10	5	12"	9'-10	48	7	14"	21'-6	7'-7	4'-4	9½"	4	14"	22'-4	7	14"	22'-4	24	5'-0	5	7"	5'-10	2'-8
	4'	12½"	11"	5	12"	5'-10	5	12"	11'-10	54	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	4	6½"	6'-4	2'-8
	5'	12½"	11"	5	12"	6'-10	5	12"	13'-10	54	7	14"	21'-6	7'-7	4'-4	9½"	4	14"	22'-4	7	14"	22'-4	24	5'-0	5	7"	6'-10	2'-8
	6'	12½"	11"	5	12"	7'-10	5	12"	15'-10	60	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	7'-4	2'-8
	7'	12½"	11"	5	12"	8'-10	5	12"	17'-10	66	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	7'-10	2'-8
	8'	12½"	11"	5	12"	9'-10	5	12"	19'-10	66	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	8'-4	2'-8
	9'	12½"	11"	5	12"	10'-10	5	12"	21'-10	72	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	8'-10	2'-8
	10'	12½"	11"	5	12"	11'-10	5	12"	23'-10	78	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	9'-4	2'-8
12'	8'	15"	13"	5	12"	10'-3	5	12"	20'-9	66	8	15"	25'-10	9'-1	5'-1	12"	4	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	8'-9	2'-11
	9'	15"	13"	5	12"	11'-3	5	12"	22'-9	72	8	15"	25'-10	9'-1	5'-1	12"	4	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	9'-3	2'-11
	10'	15"	13"	5	12"	12'-3	5	12"	24'-9	78	8	15"	25'-10	9'-1	5'-1	12"	5	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	9'-9	2'-11
	11'	15"	13"	5	12"	13'-3	5	12"	26'-9	78	8	14"	25'-10	9'-1	5'-1	12"	4	14"	26'-10	8	14"	26'-10	28	6'-0	5	7"	10'-9	3'-5
	12'	15"	13"	5	12"	14'-3	5	12"	28'-9	84	8	14"	25'-10	9'-1	5'-1	12"	5	14"	26'-10	8	14"	26'-10	28	6'-0	6	7"	11'-3	3'-5



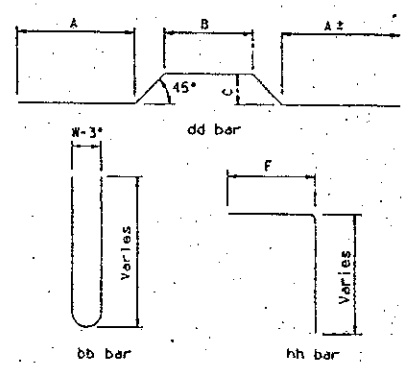
TYPICAL SECTION

NOTE:
Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.



REINFORCING BAR PLACING DIAGRAM

Height "H"	"J" Dim.	"K" Spaces
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11'	12"	6
12'	9"	7



BENDS

NOTE:
See B-02.25 for Tables III thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.10 for Quantities.

DESIGN APPROVED
APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

DOUBLE BARREL
BOX CULVERT

REVISION 4-92

STANDARD NO. B-02.20

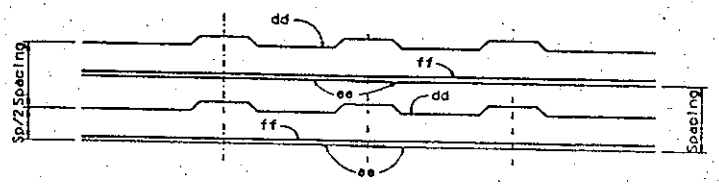
TABLE I
0'-10' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	9½"	8"	12"	4'-4	12"	8'-9	88	5	14"	21'-3	4'-1	2'-2	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	5'-1	2'-5
	4'	9½"	8"	12"	5'-4	12"	10'-9	98	5	14"	21'-3	4'-2	2'-1	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	5'-1	2'-5
	5'	9½"	8"	12"	6'-4	12"	12'-9	98	5	14"	21'-3	4'-3	2'-1	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	6'-1	2'-5
	6'	9½"	8"	12"	7'-4	12"	14'-9	108	5	14"	21'-3	4'-3	2'-1	6½"	3'-1	5	14"	14'-0	5	14"	26'-11	40	4	7"	6'-1	2'-5
	7'	9½"	8"	12"	8'-4	12"	16'-9	118	5	13"	21'-3	4'-3	2'-1	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	40	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	12"	4'-4	12"	8'-9	88	6	14"	35'-3	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	7"	5'-6	2'-6
	4'	9½"	9"	12"	5'-4	12"	10'-9	98	6	14"	35'-3	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	7"	6'-0	2'-6
	5'	9½"	9"	12"	6'-4	12"	12'-9	98	6	14"	35'-3	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	7"	6'-6	2'-6
	6'	9½"	9"	12"	7'-4	12"	14'-9	108	6	14"	35'-3	6'-1	3'-8	6½"	4'-2	6	14"	18'-3	6	14"	35'-4	56	6	7"	6'-11	2'-6
	7'	9½"	9"	12"	8'-4	12"	16'-9	118	6	13"	35'-3	6'-1	3'-8	6½"	4'-2	6	13"	18'-3	6	13"	35'-4	56	5	6½"	7'-6	2'-6
	8'	9½"	9"	12"	9'-4	12"	18'-9	118	6	13"	35'-3	6'-1	3'-8	6½"	4'-2	6	13"	18'-3	6	13"	35'-4	56	5	6½"	8'-0	2'-6
10'	3'	10½"	11"	12"	4'-6	12"	9'-2	88	7	17"	44'-2	7'-1	4'-8	7½"	5'-2	6	17"	22'-8	7	17"	44'-2	64	5	8½"	6'-1	3'-0
	4'	10½"	11"	12"	5'-6	12"	11'-2	98	7	17"	44'-2	7'-1	4'-8	7½"	5'-2	6	17"	22'-8	7	17"	44'-2	64	6	8½"	6'-7	3'-0
	5'	10½"	11"	12"	6'-6	12"	13'-2	98	6	12"	44'-2	7'-3	4'-8	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	8"	6'-8	2'-9
	6'	10½"	11"	12"	7'-6	12"	15'-2	108	6	12"	44'-2	7'-3	4'-8	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	8"	7'-2	2'-9
	7'	10½"	11"	12"	8'-6	12"	17'-2	118	7	15"	44'-2	7'-3	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	7'-8	2'-9
	8'	10½"	11"	12"	9'-6	12"	19'-2	118	7	15"	44'-2	7'-3	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	8'-3	2'-9
	9'	10½"	11"	12"	10'-6	12"	21'-2	128	7	15"	44'-2	7'-3	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	8'-9	2'-9
	10'	10½"	11"	12"	11'-6	12"	23'-2	138	7	14"	44'-2	7'-3	4'-8	7½"	5'-2	5	14"	22'-8	7	14"	44'-2	64	6	7"	9'-3	2'-9
12'	8'	12½"	13"	12"	9'-10	12"	20'-0	118	8	13"	53'-0	9'-1	5'-6	9½"	6'-2	5	13"	27'-0	8	13"	53'-0	88	6	8½"	8'-7	2'-10
	9'	12½"	13"	12"	10'-10	12"	22'-0	128	8	16"	53'-0	9'-1	5'-6	9½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	6	8"	9'-1	2'-10
	10'	12½"	13"	12"	11'-10	12"	24'-0	138	8	16"	53'-0	9'-1	5'-6	9½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	6	8"	9'-7	2'-10
	11'	12½"	13"	12"	12'-10	12"	26'-0	138	7	12"	53'-0	9'-1	5'-6	9½"	6'-2	4	12"	27'-0	7	12"	53'-0	88	6	8"	10'-1	2'-10
	12'	12½"	13"	12"	13'-10	12"	28'-0	146	7	12"	53'-0	9'-1	5'-6	9½"	6'-2	5	12"	27'-0	7	12"	53'-0	88	6	8"	10'-7	2'-10

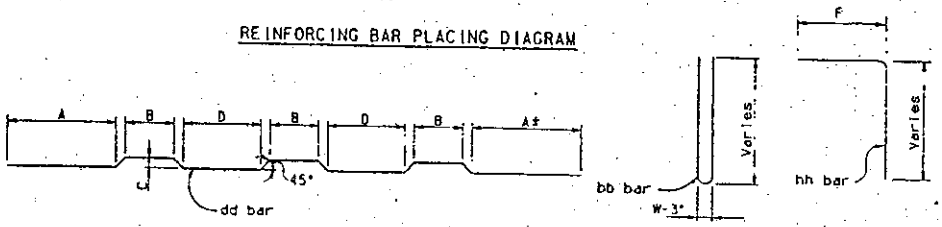
+ Total number of bars in the cross-section.

NORTHERN DIVERSION CULVERT (SEE TABLE II) B-02.45

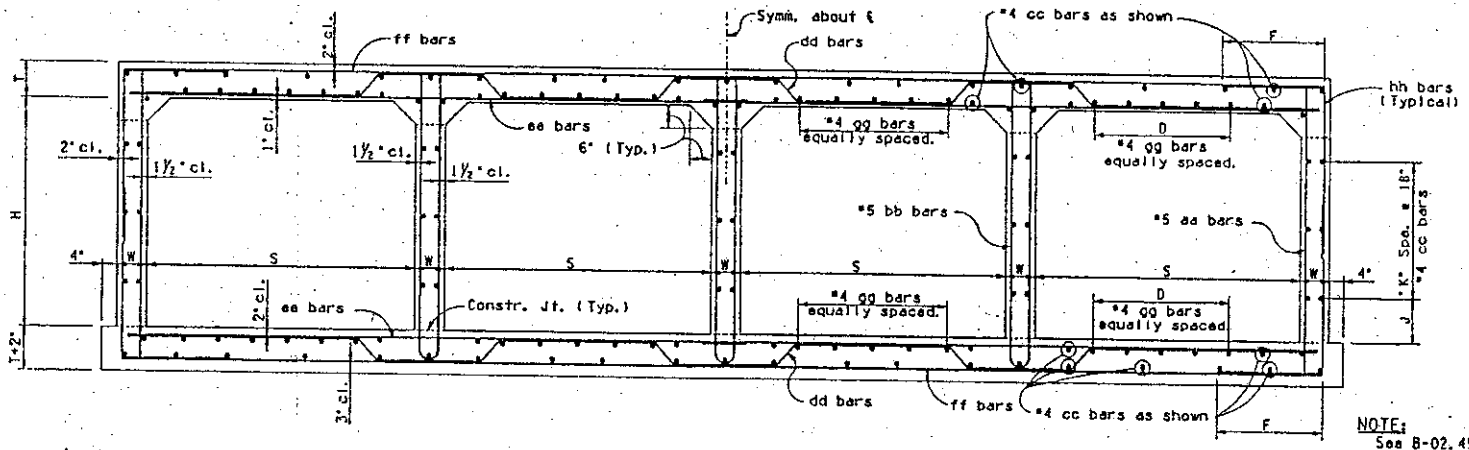
NORTHERN WASH CULVERT



REINFORCING BAR PLACING DIAGRAM



BENDS



Height "H"	Bin. "J"	Spaces "K"
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11'	12"	6
12'	9"	7

TYPICAL SECTION

NOTE:
Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.

NOTE:
See B-02.45 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

FOUR BARREL
BOX CULVERT

REVISION 4-88

STANDARD NO. B-02.40

DESIGN			NO.	DESCRIPTION OF REVISIONS	MADE BY	DATE
DRAWN			1	Total Redesign of Box	J.K.	6-88
CHECKED			2			
			3			
			4			

TABLE II
10'-15' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	8"	8"	12"	4'-1	12"	8'-0	86	5	14"	26'-11	4'-7	2'-10	5"	3'-1	5	14"	14'-0	5	14"	26'-11	32	4	7"	5'-0	2'-5
	4'	8"	8"	12"	5'-1	12"	10'-0	94	5	14"	26'-11	4'-7	2'-10	5"	3'-1	5	14"	14'-0	5	14"	26'-11	32	4	7"	5'-6	2'-5
	5'	8"	8"	12"	6'-1	12"	12'-0	98	5	14"	26'-11	4'-7	2'-10	5"	3'-1	5	14"	14'-0	5	14"	26'-11	32	4	7"	6'-0	2'-5
	6'	8"	8"	12"	7'-1	12"	14'-0	108	5	14"	26'-11	4'-7	2'-10	5"	3'-1	5	14"	14'-0	5	14"	26'-11	32	4	7"	6'-6	2'-5
	7'	8"	8"	12"	8'-1	12"	16'-0	118	5	14"	26'-11	4'-7	2'-10	5"	3'-1	5	14"	14'-0	5	14"	26'-11	32	4	7"	7'-0	2'-5
8'	3'	10½"	9"	12"	4'-6	12"	9'-2	88	6	13"	35'-9	6'-1	3'-6	7½"	4'-2	5	13"	18'-3	6	13"	35'-4	40	4	6½"	5'-3	2'-6
	4'	10½"	9"	12"	5'-6	12"	11'-2	98	6	13"	35'-9	6'-1	3'-6	7½"	4'-2	4	13"	18'-3	6	13"	35'-4	40	4	6½"	5'-9	2'-6
	5'	10½"	9"	12"	6'-6	12"	13'-2	98	6	13"	35'-9	6'-1	3'-6	7½"	4'-2	4	13"	18'-3	6	13"	35'-4	40	4	6½"	6'-3	2'-6
	6'	10½"	9"	12"	7'-6	12"	15'-2	108	6	13"	35'-9	6'-1	3'-6	7½"	4'-2	4	13"	18'-3	6	13"	35'-4	40	4	6½"	6'-9	2'-6
	7'	10½"	9"	12"	8'-6	12"	17'-2	118	6	13"	35'-9	6'-1	3'-6	7½"	4'-2	4	13"	18'-3	6	13"	35'-4	40	4	6½"	7'-3	2'-6
	8'	10½"	9"	12"	9'-6	12"	19'-2	118	6	12"	35'-9	6'-1	3'-6	7½"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-9	2'-6
10'	3'	12½"	11"	12"	4'-10	12"	9'-8	88	7	14"	44'-7	7'-7	4'-4	9½"	5'-2	4	14"	22'-8	7	14"	44'-2	48	5	7"	5'-10	2'-8
	4'	12½"	11"	12"	5'-10	12"	11'-8	98	7	13"	44'-7	7'-7	4'-4	9½"	5'-2	4	13"	22'-8	7	13"	44'-2	48	4	6½"	6'-1	2'-8
	5'	12½"	11"	12"	6'-10	12"	13'-8	98	7	14"	44'-7	7'-7	4'-4	9½"	5'-2	4	14"	22'-8	7	14"	44'-2	48	5	7"	6'-10	2'-8
	6'	12½"	11"	12"	7'-10	12"	15'-8	108	7	13"	44'-7	7'-7	4'-4	9½"	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	7'-4	2'-8
	7'	12½"	11"	12"	8'-10	12"	17'-8	118	7	13"	44'-7	7'-7	4'-4	9½"	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	7'-10	2'-8
	8'	12½"	11"	12"	9'-10	12"	19'-8	118	7	13"	44'-7	7'-7	4'-4	9½"	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	8'-4	2'-8
	9'	12½"	11"	12"	10'-10	12"	21'-8	128	7	13"	44'-7	7'-7	4'-4	9½"	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	8'-10	2'-8
	10'	12½"	11"	12"	11'-10	12"	23'-8	138	7	13"	44'-7	7'-7	4'-4	9½"	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	9'-4	2'-8
12'	8'	15"	13"	12"	10'-3	12"	20'-6	118	8	15"	53'-6	9'-1	5'-1	12"	6'-2	4	15"	27'-0	8	15"	53'-0	56	6	7½"	8'-10	2'-11
	9'	15"	13"	12"	11'-3	12"	22'-6	128	8	15"	53'-6	9'-1	5'-1	12"	6'-2	4	15"	27'-0	8	15"	53'-0	56	6	7½"	9'-4	2'-11
	10'	15"	13"	12"	12'-3	12"	24'-6	138	8	15"	53'-6	9'-1	5'-1	12"	6'-2	5	15"	27'-0	8	15"	53'-0	56	6	7½"	9'-10	2'-11
	11'	15"	13"	12"	13'-3	12"	26'-6	138	8	14"	53'-6	9'-1	5'-1	12"	6'-2	4	14"	27'-0	8	14"	53'-0	56	5	7"	10'-9	3'-5
	12'	15"	13"	12"	14'-3	12"	28'-6	148	8	14"	53'-6	9'-1	5'-1	12"	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	11'-2	3'-5

NORTHERN DIVERSION CULVERT →

TABLE III
15'-20' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	9½"	8"	12"	4'-4	12"	8'-9	88	5	13"	27'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	32	4	6½"	5'-1	2'-5
	4'	9½"	8"	12"	5'-4	12"	10'-9	98	5	13"	27'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	32	4	6½"	5'-7	2'-5
	5'	9½"	8"	12"	6'-4	12"	12'-9	98	5	13"	27'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	32	4	6½"	6'-1	2'-5
	6'	9½"	8"	12"	7'-4	12"	14'-9	108	5	13"	27'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	32	4	6½"	6'-7	2'-5
	7'	9½"	8"	12"	8'-4	12"	16'-9	118	5	13"	27'-3	4'-7	2'-7	6½"	3'-1	5	13"	14'-0	5	13"	26'-11	32	4	6½"	7'-1	2'-5
8'	3'	12"	9"	12"	4'-9	12"	9'-8	88	6	12"	36'-1	6'-1	3'-3	9"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	5'-5	2'-6
	4'	12"	9"	12"	5'-9	12"	11'-8	98	6	12"	36'-1	6'-1	3'-3	9"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	5'-11	2'-6
	5'	12"	9"	12"	6'-9	12"	13'-8	98	6	12"	36'-1	6'-1	3'-3	9"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	6'-5	2'-6
	6'	12"	9"	12"	7'-9	12"	15'-8	108	6	12"	36'-1	6'-1	3'-3	9"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	6'-11	2'-6
	7'	12"	9"	12"	8'-9	12"	17'-8	118	6	12"	36'-1	6'-1	3'-3	9"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-5	2'-6
	8'	12"	9"	12"	9'-9	12"	19'-8	118	6	12"	36'-1	6'-1	3'-3	9"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-11	2'-6
10'	3'	15"	11"	12"	5'-3	12"	10'-8	88	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	6'-0	2'-8
	4'	15"	11"	12"	6'-3	12"	12'-8	98	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	6'-6	2'-8
	5'	15"	11"	12"	7'-3	12"	14'-8	98	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	7'-0	2'-8
	6'	15"	11"	12"	8'-3	12"	16'-8	108	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	7'-6	2'-8
	7'	15"	11"	12"	9'-3	12"	18'-8	118	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	8'-0	2'-8
	8'	15"	11"	12"	10'-3	12"	20'-8	118	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	8'-6	2'-8
	9'	15"	11"	12"	11'-3	12"	22'-8	128	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	9'-0	2'-8
	10'	15"	11"	12"	12'-3	12"	24'-8	138	7	13"	45'-1	7'-7	3'-11	1'-0	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	9'-7	2'-9
12'	8'	18"	13"	12"	10'-9	12"	21'-6	118	8	14"	54'-2	9'-1	4'-7	1'-3	6'-2	4	14"	27'-0	8	14"	53'-0	56	5	7"	9'-6	3'-5
	9'	18"	13"	12"	11'-9	12"	23'-6	128	8	14"	54'-2	9'-1	4'-7	1'-3	6'-2	4	14"	27'-0	8	14"	53'-0	56	5	7"	10'-0	3'-5
	10'	18"	13"	12"	12'-9	12"	25'-6	138	8	14"	54'-2	9'-1	4'-7	1'-3	6'-2	4	14"	27'-0	8	14"	53'-0	56	6	7"	10'-6	3'-5
	11'	18"	13"	12"	13'-9	12"	27'-6	138	8	14"	54'-2	9'-1	4'-7	1'-3	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	11'-0	3'-5
	12'	18"	13"	12"	14'-9	12"	29'-6	148	8	14"	54'-2	9'-1	4'-7	1'-3	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	11'-6	3'-5

TABLE IV
20'-25' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	11"	8"	12"	4'-7	12"	9'-2	88	5	12"	27'-7	4'-7	2'-4	8"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	5'-3	2'-5
	4'	11"	8"	12"	5'-7	12"	11'-2	98	5	12"	27'-7	4'-7	2'-4	8"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	5'-9	2'-5
	5'	11"	8"	12"	6'-7	12"	13'-2	98	5	12"	27'-7	4'-7	2'-4	8"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	6'-3	2'-5
	6'	11"	8"	12"	7'-7	12"	15'-2	108	5	12"	27'-7	4'-7	2'-4	8"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	6'-9	2'-5
	7'	11"	8"	12"	8'-7	12"	17'-2	118	5	12"	27'-7	4'-7	2'-4	8"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	7'-3	2'-5
8'	3'	14"	9"	12"	5'-1	12"	10'-2	88	6	12"	36'-6	6'-1	2'-11	11"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	5'-7	2'-6
	4'	14"	9"	12"	6'-1	12"	12'-2	98	6	12"	36'-6	6'-1	2'-11	11"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	6'-1	2'-6
	5'	14"	9"	12"	7'-1	12"	14'-2	98	6	12"	36'-6	6'-1	2'-11	11"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	6'-7	2'-6
	6'	14"	9"	12"	8'-1	12"	16'-2	108	6	12"	36'-6	6'-1	2'-11	11"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-1	2'-6
	7'	14"	9"	12"	9'-1	12"	18'-2	118	6	12"	36'-6	6'-1	2'-11	11"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-7	2'-6
	8'	14"	9"	12"	10'-1	12"	20'-2	118	6	12"	36'-6	6'-1	2'-11	11"	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	8'-1	2'-6
10'	3'	17"	11"	12"	5'-7	12"	11'-2	88	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	6'-3	2'-9
	4'	17"	11"	12"	6'-7	12"	13'-2	98	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	6'-9	2'-9
	5'	17"	11"	12"	7'-7	12"	15'-2	98	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	7'-3	2'-9
	6'	17"	11"	12"	8'-7	12"	17'-2	108	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	7'-9	2'-9
	7'	17"	11"	12"	9'-7	12"	19'-2	118	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	8'-3	2'-9
	8'	17"	11"	12"	10'-7	12"	21'-2	118	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	8'-9	2'-9
	9'	17"	11"	12"	11'-7	12"	23'-2	128	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	9'-3	2'-9
	10'	17"	11"	12"	12'-7	12"	25'-2	138	7	13"	45'-6	7'-7	3'-7	1'-2	5'-2	4	13"	22'-8	7	13"	44'-2	48	5	6½"	9'-9	2'-9
12'	8'	20½"	13"	12"	11'-2	12"	22'-6	118	8	14"	54'-8	9'-1	4'-2	1'-5½	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	9'-4	2'-11
	9'	20½"	13"	12"	12'-2	12"	24'-6	128	8	14"	54'-8	9'-1	4'-2	1'-5½	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	9'-10	2'-11
	10'	20½"	13"	12"	13'-2	12"	26'-6	138	8	14"	54'-8	9'-1	4'-2	1'-5½	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	10'-4	2'-11
	11'	20½"	13"	12"	14'-2	12"	28'-6	138	8	14"	54'-8	9'-1	4'-2	1'-5½	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	11'-4	3'-5
	12'	20½"	13"	12"	15'-2	12"	30'-6	148	8	13"	54'-8	9'-1	4'-2	1'-5½	6'-2	5	13"	27'-0	8	13"	53'-0	56	5	6½"	11'-9	3'-5

+ Total number of bars in the cross-section.

TABLE V
25'-30' FILL

Span "S"	Height "H"	Top Slab "T"	Walls "W"	aa Spacing	aa Length	bb Spacing	bb Length	cc Number +	dd Bar Size	dd Spacing	dd Length	A	B	C	D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number +	hh Bar Size	hh Spacing	hh Length	F
6'	3'	12½"	8"	12"	4'-8	12"	9'-10	88	6	16"	27'-9	4'-7	2'-1	9½"	3'-1	6	16"	14'-0	6	16"	26'-11	32	4	8"	5'-4	2'-5
	4'	12½"	8"	12"	5'-8	12"	11'-10	98	6	16"	27'-9	4'-7	2'-1	9½"	3'-1	6	16"	14'-0	6	16"	26'-11	32	4	8"	5'-10	2'-5
	5'	12½"	8"	12"	6'-8	12"	13'-10	98	6	16"	27'-9	4'-7	2'-1	9½"	3'-1	6	16"	14'-0	6	16"	26'-11	32	4	8"	6'-4	2'-5
	6'	12½"	8"	12"	7'-8	12"	15'-10	108	5	12"	27'-9	4'-7	2'-1	9½"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	6'-10	2'-5
	7'	12½"	8"	12"	8'-8	12"	17'-10	118	5	12"	27'-9	4'-7	2'-1	9½"	3'-1	5	12"	14'-0	5	12"	26'-11	32	4	6"	7'-4	2'-5
8'	3'	16"	9"	12"	5'-5	12"	11'-1	88	7	16"	36'-10	6'-1	2'-7	1'-1	4'-2	4	16"	18'-3	7	16"	35'-4	40	5	8"	6'-0	2'-7
	4'	16"	9"	12"	6'-5	12"	13'-1	98	7	16"	36'-10	6'-1	2'-7	1'-1	4'-2	4	16"	18'-3	7	16"	35'-4	40	5	8"	6'-6	2'-7
	5'	16"	9"	12"	7'-5	12"	15'-1	98	6	12"	36'-10	6'-1	2'-7	1'-1	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	6'-9	2'-6
	6'	16"	9"	12"	8'-5	12"	17'-1	108	6	12"	36'-10	6'-1	2'-7	1'-1	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-3	2'-6
	7'	16"	9"	12"	9'-5	12"	19'-1	118	6	12"	36'-10	6'-1	2'-7	1'-1	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	7'-9	2'-6
	8'	16"	9"	12"	10'-5	12"	21'-1	118	6	12"	36'-10	6'-1	2'-7	1'-1	4'-2	4	12"	18'-3	6	12"	35'-4	40	4	6"	8'-3	2'-6
10'	3'	19"	11"	12"	5'-11	12"	11'-9	88	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	6'-4	2'-9
	4'	19"	11"	12"	6'-11	12"	13'-9	98	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	6'-10	2'-9
	5'	19"	11"	12"	7'-11	12"	15'-9	98	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	7'-4	2'-9
	6'	19"	11"	12"	8'-11	12"	17'-9	108	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	7'-10	2'-9
	7'	19"	11"	12"	9'-11	12"	19'-9	118	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	8'-4	2'-9
	8'	19"	11"	12"	10'-11	12"	21'-9	118	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	8'-10	2'-9
	9'	19"	11"	12"	11'-11	12"	23'-9	128	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	9'-4	2'-9
	10'	19"	11"	11½"	12'-11	12"	25'-9	138	7	12"	45'-11	7'-7	3'-3	1'-4	5'-2	4	12"	22'-8	7	12"	44'-2	48	5	6"	9'-10	2'-9
12'	8'	23"	13"	12"	11'-7	12"	23'-0	118	8	14"	55'-2	9'-1	3'-9	1'-8	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	10'-0	3'-5
	9'	23"	13"	12"	12'-7	12"	25'-0	128	8	14"	55'-2	9'-1	3'-9	1'-8	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	10'-6	3'-5
	10'	23"	13"	12"	13'-7	12"	27'-0	138	8	14"	55'-2	9'-1	3'-9	1'-8	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	11'-0	3'-5
	11'	23"	13"	12"	14'-7	12"	29'-0	138	8	14"	55'-2	9'-1	3'-9	1'-8	6'-2	5	14"	27'-0	8	14"	53'-0	56	6	7"	11'-6	3'-5
	12'	23"	13"	9½"	15'-7	12"	31'-0	148	8	14"	55'-2	9'-1	3'-9	1'-8	6'-2	6	14"	27'-0	8	14"	53'-0	56	6	7"	12'-0	3'-5

	DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 7-88
	APPROVED FOR DISTRIBUTION	FOUR BARREL BOX CULVERT	STANDARD NO. B-02.45

DOUBLE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	1.172	172.1	1.039	167.5	1.172	177.7	1.305	190.0	1.437	187.7
	4	1.246	183.8	1.113	179.2	1.246	189.8	1.379	202.3	1.511	199.0
	5	1.320	191.6	1.187	187.0	1.320	197.8	1.453	210.7	1.585	206.3
	6	1.394	203.3	1.261	198.7	1.394	209.8	1.527	223.0	1.659	225.1
	7	1.468	224.5	1.335	210.5	1.468	221.8	1.601	235.4	1.734	237.5
8'	3	1.475	261.6	1.590	236.4	1.762	253.5	1.991	256.6	2.221	242.2
	4	1.558	274.9	1.673	248.5	1.845	265.8	2.075	268.9	2.304	253.5
	5	1.642	284.3	1.756	256.5	1.928	274.1	2.158	271.3	2.387	280.5
	6	1.725	297.6	1.840	268.5	2.012	286.5	2.241	285.6	2.473	292.8
	7	1.808	301.3	1.923	280.5	2.095	298.9	2.325	302.0	2.554	305.2
	8	1.892	337.1	2.006	304.5	2.118	307.2	2.408	310.3	2.637	313.5
10'	3	1.965	256.9	2.250	303.7	2.606	325.7	2.891	329.2	3.176	354.8
	4	2.067	310.0	2.352	333.8	2.708	337.8	2.993	341.2	3.278	367.1
	5	2.168	318.4	2.453	323.2	2.810	345.8	3.095	349.3	3.380	375.4
	6	2.270	330.7	2.555	353.9	2.912	357.8	3.197	361.3	3.481	387.8
	7	2.372	355.9	2.657	365.8	3.013	369.9	3.298	373.3	3.583	400.2
	8	2.474	364.9	2.759	373.9	3.115	377.5	3.400	381.3	3.685	408.5
	9	2.576	394.3	2.861	385.9	3.217	389.9	3.502	393.4	3.787	420.8
	10	2.678	410.1	2.963	398.0	3.319	401.9	3.604	405.4	3.888	434.4
12'	8	3.282	456.2	3.708	458.6	4.219	465.8	4.644	495.8	5.070	505.6
	9	3.403	453.7	3.828	471.6	4.338	477.5	4.765	509.1	5.190	518.0
	10	3.523	466.4	3.949	486.6	4.459	523.2	4.885	522.4	5.311	532.3
	11	3.643	523.5	4.069	491.1	4.580	532.5	5.005	536.9	5.431	541.6
	12	3.764	537.7	4.189	538.3	4.700	545.8	5.126	542.1	5.551	584.6

TRIPLE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	1.687	237.6	1.493	231.1	1.687	244.7	1.882	261.0	2.076	262.9
	4	1.786	252.8	1.592	246.3	1.786	260.2	1.980	276.8	2.175	277.6
	5	1.885	262.6	1.690	256.1	1.885	270.3	2.079	287.2	2.274	287.0
	6	1.984	277.8	1.789	271.3	1.984	285.7	2.178	303.0	2.372	305.8
	7	2.082	305.2	1.888	286.5	2.082	301.2	2.277	318.8	2.471	321.5
8'	3	2.135	358.1	2.303	330.0	2.557	356.4	2.894	360.3	3.231	344.1
	4	2.246	374.9	2.415	348.2	2.668	372.2	3.005	376.1	3.343	358.8
	5	2.357	386.3	2.526	358.4	2.779	382.6	3.116	386.5	3.454	391.2
	6	2.468	403.0	2.637	373.8	2.890	398.4	3.227	402.3	3.565	407.0
	7	2.578	415.4	2.748	388.3	3.001	414.2	3.338	418.0	3.676	422.8
	8	2.690	453.3	2.859	420.9	3.112	424.6	3.450	428.5	3.787	433.2
10'	3	2.851	430.6	3.271	435.3	3.795	464.5	4.215	469.1	4.635	503.4
	4	2.987	446.4	3.406	472.5	3.931	479.9	4.351	484.5	4.771	519.2
	5	3.122	459.1	3.542	458.3	4.067	450.0	4.487	494.7	4.906	529.7
	6	3.258	474.8	3.678	500.0	4.203	505.5	4.622	510.1	5.042	545.4
	7	3.394	504.9	3.814	515.5	4.338	520.9	4.758	525.6	5.178	561.2
	8	3.530	516.0	3.950	525.6	4.474	531.1	4.894	535.7	5.314	571.6
	9	3.666	556.8	4.085	541.0	4.610	546.5	5.030	551.1	5.450	587.4
	10	3.801	574.5	4.221	556.5	4.746	562.0	5.166	566.6	5.585	604.3
12'	9	4.703	646.9	5.330	643.6	6.083	662.3	6.711	695.8	7.338	705.2
	9	4.863	648.1	5.491	660.0	6.244	677.5	6.871	711.7	7.499	722.0
	10	5.024	665.2	5.651	676.4	6.404	726.5	7.032	728.4	7.659	738.7
	11	5.184	733.7	5.812	695.0	6.565	737.9	7.192	745.0	7.820	750.2
	12	5.345	752.3	5.972	745.4	6.725	754.7	7.353	764.1	7.980	806.9

FOUR BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	2.203	305.2	1.947	295.8	2.203	313.9	2.459	334.3	2.715	340.3
	4	2.326	323.8	2.070	314.4	2.326	332.8	2.582	353.5	2.838	358.4
	5	2.450	335.7	2.193	326.3	2.450	345.0	2.706	366.0	2.962	368.9
	6	2.573	354.3	2.317	344.8	2.573	363.9	2.829	385.2	3.085	388.5
	7	2.697	388.1	2.440	363.5	2.697	382.8	2.953	404.4	3.209	407.7
8'	3	2.794	465.8	3.017	431.4	3.351	461.5	3.797	466.4	4.242	447.4
	4	2.933	486.0	3.156	450.3	3.490	480.1	3.936	485.6	4.381	465.6
	5	3.072	499.5	3.295	462.5	3.629	493.2	4.075	498.1	4.520	504.1
	6	3.211	518.8	3.434	481.3	3.768	512.4	4.213	517.3	4.659	523.3
	7	3.350	541.0	3.573	500.2	3.907	531.6	4.352	536.5	4.798	542.5
	8	3.489	581.0	3.712	539.7	4.046	544.2	4.491	549.1	4.933	555.0
10'	3	3.737	542.2	4.291	564.9	4.985	605.5	5.539	611.2	6.094	655.6
	4	3.907	561.5	4.461	615.2	5.154	624.3	5.709	630.1	6.263	674.8
	5	4.076	578.5	4.631	595.5	5.324	636.5	5.879	642.3	6.433	687.3
	6	4.246	597.7	4.801	648.2	5.494	655.4	6.048	661.2	6.603	706.5
	7	4.416	632.1	4.970	667.1	5.664	674.3	6.268	680.0	6.173	725.7
	8	4.586	645.2	5.140	679.3	5.833	686.5	6.388	692.2	6.942	738.2
	9	4.755	698.3	5.310	698.2	6.003	705.4	6.558	711.1	7.112	757.4
	10	4.925	717.3	5.480	717.1	6.173	724.9	6.727	730.0	7.282	777.8
12'	8	6.123	819.9	6.953	831.8	7.948	860.9	8.778	895.4	9.607	907.0
	9	6.324	826.6	7.153	851.6	8.149	879.5	8.978	915.6	9.808	927.2
	10	6.524	848.1	7.354	871.4	8.349	931.2	9.179	935.8	10.008	941.3
	11	6.725	926.2	7.555	891.1	8.550	944.7	9.379	954.4	10.209	960.8
	12	6.926	947.3	7.755	954.2	8.751	966.9	9.580	988.5	10.409	1032.1

FIVE BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	2.718	369.1	2.400	364.3	2.718	386.4	3.036	411.2	3.354	421.8
	4	2.866	391.1	2.548	386.3	2.866	408.7	3.184	433.9	3.502	443.4
	5	3.014	405.1	2.697	400.3	3.014	423.0	3.332	448.5	3.650	457.0
	6	3.163	427.1	2.845	422.3	3.163	445.3	3.480	471.1	3.798	475.1
	7	3.311	467.6	2.993	444.3	3.311	467.6	3.629	493.7	3.947	497.7
8'	3	3.454	567.4	3.731	535.9	4.146	573.2	4.700	578.9	5.253	557.7
	4	3.621	591.0	3.898	558.1	4.313	595.9	4.866	601.5	5.420	579.3
	5	3.788	606.6	4.064	572.4	4.479	610.5	5.033	616.1	5.586	623.2
	6	3.954	630.2	4.231	594.7	4.646	633.1	5.200	638.8	5.753	645.8
	7	4.121	661.4	4.398	617.0	4.813	655.7	5.366	661.4	5.920	668.4
	8	4.288	702.8	4.564	664.8	4.979	670.3	5.533	676.0	6.086	683.0
10'	3	4.623	685.6	5.140	705.8	6.174	756.5	6.863	763.1	7.552	820.4
	4	4.827	708.3	5.516	768.0	6.378	778.8	7.067	785.4	7.756	843.0
	5	5.030	730.0	5.720	741.9	6.581	793.0	7.271	799.6	7.960	857.6
	6	5.234	752.6	5.923	806.5	6.785	815.3	7.474	821.9	8.164	880.2
	7	5.438	792.7	6.127	828.8	6.989	837.6	7.678	844.2	8.367	902.8
	8	5.641	808.0	6.331	843.1	7.192	851.9	7.882	858.5	8.571	917.4
	9	5.445	872.4	6.534	865.4	7.396	874.2	8.085	880.8	8.775	940.1
	10	6.049	894.1	6.738	887.7	7.600	896.5	8.289	903.1	9.978	963.9
12'	8	7.544	1025.0	8.575	1031.1	9.815	1072.9	10.844	1109.2	11.876	1122.1
	9	7.784	1037.5	8.816	1054.4	10.053	1095.0	11.085	1132.8	12.116	1145.7
	10	8.025	1060.4	9.057	1077.6	10.294	1150.9	11.326	1156.4	12.357	1169.3
	11	8.266	1151.9	9.297	1120.8	10.535	1166.5	11.566	1177.1	12.598	1184.9
	12	8.507	1176.3	9.538	1178.5	10.776	1190.1	11.807	1227.3	12.838	1269.7

SIX BARREL

Span "S"	Height "H"	Table I Concrete C.Y.	Table I Reinf. Steel Lbs.	Table II Concrete C.Y.	Table II Reinf. Steel Lbs.	Table III Concrete C.Y.	Table III Reinf. Steel Lbs.	Table IV Concrete C.Y.	Table IV Reinf. Steel Lbs.	Table V Concrete C.Y.	Table V Reinf. Steel Lbs.
6'	3	3.234	431.8	2.854	415.4	3.234	439.6	3.613	467.0	3.993	481.4
	4	3.406	457.2	3.027	440.9	3.406	465.3	3.786	493.0	4.166	506.4
	5	3.579	473.3	3.200	457.0	3.579	481.1	3.959	509.7	4.338	522.1
	6	3.752	498.8	3.372	482.4	3.752	507.4	4.132	535.7	4.511	541.3
	7	3.925	545.3	3.545	507.9	3.925	533.1	4.305	561.8	4.684	567.3
8'	3	4.114	679.4	4.445	609.6	4.941	650.2	5.602	656.3	6.264	634.1
	4	4.304	706.4	4.639	635.3	5.135	676.2	5.797	682.4	6.458	659.1
	5	4.503	724.0	4.834	651.7	5.330	692.9	5.991	699.1	6.653	709.0
	6	4.697	751.1	5.028	677.4	5.524	718.9	6.186	725.1	6.847	735.1
	7	4.892	790.1	5.222	703.1	5.719	745.0	6.380	751.2	7.042	761.1
	8	5.086	834.3	5.417	756.6	5.913	761.7	6.575	767.8	7.236	777.8
10'	3	5.509	816.5	6.333	801.8	7.363	857.6	8.187	864.3	9.011	926.5
	4	5.747	842.6	6.571	873.6	7.601	883.5	8.425	890.0	9.249	952.6
	5	5.984	868.7	6.808	843.3	7.838	899.9	8.663	906.4	9.487	969.3
	6	6.222	894.7	7.046	916.3	8.076	925.6	8.900	932.1	9.724	995.3
	7	6.460	939.5	7.284	942.1	8.314	951.3	9.138	957.8	9.962	1021.3
	8	6.697	956.9	7.521	958.4	8.551	967.1	9.376	974.2	10.200	1038.0
	9	6.935	1032.7	7.759	984.1	8.789	993.4	9.613	999.9	10.437	1064.1
	10	7.173	1056.3	7.997	1005.9	9.027	1019.6	9.851	1025.6	10.675	1091.3
12'	8	8.964	1208.2	10.198	1172.4	11.677	1220.8	12.911	1257.4	14.144	1270.0
	9	9.245	1225.6	10.478	1199.5	11.958	1246.3	13.192	1284.4	14.425	1297.1
	10	9.526	1252.0	10.759	1226.2	12.239	1305.6	13.472	1311.4	14.706	1324.1
	11	9.807	1354.6	11.040	1277.5	12.520	1321.3	13.753	1334.3	14.987	1341.0
	12	10.088	1382.5	11.321	1338.2	12.801	1350.3	14.034	1395.4	15.267	1440.3

OLIVE DIVERSION CULVERT

100% NORTHERN DIVERSION CULVERT

60%/40% NORTHERN DIVERSION CULVERT

NOTE:

Quantities shown in tables are per lin. foot of culvert length.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

CULVERT QUANTITIES

REVISION

STANDARD NO. 8-02.70

MODIFICATIONS TO STANDARD ADOT CULVERT DRAWINGS

Location	Standard No.	Parameter	Standard Value	Modified Value
Northern Avenue Wash Culvert Outlet	B-04.10	E	11' 0"	15' 6"
		G	11' 0"	15' 6"
	B-06.20	A	14' 3 3/4"	14' 8 7/8"
		B	62' 7 1/2"	53' 11 1/8"
		C	5' 2 1/2"	5' 4 3/8"
Northern Avenue Wash Box Culvert	B-02.40	H	8' 0"	6' 0"
Northern Avenue NIC Diversion Culvert Outlet	B-04.10	E	9' 6"	22' 0"
		G	9' 6"	22' 0"
	B-06.20	A	9' 5 1/4"	21' 2 1/4"
		B	52' 8 1/4"	41' 9 3/4"
		C	3' 5 1/4"	7' 8 1/2"
Northern Avenue NIC Diversion Culvert Inlet	B-04.30	E	8' 6"	12' 0"
		G	8' 6"	12' 0"
Olive Avenue NIC Diversion Culvert Outlet	B-04.10	E	9' 6"	12' 0"
		G	9' 6"	15' 6"
		Θ_1	70°	90°
		Θ_2	70°	45°
	B-06.20	A	7' 6"	12' 0"
		B	30' 10 1/4"	25' 2 3/8"
		C	14' 9 5/8"	12' 0"
		D	8' 6 5/8"	12' 0"

FRS#3 CHANNEL MODIFICATION

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/4/05

Subject CULVERT QUANTITIES Designed ACL Checked JRK

DETAILS & DIMENSIONS ON FOLLOWING SHEETS

QUANTITIES OBTAINED FROM ADOT STD. NO. B-02.70

○ OLIVE AVE. DIVERSION CULVERT

(2) 10'x5' BOX CULVERT = (~~2.168~~ 2.453 CY/L.F.) (~~320'~~ 331) = ~~693.7~~ 811.94 CY OF REINF. CONC

TABLE II

CULVERT LENGTH

□ NORTHERN AVE. DIVERSION CULVERT

~~(4)~~ 10'x5' BOX CULVERT = (~~4.076~~ 4.63 CY/L.F.) (~~330~~ 336) = ~~1556.01~~ ~~1300.24~~ 1190.11 CY OF REINF. CONC

(3) 3.542

TABLE II

CULVERT LENGTH

☆ NORTHERN AVE. WASH CULVERT

(4) 12'x6' BOX CULVERT => NO STANDARD EXISTS FOR A 12'x6' BOX CULVERT. THE STD. FOR 12'x8' WILL BE MODIFIED TO HAVE 6' HEIGHT.

AREA OF FACE

FOOTING AREA = (14.5'/2)[(12'·4) + (13'/12·5) + 8'/12] = 65.35 SQ FT

WALL AREA = 2(6')(13'/12) = 32.50 SQ FT

CHAMFER AREA = 8(1/2 (6"/12)(6"/12)) = 1.00 SQ FT

TOP SLAB AREA = (12.5'/12)[(12·4) + (13'/12·5)] = 55.64 SQ FT

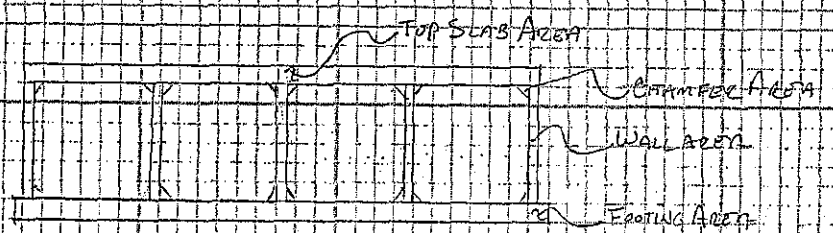
154.49 SQ FT

≈ 17.17 SQ YD

CULVERT LENGTH

QUANTITY OF CONCRETE = 17.17 SQ YD · 67 FT/3 YD

= 383.37 CU YD OF CONCRETE



KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 2

Project NORTH INLET CHANNEL Date 3/9/05

Subject WINGWALL QUANTITIES Designed ACC Checked JKK

SEE DETAILS & DIMENSIONS ON SUBSEQUENT SHEETS

○ DIVE DIVERSION OUTLET

MIN CROSS SECTIONAL AREA = (1.58')(0.75')
= ~~0.44 SF~~ 1.19 SF

MAX CROSS SECTIONAL AREA = (~~5.87~~ 6.04')(0.75')
= ~~4.40~~ 4.53 SF

AVE CROSS SECTIONAL AREA = (~~4.40~~ 4.53 SF + ~~0.44~~ 1.19 SF)/2
= ~~2.42~~ 2.86 SF

LENGTH OF W WINGWALL = 12'
LENGTH OF E. WINGWALL = 15.5'

VOLUME OF WINGWALLS = (~~2.42~~ 2.86 SF)(12') + (~~2.42~~ 2.86 SF)(15.5')
= ~~66.55~~ 78.65 CF ≈ ~~2.5~~ CY 2.91

□ NORTHERN DIVERSION INLET

MIN CROSS SECTIONAL AREA = (3.08')(0.75')
= 2.31 SF

MAX CROSS SECTIONAL AREA = (~~5.87~~ 6.04')(0.75')
= ~~4.40~~ SF 4.53

AVE WINGWALL AREA = ~~3.36~~ SF 3.42

LENGTH OF BOTH WINGWALLS = 12.00'

VOLUME OF WINGWALLS = 2[(12')(~~3.36~~ 3.42')]
= ~~80.64~~ 82.08 SF ≈ 3.04 CY

△ NORTHERN DIVERSION OUTLET

MIN CROSS SECTIONAL AREA = (1.58')(0.75')
= ~~0.44~~ SF 1.19

MAX CROSS SECTIONAL AREA = (~~5.87~~ 6.04')(0.75')
= ~~4.40~~ SF 4.53

AVE. CROSS SECTIONAL AREA = (~~4.40~~ 4.53 SF + ~~0.44~~ 1.19 SF)/2
= ~~2.42~~ SF 2.86

BOTH WING LENGTHS = 22.00'

VOLUME OF WINGWALLS = 2[(22')(~~2.42~~ 2.86 SF)]
= ~~106.48~~ 125.84 CF ≈ ~~3.9~~ CY 4.66

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number

Sheet 2 of 2

Project NORTH INLET CHANNEL Date 3/9/05

Subject WING WALL QUANTITIES Designed ACC Checked JKK

☆ NORTHERN WASH INLET

MIN CROSS SECTIONAL AREA = (1.92')(0.75')
= 1.44 SF

MAX. CROSS SECTIONAL AREA = (7.04')(0.75')
= 5.28 SF

AVE CROSS SECTIONAL AREA = (5.28 SF + 1.44 SF) / 2
= ~~3.80~~ SF 3.36

LENGTH OF BOTH WINGS = 15.50'

WING WALL VOLUME = 2 [(15.50')(~~3.80~~ 3.36 SF)]
= ~~117.80~~ CF ≈ ~~4.4~~ CY
104.16 3.86

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 2

Project NORTH INLET CHANNEL Date 3/9/05

Subject WING WALL FOOTING QUANTITIES Designed ACC Checked JPK

SEE SUBSEQUENT SHEETS FOR DIMENSIONS

○ OLIVE DIVERSION OUTLET ADOT B-04.10

AVE OF WIDTH = [(1.5' + 1.08' + 1.00') + (1.5' + 1.08')]/2
(A) (B) (C) (A) (B)
= 3.08'

HAS APRON - CUTOFF WALL ELIMINATED

LENGTH OF W. WINGWALL = 12'

LENGTH OF E. WINGWALL = 15.50'

WING WALL VOLUME = (3.08')(15.50')(1.25') + (12')(3.08')(1.25')
= 105.88 CF ≈ 3.9 CY

HEADWALL CURB VOLUME = (1')(~~45.75'~~ 22.75)(0.5')
= ~~22.88~~ 11.38 CF ≈ ~~0.8~~ 0.42 CY

TOTAL VOLUME = 3.9 CY + ~~0.8~~ 0.42 CY
= ~~4.7~~ CY 4.32

☐ NORTHERN DIVERSION INLET

AVE WIDTH = [(1.5' + 1.08' + 1.25') + (1.50' + 1.08')]/2
(A) (B) (C) (A) (B)
= 3.21'

LENGTH W. WINGWALL = 12'

LENGTH E. WINGWALL = 12'

WINGWALL VOLUME = (3.21')(12')(1.25') + (12')(3.21')(1.25')
FOOTING = 96.30 CF ≈ 3.6 CY

HEADWALL CURB VOLUME = (0.5')(1')(~~42.25'~~ 44.53)
= ~~253.50~~ 22.29 CF ≈ ~~9.4~~ 0.83 CY

CUTOFF WALL AREA = ½(4')(12')
= 24 SF

CUTOFF WALL WIDTH = 0.75

CUTOFF WALL VOLUME = [0.75' · 24 SF]
= 36 CF ≈ 1.3 CY

CUTOFF WALL AT BOX
V = (4')(0.75')(44.53)/27
V = 4.95 CY

TOTAL VOLUME = 1.3 CY + ~~9.4~~ CY + 3.6 CY + 4.95
= ~~19.3~~ CY
10.7

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 2 of 2

Project NORTH INLET CHANNEL Date 3/9/05

Subject WING WALL FOOTING QUANTITIES Designed ACL Checked JRK

△ NORTHERN DIVERSION OUTLET

AVE WIDTH = [(1.5' + 1.08' + 1') + (1.50' + 1.08')]/2
= 3.08'

LENGTH E. WING WALL = 22'
LENGTH W. WING WALL = 22'
WINGWALL VOLUME = 2' [(22')(1.25)(3.08')]
= 169.40 CF ≈ 6.3 cy

HEADWALL VOLUME = (1')(0.5')(~~42.22~~ 44.58)
= 22.~~5~~29 CF ≈ 0.8 cy

TOTAL VOLUME = 0.8 cy + 6.3 cy
= 7.1 cy

☆ NORTHERN WASH OUTLET

AVE WIDTH = [(1.5' + 1.17' + 1.42') + (1.50' + 1.17')]/2
= 3.38'

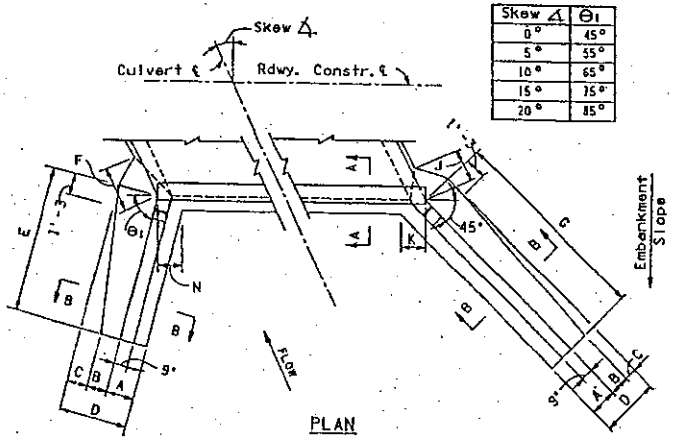
LENGTH E. WINGWALL = 15.5'
LENGTH W. WINGWALL = 15.5'
WING WALL VOLUME = 2 [(15.5')(3.38')(1.25)]
= 130.98 CF ≈ 4.9 cy

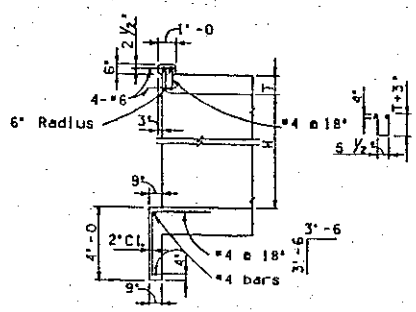
HEADWALL VOLUME = (1')(0.5')(~~54.08~~ 53.21)
= ~~27.04~~ 26.60 CF ≈ 1.0 cy

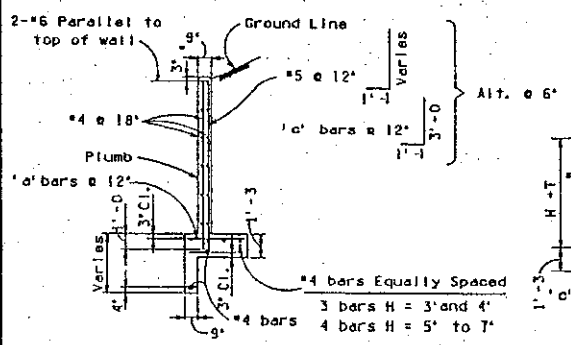
TOTAL VOLUME = 1.0 cy + 4.9 cy
= 5.9 cy

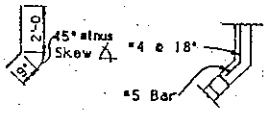
NORTHBOUND DIVERSION INLET MODIFIED

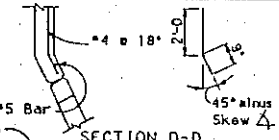
Skew Δ	θ1
0°	45°
5°	55°
10°	65°
15°	75°
20°	85°

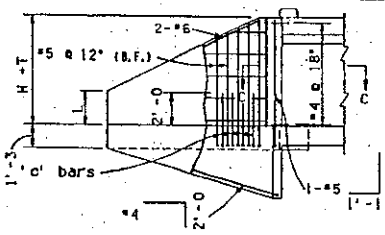


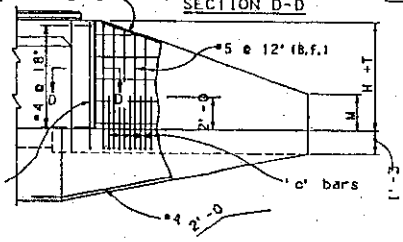












Skew Δ	0°					5°					10°					15°					20°				
2 : 1 Slope Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
Dimensions A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	6"	9"	1'-3	1'-8	2'-1	6"	9"	1'-3	1'-8	2'-1	6"	9"	1'-3	1'-8	2'-1	6"	9"	1'-3	1'-8	2'-1	6"	9"	1'-3	1'-8	2'-1
D	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10	2'-9	3'-3	3'-10	4'-4	4'-10
E	6'-0	7'-6	8'-6	10'-0	11'-6	5'-6	7'-0	8'-6	10'-0	11'-0	5'-6	7'-0	8'-6	9'-6	11'-0	5'-6	7'-0	8'-6	10'-0	11'-0	6'-0	7'-6	8'-6	10'-0	11'-6
F	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	2'-11	3'-8	4'-4	1'-5	2'-1	2'-11	3'-7	4'-3	1'-4	2'-0	2'-9	3'-5	4'-1
G	6'-0	7'-6	8'-6	10'-0	11'-6	6'-0	7'-6	9'-6	10'-6	12'-0	6'-6	8'-0	9'-6	11'-0	12'-6	7'-0	8'-6	10'-0	12'-0	13'-6	7'-6	9'-0	11'-0	12'-6	14'-6
J	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	3'-0	3'-8	4'-5	1'-5	2'-2	2'-11	3'-8	4'-4	1'-5	2'-1	2'-11	3'-7	4'-3	1'-4	2'-0	2'-9	3'-5	4'-1
K	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½
L	1'-11	2'-5	3'-1	3'-6	4'-0	1'-10	2'-2	2'-5	3'-0	3'-7	1'-7	1'-11	2'-3	2'-9	3'-1	1'-5	1'-8	1'-11	2'-3	2'-9	1'-1	1'-4	1'-10	2'-1	2'-4
M	1'-11	2'-5	3'-1	3'-6	4'-0	1'-11	2'-5	2'-11	3'-4	3'-10	1'-9	2'-3	2'-8	3'-2	3'-8	1'-7	2'-1	2'-6	2'-10	3'-3	1'-5	1'-11	2'-2	2'-8	2'-11
N	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼

Skew Δ	0°					5°					10°					15°					20°				
4 : 1 Slope Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
Dimensions A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-4	1'-8	9"	1'-0	1'-1	1'-3	1'-7	9"	1'-0	1'-1	1'-2	1'-6	9"	1'-0	1'-1	1'-2	1'-5	9"	1'-0	1'-1	1'-2	1'-3
C	4"	7"	1'-0	1'-3	1'-5	4"	7"	1'-0	1'-4	1'-6	4"	7"	1'-0	1'-5	1'-7	4"	7"	1'-0	1'-5	1'-8	4"	7"	1'-0	1'-5	1'-10
D	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7
E	8'-0	9'-6	11'-6	13'-6	15'-6	8'-0	10'-0	11'-6	13'-6	15'-6	8'-0	10'-0	12'-0	14'-0	16'-0	8'-6	10'-6	12'-6	14'-6	16'-6	9'-0	11'-0	13'-6	15'-6	17'-6
F	1'-3	1'-11	2'-8	3'-4	4'-1	1'-3	1'-11	2'-7	3'-4	4'-0	1'-2	1'-11	2'-7	3'-3	4'-0	1'-2	1'-10	2'-6	3'-3	3'-11	1'-2	1'-10	2'-5	3'-1	3'-9
G	8'-0	9'-6	11'-6	13'-6	15'-6	8'-6	10'-6	12'-6	14'-6	16'-6	9'-0	11'-0	13'-0	15'-6	17'-6	9'-6	12'-0	14'-6	16'-6	19'-0	10'-6	13'-0	15'-6	18'-6	21'-0
J	1'-3	1'-11	2'-8	3'-4	4'-1	1'-3	1'-11	2'-7	3'-4	4'-0	1'-2	1'-11	2'-7	3'-3	4'-0	1'-2	1'-10	2'-6	3'-3	3'-11	1'-2	1'-10	2'-5	3'-1	3'-9
K	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½
L	2'-8	3'-5	4'-0	4'-8	5'-4	2'-5	3'-0	3'-8	4'-4	4'-11	2'-3	2'-10	3'-4	3'-11	4'-5	2'-0	2'-6	3'-1	3'-7	4'-1	1'-10	2'-4	2'-8	3'-2	3'-8
M	2'-8	3'-5	4'-0	4'-8	5'-4	2'-7	3'-2	3'-10	4'-6	5'-2	2'-6	3'-1	3'-9	4'-4	5'-0	2'-5	2'-11	3'-6	4'-2	4'-8	2'-2	2'-9	3'-4	3'-10	4'-4
N	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼

Skew Δ	0°					5°					10°					15°					20°				
6 : 1 Slope Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
Dimensions A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-3	1'-7	2'-0	9"	1'-0	1'-2	1'-7	1'-11	9"	1'-0	1'-1	1'-6	1'-10	9"	1'-0	1'-1	1'-4	1'-8	9"	1'-0	1'-1	1'-3	1'-7
C	3"	6"	9"	11"	1'-0	3"	6"	10"	11"	1'-1	3"	6"	11"	1'-0	1'-2	3"	6"	11"	1'-2	1'-4	3"	6"	11"	1'-3	1'-5
D	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6
E	8'-6	11'-0	13'-0	15'-0	17'-0	9'-0	11'-0	13'-6	15'-6	17'-6	9'-6	11'-6	14'-0	16'-6	18'-6	10'-0	12'-6	15'-0	17'-6	19'-6	11'-0	13'-6	16'-0	19'-0	21'-6
F	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-9	2'-6	3'-2	3'-10	1'-1	1'-9	2'-5	3'-1	3'-9	1'-0	1'-8	2'-4	3'-0	3'-8
G	8'-6	11'-0	13'-0	15'-0	17'-0	9'-6	11'-6	14'-0	16'-0	18'-6	10'-0	12'-6	15'-0	17'-6	20'-0	11'-0	14'-0	16'-6	19'-6	22'-0	12'-6	15'-6	18'-6	21'-6	24'-6
J	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-10	2'-6	3'-3	3'-11	1'-1	1'-9	2'-6	3'-2	3'-10	1'-1	1'-9	2'-5	3'-1	3'-9	1'-0	1'-8	2'-4	3'-0	3'-8
K	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½
L	3'-1	3'-9	4'-6	5'-4	6'-1	2'-10	3'-7	4'-3	4'-11	5'-8	2'-8	3'-4	3'-11	4'-7	5'-3	2'-5	3'-1	3'-8	4'-3	4'-11	2'-3	2'-10	3'-5	3'-11	4'-6
M	3'-1	3'-9	4'-6	5'-4	6'-1	2'-11	3'-8	4'-5	5'-2	5'-11	2'-11	3'-7	4'-4	5'-0	5'-8	2'-9	3'-5	4'-1	4'-9	5'-6	2'-7	3'-3	3'-11	4'-6	5'-2
N	1'-4½	1'-4½	1'-4½	1'-4½	1'-4½	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-4¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼	1'-5¼

'c' bars			
Hgt. H	Slope	Short Wing 0° to 10°	Long Wing 0° to 20°
7'	2 : 1	3 - #5	3 - #5
	4 : 1	5 - #5	5 - #5

'a' bars			
Height H	Short Wing 0° to 10°	Short Wing 15° & 20°	Long Wing 0° to 20°
3'	#4	#4	#4
4'	#4	#4	#4
5'	#4	#4	#4
6'	#5	#4	#5
7'	#6	#4	#6

NOTE :

For General Notes and Miscellaneous Details see B-01.10.
For Headwall Quantities see B-05.10, B-05.20 and B-05.30.

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

INLET WINGS
CULVERT HEIGHT 3' to 7'
SKEW 0° to 20°

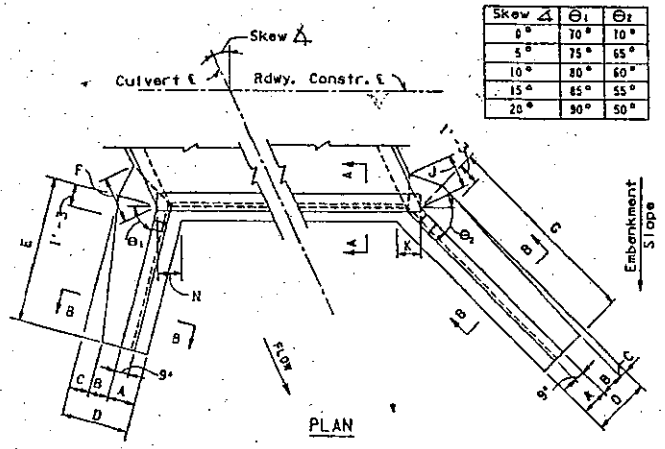
REVISION 7-88

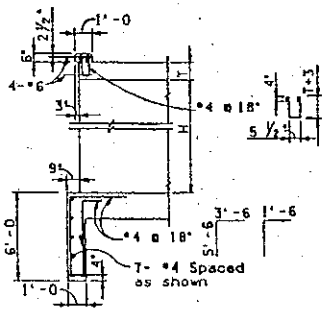
STANDARD NO. B-04.30

NORTHERN DIVERSION OUTLET
&
OLIVE DIVERSION OUTLET
BOTH ARE MODIFIED

NORTHERN WASH OUTLET
MODIFIED

Skew ∆	θ_1	θ_2
0°	70°	70°
5°	75°	65°
10°	80°	60°
15°	85°	55°
20°	90°	50°



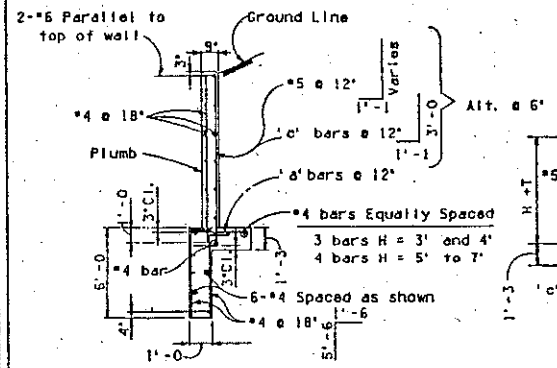


SECTION A-A

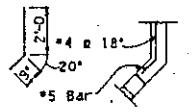
2 : 1 Slope Dimensions	Skew ∆ 0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	4"	7"	1'-0	1'-5	1'-10	4"	7"	1'-0	1'-5	1'-10	5"	8"	1'-1	1'-6	1'-11	5"	8"	1'-1	1'-7	2'-0	6"	9"	1'-2	1'-7	2'-1
D	2'-7	3'-1	3'-7	4'-1	4'-7	2'-7	3'-1	3'-7	4'-1	4'-7	2'-8	3'-2	3'-8	4'-2	4'-8	2'-8	3'-2	3'-8	4'-3	4'-9	2'-9	3'-3	3'-9	4'-3	4'-10
E	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	9'-6	11'-0	12'-6	6'-0	7'-6	9'-0	10'-6	12'-0
F	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
G	6'-6	8'-0	9'-6	11'-0	12'-6	6'-6	8'-0	10'-0	11'-6	13'-0	7'-0	8'-6	10'-0	12'-0	13'-6	7'-0	8'-0	10'-6	12'-6	14'-0	7'-6	9'-6	11'-0	13'-0	14'-6
J	1'-1	1'-9	2'-4	3'-0	3'-8	1'-1	1'-9	2'-4	3'-0	3'-8	1'-2	1'-10	2'-6	3'-1	3'-9	1'-2	1'-10	2'-6	3'-3	3'-10	1'-3	1'-11	2'-7	3'-3	4'-0
K	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4	1'-4	1'-4	1'-4	1'-4
L	1'-0	1'-4	1'-7	1'-11	2'-2	11"	1'-2	1'-6	1'-9	2'-0	10"	1'-1	1'-5	1'-8	1'-11	1'-1	1'-4	1'-7	1'-10	2'-1	1'-1	1'-4	1'-7	1'-10	2'-1
M	1'-0	1'-4	1'-7	1'-11	2'-2	1'-1	1'-5	1'-6	1'-10	2'-2	1'-0	1'-5	1'-9	1'-10	2'-3	1'-2	1'-5	1'-9	1'-11	2'-4	1'-2	1'-5	1'-10	2'-1	2'-6
N	1'-5⅝	1'-5⅝	1'-5⅝	1'-5⅝	1'-5⅝	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-7⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-6	1'-6	1'-6	1'-6	1'-6

4 : 1 Slope Dimensions	Skew ∆ 0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	4"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9	3"	7"	1'-0	1'-5	1'-10
D	2'-7	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-1	3'-7	4'-1	4'-7
E	10'-0	12'-6	15'-0	17'-6	20'-0	10'-0	12'-6	15'-0	17'-0	19'-6	10'-0	12'-6	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6	10'-0	12'-0	14'-6	17'-0	19'-6
F	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-9	2'-4	3'-0	3'-8
G	10'-0	12'-6	15'-0	17'-6	20'-0	10'-6	13'-0	15'-6	18'-0	20'-6	10'-6	13'-0	16'-0	18'-6	21'-0	11'-0	13'-6	16'-0	19'-0	21'-6	11'-6	14'-0	17'-0	19'-6	22'-6
J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-9	2'-4	3'-0	3'-8
K	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4	1'-4	1'-4	1'-4	1'-4
L	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-5	2'-11	3'-4	1'-7	2'-0	2'-6	2'-11	3'-3	1'-7	2'-1	2'-5	2'-10	3'-2	1'-7	2'-1	2'-5	2'-10	3'-2
M	1'-9	2'-2	2'-6	2'-11	3'-4	1'-8	2'-1	2'-7	3'-0	3'-5	1'-9	2'-3	2'-7	3'-1	3'-6	1'-10	2'-4	2'-9	3'-2	3'-8	1'-10	2'-5	2'-10	3'-4	3'-9
N	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-6	1'-6	1'-6	1'-6	1'-6

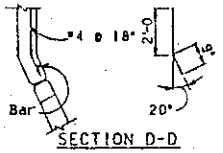
6 : 1 Slope Dimensions	Skew ∆ 0°					5°					10°					15°					20°				
Height H	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'	3'	4'	5'	6'	7'
A	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6	1'-6
B	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3	9"	1'-0	1'-1	1'-2	1'-3
C	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-8	3"	6"	11"	1'-4	1'-9	3"	6"	11"	1'-4	1'-9
D	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-5	2'-6	3'-0	3'-6	4'-0	4'-6	2'-6	3'-0	3'-6	4'-0	4'-6
E	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	15'-6	18'-6	21'-6	24'-6	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0	12'-0	15'-0	18'-0	21'-0	24'-0
F	1'-0	1'-3	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
G	12'-6	15'-6	18'-6	21'-6	24'-6	12'-6	16'-0	19'-0	22'-0	25'-0	13'-0	16'-0	19'-6	22'-6	25'-6	13'-6	16'-6	20'-0	23'-0	26'-6	13'-6	17'-0	20'-6	23'-6	27'-0
J	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-5	1'-0	1'-7	2'-3	2'-11	3'-6	1'-0	1'-7	2'-3	2'-11	3'-6
X	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4	1'-4	1'-4	1'-4	1'-4
L	2'-1	2'-8	3'-2	3'-8	4'-3	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1	2'-1	2'-7	3'-1	3'-7	4'-1
M	2'-3	2'-8	3'-2	3'-8	4'-3	2'-2	2'-8	3'-2	3'-9	4'-3	2'-2	2'-9	3'-3	3'-10	4'-5	2'-3	2'-10	3'-4	3'-11	4'-5	2'-4	2'-11	3'-5	4'-1	4'-7
N	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-3⅝	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-4⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-5⅞	1'-6	1'-6	1'-6	1'-6	1'-6



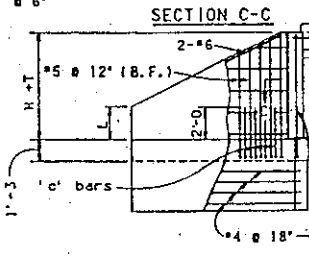
SECTION B-B



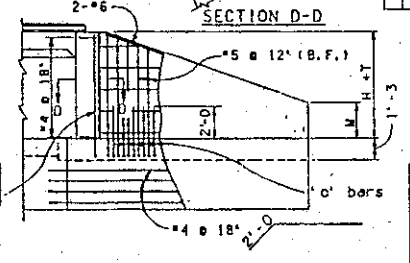
SECTION C-C



SECTION D-D



SHORT WING ELEVATION



LONG WING ELEVATION

'c' bars			
Hgt. H	Slope	Short Wing 0° to 10°	Long Wing 0° to 20°
T'	2 : 1	3 - *5	3 - *5
	4 : 1	5 - *5	5 - *5

'a' bars		
Height H	Short Wing 0° to 20°	Long Wing 0° & 5°	Long Wing 10° to 20°
3'	*4	*4	*4
4'	*4	*4	*4
5'	*4	*4	*4
6'	*4	*4	*5
7'	*4	*4	*6

NOTE :

For General Notes and Miscellaneous Details see B-01.10.
For Headwall Quantities see B-05.10, B-05.20 and B-05.30.

DESIGN APPROVED

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ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

OUTLET WINGS
CULVERT HEIGHT 3' to 7'
SKEW 0° to 20°

REVISION 7-88

STANDARD NO. B-04.10

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/9/05

Subject OUTLET APRON QUANTATIES Designed ACC Checked JPK

SEE FOLLOWING SHEETS FOR DETAILS & DIMENSIONS

○ ALIVE DIVERSION APRON

APRON VOLUME = [(25.20')(12')(0.5') + ½(12')(12')(0.5')] OKAY
= 187.19 CF ≈ 6.9 CY

LIP VOLUME = [(0.5')(0.5') + (½(1.50')(0.50'))] (25.20' + 12.00')
= 23.25 CF ≈ 0.9 CY

CUTOFF WALL VOLUME = (6')(1')(25.20' + 12.00')
= 223.2 CF ≈ 8.3 CY

TOTAL VOLUME = 8.3 CY + 0.9 CY + 6.9 CY
= 16.1 CY

△ NORTHERN DIVERSION APRON

APRON VOLUME = (41.81')(21.19')(0.5') + 2[½(21.19')(7.71')(0.5')]
= 524.67 CF ≈ 19.4 CY

LIP VOLUME = [(0.5')(0.5') + ½(1.50')(0.50')] (41.81' + 7.71' + 7.71')
= 35.77 CF ≈ 1.3 CY

CUTOFF WALL VOLUME = (6')(1')(41.81' + 7.71' + 7.71')
= 343.38 CF ≈ 12.7 CY

TOTAL VOLUME = 12.7 CY + 1.3 CY + 19.4 CY
= 33.4 CY

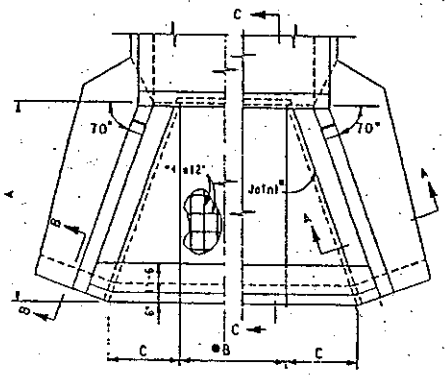
☆ NORTHERN WASH APRON

APRON VOLUME = (53.93')(14.74')(0.5') + 2[½(0.5')(14.74')(5.36')]
= 436.97 CF ≈ 16.2 CY

LIP VOLUME = [(0.5')(0.5') + ½(1.5')(0.5')] (53.93' + 5.36' + 5.36')
= 40.40 CF ≈ 1.5 CY

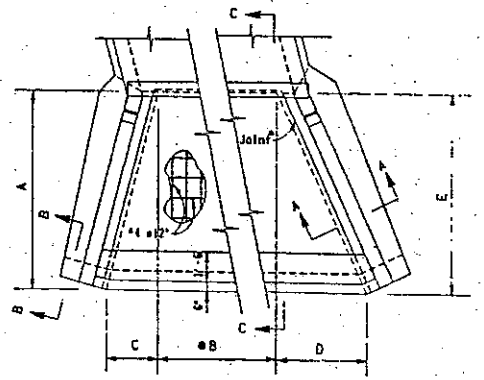
CUTOFF WALL VOLUME = (6')(1')(53.93' + 5.36' + 5.36')
= 387.70 CF ≈ 14.4 CY

TOTAL VOLUME = 14.4 CY + 1.5 CY + 16.2 CY
= 32.1 CY



PLAN

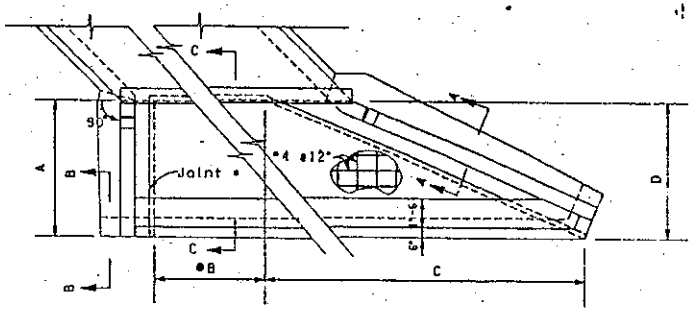
Apron for 0° skew box culvert



PLAN

Apron for 0° to 15° skew box culvert

* Optional construction joint. Apron may be poured with wingwall footings and bottom slab of barrel.

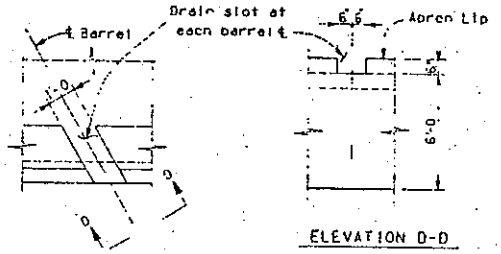


PLAN

Apron for 20° to 45° skew box culvert

Span	0° Skew	5° Skew	10° Skew	15° Skew	20° Skew	25° Skew	30° Skew	35° Skew	40° Skew	45° Skew
	△									
6'	6'-8	6'-8 7/8	6'-9 7/8	6'-10 7/8	7'-1 7/8	7'-4 7/8	7'-8 3/8	8'-1 3/8	8'-8 3/8	9'-5 7/8
8'	8-9	8'-9 3/8	8'-10 3/8	9'-0 7/8	9'-3 7/8	9'-7 3/8	10'-1 7/8	10'-8 3/8	11'-5 3/8	12'-4 7/8
10'	10'-11	10'-11 7/8	11'-1	11'-3 3/8	11'-7 3/8	12'-0 7/8	12'-7 7/8	13'-3 3/8	14'-3	15'-5 7/8
12'	13'-1	13'-1 3/8	13'-3 3/8	13'-6 7/8	13'-11 7/8	14'-5 7/8	15'-1 7/8	15'-11 3/8	17'-1	18'-6

* Dimension varies with number of barrels. △ equals length to be added to dimension 'B' for each additional barrel.



ELEVATION D-D

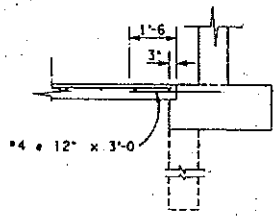
APRON DRAIN DETAIL

NOTES:

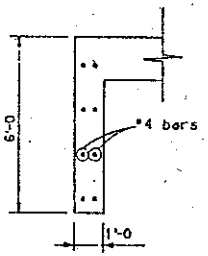
For General Notes and miscellaneous details see B-01.10.

See B-06.20, B-06.30 and B-06.40 for apron dimensions and quantities.

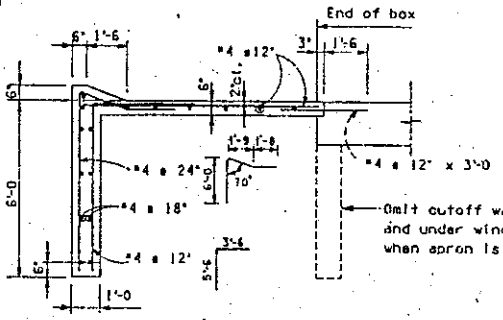
The apron quantities take into consideration the cutoff walls being omitted along outlet headwall and shall be used on new box culverts only.



SECTION A-A



SECTION B-B



SECTION C-C

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HIGHWAYS DIVISION
STANDARD DRAWINGS

REVISION

CULVERT APRON DETAILS

STANDARD NO.
B-06.10

DIMENSIONS

Span	Hgt.	0° Skew A	0° Skew B	0° Skew C	5° Skew A	5° Skew B	5° Skew C	5° Skew D	5° Skew E	10° Skew A	10° Skew B	10° Skew C	10° Skew D	10° Skew E	15° Skew A	15° Skew B	15° Skew C	15° Skew D	15° Skew E
6'	3'	6'-7½	4'-8½	2'-4¾	6'-8	4'-8½	1'-9¾	3'-0½	6'-6½	6'-8	4'-9½	1'-2½	3'-11½	6'-9½	6'-1½	4'-10½	6 3/4"	4'-7¾	6'-7½
	4'	8'-0¾	4'-8½	2'-11½	8'-1¾	4'-8½	2'-2½	3'-8½	7'-10¾	8'-1¾	4'-9½	1'-5½	4'-8½	8'-1¾	7'-7½	4'-10½	8"	5'-9½	8'-2½
	5'	9'-5½	4'-8½	3'-5½	9'-6½	4'-8½	2'-6½	4'-6½	9'-4¾	9'-7¾	4'-9½	1'-8¾	5'-5½	9'-4¾	9'-1½	4'-10½	9 1/2"	6'-7½	9'-5½
	6'	10'-10½	4'-8½	3'-11¾	11'-0½	4'-8½	2'-11¾	5'-1¾	11'-0¾	11'-1½	4'-9½	1'-11½	6'-5½	11'-1½	10'-7½	4'-10½	11 1/4"	7'-9½	11'-1½
	7'	12'-3½	4'-8½	4'-5½	12'-5½	4'-8½	3'-4½	5'-9½	12'-5	12'-6¾	4'-9½	2'-2¾	7'-2½	12'-5½	12'-1	4'-10½	1'-0¾	8'-1¾	12'-3¾
8'	3'	6'-7½	6'-10½	2'-4¾	6'-8	6'-10½	1'-9¾	3'-0½	6'-6½	6'-8	6'-11½	1'-2½	3'-11½	6'-9½	6'-1½	7'-1½	6 3/4"	4'-7¾	6'-7½
	4'	8'-0¾	6'-10½	2'-11½	8'-1¾	6'-10½	2'-2½	3'-8½	7'-10¾	8'-1¾	6'-11½	1'-5½	4'-8½	8'-1¾	7'-7½	7'-1½	8"	5'-9½	8'-2½
	5'	9'-5½	6'-10½	3'-5½	9'-6½	6'-10½	2'-6½	4'-6½	9'-4¾	9'-7¾	6'-11½	1'-8¾	5'-5½	9'-4¾	9'-1½	7'-1½	9 1/2"	6'-7½	9'-5½
	6'	10'-10½	6'-10½	3'-11¾	11'-0½	6'-10½	2'-11¾	5'-1¾	11'-0¾	11'-1½	6'-11½	1'-11½	6'-5½	11'-1½	10'-7½	7'-1½	11 1/8"	7'-9½	11'-1½
	7'	12'-3½	6'-10½	4'-5½	12'-5½	6'-10½	3'-4½	5'-9½	12'-5	12'-6¾	6'-11½	2'-2¾	7'-2½	12'-5½	12'-1	7'-1½	1'-0¾	8'-1¾	12'-3¾
	8'	14'-3½	5'-9½	5'-2½	14'-0½	5'-9½	3'-9½	6'-6½	13'-11¾	14'-1¾	5'-10½	2'-5¾	8'-0¾	13'-11¾	13'-7½	5'-11¾	1'-2½	9'-8¾	13'-10½
10'	3'	6'-7½	9'-0½	2'-4¾	6'-8	9'-0¾	1'-9¾	3'-0½	6'-6½	6'-8	9'-1¾	1'-2½	3'-11½	6'-9½	6'-1½	9'-4	6 3/4"	4'-7¾	6'-7½
	4'	8'-0¾	9'-0½	2'-11½	8'-1¾	9'-0¾	2'-2½	3'-8½	7'-10¾	8'-1¾	9'-1¾	1'-5½	4'-8½	8'-1¾	7'-7½	9'-4	8"	5'-9½	8'-2½
	5'	9'-5½	9'-0½	3'-5½	9'-6½	9'-0¾	2'-6½	4'-6½	9'-4¾	9'-7¾	9'-1¾	1'-8¾	5'-5½	9'-4¾	9'-1½	9'-4	9 1/2"	6'-7½	9'-5½
	6'	10'-10½	9'-0½	3'-11¾	11'-0½	9'-0¾	2'-11¾	5'-1¾	11'-0¾	11'-1½	9'-1¾	1'-11½	6'-5½	11'-1½	10'-7½	9'-4	11 1/8"	7'-9½	11'-1½
	7'	12'-3½	9'-0½	4'-5½	12'-5½	9'-0¾	3'-4½	5'-9½	12'-5	12'-6¾	9'-1¾	2'-2¾	7'-2½	12'-5½	12'-1	9'-4	1'-0¾	8'-1¾	12'-3¾
	8'	14'-3½	7'-11½	5'-2½	14'-0½	7'-11½	3'-9½	6'-6½	13'-11¾	14'-1¾	8'-0¾	2'-5¾	8'-0¾	13'-11¾	13'-7½	8'-2¾	1'-2½	9'-8¾	13'-10½
	9'	15'-9	7'-9¾	5'-6½	15'-6½	7'-9¾	4'-1¾	7'-4¾	15'-10	15'-7½	7'-10½	2'-9	9'-1½	15'-9½	15'-1½	8'-0¾	1'-3¾	10'-10½	15'-6¾
	10'	17'-2½	7'-7½	6'-3	16'-11½	7'-7½	4'-6¾	8'-0¾	17'-2½	17'-1¾	7'-8½	3'-0½	9'-10½	17'-1½	16'-7½	7'-10½	1'-5½	11'-9½	16'-9¾
12'	8'	14'-3½	10'-3½	5'-2½	14'-0½	10'-3¾	3'-9½	6'-6½	13'-11¾	14'-1¾	10'-5½	2'-5¾	8'-0¾	13'-11¾	13'-7½	10'-7¾	1'-2½	9'-8¾	13'-10½
	9'	15'-9	10'-1	5'-8½	5'-6½	10'-1½	4'-1¾	7'-4¾	15'-10	15'-7½	10'-3½	2'-9	9'-1½	15'-9½	15'-1½	10'-5¾	1'-3¾	10'-10½	15'-6¾
	10'	17'-2½	9'-11½	6'-3	16'-11½	9'-11¾	4'-6¾	8'-0¾	17'-2½	17'-1¾	10'-1	3'-0½	9'-10½	17'-1½	16'-7½	10'-3½	1'-5½	11'-9½	16'-9¾
	11'	18'-7½	9'-9⅛	6'-9¾	18'-5¾	9'-9½	4'-11¾	8'-8½	18'-7½	18'-7¾	9'-10½	3'-3¾	10'-7½	18'-5¾	18'-1½	10'-1	1'-7	12'-11¾	18'-5¾
	12'	20'-0½	9'-7	7'-3¾	19'-11½	9'-7¾	5'-4½	9'-4	20'-0½	20'-1½	9'-8¾	3'-6½	11'-0¾	20'-2¾	19'-7½	9'-10½	1'-8¾	13'-10½	19'-9½

Span	Hgt.	20° Skew A	20° Skew B	20° Skew C	20° Skew D	25° Skew A	25° Skew B	25° Skew C	25° Skew D	30° Skew A	30° Skew B	30° Skew C	30° Skew D	35° Skew A	35° Skew B	35° Skew C	35° Skew D	40° Skew A	40° Skew B	40° Skew C	40° Skew D	45° Skew A	45° Skew B	45° Skew C	45° Skew D
6'	3'	6'-0	4'-11½	5'-7½	6'-4½	6'-0	5'-2¾	6'-8¾	6'-7¾	5'-6	5'-6¾	7'-10¾	6'-7¾	5'-6	5'-10¾	9'-1½	6'-4½	5'-0	6'-4½	10'-10¾	6'-3¾	5'-0	6'-11½	12'-5½	5'-9¾
	4'	7'-6	4'-11½	6'-11	8'-2¾	7'-6	5'-2¾	8'-1¾	8'-1¾	7'-0	5'-6¾	9'-5	7'-10½	6'-6	5'-10¾	10'-9½	7'-6½	6'-6	6'-4½	12'-7½	7'-3¾	6'-0	6'-11½	15'-1½	7'-0½
	5'	9'-0	4'-11½	7'-10½	9'-4½	8'-6	5'-2¾	9'-2½	9'-2½	8'-0	5'-6¾	10'-11¾	9'-2½	8'-0	5'-10¾	12'-9½	8'-11¾	7'-6	6'-4½	14'-9¾	8'-6¾	7'-0	6'-11½	17'-5	8'-1½
	6'	10'-6	4'-11½	9'-2	10'-11½	10'-0	5'-2¾	10'-7½	10'-7½	9'-6	5'-6¾	12'-5½	10'-5¾	9'-0	5'-10¾	14'-5¾	10'-1¾	8'-6	6'-4½	16'-11¾	9'-9¾	8'-6	6'-11½	19'-8½	9'-2½
	7'	12'-0	4'-11½	10'-1½	12'-0¾	11'-6	5'-2¾	12'-0½	12'-0½	11'-0	5'-6¾	14'-0½	11'-9	10'-6	5'-10¾	16'-1½	11'-3½	10'-0	6'-4½	19'-1¾	11'-0¾	9'-6	6'-11½	21'-11¾	10'-2½
8'	3'	6'-0	7'-3¾	5'-7½	6'-4½	6'-0	7'-1¾	6'-8¾	6'-7¾	5'-6	8'-0¾	7'-10¾	6'-7¾	5'-6	8'-6¾	9'-1½	6'-4½	5'-0	9'-2¾	10'-10¾	6'-3¾	5'-0	9'-11¾	12'-5½	5'-9¾
	4'	7'-6	7'-3¾	6'-11	8'-2¾	7'-6	7'-1¾	8'-1¾	8'-1¾	7'-0	8'-0¾	9'-5	7'-10½	6'-6	8'-6¾	10'-9½	7'-6½	6'-6	9'-2¾	12'-7½	7'-3¾	6'-0	9'-11¾	15'-1½	7'-0½
	5'	9'-0	7'-3¾	7'-10½	9'-4½	8'-6	7'-1¾	9'-2½	9'-2½	8'-0	8'-0¾	10'-11¾	9'-2½	8'-0	8'-6¾	12'-9½	8'-11¾	7'-6	9'-2¾	14'-9¾	8'-6¾	7'-0	9'-11¾	17'-5	8'-1½
	6'	10'-6	7'-3¾	9'-2	10'-11½	10'-0	7'-1¾	10'-7½	10'-7½	9'-6	8'-0¾	12'-5½	10'-5¾	9'-0	8'-6¾	14'-5¾	10'-1¾	8'-6	9'-2¾	16'-11¾	9'-9¾	8'-6	9'-11¾	19'-8½	9'-2½
	7'	12'-0	7'-3¾	10'-1½	12'-0¾	11'-6	7'-1¾	12'-0½	12'-0½	11'-0	8'-0¾	14'-0½	11'-9	10'-6	8'-6¾	16'-1½	11'-3½	10'-0	9'-2¾	19'-1¾	11'-0¾	9'-6	9'-11¾	21'-11¾	10'-2½
	8'	13'-6	6'-1½	11'-0½	13'-11½	13'-0	6'-4¾	13'-9½	13'-9½	12'-0	6'-9	16'-0	13'-5½	11'-6	7'-2½	18'-8¾	13'-1¾	11'-0	7'-8¾	21'-7½	12'-5½	11'-0	8'-3½	25'-7¾	11'-11½
10'	3'	6'-0	9'-7	5'-7½	6'-8¾	13'-0	10'-0	6'-8¾	6'-1¾	5'-6	10'-6¾	7'-10¾	6'-7¾	5'-6	11'-2¾	9'-1½	6'-4½	5'-0	12'-0¾	10'-10¾	6'-3¾	5'-0	13'-0½	12'-5½	5'-9¾
	4'	7'-6	9'-7	6'-11	8'-2¾	7'-6	10'-0	8'-1¾	8'-1¾	7'-0	10'-6¾	9'-5	7'-10½	6'-6	11'-2¾	10'-9½	7'-6½	6'-6	12'-0¾	12'-7½	7'-3¾	6'-0	13'-0½	15'-1½	7'-0½
	5'	9'-0	9'-7	7'-10½	9'-4½	8'-6	10'-0	9'-2½	9'-2½	8'-0	10'-6¾	10'-11¾	9'-2½	8'-0	11'-2¾	12'-9½	8'-11¾	7'-6	12'-0¾	14'-9¾	8'-6¾	7'-0	13'-0½	17'-5	8'-1½
	6'	10'-6	9'-7	9'-2	10'-11½	10'-0	10'-0	10'-7½	10'-7½	9'-6	10'-6¾	12'-5½	10'-5¾	9'-0	11'-2¾	14'-5¾	10'-1¾	8'-6	12'-0¾	16'-11¾	9'-9¾	8'-6	13'-0½	19'-1½	9'-2½
	7'	12'-0	9'-7	10'-1½	12'-0¾	11'-6	10'-0	12'-0½	12'-0½	11'-0	10'-6¾	14'-0½	11'-9	10'-6	11'-2¾	16'-1½	11'-3½	10'-0	12'-0¾	19'-1¾	11'-0¾	9'-6	13'-0½	21'-11¾	10'-2½
	8'	13'-6	8'-5½	11'-0½	13'-11½	13'-0	8'-9½	13'-9½	13'-9½	12'-0	9'-3	16'-0	13'-5½	11'-6	9'-9¾	18'-8¾	13'-1¾	11'-0	10'-6¾	21'-7½	12'-5½	11'-0	11'-4½	25'-1¾	11'-11½
	9'	15'-0	8'-2¾	13'-0½	15'-6½	14'-6	8'-7½	15'-3½	15'-3½	13'-6	9'-0½	17'-7½	14'-9½	13'-0	9'-7½	20'-5½	14'-3¾	12'-6	10'-3¾	23'-10½	13'-9¾	12'-0	11'-1½	28'-0½	13'-1
	10'	16'-5	8'-0¾	14'-0½	16'-8¾	15'-6	8'-4½	16'-4¾	16'-4¾	15'-0	8'-9¾	19'-2¾	16'-1½	14'-0	9'-4¾	22'-7½	15'-9¾	13'-6	10'-0¾	26'-2¾	15'-1½	13'-0	10'-9½	30'-5¾	14'-2¾
12'	8'	13'-6	10'-11	11'-8½	13'-11½	13'-0	11'-4¾	13'-9½	13'-9½	12'-0	11'-11¾	16'-0	13'-5½	11'-6	12'-8½	18'-8¾	13'-1¾	11'-0	13'-6¾	21'-7½	12'-5½	11'-0	14'-8½	25'-7¾	13'-11½
	9'	15'-0	10'-8½	13'-0½	15'-6½	14'-6	11'-2	15'-3½	15'-3½	13'-6	11'-8¾	17'-7½	14'-9½	13'-0	12'-5¾	20'-5½	14'-3¾	12'-6	13'-3¾	23'-10¾	13'-9¾	12'-0	14'-4½	28'-0½	13'-1
	10'	15'-5	10'-6¾	14'-0½	16'-8¾	15'-6	10'-11¾	16'-4¾	16'-4¾	15'-0	11'-6½	19'-2¾	16'-1½	14'-0	12'-2¾	22'-7½	15'-9¾	13'-6	13'-0¾	26'-2¾	15'-1½	13'-0	14'-1¾	30'-5¾	14'-2¾
	11'	18'-0	10'-4½	15'-4½	18'-3¾	17'-0	10'-9½	17'-10½	17'-10½	16'-0	11'-3½	20'-9¾	17'-5¾	15'-6	11'-11¾	24'-4½	17'-0½	15'-0	12'-9¾	28'-5¾	16'-5¾	14'-6	13'-10	32'-11½	15'-4½
	12'	19'-6	10'-1½	16'-4¾	19'-6	18'-6	10'-6½	19'-3¾	19'-3¾	17'-6	11'-1½	22'-5½	18'-9¾	16'-6	11'-9½	26'-0¾	18'-3½	16'-0	12'-6¾	30'-4½	17'-6½	15'-6	13'-6¾	35'-9¾	16'-4¾

QUANTITIES

Span	Hgt.	0° Skew Conc. C.Y. 1Bbl.	0° Conc. C.Y. Δc	0° Steel lbs. 1Bbl.	0° Steel lbs. Δs	5° Skew Conc. C.Y. 1Bbl.	5° Conc. C.Y. Δc	5° Steel lbs. 1Bbl.	5° Steel lbs. Δs	10° Skew Conc. C.Y. 1Bbl.	10° Conc. C.Y. Δc	10° Steel lbs. 1Bbl.	10° Steel lbs. Δs	15° Skew Conc. C.Y. 1Bbl.	15° Conc. C.Y. Δc	15° Steel lbs. 1Bbl.	15° Steel lbs. Δs	20° Skew Conc. C.Y. 1Bbl.	20° Conc. C.Y. Δc	20° Steel lbs. 1Bbl.	20° Steel lbs. Δs
6'	3'	0.44	1.05	22	91	0.44	1.05	22	91	0.46	1.08	25	94	0.50	1.06	27	92	0.55	1.08	33	94
	4'	0.50	1.23	31	104	0.50	1.23	31	104	0.51	1.26	34	107	0.57	1.26	39	107	0.62	1.28	45	109
	5'	0.52	1.40	42	117	0.53	1.43	44	119	0.54	1.43	44	120	0.59	1.45	49	120	0.64	1.46	54	122
	6'	0.57	1.58	54	130	0.58	1.61	57	132	0.61	1.63	61	135	0.66	1.63	65	135	0.72	1.66	71	137
	7'	0.65	1.75	69	143	0.66	1.78	72	145	0.69	1.81	76	148	0.74	1.80	80	148	0.79	1.83	85	150
8'	3'	0.84	1.45	51	118	0.84	1.45	51	118	0.86	1.49	55	122	0.90	1.46	56	119	0.96	1.50	63	122
	4'	0.95	1.68	64	135	0.95	1.68	64	135	0.97	1.72	68	138	1.03	1.72	73	139	1.10	1.76	79	142
	5'	1.03	1.91	79	152	1.05	1.95	82	155	1.05	1.95	83	155	1.11	1.95	87	156	1.17	1.99	93	159
	6'	1.13	2.14	96	169	1.16	2.17	99	172	1.19	2.21	104	175	1.25	2.21	108	175	1.31	2.25	115	178
	7'	1.27	2.36	115	186	1.29	2.40	119	189	1.33	2.44	123	192	1.38	2.44	127	192	1.44	2.48	133	195
	8'	1.56	2.70	112	210	1.54	2.66	108	208	1.59	2.70	113	211	1.64	2.70	117	211	1.76	2.77	130	217
10'	3'	1.28	1.88	85	147	1.28	1.88	85	148	1.32	1.93	89	151	1.35	1.89	90	148	1.42	1.94	97	153
	4'	1.45	2.16	102	169	1.46	2.16	102	169	1.49	2.22	107	173	1.55	2.21	111	173	1.63	2.27	119	177
	5'	1.59	2.45	121	190	1.62	2.50	125	193	1.63	2.50	126	194	1.69	2.50	130	194	1.76	2.55	138	198
	6'	1.76	2.73	143	211	1.79	2.78	147	214	1.84	2.83	152	218	1.89	2.83	157	218	1.97	2.88	164	222
	7'	1.95	3.02	166	232	1.99	3.07	171	236	2.04	3.11	176	239	2.09	3.11	180	239	2.17	3.16	187	243
	8'	2.33	3.43	169	263	2.30	3.39	166	259	2.36	3.43	171	263	2.41	3.43	175	263	2.56	3.52	189	270
	9'	2.56	3.72	190	284	2.57	3.72	191	284	2.64	3.77	197	288	2.69	3.77	201	288	2.85	3.86	216	295
	10'	2.81	4.01	212	306	2.82	4.01	213	306	2.89	4.06	219	310	2.94	4.06	223	311	3.10	4.15	237	316
12'	8'	3.15	4.21	227	315	3.11	4.16	223	311	3.17	4.22	229	315	3.23	4.22	233	315	3.39	4.33	249	324
	9'	3.44	4.56	253	341	3.45	4.56	254	341	3.52	4.62	260	345	3.58	4.62	265	345	3.76	4.73	281	353
	10'	3.75	4.91	279	67	3.76	4.91	280	366	3.83	4.97	287	371	3.89	4.97	291	371	4.07	5.08	307	379
	11'	4.07	5.26	307	392	4.08	5.26	308	392	4.16	5.32	315	397	4.29	5.37	326	400	4.47	5.47	342	409
	12'	4.42	5.61	337	418	4.43	5.61	338	418	4.54	5.72	352	427	4.63	5.71	355	426	4.83	5.82	371	434

Span	Hgt.	25° Skew Conc. C.Y. 1Bbl.	25° Conc. C.Y. Δc	25° Steel lbs. 1Bbl.	25° Steel lbs. Δs	30° Skew Conc. C.Y. 1Bbl.	30° Conc. C.Y. Δc	30° Steel lbs. 1Bbl.	30° Steel lbs. Δs	35° Skew Conc. C.Y. 1Bbl.	35° Conc. C.Y. Δc	35° Steel lbs. 1Bbl.	35° Steel lbs. Δs	40° Skew Conc. C.Y. 1Bbl.	40° Conc. C.Y. Δc	40° Steel lbs. 1Bbl.	40° Steel lbs. Δs	45° Skew Conc. C.Y. 1Bbl.	45° Conc. C.Y. Δc	45° Steel lbs. 1Bbl.	45° Steel lbs. Δs
6'	3'	0.77	1.13	52	98	1.03	1.13	73	99	1.27	1.18	95	104	1.58	1.22	123	108	1.84	1.26	147	113
	4'	0.89	1.32	67	113	1.20	1.33	92	114	1.50	1.34	116	116	1.84	1.42	147	123	2.25	1.47	165	128
	5'	0.94	1.46	81	123	1.37	1.50	113	126	1.75	1.57	146	132	2.15	1.60	180	136	2.60	1.65	220	141
	6'	1.15	1.66	101	138	1.55	1.69	137	142	2.00	1.73	173	144	2.50	1.78	216	150	3.02	1.88	260	158
	7'	1.28	1.86	124	153	1.78	1.89	164	156	2.28	1.93	204	159	2.91	2.00	257	166	3.46	2.06	302	171
8'	3'	1.19	1.55	83	127	1.46	1.57	105	129	1.72	1.64	128	134	2.05	1.69	157	139	2.33	1.77	183	146
	4'	1.38	1.81	103	146	1.69	1.83	128	148	2.00	1.85	153	150	2.37	1.95	186	159	2.81	2.03	226	166
	5'	1.51	2.00	120	160	1.91	2.04	154	164	2.32	2.14	189	172	2.74	2.19	223	176	3.21	2.27	265	183
	6'	1.71	2.26	145	179	2.17	2.30	182	183	2.62	2.35	220	188	3.14	2.43	264	194	3.71	2.56	311	205
	7'	1.95	2.52	173	199	2.46	2.56	214	203	2.98	2.61	254	207	3.63	2.72	311	216	4.21	2.80	357	223
	8'	2.35	2.81	175	220	2.93	2.81	220	221	3.58	2.89	273	228	4.24	2.97	326	235	5.12	3.16	396	250
10'	3'	1.67	2.01	119	158	1.94	2.03	141	160	2.22	2.12	166	167	2.57	2.19	197	173	2.88	2.30	224	182
	4'	1.93	2.34	144	182	2.25	2.36	169	184	2.56	2.39	195	187	2.97	2.52	230	198	3.43	2.63	272	206
	5'	2.11	2.57	165	199	2.52	2.63	199	204	2.96	2.75	236	214	3.40	2.82	273	220	3.90	2.92	316	228
	6'	2.38	2.89	195	224	2.85	2.95	233	228	3.32	3.02	272	234	3.87	3.12	314	241	4.47	3.29	368	255
	7'	2.68	3.22	228	248	3.21	3.28	270	253	3.74	3.34	312	258	4.43	3.48	370	269	5.03	3.58	419	277
	8'	3.16	3.58	236	275	3.74	3.59	281	276	4.42	3.68	336	284	5.10	3.80	390	293	6.03	4.04	465	311
	9'	3.52	3.91	268	299	4.16	3.92	317	300	4.91	4.03	376	309	5.75	4.17	444	320	6.69	4.35	518	334
	10'	3.80	4.15	291	317	4.62	4.25	355	325	5.48	4.34	426	332	6.38	4.48	497	343	7.37	4.65	574	357
12'	8'	4.01	4.40	297	329	4.60	4.42	342	330	5.31	4.55	399	340	6.02	4.69	455	351	7.01	4.99	534	373
	9'	4.44	4.80	334	359	5.09	4.82	383	360	5.87	4.95	445	370	6.75	5.13	514	384	7.73	5.35	592	400
	10'	4.78	5.08	361	380	5.63	5.21	427	389	6.50	5.32	499	398	7.44	5.50	572	411	8.48	5.72	652	427
	11'	5.26	5.48	402	409	6.12	5.54	469	414	7.13	5.72	549	427	8.26	5.95	638	441	9.39	6.17	722	461
	12'	5.77	5.88	445	439	6.71	5.94	517	444	7.72	6.05	598	452	8.91	6.27	690	468	10.36	6.57	800	491

NOTATIONS:

Δc = Apron concrete quantity per additional barrel.

Δs = Apron steel quantity per additional barrel.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION
APPROVED FOR DISTRIBUTION	OUTLET APRON DIMENSIONS & QUANTITIES 2 : 1 SLOPE	7-88
		STANDARD NO. B-06.20

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of _____

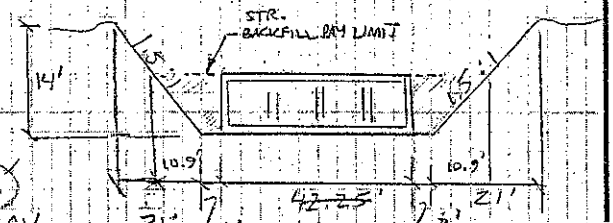
Project NORTH INLET CHANNEL Date 3/8/05

Subject CULVERT EXCAVATION/BACKFILL QUANT. Designed ACC Checked JPK

SEE FOLLOWING SHEETS FOR DIMENSIONS

☐ NORTHERN DIVERSION CULVERT

SEE ADOT STD B-19.50



EXCAVATION AREA = (14')(44.25) + 2[½ (21)(14')] (AVE DEPTH (SEE PROFILE))
= 913.50 SF

LENGTH = ~~319'~~ 336'

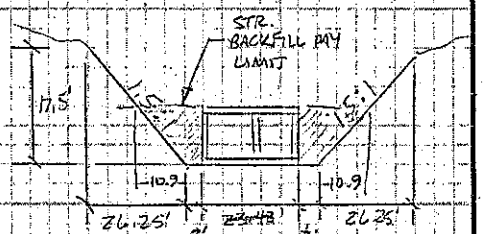
EXCAVATION = ~~319'~~ 336' · ~~913.50~~ 960.2 SF (12,054)
= ~~291,424 CF~~ 325,736 CF ≈ ~~10,793 CY~~

BACKFILL = 10,793 CY − (42.25')(319')(6.76')/27
= ~~2,479 CY~~

$V_{BF} = [2(\frac{1}{2}(10.9)(7.25)) + 2(1.5 * 7.25)] * 336/27$

V_{BF} = 1254 CY

○ OLIVE DIVERSION CULVERT



EXCAVATION AREA = (~~27.75'~~ 23.42')(17.5') + 2[½ (17.5')(26.25')] (AVE DEPTH (SEE PROFILE))
= ~~939.23~~ 857.5 SF

LENGTH = ~~320'~~ 331'

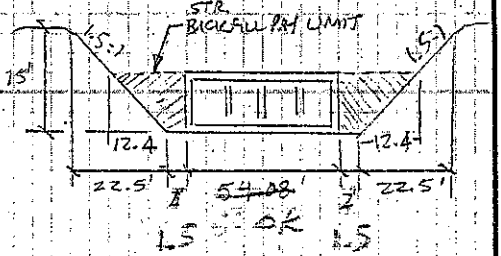
EXCAVATION = 320' · ~~939.23~~ 921.73 SF (11,300)
= ~~300,552 CF~~ 305,091 CF ≈ ~~11,132 CY~~

BACKFILL = 11,132 CY − (23.42')(320')(6.76')/27
= ~~9,255 CY~~

$V_{BF} = [2(\frac{1}{2}(10.9)(7.25)) + 2(1.5 * 7.25)] * 331/27$

V_{BF} = 1235 CY

☆ NORTHERN WASH CULVERT



EXCAVATION AREA = (58.08')(15') + 2[½ (22.5)(15')]
= ~~1208.79 SF~~ 1193.7

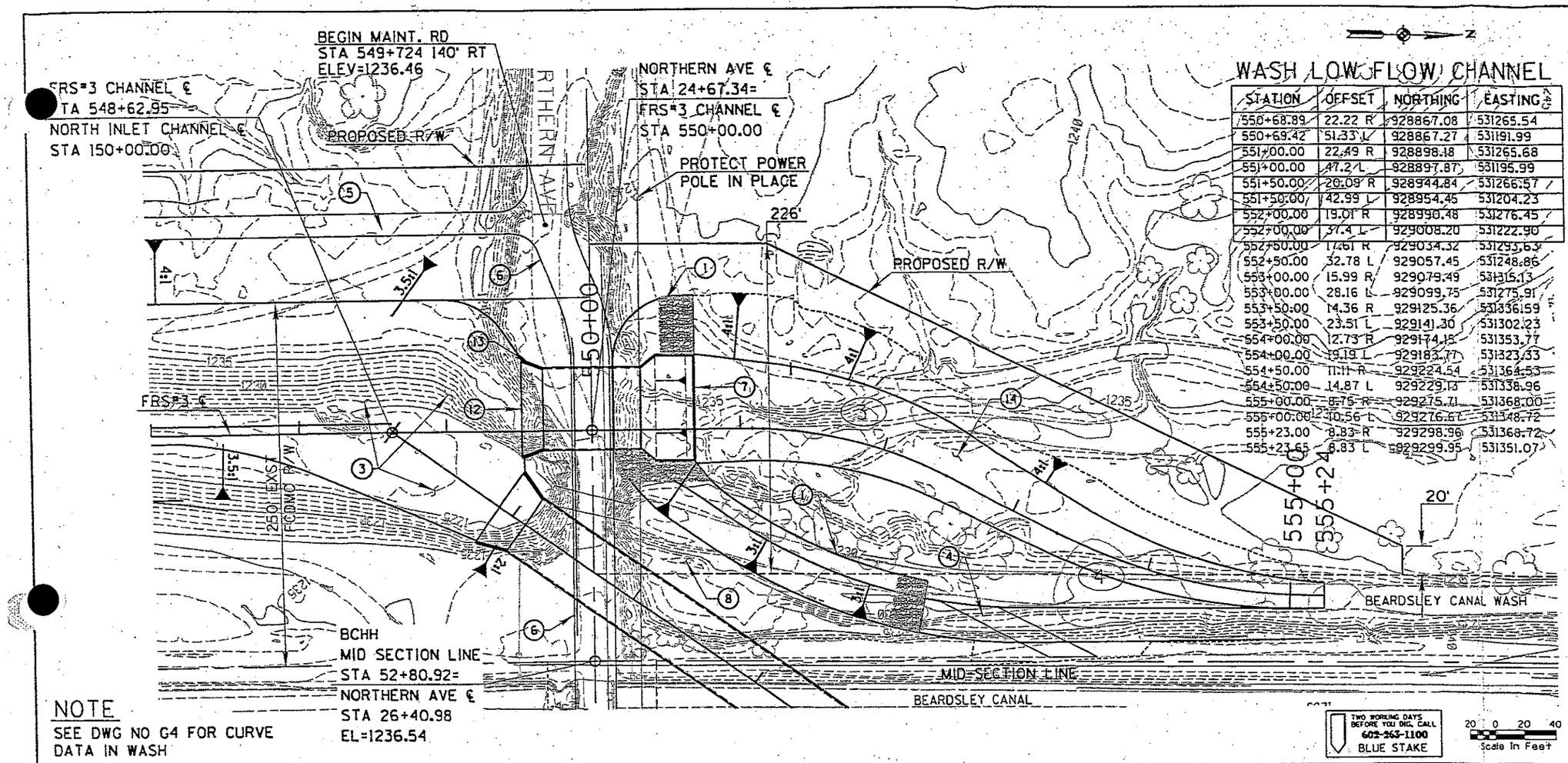
LENGTH = 67'

EXCAVATION = 67' · ~~1208.79~~ 1193.7 SF (2962)
= ~~80,982.9 SF ≈ 3,000 CY~~ 79,979

BACKFILL = 3,000 CY − (54.08')(8.25')(67')/27
= ~~1,896 CY~~

$V_{BF} = [2(\frac{1}{2}(12.4)(8.25)) + 2(1.5 * 8.25)] * 67/27$

V_{BF} = 315.3 CY

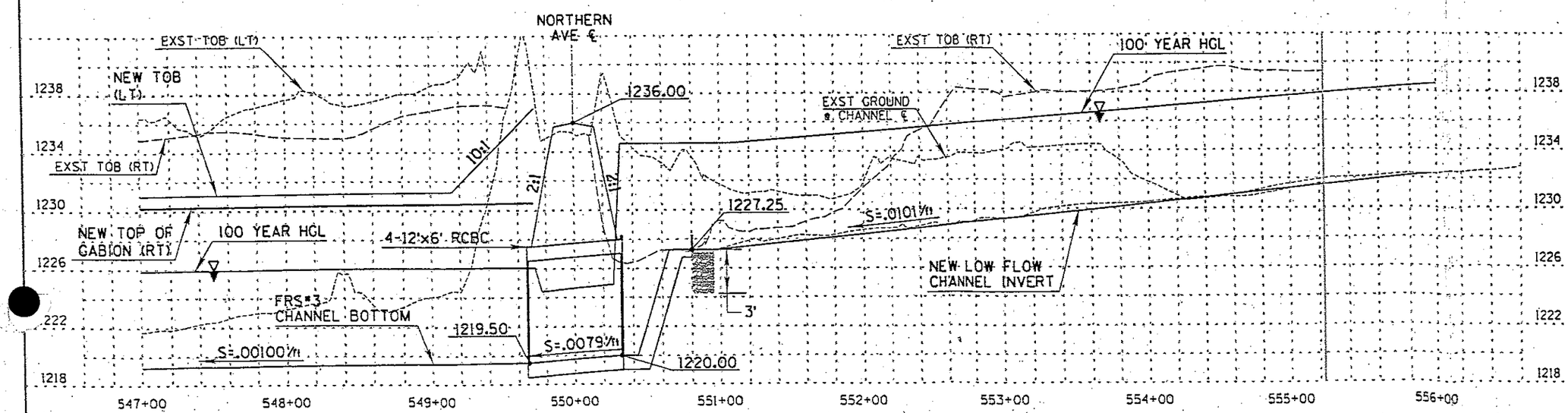


WASH LOW FLOW CHANNEL

STATION	OFFSET	NORTHING	EASTING
550+68.89	22.22 R	928867.08	531265.54
550+69.42	51.33 L	928867.27	531191.99
551+00.00	22.49 R	928898.18	531265.68
551+00.00	47.2 L	928897.87	531195.99
551+50.00	20.09 R	928944.84	531266.57
551+50.00	42.99 L	928954.45	531204.23
552+00.00	19.01 R	928990.48	531276.45
552+00.00	37.4 L	929008.20	531222.90
552+50.00	17.61 R	929034.32	531293.63
552+50.00	32.78 L	929057.45	531248.86
553+00.00	15.99 R	929079.49	531316.13
553+00.00	28.16 L	929099.75	531275.91
553+50.00	14.36 R	929125.36	531336.59
553+50.00	23.51 L	929141.30	531302.23
554+00.00	12.73 R	929174.15	531353.77
554+00.00	19.19 L	929183.77	531323.33
554+50.00	11.11 R	929224.54	531364.53
554+50.00	14.87 L	929229.13	531338.96
555+00.00	8.75 R	929275.71	531368.00
555+00.00	10.56 L	929276.61	531348.72
555+23.00	8.83 R	929298.96	531368.72
555+23.65	8.83 L	929299.95	531351.07

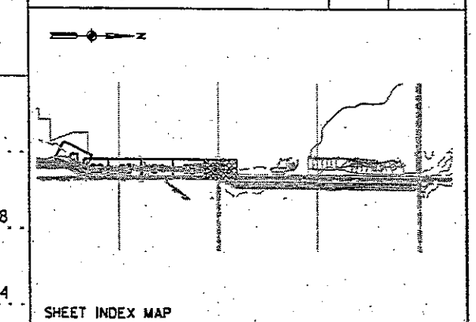
NOTE

SEE DWG NO G4 FOR CURVE DATA IN WASH



REMOVE		

CONSTRUCT		
(1) 9" RENO MATTRESS BANK PROTECTION PER TYP SEC, DWG NO G7	CY	CY
(3) FRS#3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET	CY	CY
(4) O&M RAMP PER DET#XX DWG NO D2	EA	1
(5) O&M ROAD PER TYPICAL SECTION DWG NO D2	SY	SY
(6) ADJUST NORTHERN AVE RDWY PROFILE PER DET. SHT #		
• EMBANKMENT	CY	CY
• SUBGRADE	SY	CY
(7) DROP INLET PER DETAILS DWG NO DSXX	SY	SY
(8) COMPACTED FILL/ EMBANKMENT PER TYP SECTION (550+69) DWG NO G6	CY	SY



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

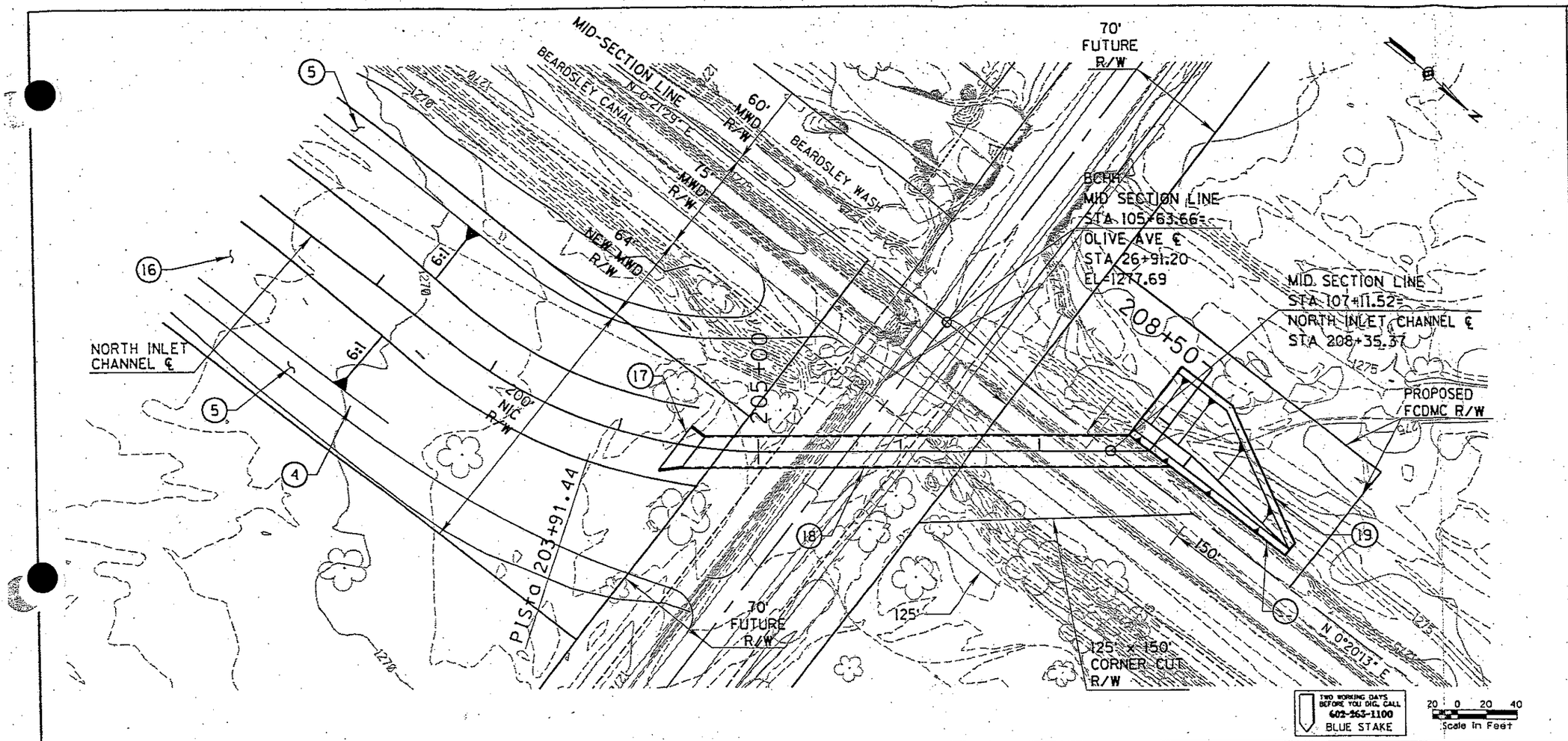
WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

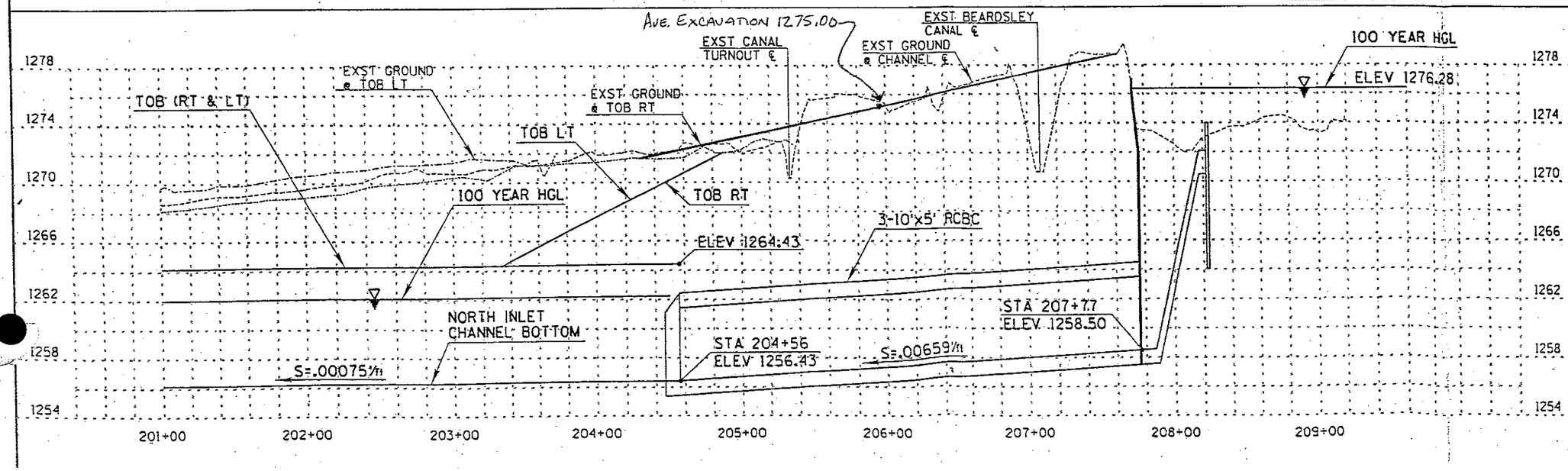
PRELIMINARY 60% NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO. FRS#3 / BEARDSLEY WASH SHEET OF

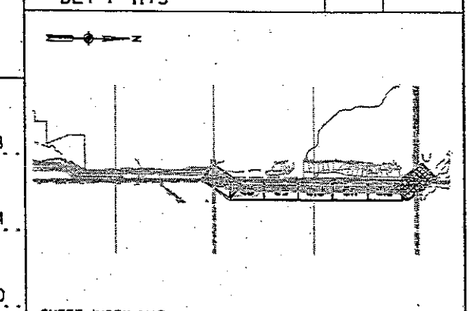




☐ REMOVE ☐

○ CONSTRUCT ○

(4) STA ___+____ O&M RAMP PER DET*XX DWG NO D2	XX	EA
(5) O&M ROAD PER TYPICAL SECTION DWG NO D2	XX	SY
(16) NIC CHANNEL EXCAVATION PER LIMITS SHOWN, PER TYP. SECTION DWG NO. G7 & PER CROSS SECTION DWG NOS XS07-XS13	XX	CY
(17) OUTLET HEADWALL & WING WALLS PER ADOT STD NO B-04.10, 2:1 SLOPE, 0° SKEW AND OUTLET APRON PER ADOT STD NO B-06.10 AND PER MODIFICATION TABLE ON DWG NO D1	XX	EA
(18) 2-10'x5'x315' RCBC PER ADOT STD NO B-02.20	XX	EA
(19) SIDE WIER/DROP INLET STRUCTURE PER DETAIL DWG NO DS1	XX	EA
(--) HANDRAIL PER COP STD DET P-1173	XX	LF



NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

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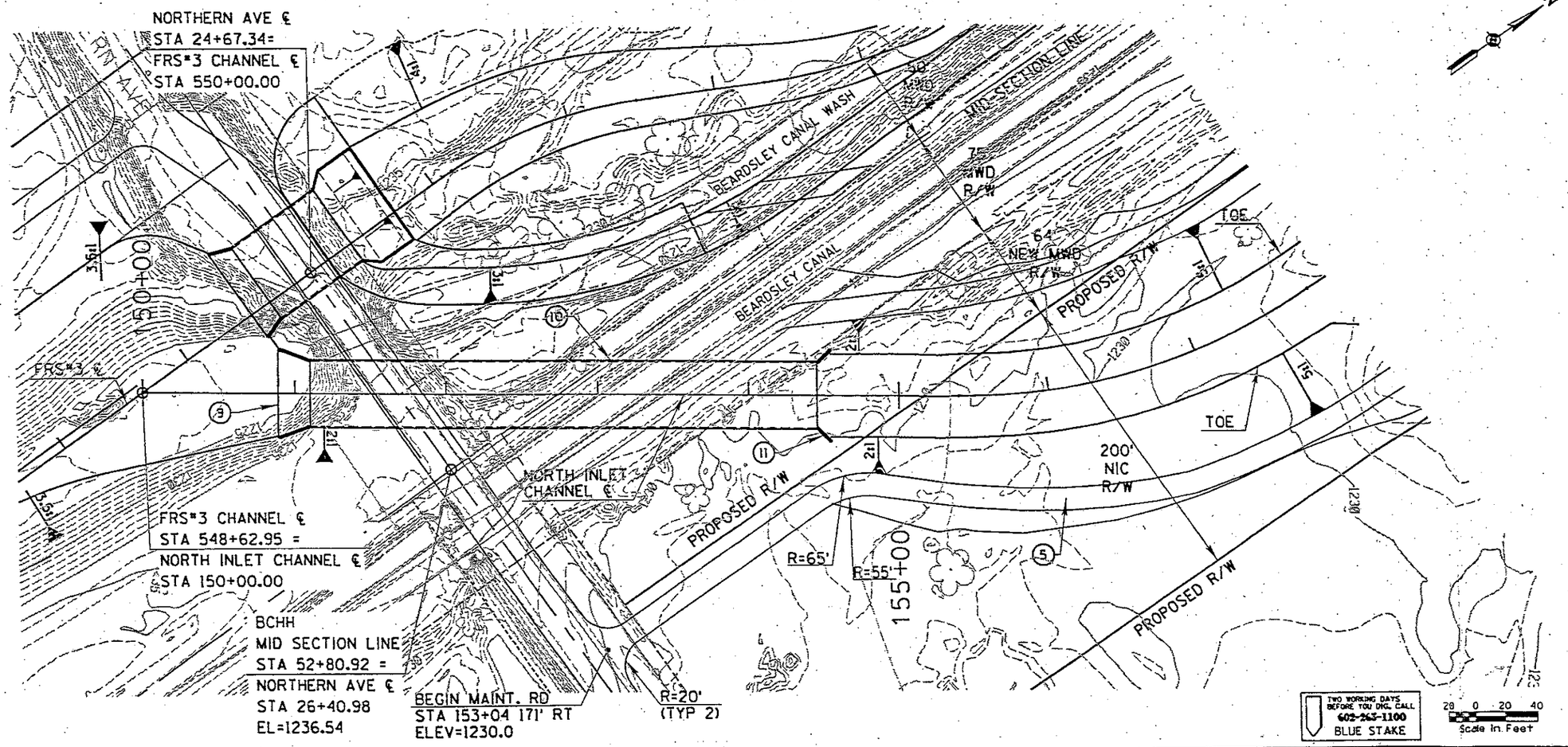
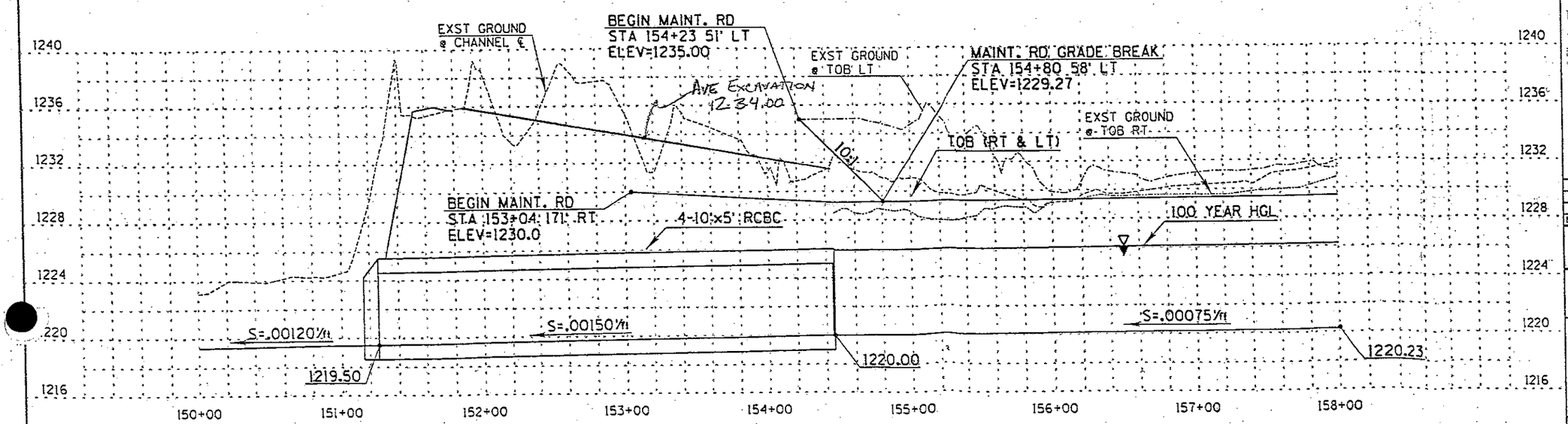
KIRKHAM MICHAEL

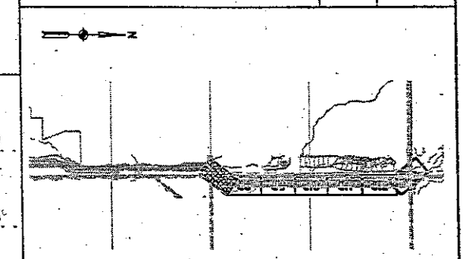
DRAWING NO. | NORTH INLET CHANNEL | SHEET OF





REMOVE		

CONSTRUCT		
(5) O&M ROAD PER TYPICAL SECTION DWG NO D2	SY	SY
(9) OUTLET HEADWALL & WINGWALLS PER ADOT STD DET NO B-04.10, 2:1 SLOPE, 0° SKEW & OULET APRON PER ADOT STD DET B-06.10 & PER MODIFIED TABLE DWG. NO. D1	EA	CY
(10) 4-10'x5'x335' RCBC PER ADOT STD DET B-02.40	EA	CY
(12) INLET HEADWALL & WINGWALLS PER ADOT STD DET NO B-04.30, 2:1 SLOPE, 0° SKEW & PER MODIFIED TABLE DWG. NO. D1	EA	CY



SHEET INDEX MAP

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

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	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO. 07 | NORTH INLET CHANNEL STA 150+00 TO STA 158+00 | SHEET OF

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/8/04

Subject ~~INLET~~ SIDE WEIR QUANTATIES Designed ACC Checked JEH

SEE THE FOLLOWING SHEET FOR DETAIL OF INLET WEIR INCLUDING DIMENSIONS

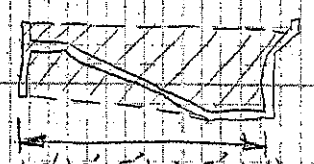
BASE

FACE AREA = (1')(9') + (0.5')[5' + 42.69' + 10' + 13.5' + 7.07' + 1']
= 48.63 SQ FT.

LENGTH = 45.13'

VOLUME = 45.13' · 48.63 SF
= 2194.67 CF ≈ 81.3 CY

END BASE CUT-OFF WALL



L = (1.0' + 5' + 40.5' + 10') = 56.5'
V = (56.5 × 1.0 × 13.5)/27
V = 28.3 CY

WING

MAXIMUM WING AREA = 48.63 SF

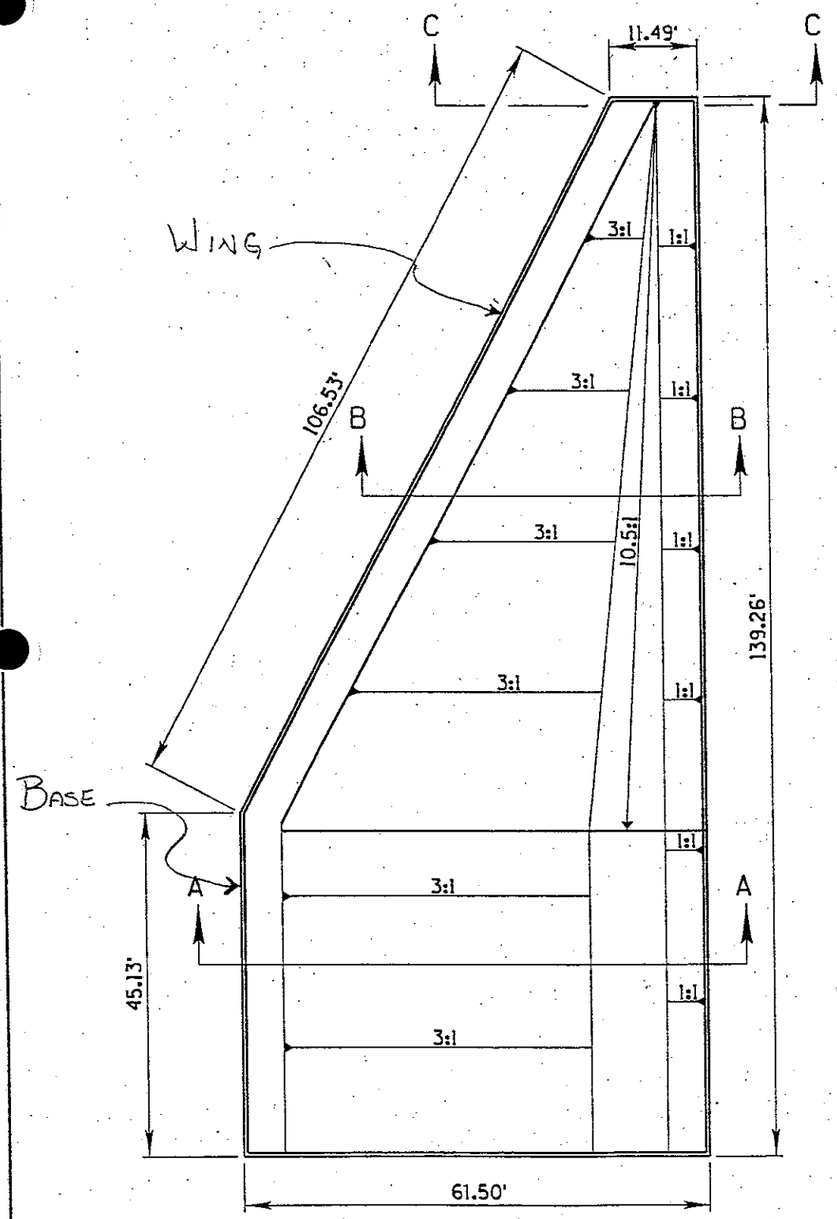
MINIMUM WING AREA = (1')(9') + (0.5')(5.49' + 7.07' + 1')
= 15.78 SF

AVERAGE WING AREA = (15.78 SF + 48.63 SF)/2
= 32.21 SF

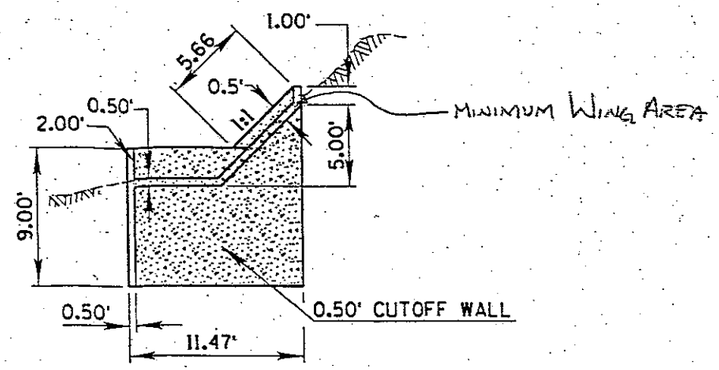
LENGTH = 139.26' − 45.13'
= 94.13'

VOLUME = 94.13' · 32.21 SF
= 3,031.93 CF ≈ 112.3 CY

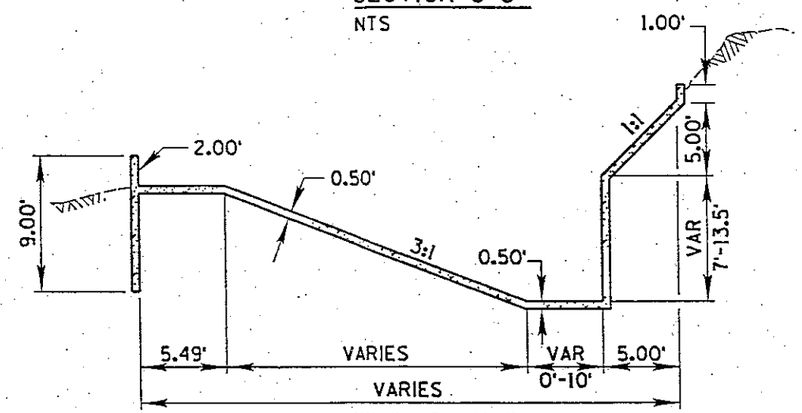
TOTAL VOLUME = 112.3 CY + 81.3 CY + 28.3
= ~~193.6 CY~~ 221.9 CY



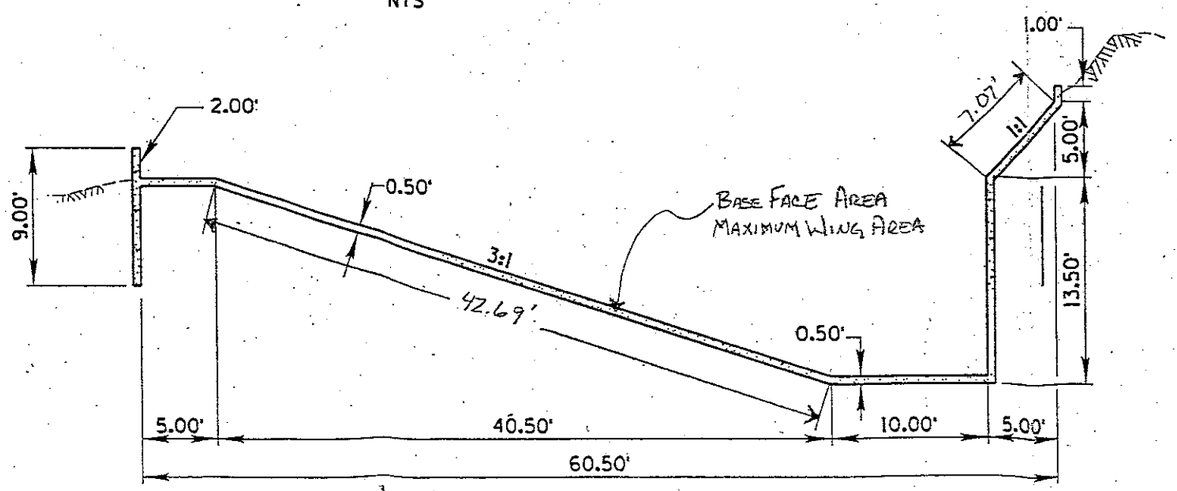
WEIR STRUCTURE DETAIL
NTS



SECTION C-C
NTS



SECTION B-B
NTS



SECTION A-A
NTS

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO. DS1 | WEIR STRUCTURE DETAIL | SHEET OF

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of _____

Project NORTH INLET CHANNEL WASH CROSSING Date 3/8/05

Subject DROP INLET QUANTATIES Designed ACC Checked JEK

SEE FOLLOWING SHEET FOR THE DROP INLET DETAIL, INCLUDING DIMENSIONS

DROP

CROSS-SECTION AREA = (1')(7.50') + (0.5')(23.09' + 5')
= 21.55 SQF

LENGTH = 73.25'

VOLUME = 73.25' · 21.55 SF
= 1578.54 CF ≈ 58.5 cy

SILL VOLUME = 2(1')(1')(1') + 2[½(32.63')(1')(1')]
= 34.63 CF ≈ 1.3 cy

SIDE WALL VOLUME = 2[(21.75' + 5' + 1')(8.75')(1')]
= 485.63 CF ≈ 18.0 cy

TOTAL DROP VOLUME = 18.0 cy + 1.3 cy + 58.5 cy
= 77.8 cy

INLET

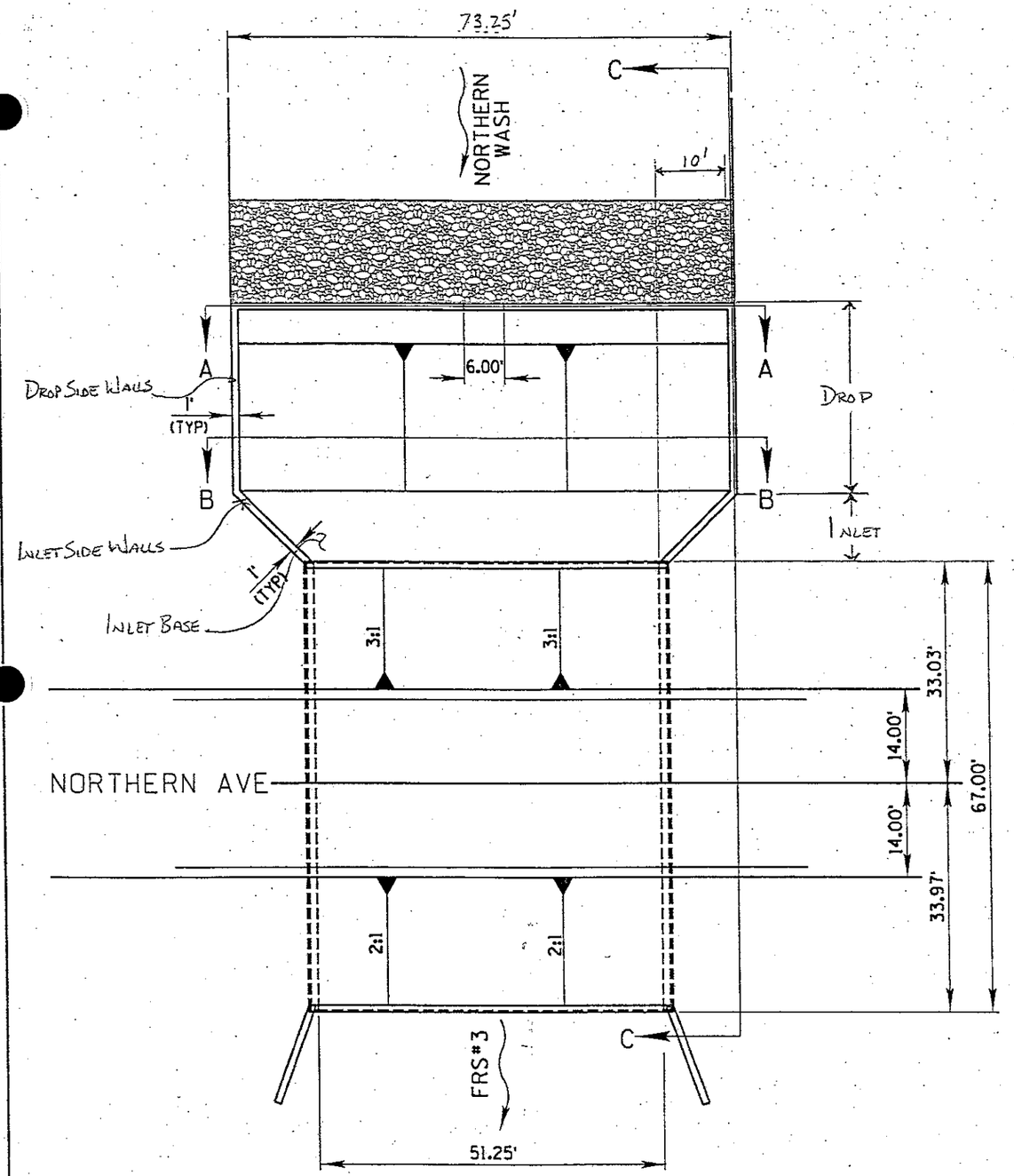
BASE VOLUME = 0.5[(10')(51.25') + 2(½(10' · 10'))]
= 306.25 CF ≈ 11.3 cy

SIDE WALL VOLUME = 2[(10' + 10')(1')(8.75')]
= 247.49 CF ≈ 9.2 cy

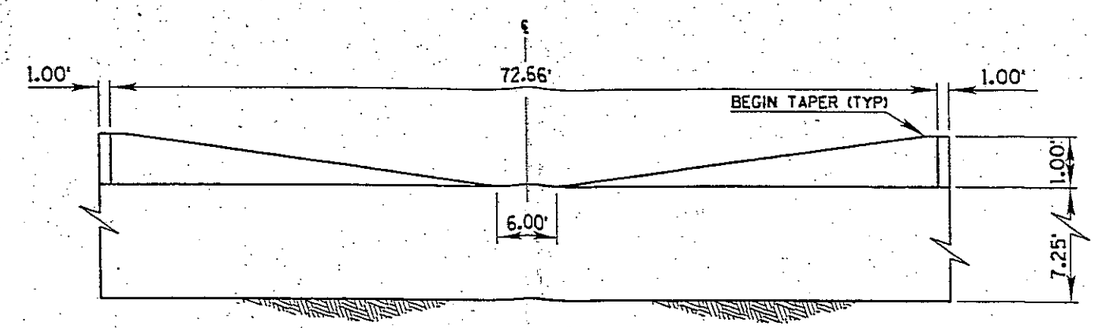
HEADWALL VOLUME = (1')(1.21')(51.25 + 2(13½/12))
= 64.63 CF ≈ 2.4 cy

TOTAL INLET VOLUME = 2.4 cy + 9.2 cy + 11.3 cy
= 22.9 cy

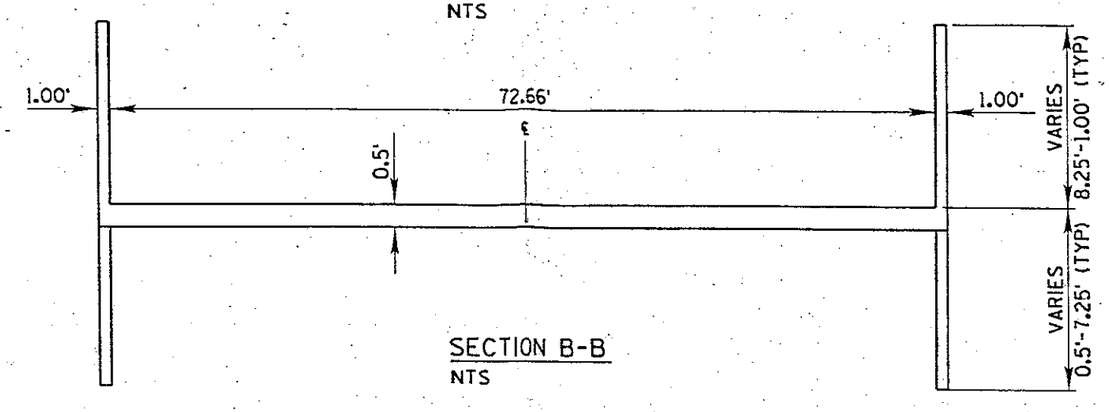
TOTAL DROP INLET VOLUME = 22.9 cy + 77.8 cy
= 100.7 cy



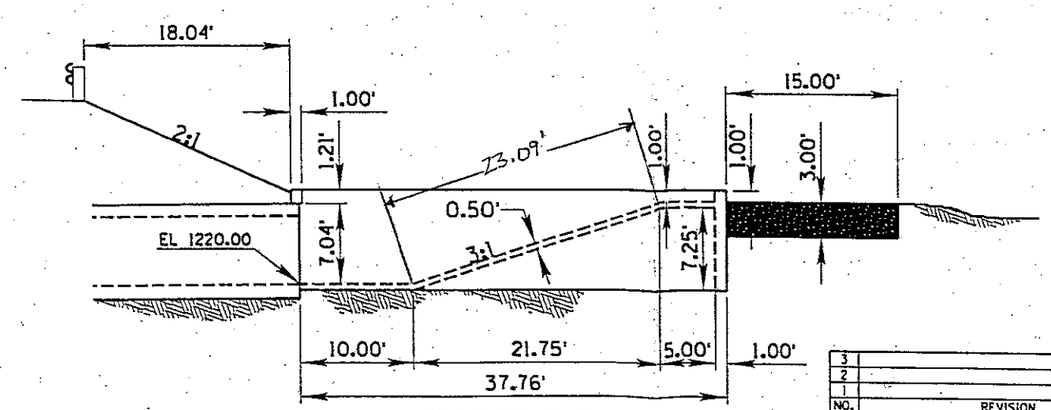
NORTHERN WASH DROP STRUCTURE
NTS



SECTION A-A
NTS



SECTION B-B
NTS



SECTION C-C
NTS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO. DS1 | WEIR STRUCTURE DETAIL | SHEET OF

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of _____

Project NORTH INLET CHANNEL Date 3/9/05

Subject ~~INLET~~ SIDE WEIR & WASH DROP INLET EXCAVATION QUANTITIES Designed ACC Checked JKK

SEE FOLLOWING SHEETS FOR DIMENSIONS

~~INLET~~ SIDE WEIR (AT OLIVE AVENUE)

BASE AREA = (10')(34.50') + (8')(46.50') + ½(6.5')(46.50') + ½(12')(8')
= 716.13 SF

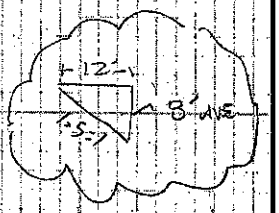
BASE LENGTH = 45.13'

BASE EXCAVATION = (45.13')(716.13 SF)
= 32318.72 CF ≈ 1197 CY

MAX. WING AREA = 668.13 SF

MIN. WING AREA = (11.47')(8') + ½(12')(8')
= 139.76 SF

AVE WING AREA = (139.76 SF + 716.13 SF)/2
= 427.95 SF



WING LENGTH = 94.13'

WING EXCAVATION = (427.95 SF)(94.13')
= 40,282.46 CF ≈ 1492 CY

TOTAL EXCAVATION = 1492 CY + 1197 CY
= 2689 CY

BACKFILL
PERIMETER LENGTH = 225 ft
$V_{BF} = [\frac{1}{2}(12*8)*225]/27$
$V_{BF} = 400$ CY

WASH DROP INLET (WASH CULVERT AT NORTHERN)

CROSS SECTIONAL AREA = (37.76')(13.50') + ½(20.25')(13.50')
= 646.45 SF

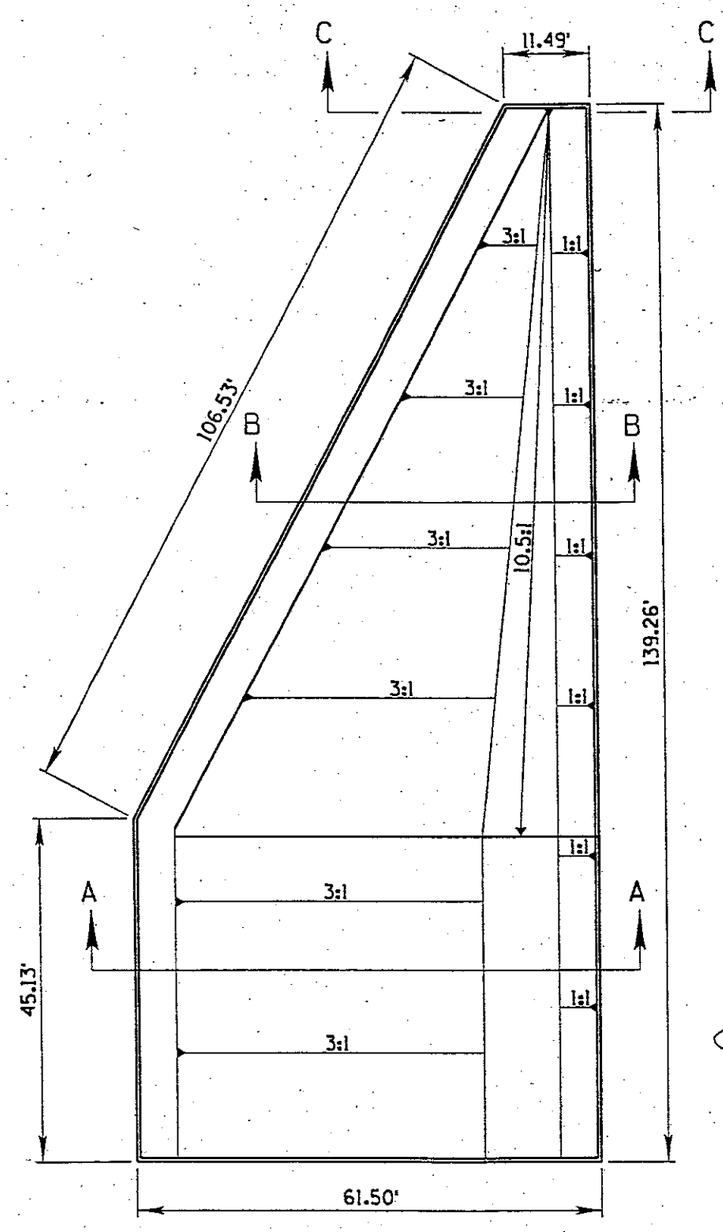
LENGTH = 73.25'

EXCAVATION = (73.25')(646.45 SF)
= 47,352.28 CF ≈ 1754 CY

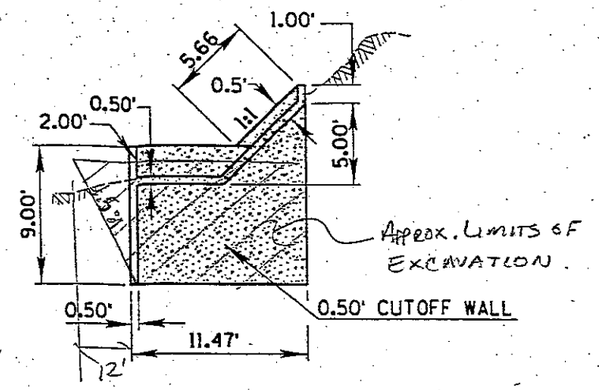
ADDITIONAL CONSTRUCTION EXCAVATION = 2{[½(13.5')(20.25')][37.76']}
= 10,322.64 CF ≈ 382 CY

TOTAL EXCAVATION = 382 CY + 1754 CY
= 2136 CY

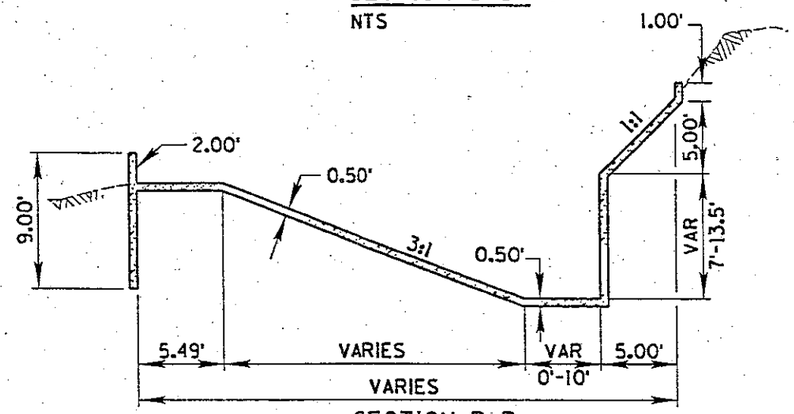
BACKFILL
PERIMETER LENGTH = 151 ft
$V_{BF} = [\frac{1}{2}(12*8)*151]/27$
$V_{BF} = 268$ CY



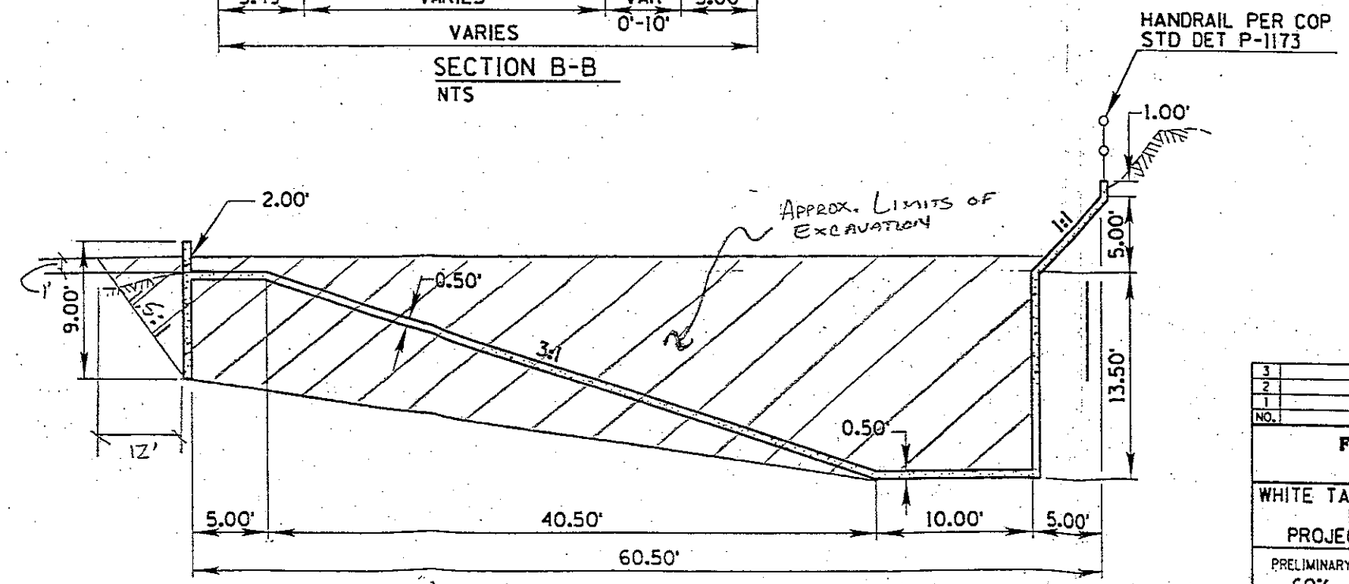
WEIR STRUCTURE DETAIL
NTS



SECTION C-C
NTS



SECTION B-B
NTS



SECTION A-A
NTS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

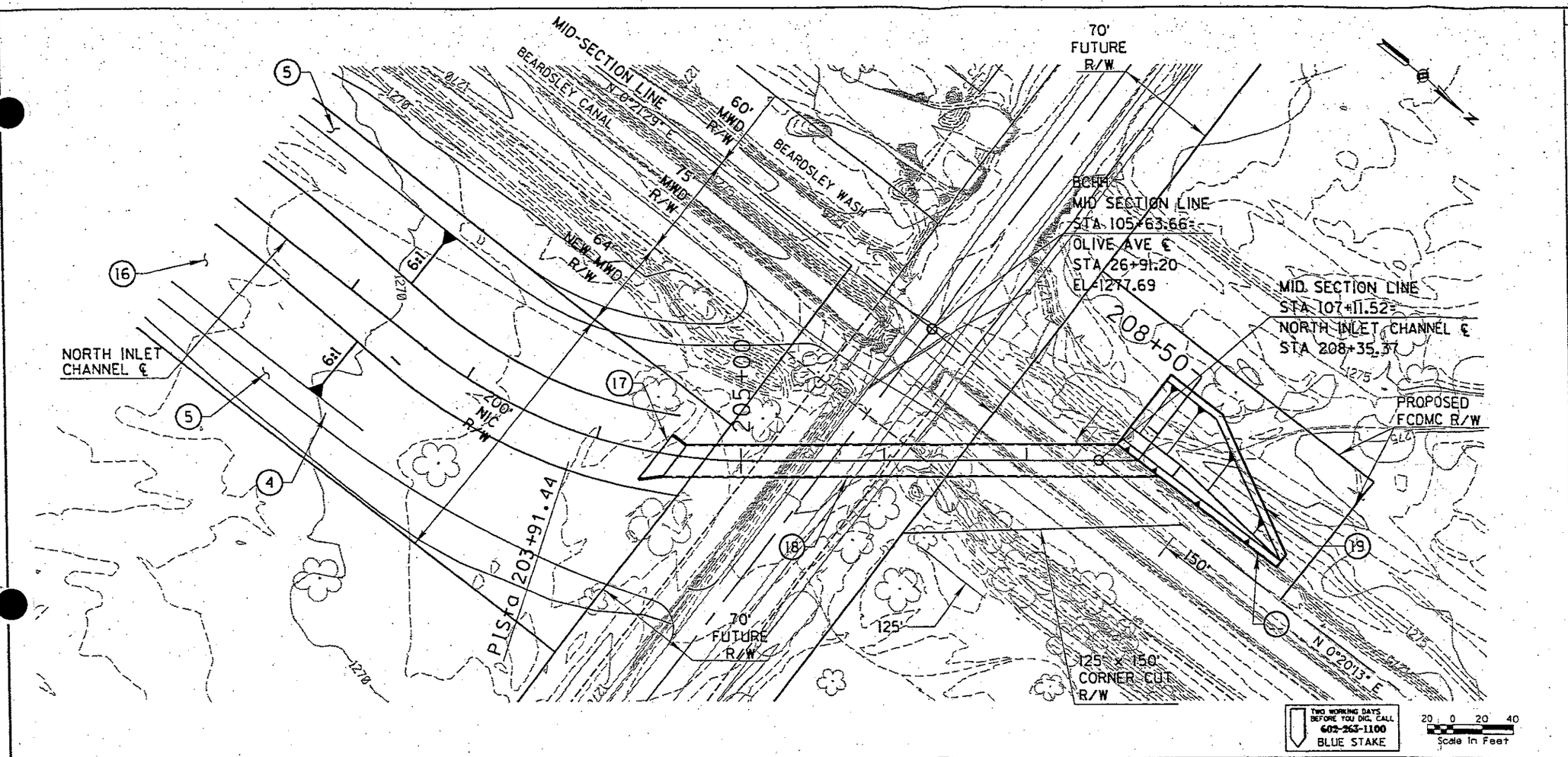
WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

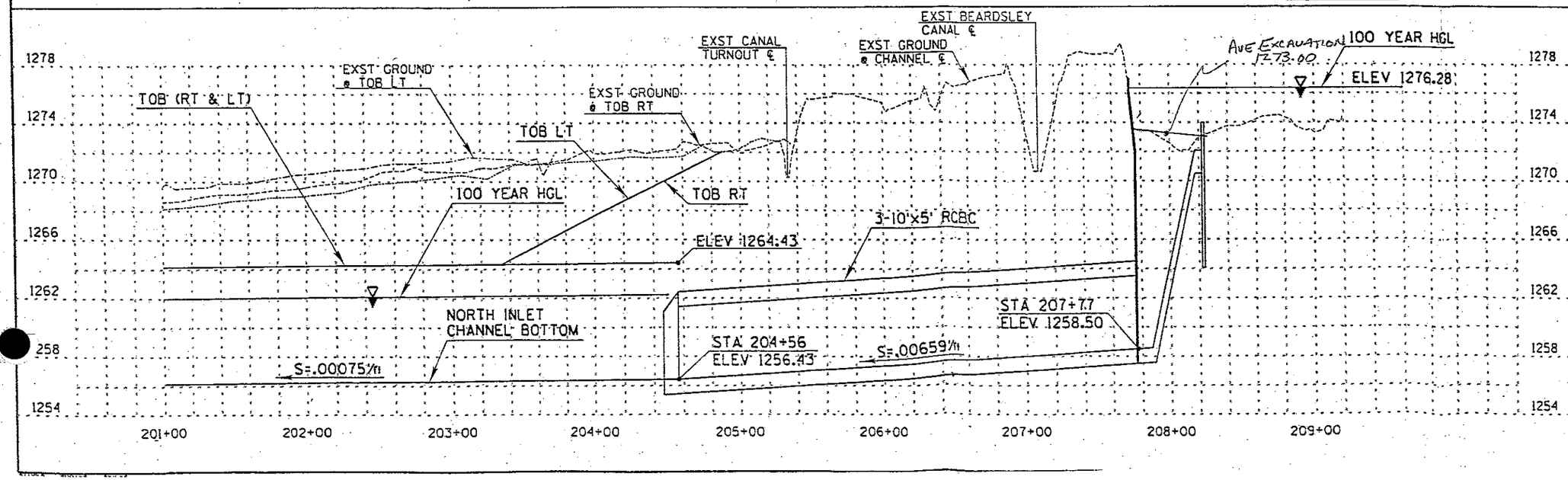
PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

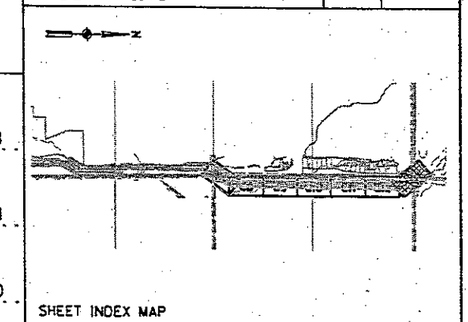
DRAWING NO. DS1 | SIDE WEIR STRUCTURE DETAIL | SHEET X OF XXX





REMOVE		

CONSTRUCT		
(4) STA ___+____ O&M RAMP PER DET#XX DWG NO D2	XX	EA
(5) O&M ROAD PER TYPICAL SECTION DWG NO D2	XX	SY
(16) NIC CHANNEL EXCAVATION PER LIMITS SHOWN, PER TYP. SECTION DWG NO. G7 & PER CROSS SECTION DWG NOS XS07-XS13	XX	CY
(17) OUTLET HEADWALL & WING WALLS PER ADOT STD NO B-04.10, 2:1 SLOPE, 0° SKEW AND OUTLET APRON PER ADOT STD NO B-06.10 AND PER MODIFICATION TABLE ON DWG NO D1	XX	EA
(18) 2-10'x5'x315' RCBC PER ADOT STD NO B-02.20	XX	EA
(19) SIDE WIER/DROP INLET STRUCTURE PER DETAIL DWG NO DS1	XX	EA
(--) HANDRAIL PER COP STD DET P-1173	XX	LF



NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY 60% NOT FOR CONSTRUCTION OR RECORDING

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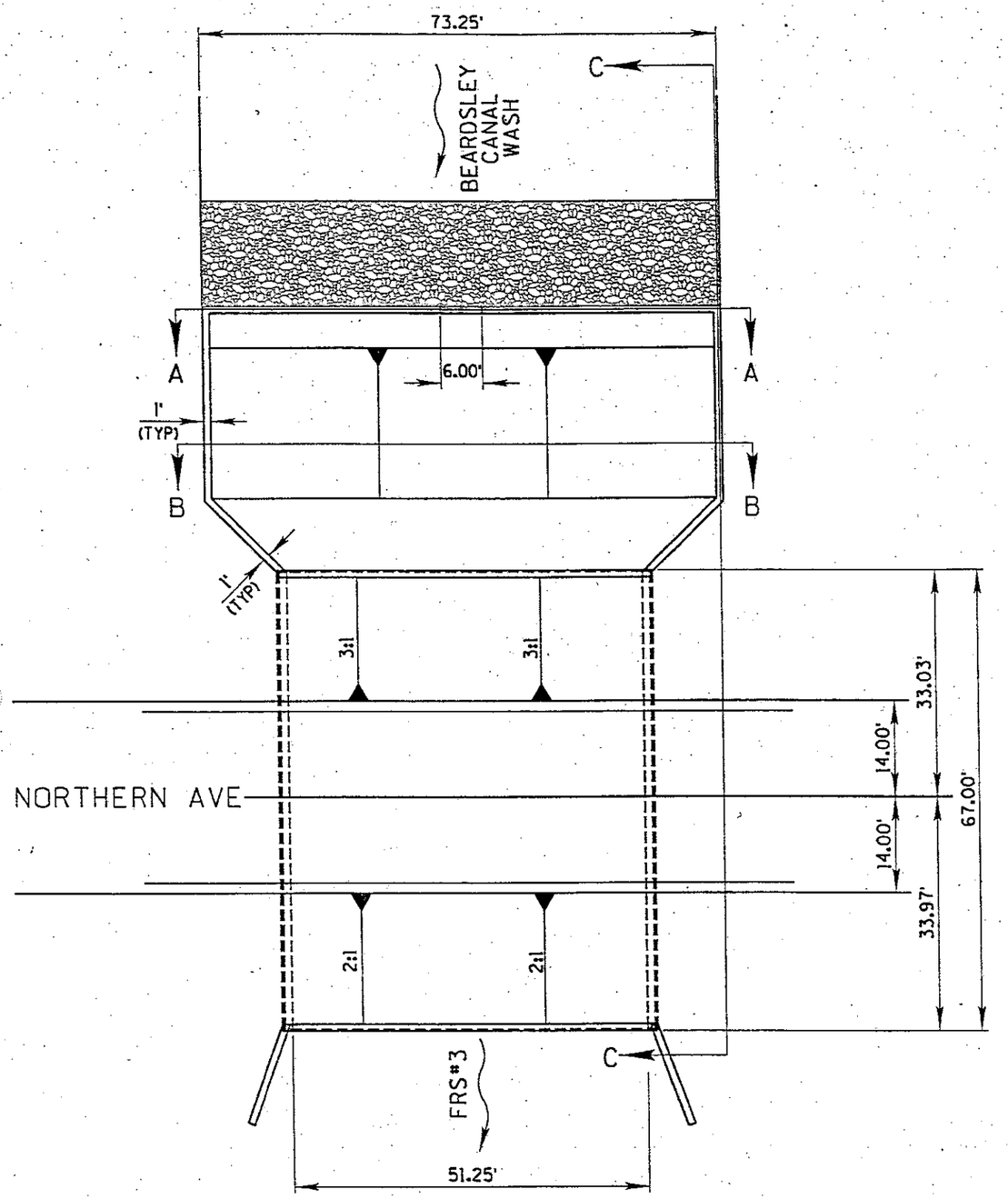
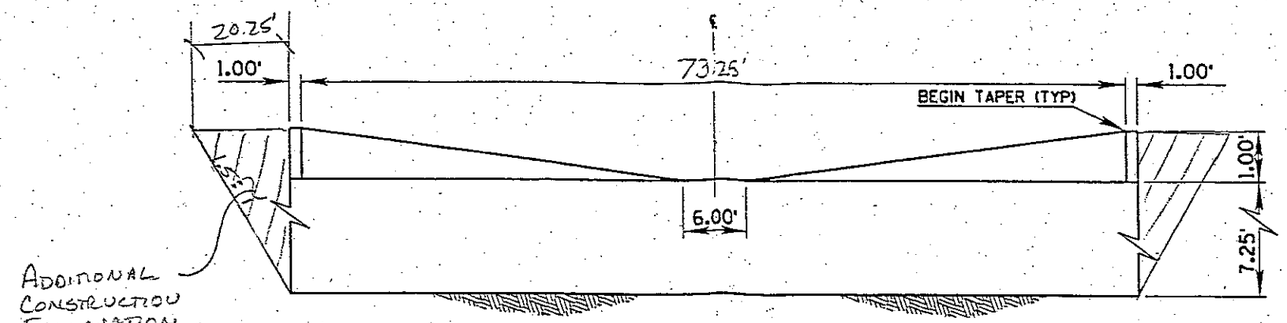
CHECKED	JKK	03/05

KIRKHAM MICHAEL

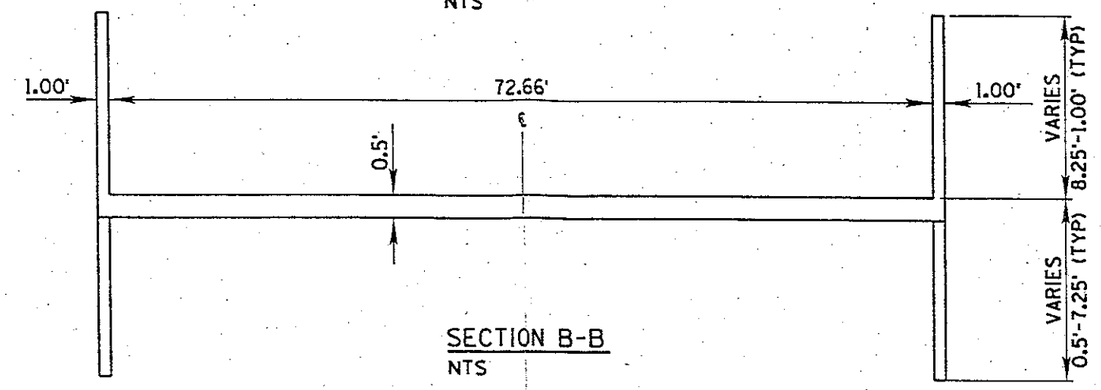
DRAWING NO. C13 | NORTH INLET CHANNEL STA 201+00 TO STA 209+00 | SHEET OF XXX



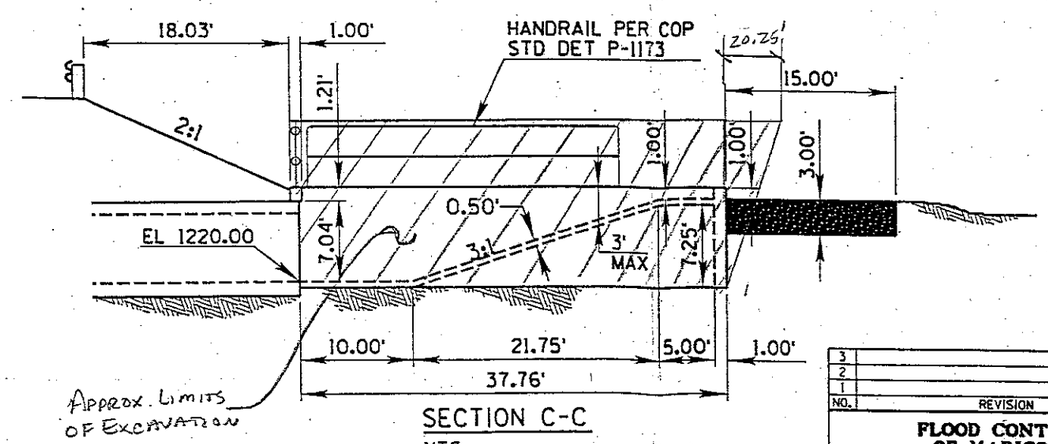
NORTHERN WASH DROP STRUCTURE
NTS



SECTION A-A
NTS



SECTION B-B
NTS



SECTION C-C
NTS

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

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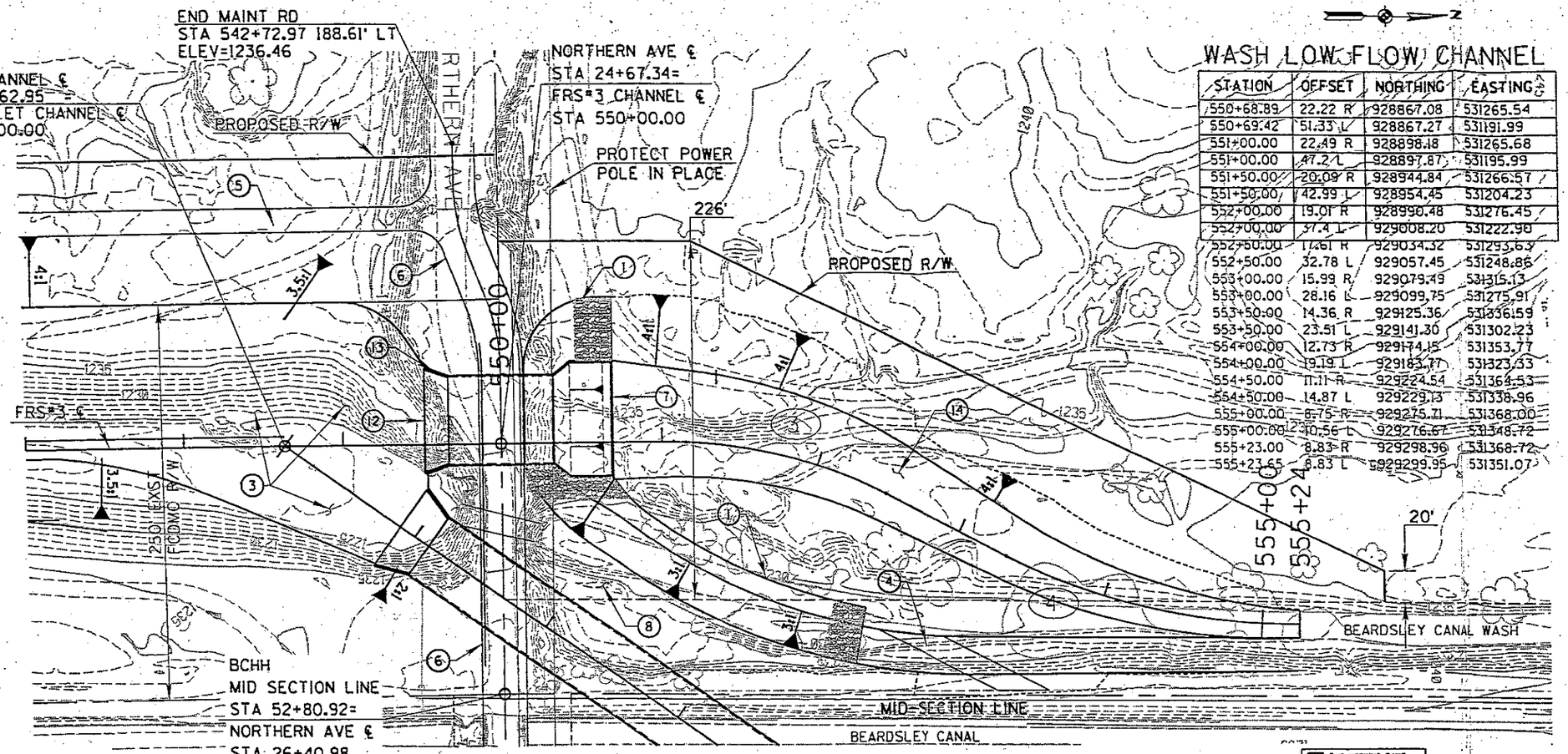
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO. DS2

BCW @ NORTHERN CULVERT INLET DETAIL

SHEET X OF XXX

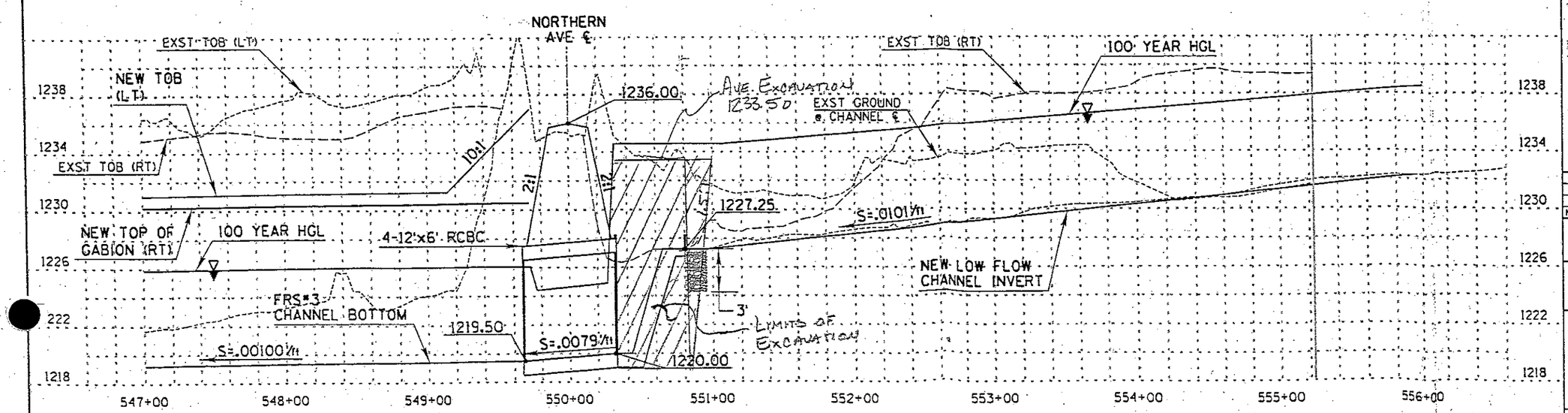


WASH LOW FLOW CHANNEL

STATION	OFFSET	NORTHING	EASTING
550+68.89	22.22 R	928867.08	531265.54
550+69.42	51.33 L	928867.27	531191.99
551+00.00	22.49 R	928898.48	531265.68
551+00.00	47.2 L	928897.87	531195.99
551+50.00	20.09 R	928944.84	531266.57
551+50.00	42.99 L	928954.45	531204.23
552+00.00	19.01 R	928990.48	531276.45
552+00.00	37.4 L	929008.20	531222.98
552+50.00	17.61 R	929034.32	531293.63
552+50.00	32.78 L	929057.45	531248.86
553+00.00	15.99 R	929079.49	531315.13
553+00.00	28.16 L	929099.75	531275.91
553+50.00	14.36 R	929125.36	531336.59
553+50.00	23.51 L	929141.30	531302.23
554+00.00	12.73 R	929174.15	531353.77
554+00.00	19.19 L	929183.77	531323.33
554+50.00	11.11 R	929224.54	531364.53
554+50.00	14.87 L	929229.13	531338.96
555+00.00	6.75 R	929275.71	531368.00
555+00.00	10.56 L	929276.67	531348.72
555+23.00	8.83 R	929298.96	531368.72
555+23.65	8.83 L	929299.95	531351.07

NOTE

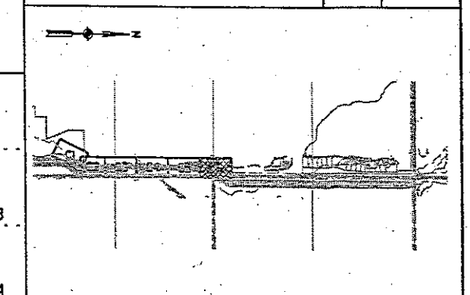
SEE DWG NO G4 FOR CURVE DATA IN WASH



REMOVE

CONSTRUCT

(1) 9" RENO MATTRESS BANK PROTECTION PER TYP SEC, DWG NO G7	CY	CY
(3) FRS#3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET	CY	CY
(4) O&M RAMP PER DET#XX DWG NO D2	EA	1
(5) O&M ROAD PER TYPICAL SECTION DWG NO D2	SY	SY
(6) ADJUST NORTHERN AVE RDWY PROFILE PER DET. SHT #		
• EMBANKMENT	CY	CY
• SUBGRADE	SY	CY
(7) DROP INLET PER DETAILS DWG NO DSXX	SY	SY
(8) COMPACTED FILL/ EMBANKMENT PER TYP SECTION (550+69) DWG NO G6	CY	SY



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY 60% NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO. C6 | FRS#3 / BEARDSLEY WASH STA 547+00 TO STA 556+00 | SHEET OF XXX

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 2

Project NORTH INLET CHANNEL Date 3/4/05

Subject NIC DROP STRUCTURES QUANTITIES Designed ACL Checked JHL

DETAILS & DIMENSIONS OF FOLLOWING SHEETS

ALL DROP STRUCTURES

UPSTREAM / DOWNSTREAM BANK PROTECTION, RIP RAP

BOTTOM => (55') (15') (3') 2 = ~~2475~~ 1650 CU FT

SIDES => [(33' + 22')/2 (15')(3')] · 2' = ~~2475~~ 1233 CU FT

~~4950~~ 2883 CU FT ≈ ~~183.3~~ 107 CU YD.

CONSTRICTION, GROUTED ROCK

BOTTOM => ((55' + 25')/2 (15') = 600 SQ FT

SIDES => (22.16')($\sqrt{15^2+15^2}$) = 469 SQ FT

1069 SQ FT. ≈ 118.5 SQ YD

3.5' DROP STRUCTURE

DROP, GROUTED ROCK

BOTTOM => (25')($\sqrt{3.5^2+14^2}$) = 361 SQ FT

SIDES => 2[($\sqrt{3.5^2+14^2}$)(22' + ½ 2.38')] = 670 SQ FT

1031 SQ FT ≈ 114.6 SQ YD.

APRON / EXPANSION, GROUTED ROCK

BOTTOM => [(55' + 25')/2] (30') = 1200 SQ FT

SIDES => 2[(30')(22' + ½ 1.12')] = 1354 SQ FT

2554 SQ FT ≈ 283.8 SQ YD.

4.5' DROP STRUCTURE

DROP, GROUTED ROCK

BOTTOM => (25')($\sqrt{4.5^2+18^2}$) = 464 SQ FT

SIDES => 2[($\sqrt{4.5^2+18^2}$)(22' + ½ 2.83')] = 869 SQ FT

1333 SQ FT ≈ 148.1 SQ YD.

APRON / EXPANSION, GROUTED ROCK

BOTTOM => ((55' + 25')/2)(30') = 1240 SQ FT

SIDES => 2(30')(22' + ½ 1.67') = 1416 SQ FT

2656 SQ FT ≈ 295.1 SQ YD.

6.25' DROP STRUCTURE

DROP, GROUTED ROCK

BOTTOM => (25')($\sqrt{6.25^2+25^2}$) = 645 SQ FT

SIDES => 2[($\sqrt{6.25^2+25^2}$)(43.5' + ½ (2.50')] = 2307 SQ FT

2952 SQ FT ≈ 328.0 SQ YD.

APRON / EXPANSION, GROUTED ROCK

BOTTOM => [(55 + 25)/2](36') = 1440 SQ FT

SIDES => 2(36')(43.5 + ½ (1.00') = 3168 SQ FT

4608 SQ FT ≈ 512.0 SQ YD.

DOWNSTREAM BANK PROTECTION, ~~GROUTED ROCK~~ RIP RAP

BOTTOM => (55')(3')(15') = 1650 CU FT

SIDES => 2[(46.25 + 37)/2](3')(15') = ~~3777~~ 2475 CU FT

~~6227~~ 4125 CU FT. ≈ ~~231.4~~ 153 CU YD

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 2 of 2

Project NORTH INLET CHANNEL Date 3/4/05

Subject NIC DROP STRUCTURES QUANTITIES Designed ACC Checked JKK

3.5' DROP STRUCTURE

RIP RAP = ~~184~~ 107 cy + ~~184~~ 107 cy = ~~368~~ 214 cu yd

GROUTED BOULDERS = 118.5 sy + 114.63 sy + 283.8 sy = $\left[516.9\ sy * \left(\frac{18''}{12}\right)/3\right]$ = 258.5 cy (D_{EFF} (SEE BELOW))

GROUT CUTOFF WALL = $2\left[(55.00') + 2\left(\sqrt{6.5^2 + 22.0^2}\right)\right] * (4')(1') = 802.83\ cf \approx 29.7\ cy$

(BOTTOM WIDTH; SIDE LENGTH; DEPTH; WIDTH)

4.5' DROP STRUCTURE

RIP RAP = ~~184~~ 107 cy + ~~184~~ 107 cy = ~~368~~ 214 cu yd

GROUTED BOULDERS = 118.5 sy + 148.1 sy + 295.1 sy = $\left[561.7\ sy * \left(\frac{22.5}{12}\right)/3\right]$ = 351 cy

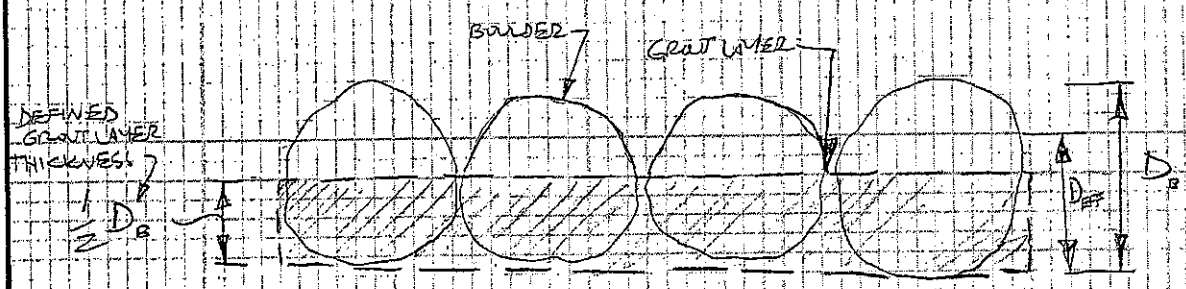
GROUT CUTOFF WALL = $2\left[(55.00') + 2\left(\sqrt{5.5^2 + 22.0^2}\right)\right](3')(1') = 702.49\ cf \approx 26.0\ cy$

6.25' DROP STRUCTURE

RIP RAP = ~~184~~ 107 cy + ~~230~~ 153 cy = ~~414~~ 260 cy

GROUTED BOULDER = 118.5 sy + 328.0 sy + 512.0 sy = $\left[958.5\ sy * \left(\frac{27}{12}\right)/3\right]$ = 718.9 cy

GROUT CUTOFF WALL = $\left[(55) + 2\left(\sqrt{5.5^2 + 22^2}\right) + (55') + 2\left(\sqrt{7.25^2 + 27^2}\right)\right](3')(1') = 645.42\ cf \approx 23.9\ cy$



D_B = NOMINAL BOULDER DIAMETER

D_B = 36" FOR 6.25' DROP (D_{EFF} = 27")
30" FOR 4.50' DROP (D_{EFF} = 22.5")
24" FOR 3.50' DROP (D_{EFF} = 18")

ASSUMPTIONS FOR COMPUTING CUBIC YARDS OF BOULDERS:

1) ONE HALF OF BOULDER/GROUT LAYER HAS NO VOIDS

2) OTHER HALF OF BOULDER LAYER CONTAINING NO GROUT IS ONE HALF VOIDS

∴ $\frac{3}{4} D_B \simeq$ SOLID THICKNESS OF GROUTED BOULDER LAYER = D_{EFF}

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/11/05

Subject DROP STRUCTURE EXCAVATION QUANT. Designed ACL Checked JFK

AREAS OF DROP STRUCTURES FROM NIC DROP STRUCT. QUANTITIES.

SEE PREVIOUS SHEET FOR DETAILS & DIMENSION.

3.5' DROP STRUCTURE

24" BOULDERS WITH 12" GRAVEL BEDDING

THICKNESS = (24" + 12")/12"/' = 3.00' ≈ 1 yd

AREA = 516.9 sy

CUTOFF WALL VOLUME = 30 cy

TOTAL EXCAVATION = 30 cy + (516.9 sf)(1 yd) = 546.9 cy

4.5' DROP STRUCTURE

30" BOULDERS WITH 12" GRAVEL BEDDING

THICKNESS = (12" + 30")/12"/' = 3.5' ≈ 1.17 yd

AREA = 561.7 sy

CUTOFF WALL VOLUME = 26 cy

TOTAL EXCAVATION = 26 cy + (561.7 sy)(1.2 yd) = 700.0 cy

6.25' DROP STRUCTURE

36" BOULDERS WITH 12" GRAVEL BEDDING

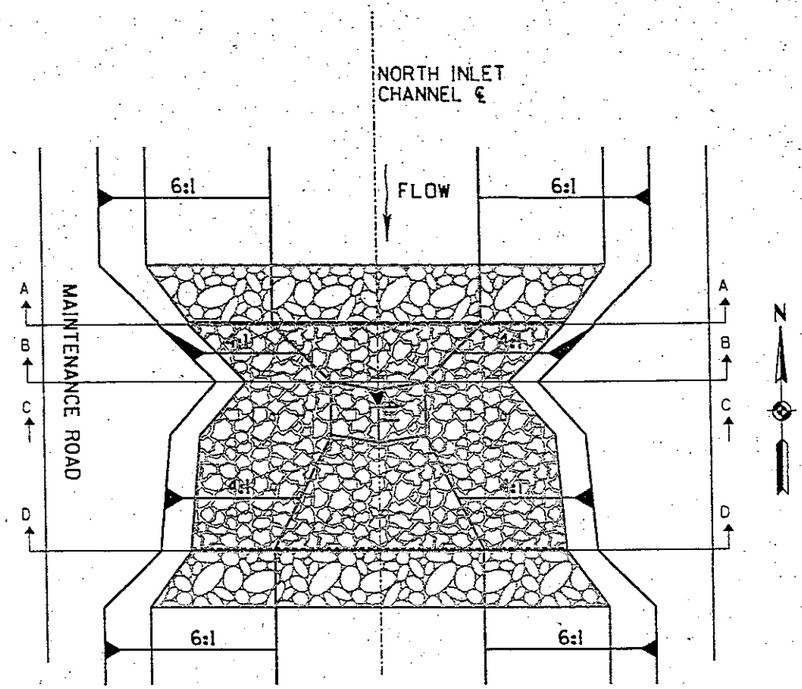
THICKNESS = (12" + 36")/(12"/') = 4.0' ≈ 1.33 yd

AREA = 958.5 sy

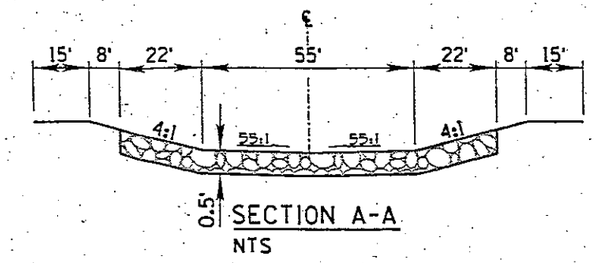
CUTOFF WALL VOLUME = 23.9 cy

TOTAL EXCAVATION = 23.9 cy + (1.3 yd)(958.5 sy) = 1270.0 cy

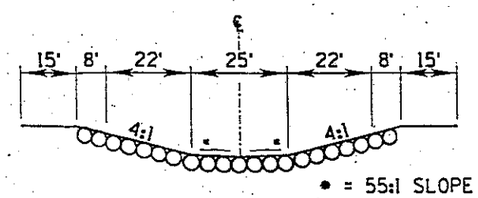
N/A: INCIDENTAL TO LINE & GRADE CHANNEL EXCAVATION



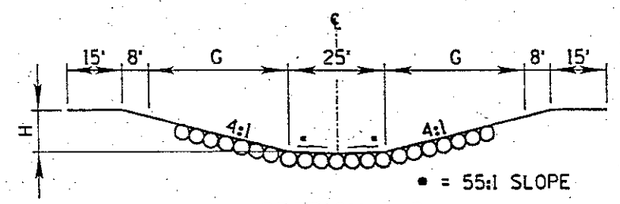
DROP STRUCTURE PLAN
NTS



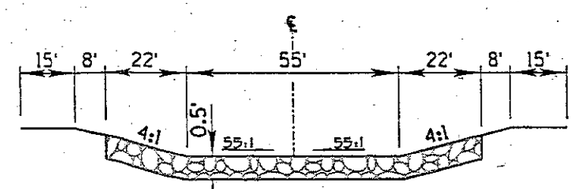
SECTION A-A
NTS



SECTION B-B
NTS



SECTION C-C
NTS



SECTION D-D
NTS

CROSS-SECTION DIMENSIONS PER DROP STRUCTURE HEIGHT

HEIGHT OF STRUCTURE	G	H
3.50' DROP STRUCTURE	36'	9.88'
4.50' DROP STRUCTURE	40'	10.33'
6.25' DROP STRUCTURE	47'	11.75'

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
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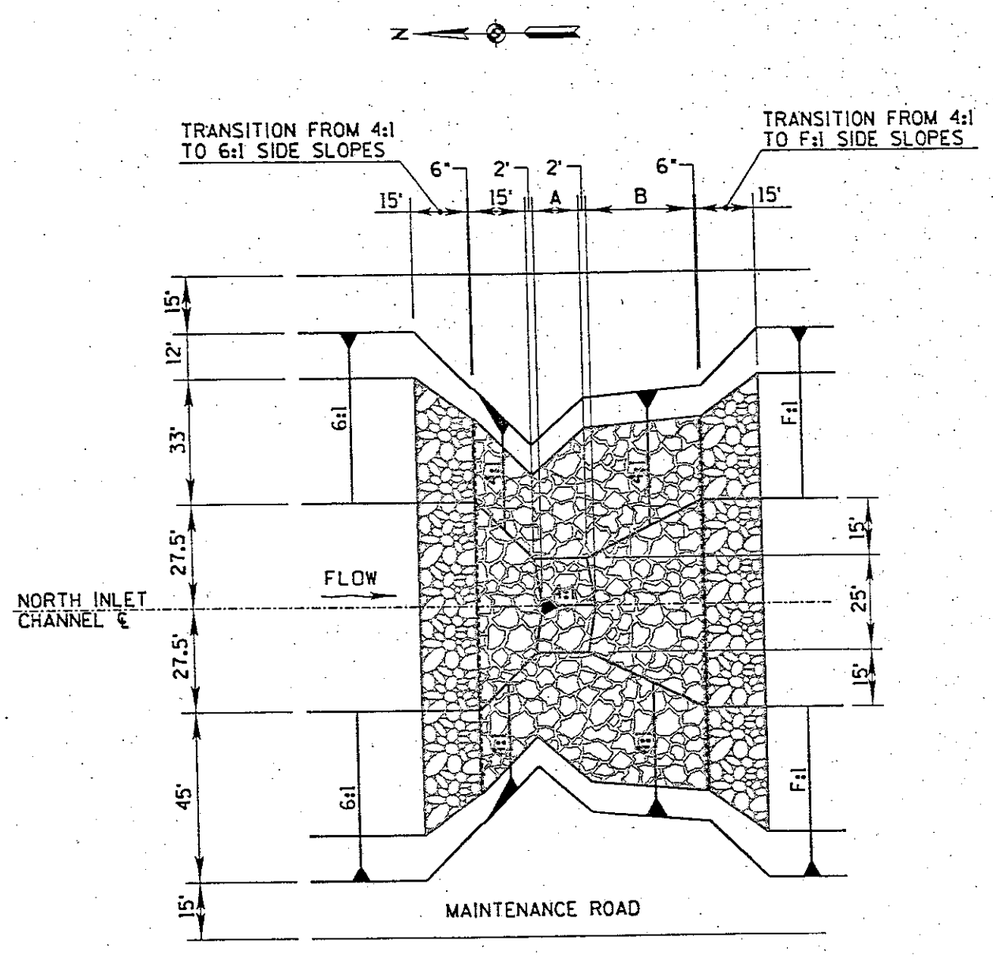
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

DRAWING NO.

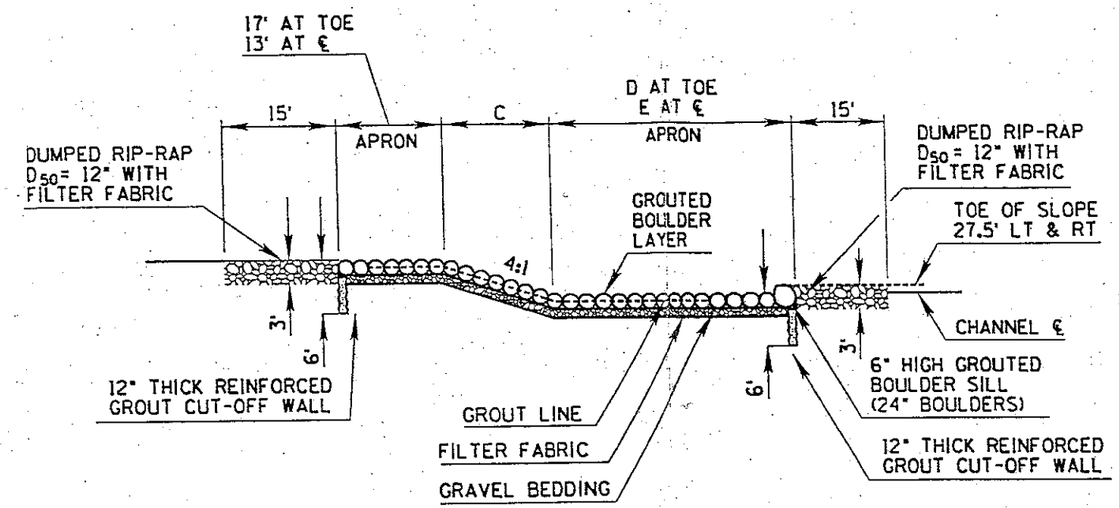
SHEET OF



DROP STRUCTURE PLAN
NTS

PLAN/PROFILE DIMENSIONS PER DROP STRUCTURE HEIGHT

HEIGHT OF STRUCTURE	A	B	C	D	E	E
3.50' DROP STRUCTURE	12'	28'	14'	30'	28'	6
4.50' DROP STRUCTURE	16'	29'	18'	31'	29'	6
6.25' DROP STRUCTURE	23'	34'	23'	36'	34'	5



DROP STRUCTURE PROFILE
NTS

NOTE:

1. SEE DWG. NO. C30 FOR DROP STRUCTURE #5 PLAN.
2. THERE IS NO DROP STRUCTURE #4 IN PROJECT
3. SEE DWG. NO. DS2 FOR GENERAL DETAIL AND NOTES
4. BOULDER SIZE FOR DROP STRUCTURE:
   36"-SLOPES AND APRONS (MAY VARY FROM 30" TO 42")
   48"-SILL (MAY VARY FROM 42" TO 54")

NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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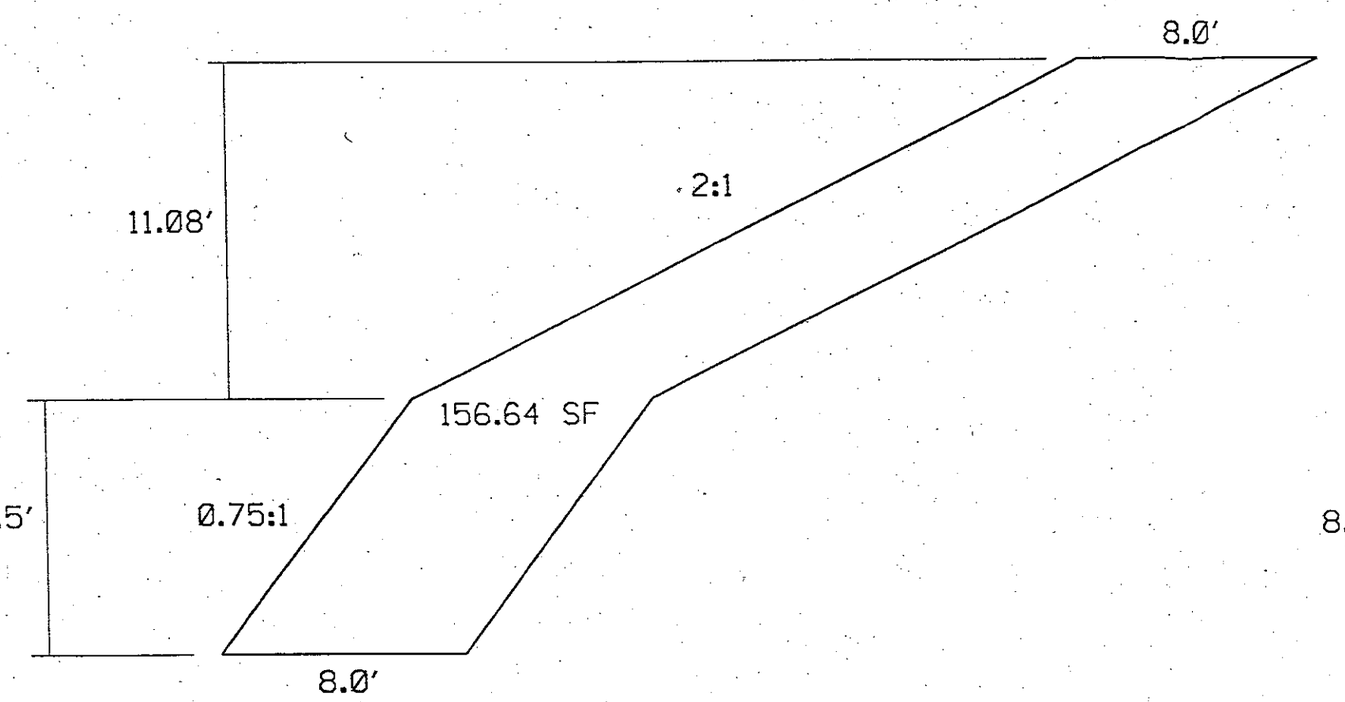
CHECKED	JKK	03/05

KIRKHAM MICHAEL

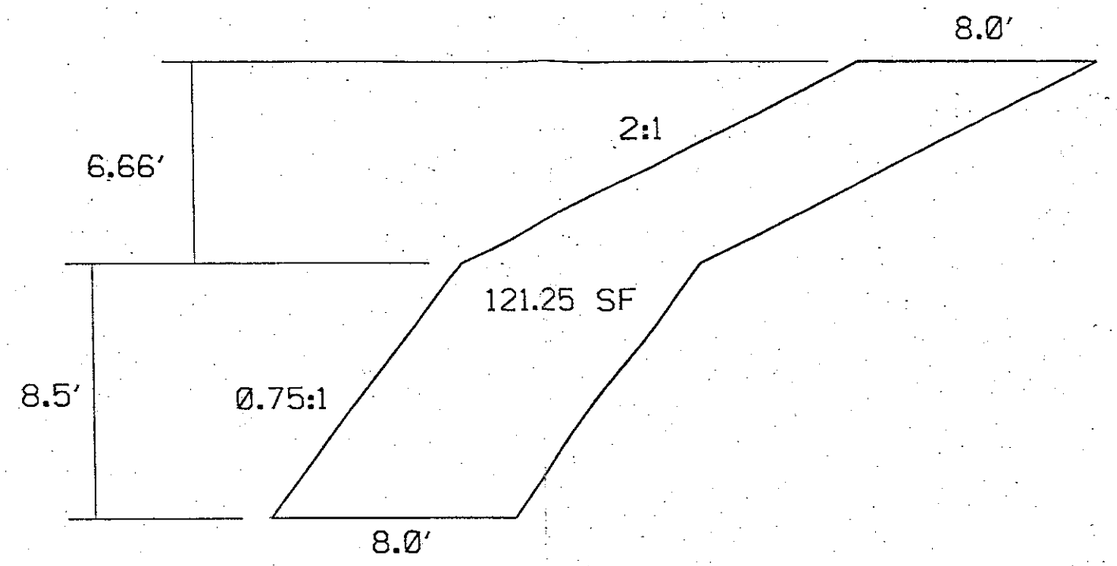
DRAWING NO. DS3 | NORTH INLET CHANNEL DROP STRUCTURE #3 | SHEET OF

SOIL CEMENT QUANTITIES

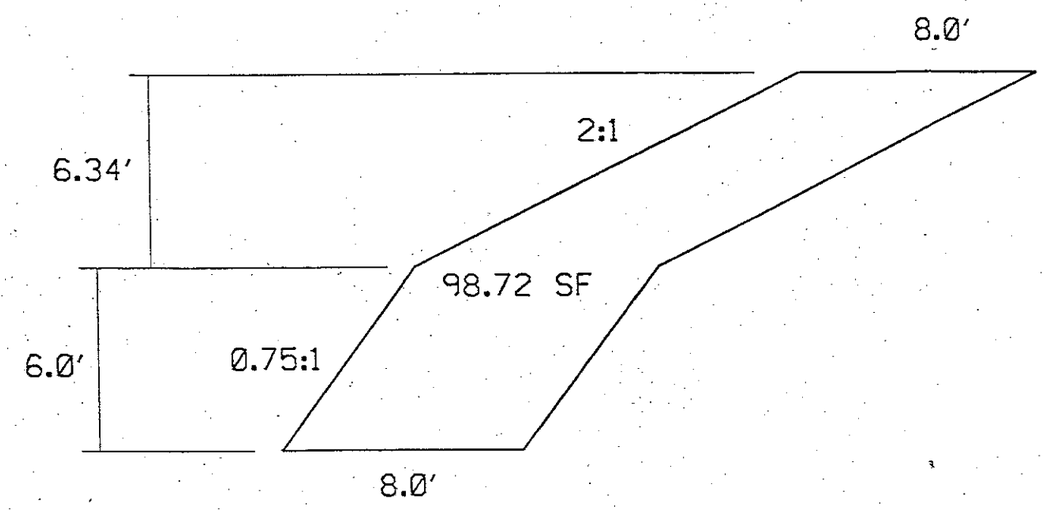
STA 71+00.00



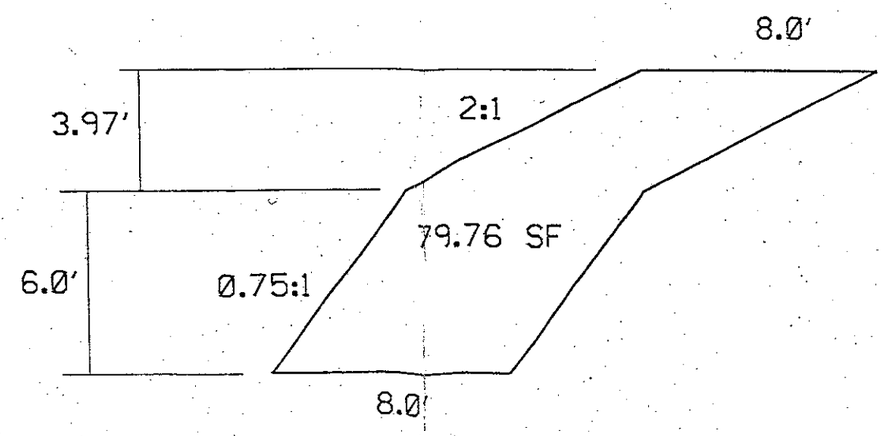
STA 76+60.00

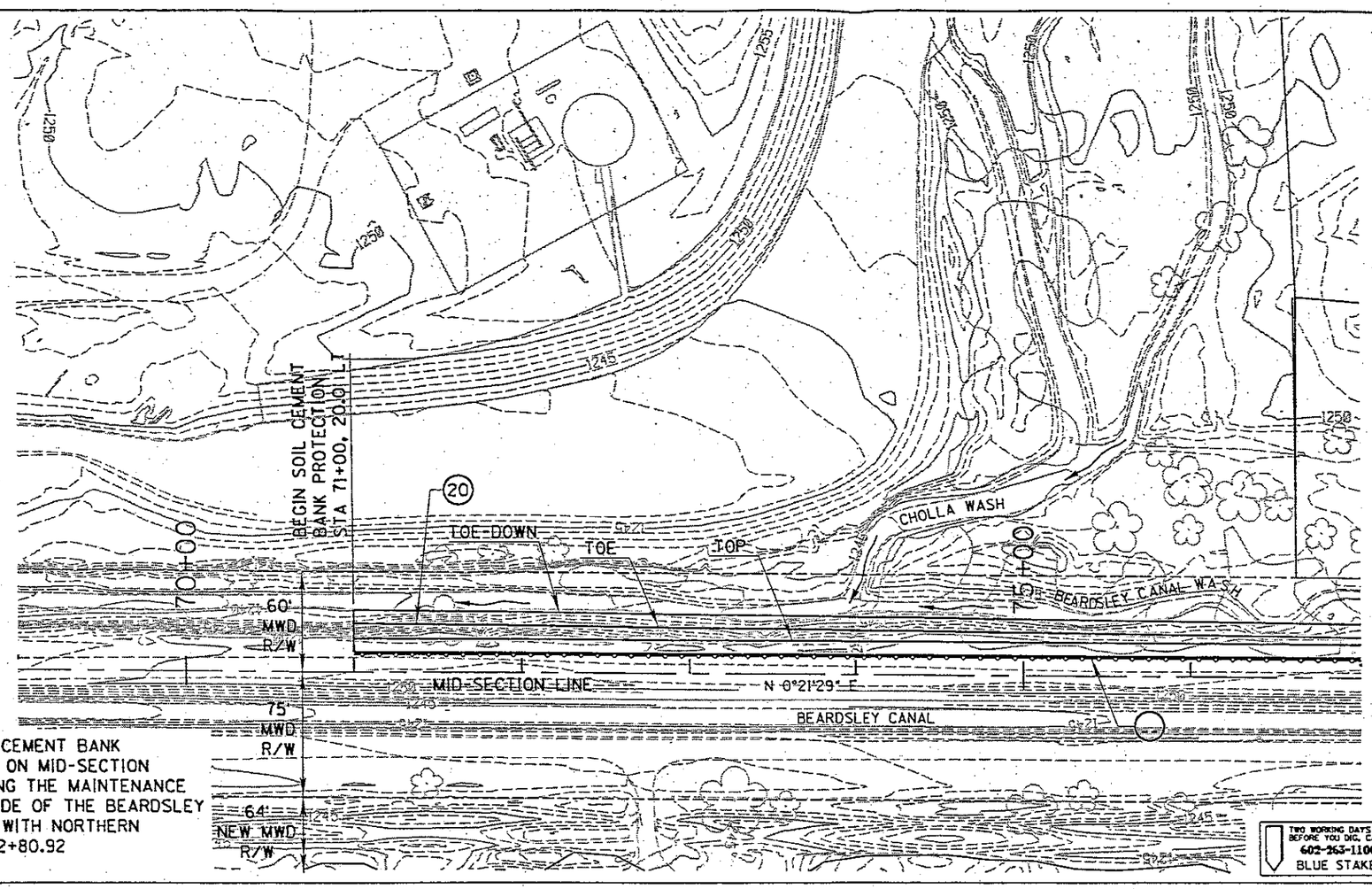


STA 77+00.00

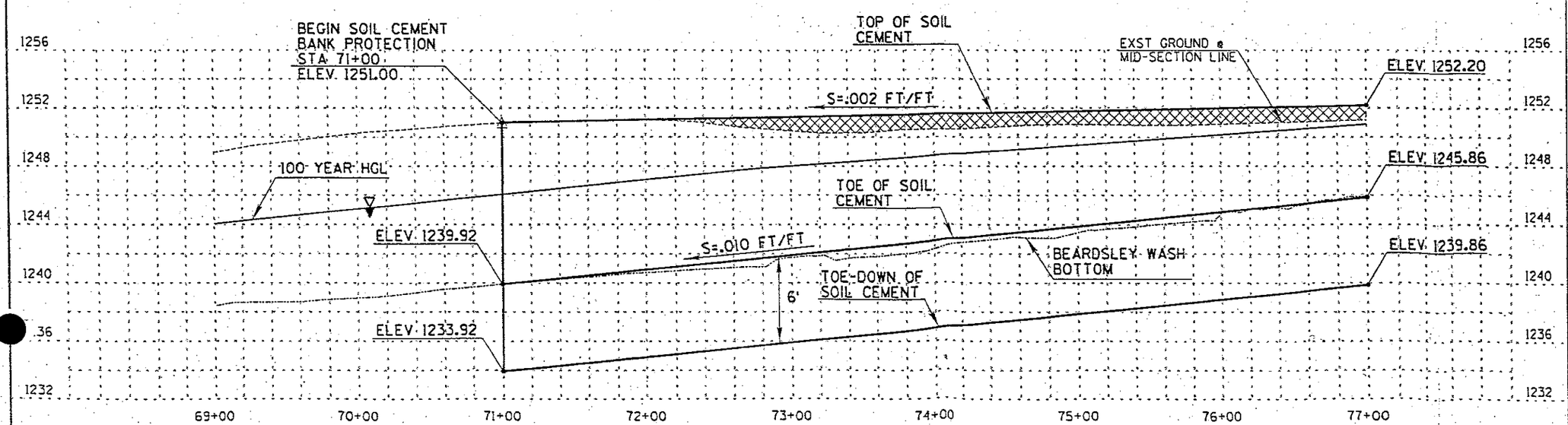


STA 81+00.00



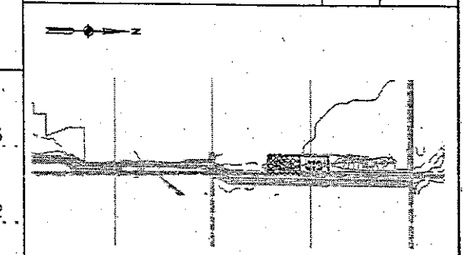


NOTE
STATIONING FOR SOIL CEMENT BANK PROTECTION IS BASED ON MID-SECTION LINE WHICH RUNS ALONG THE MAINTENANCE ROAD ON THE WEST SIDE OF THE BEARDSLEY CANAL; INTERSECTION WITH NORTHERN AVENUE IS STATION 52+80.92 (SEE DWG NO C6)



REMOVE		

CONSTRUCT		
(20) SOIL CEMENT BANK PROTECTION PER TYP SECTION, DWG NO G7	XX	CY
(--) HANDRAIL PER COP STD DET P-1173	XX	LF



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

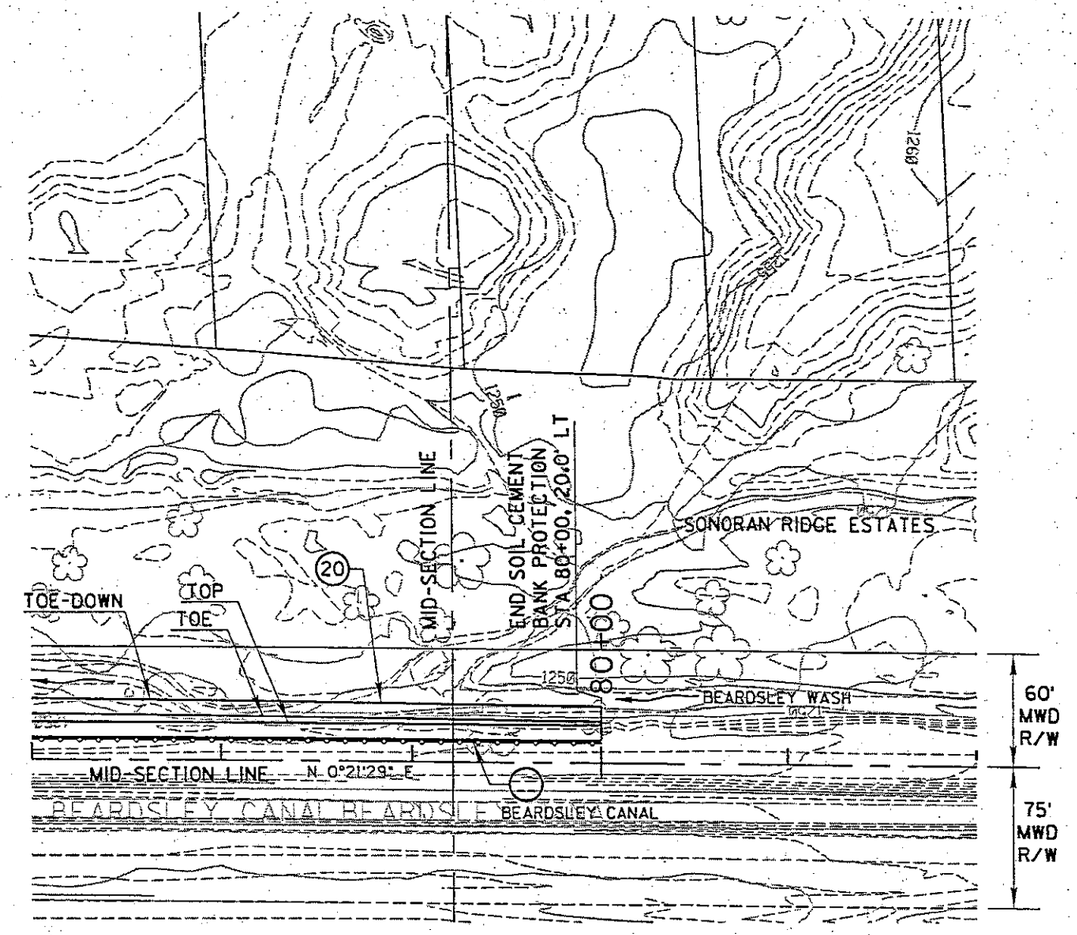
PRELIMINARY 60% NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

KIRKHAM MICHAEL

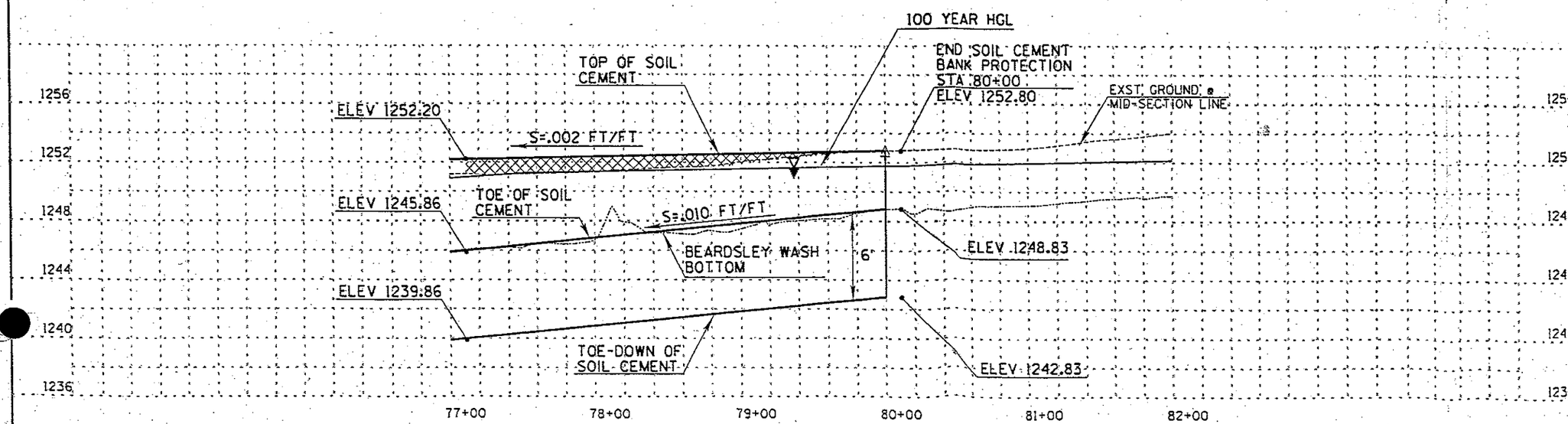
DRAWING NO. C14 | SOIL CEMENT STA 68+00 TO STA 77+00 | SHEET OF

NOTE
STATIONING FOR SOIL CEMENT BANK PROTECTION IS BASED ON MID-SECTION LINE WHICH RUNS ALONG THE MAINTENANCE ROAD ON THE WEST SIDE OF THE BEARDSLEY CANAL; INTERSECTION WITH NORTHERN AVENUE IS STATION 52+80.92 (SEE DWG NO C6)



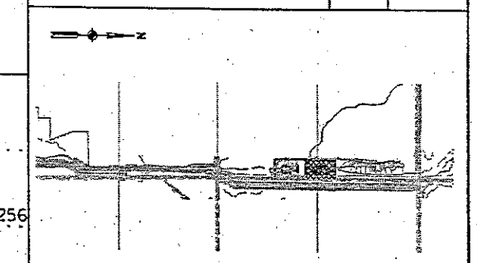
TWO WORKING DAYS BEFORE YOU DIG, CALL 602-263-1100 BLUE STAKE

20 0 20 40
Scale In Feet



REMOVE		

CONSTRUCT		
20 SOIL CEMENT BANK PROTECTION PER TYP SECTION, DWG NO G7	CY	XX
-- HANDRAIL PER COP STD DET P-1173	LF	XX



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC	03/05
DRAWN	KMA	03/05
CHECKED	JKK	03/05

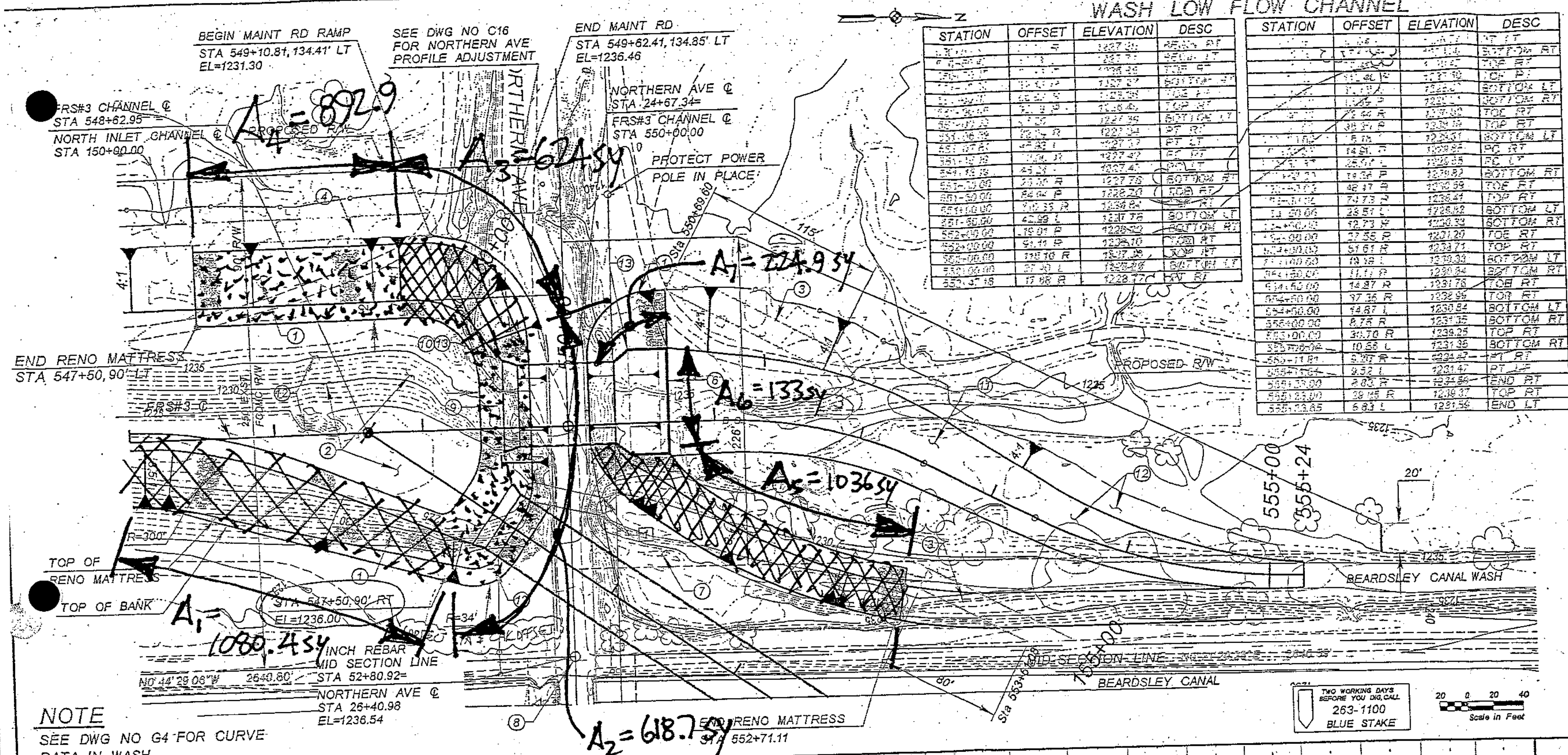
KIRKHAM MICHAEL

DRAWING NO. | SOIL CEMENT | SHEET OF

WASH LOW FLOW CHANNEL

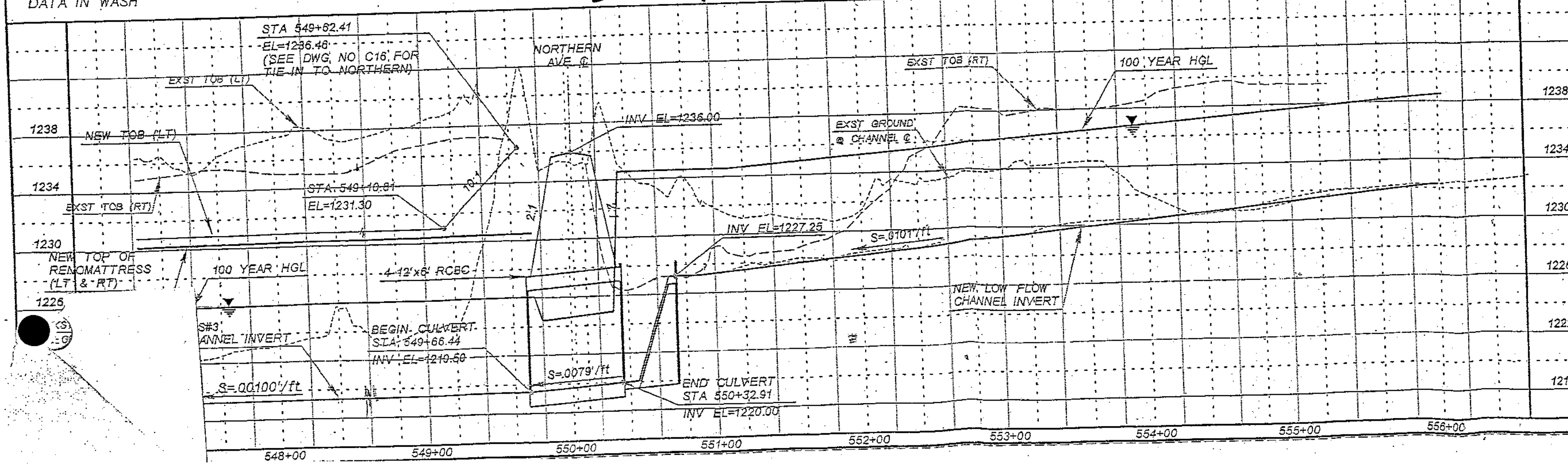
STATION	OFFSET	ELEVATION	DESC
[illegible]	[illegible] R	1227.[illegible]	BEGIN RT
[illegible]	[illegible]	1227.[illegible]	BEGIN LT
[illegible]	[illegible]	1228.[illegible]	TOP RT
[illegible]	[illegible] R	1227.27	BOTTOM RT
[illegible]	[illegible] R	1228.[illegible]	TOE RT
[illegible]	[illegible] R	1226.4[illegible]	TOP RT
551+[illegible]	[illegible]	1227.36	BOTTOM LT
551+[illegible]	[illegible] R	1227.34	PT RT
551+[illegible]	45.[illegible] L	1227.17	PT LT
551+[illegible]	[illegible] R	1227.47	PC RT
551+[illegible]	45.[illegible]	1227.4[illegible]	PC LT
551+[illegible]	23.[illegible] R	1227.78	BOTTOM RT
551+50.00	84.[illegible] R	1228.20	TOB RT
551+00.00	1[illegible].35 R	1226.84	[illegible] RT
551+50.00	42.99 L	1227.78	BOTTOM LT
552+00.00	19.01 R	1225.[illegible]	BOTTOM RT
552+00.00	91.11 R	1226.10	TOB RT
552+00.00	118.10 R	1227.[illegible]	TOP RT
552+00.00	37.[illegible] L	1228.2[illegible]	BOTTOM LT
552+47.16	17.66 R	1228.77	PT RT

STATION	OFFSET	ELEVATION	DESC
[illegible]	[illegible]	[illegible]	RT LT
[illegible]	[illegible]	[illegible]	BOTTOM RT
[illegible]	[illegible]	[illegible]	TOP RT
[illegible]	[illegible] R	1227.[illegible]	TOE RT
[illegible]	[illegible]	[illegible]	BOTTOM LT
[illegible]	[illegible] R	[illegible]	BOTTOM RT
[illegible]	72.44 R	1227.[illegible]	TOE RT
[illegible]	38.[illegible] R	1229.[illegible]	TOP RT
[illegible]	5.[illegible]	1228.31	BOTTOM LT
[illegible]	14.81 R	1229.[illegible]	PC RT
[illegible]	25.[illegible] L	1229.35	PC LT
[illegible]	19.36 R	1229.82	BOTTOM RT
[illegible]	48.47 R	1230.59	TOE RT
[illegible]	74.73 R	1236.41	TOP RT
[illegible]	28.57 L	1229.[illegible]	BOTTOM LT
[illegible]	12.73 R	1230.33	BOTTOM RT
[illegible]+00.00	27.56 R	1231.20	TOE RT
[illegible]+00.00	51.61 R	1233.71	TOP RT
[illegible]+00.00	19.19 L	1230.33	BOTTOM LT
[illegible]+50.00	11.11 R	1230.84	BOTTOM RT
[illegible]+50.00	14.87 R	1231.76	TOB RT
554+50.00	37.36 R	1232.96	TOP RT
554+50.00	14.87 L	1230.84	BOTTOM LT
555+00.00	8.75 R	1231.35	BOTTOM RT
555+00.00	30.70 R	1239.25	TOP RT
555+00.00	10.56 L	1231.35	BOTTOM RT
555+11.81	9.20 R	1234.47	PT RT
555+11.64	9.52 L	1231.47	PT LT
555+23.00	2.83 R	1234.56	END RT
555+23.00	29.55 R	1238.37	TOP RT
555+23.65	6.83 L	1231.56	END LT



NOTE

SEE DWG NO G4 FOR CURVE DATA IN WASH

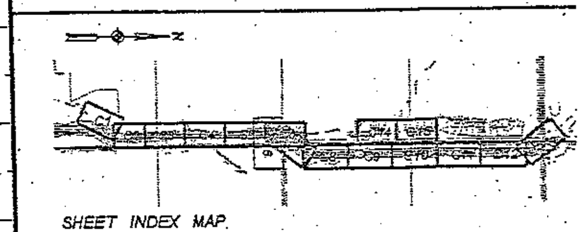


REMOVE

[1] REMOVE 60" CMP (LSUM ITEM) 100 LF

CONSTRUCT

(1)	9" RENO MATTRESS BANK PROTECTION PER TYP SEC, DWG NO G7	~~12,688~~ SY
(2)	FRS #3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET	17,007 CY
(3)	O&M RAMP PER DET DWG NO. D2	2 EA
(4)	O&M ROAD PER TYPICAL SECTION DWG NO. D2	438 SY
(6)	DROP INLET PER DETAILS DWG NO DSXX	1 EA
(7)	COMPACTED FILL/EMBANKMENT PER TYPICAL SECTION (550+69) DWG NO G6 (NPI)	2900 CY
(8)	NEW SURVEY MARKER PER MAG STD DETAIL 120-2, TYPE 'D'	1 EA
(9)	OUTLET HEADWALL & WINGWALLS PER ADOT STD DET NO B-04.10, 2:1 SLOPE, 0° SKEW & OULET APRON PER ADOT STD DETIAL B-06.10 & PER MODIFIED TABLE DWG. NO. D1	EA
(10)	4-12'x6'x66.5' RCBC PER ADOT STD DETIAL B-02.40 & PER MODIFICATION TABLE DWG NO D1	1 EA
(11)	BEARDSLEY CANAL WASH LOW FLOW CHANNELAZATION PER TYPICAL SECTIONS DWG NO G8 & PER DETIALS THIS SHT	7073 CY
(12)	NATIVE SEEDING PER SECTION 430 OF SPECIAL PROVISIONS	1.59 AC
(13)	HANDRAIL PER COP STD DET P-1173	185 LF



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

90 %
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

DRAWING NO.		SHEET
C6	PLAN AND PROFILE STA 547+00 TO STA 556+00	18

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/17/05

Subject SOIL CEMENT QUANTITIES Designed ACC Checked JRK

SEE FOLLOWING SHEETS FOR DETAILS & DIMENSIONS

STA 71+00.00 AREA = 156.64 SF
STA 76+60.00 AREA = 121.25 SF } AVE AREA = (156.64 + 121.25)/2 = 138.95 SF

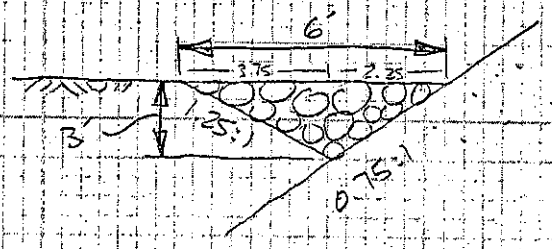
STA 76+60.00 AREA = 121.25 SF
STA 77+00.00 AREA = 98.72 SF } AVE AREA = (121.25 + 98.72)/2 = 109.99 SF

STA 77+00.00 AREA = 98.72 SF
STA 81+00.00 AREA = 79.76 SF } AVE AREA = (98.72 + 79.76)/2 = 89.24

STA 71+00 TO 76+60 VOLUME = 560' (138.95) = 77,812.0 CF
STA 76+60 TO 77+00 VOLUME = 440' (109.99 SF) = 4,399.6 CF
STA 77+00 TO 81+00 VOLUME = ~~300~~ 400' (89.24 SF) = ~~26,772.0~~ CF 35,696
~~188,933.6~~ CF 117,907 ≈ ~~4,034.58~~ 4367

EXCAVATION = (0.15)(4034.58 CY) + 403.458 CY = 4639.77 CY
BACKFILL = (0.15)(4034.58 CY) = 605.19 CY

RIP-RAP AT TOE (SEE TYP SECTION DWG NO G7)



$A_{RR} = \frac{1}{2}(3.75)(3) + \frac{1}{2}(2.25)(3)$

$A_{RR} = 9\ SF$

$V = (9\ ft^2)(900\ ft)/27 = 300\ CY$

(STA 71+00 TO STA 80+00)

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet _____ of _____

Project NLC Date 6/2/05

Subject QUANTITY CALCULATION OF RENO MATTRESSES ON SHEET C6 (NORTHERN) FRS#3 CHANNEL & NORTHERN WA'N CULVERT INLET (BEARDSLEY CANAL WASH) Designed JTR Checked _____

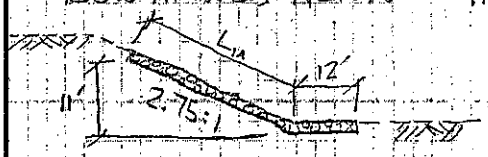
FRS#3 CHANNEL

547+00 TO BEGIN 2:1 SLOPE (RT)

$L_{R1} = 220'$

SIDE SLOPE AVE $= (3.5+2)/2 = 2.75$

RENO MATTRESS HEIGHT $= 11'$



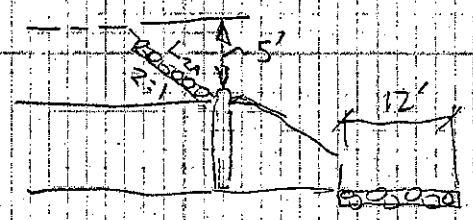
$L_{1A} = \sqrt{11^2 + (2.75 \cdot 11)^2} = 32.2$

$A_1 = (220')(32.2+12)/9 = \underline{1080.4\ SY}$

$L_{R2} = 240'$ (BEHIND HEADWALLS)

SIDE SLOPE = 2:1

RENO MATTRESS HEIGHT $= 11' - 5' = 6'$ (5' = BOX CULVERT OPENING HEIGHT)



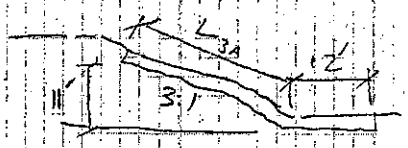
$L_{2A} = \sqrt{5^2 + (2.5)^2} = 11.2$

$A_2 = (240')(11.2' + 12')/9 = \underline{618.7\ SY}$

$L_{R3} = 120'$ CHANNEL LEFT AT CORNER 4:1 → 2:1

SIDE SLOPE AVE = 3:1

RENO MATT HEIGHT = 11'



$L_{3A} = \sqrt{11^2 + (11 \cdot 3)^2} = 34.8$

$A_3 = (120')(34.8+12)/9 = \underline{624\ SY}$

#80/cy @ 9" THICK ⟹ #20/SY

$L_{R4} = 140'$

SIDE SLOPE = 4:1

RENO MATTRESS HEIGHT = 11'

$L_{4A} = \sqrt{11^2 + (11 \cdot 4)^2} = 45.4'$

$A_4 = (140)(45.4+12)/9 = \underline{892.9\ SY}$

TOTAL RENO MATTRESS AREA

$A_T = A_1 + A_2 + A_3 + A_4 = \underline{3216\ SY}$

BEARDSLEY CANAL WASH

$L_{R5} = 250'$

SS = 3:1

H = 8

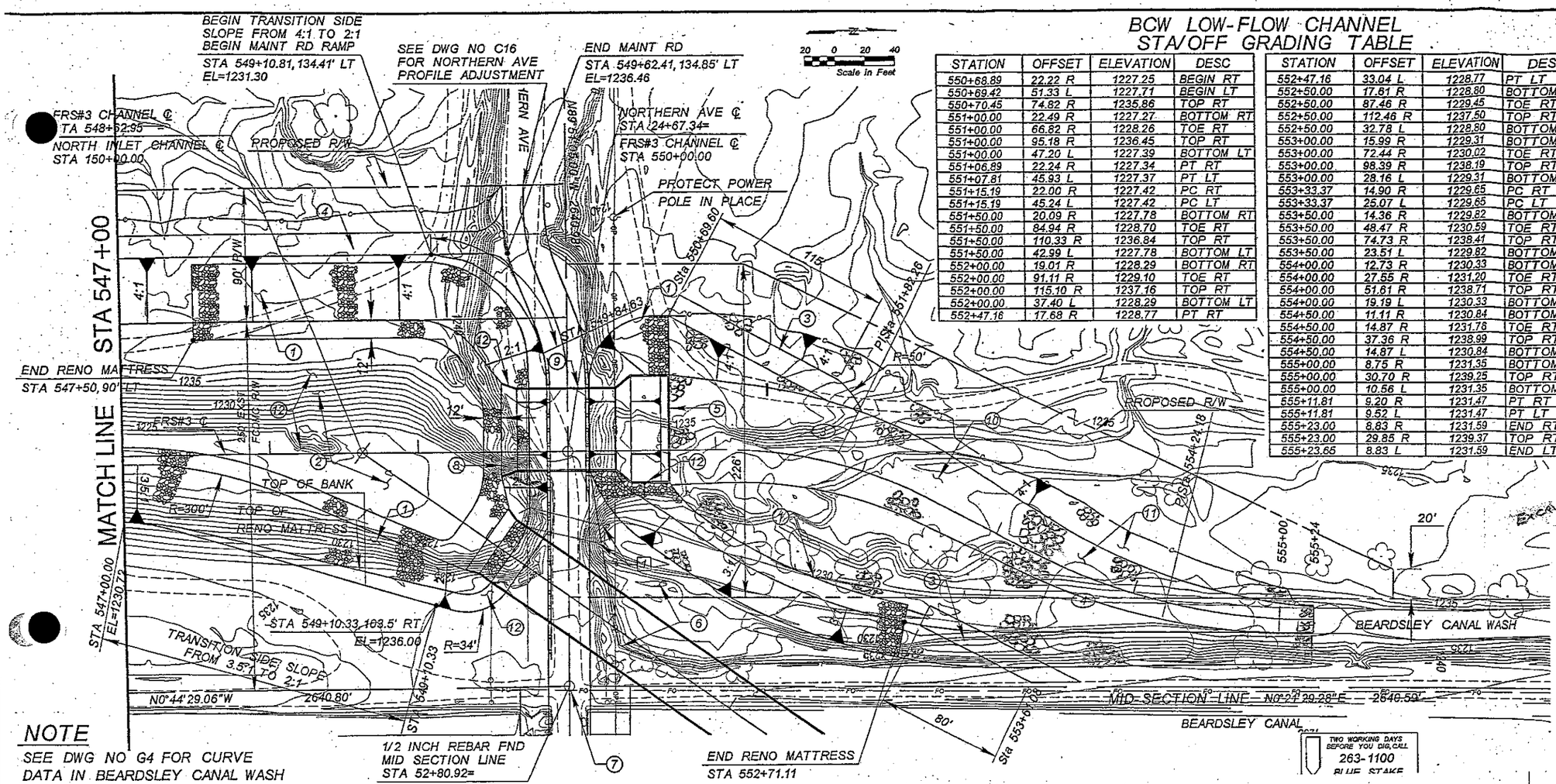
$L_{5A} = \sqrt{8^2 + (3 \cdot 8)^2} = 25.3'$

$A_5 = (250)(25.3+12)/9 = \underline{1036\ SY}$

$A_6 = (60')(20')/9 = \underline{133\ SY}$

$A_7 = (80')(25.3')/9 = \underline{224.9\ SY}$

$A_T = 1394\ SY$ (3:1 AVE)



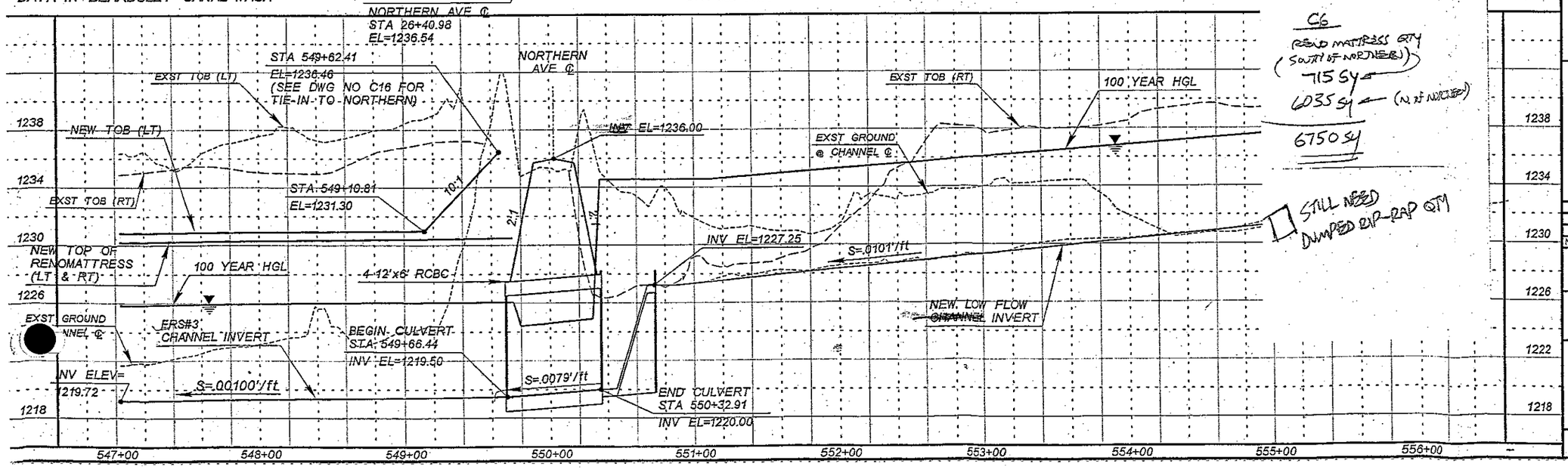
BCW LOW-FLOW CHANNEL STA/OFF GRADING TABLE

STATION	OFFSET	ELEVATION	DESC
550+68.89	22.22 R	1227.25	BEGIN RT
550+69.42	51.33 L	1227.71	BEGIN LT
550+70.45	74.82 R	1235.86	TOP RT
551+00.00	22.49 R	1227.27	BOTTOM RT
551+00.00	66.82 R	1228.26	TOE RT
551+00.00	95.18 R	1236.45	TOP RT
551+00.00	47.20 L	1227.39	BOTTOM LT
551+06.89	22.24 R	1227.34	PT RT
551+07.81	45.93 L	1227.37	PT LT
551+15.19	22.00 R	1227.42	PC RT
551+15.19	45.24 L	1227.42	PC LT
551+50.00	20.09 R	1227.78	BOTTOM RT
551+50.00	84.94 R	1228.70	TOE RT
551+50.00	110.33 R	1236.84	TOP RT
551+50.00	42.99 L	1227.78	BOTTOM LT
552+00.00	19.01 R	1228.29	BOTTOM RT
552+00.00	91.11 R	1229.10	TOE RT
552+00.00	115.10 R	1237.16	TOP RT
552+00.00	37.40 L	1228.29	BOTTOM LT
552+47.16	17.68 R	1228.77	PT RT

STATION	OFFSET	ELEVATION	DESC
552+47.16	33.04 L	1228.77	PT LT
552+50.00	17.61 R	1228.80	BOTTOM RT
552+50.00	87.46 R	1229.45	TOE RT
552+50.00	112.46 R	1237.50	TOP RT
552+50.00	32.78 L	1228.80	BOTTOM LT
553+00.00	15.99 R	1229.31	BOTTOM RT
553+00.00	72.44 R	1230.02	TOE RT
553+00.00	98.39 R	1238.19	TOP RT
553+00.00	28.16 L	1229.31	BOTTOM LT
553+33.37	14.90 R	1229.65	PC RT
553+33.37	25.07 L	1229.65	PC LT
553+50.00	14.36 R	1229.82	BOTTOM RT
553+50.00	48.47 R	1230.59	TOE RT
553+50.00	74.73 R	1238.41	TOP RT
553+50.00	23.51 L	1229.82	BOTTOM LT
554+00.00	12.73 R	1230.33	BOTTOM RT
554+00.00	27.55 R	1231.20	TOE RT
554+00.00	51.61 R	1238.71	TOP RT
554+00.00	19.19 L	1230.33	BOTTOM LT
554+50.00	11.11 R	1230.84	BOTTOM RT
554+50.00	14.87 R	1231.76	TOE RT
554+50.00	37.36 R	1238.99	TOP RT
554+50.00	14.87 L	1230.84	BOTTOM LT
555+00.00	8.75 R	1231.35	BOTTOM RT
555+00.00	30.70 R	1239.25	TOP RT
555+00.00	10.56 L	1231.35	BOTTOM RT
555+11.81	9.20 R	1231.47	PT RT
555+11.81	9.52 L	1231.47	PT LT
555+23.00	8.83 R	1231.59	END RT
555+23.00	29.85 R	1239.37	TOP RT
555+23.66	8.83 L	1231.59	END LT

NOTE

SEE DWG NO G4 FOR CURVE DATA IN BEARDSLEY CANAL WASH



C6

RENO MATTRESS QTY (SOUTH OF NORTHERN)

715 SY

6035 SY (N of NORTHERN)

6750 SY

STILL NEED DUMPED RIP-RAP QTY

☐ REMOVE ☐

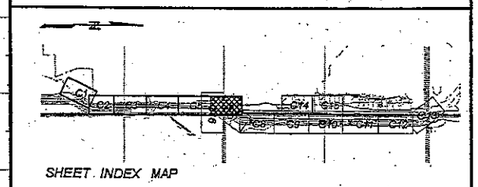
1 REMOVE 60" CMP ~~1 OR 2 EA~~ # LF

○ CONSTRUCT ○

1. 9" RENO MATTRESS BANK PROTECTION PER TYP. SECS, DWG NO G7. & G8 — ~~4,610 SY~~ 6750
2. FRS #3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET — 17,007 CY
3. O&M RAMP PER DET DWG NO. D1 — 2 EA
4. O&M ROAD PER TYPICAL SECTION DWG NO. D1 — 438 SY
5. DROP INLET PER DETAILS DWG NO.'S ST4 & ST5 — 1 EA
6. COMPACTED FILL/EMBANKMENT PER TYPICAL SECTION (550+69) DWG NO G6 (NPI) — 2900 CY
7. NEW SURVEY MARKER PER MAG STD DETAIL 120-2, TYPE 'D' — 1 EA
8. OUTLET HEADWALL & WINGWALLS PER ADOT STD DET NO B-04.10, 2:1 SLOPE, 0° SKEW & OUTLET APRON PER ADOT STD DETAIL B-06.10 — 1 EA
9. 4-12'x6'x66.5' RCBC PER ADOT STD DETAIL B-02.40 (MODIFIED FROM 8' TO 6' HEIGHT) — 1 EA
10. BEARDSLEY CANAL WASH LOW FLOW CHANNELIZATION PER TYPICAL SECTIONS DWG NO G8 & PER DETIALS THIS SHEET — 7073 CY
11. NATIVE SEEDING — 1.59 AC
12. HANDRAIL PER COP STD DET P-1173 AND PER DETAIL DWG NO. D1. PAINT PER SPECIFICATIONS — 185 LF
13. DUMPED RIP-RAP, D_{50}=18" 24" THICK W/ FILTER FABRIC — SY

NOTE:

DRAWINGS C1-C6 ARE FOR INFORMATION ONLY. MAJOR DESIGN REVISIONS ARE UNDERWAY AND WILL BE RESUBMITTED WITH ANOTHER 90% AT A LATER DATE.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

DRAWING NO.	PLAN AND PROFILE	SHEET OF
C6	STA 547+00 TO STA 556+00	18 62

KIRKHAM MICHAEL
CONSULTING ENGINEERS

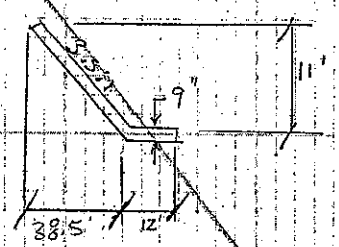
Job Number _____

Sheet 1 of _____

Project NORTH INLET CHANNEL Date 3/11/05

Subject ~~GABION~~ RENO MATTRESS QUANTATIES Designed ACC Checked JAK

FRS #3 CHANNEL (FROM FRS#3 TO NORTHERN)



LENGTH ~~GABIONS~~ RENO MAT. = STA 547+50 - STA 511+00
= ~~3,650~~ 3600'

AREA OF ~~GABIONS~~ RENO MAT. = (12')(0.75') + ($\sqrt{38.5^2+11^2}$)(0.75')
= 39.03 SF

VOLUME OF ~~GABIONS~~ RENO MAT. = (~~3,650~~ 3600')(39 SF)
= ~~142,461~~ CF ≈ ~~5,276~~ cy
140,510 CF ≈ 5204

STA 541+00 TO NORTHERN
(GABIONS WRAP AROUND OUTLET STRUCTURES)
⟹ BY AREA MEASUREMENT IN CADD ≈ 756 cy

TOTAL = 5204+756 = 5960

BEARDSLEY CANAL WASH (NORTH OF NORTHERN)

⟹ MEASUREMENT IN CADD (DWG NO. C6)

⟹ 2666 cy

OUTLET OF WIC DIVERSION STRUCTURE @ OLIVE AVE

⟹ MEASUREMENT IN CADD (DWG NO. C13)

⟹ 270 cy

TOTAL = 5960 + 2666 + 270 = 8896 cy

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/10/05

Subject HANDRAIL QUANTATIES Designed ACC Checked

NOTE: HANDRAILS ONLY WHERE DROP GREATER THAN 3' OCCUR

OLIVE AVE INLET WEIR

LENGTH OF HANDRAIL = 139.26' + 61.50' (BACK OF WEIR, SIDE OF WEIR)
= 200.76'

NORTHERN AVE DROP INLET

LENGTH OF HANDRAIL = 2(22.75') + 54.08' (SIDE OF DROP, TOP OF INLET)
= 99.58'

OLIVE DIVERSION OUTLET

LENGTH OF HANDRAIL = ~~75.13'~~ + 12.00' + 15.00' (TOP OF INLET, WEST WING, EAST WING)
= ~~72.13'~~ 22.75
49.75

NORTHERN DIVERSION INLET

LENGTH OF HANDRAIL = 42.25' + 2(12.00') (TOP OF INLET, BOTH WINGS)
= 66.25'

NORTHERN DIVERSION OUTLET

LENGTH OF HANDRAIL = 42.25' + 2(22.00') (TOP OF INLET, BOTH WINGS)
= 86.25'

NORTHERN WASH OUTLET

LENGTH OF HANDRAIL = 54.08' + 2(15.50')
= 85.08'

NOTE: CHECK LENGTHS OF HANDRAIL ON WINGS – DOESN'T NEED TO GO FULL LENGTH?

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number _____

Sheet 1 of _____

Project NORTH INLET CHANNEL Date 3/11/05

Subject BEAR/GRUB & HYDRO SEED QUANTITIES Designed ARC Checked JRK

SEE FOLLOWING SHEETS FOR DETAILS & DIMENSIONS

CLEAR & GRUB

NORTH INLET CHANNEL

WIDTH = 55' + 45' + 45' + 15' + 15' = 175 FT

LENGTH = STA 204+56 - STA 153+04 = 5,152 FT

AREA = 175 FT · 5,152 FT = 901,600 SQ FT ≈ 20.70 AC

BEARDSLEY WASH

AREA = (245')(106') + (90')(380') + ½ (380')(245' - 40') = 80,120 SF ≈ 1.84 AC

FRS #3 CHANNEL

AREA = ½ (44')(566') + (66')(88 + 106') + ½(106)(54') + (444')(66 + 54') + (120')(274')

= 114,278 SF ≈ 2.62 AC

HYDROSEEDING

NORTH INLET CHANNEL

SURFACE = 55' + 2 (45') = 145'

LENGTH = 5,152 FT - 106' - 3(95') - 4(90') = 4,401'

6.25' DROP 4.5' DROP 3.5' DROP

AREA = (4,401')(145') = 638,145 SQ FT ≈ 14.6 AC

BEARDSLEY WASH

AREA EQUIVALENT TO CLEAR & GRUB

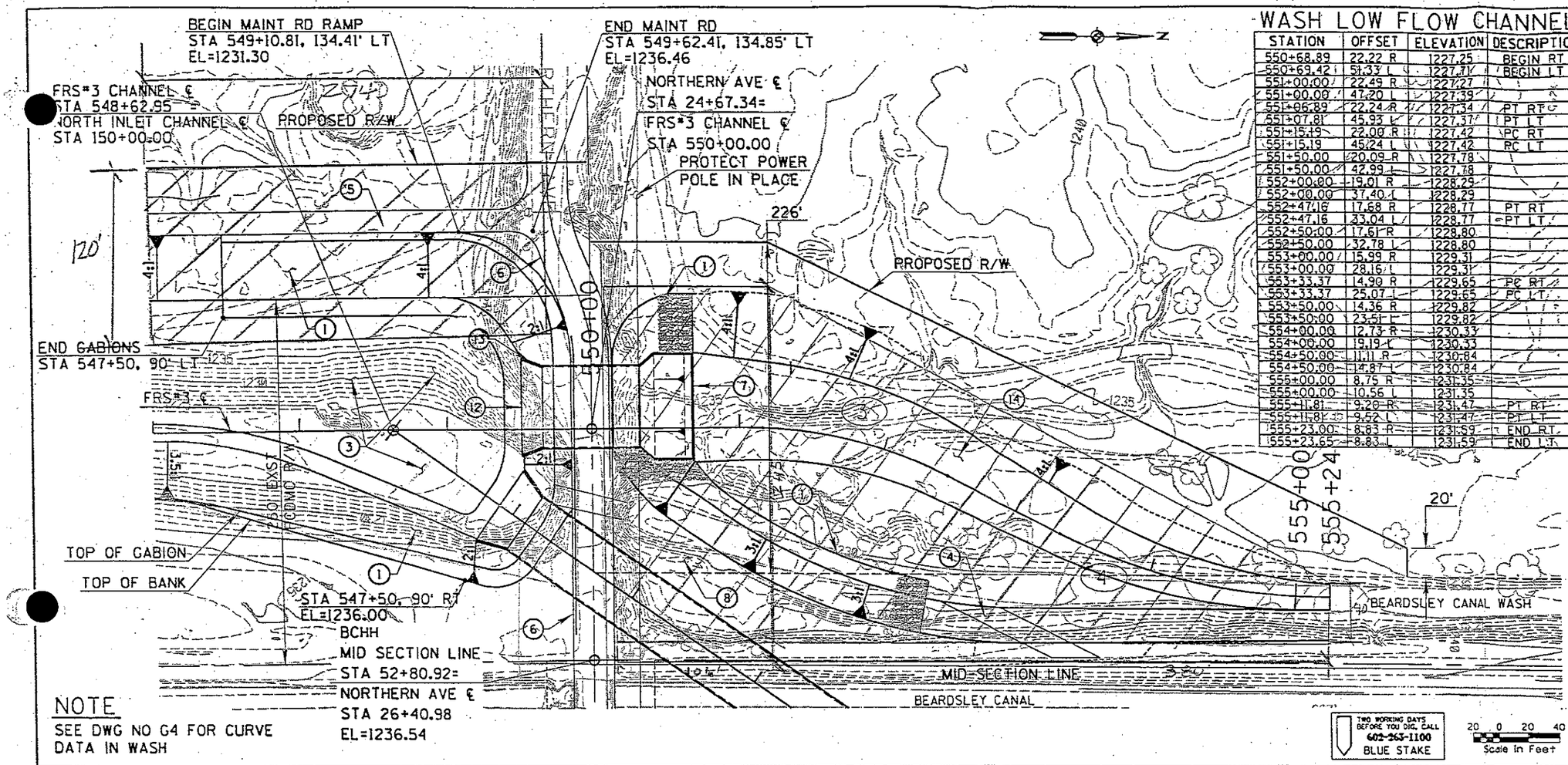
FRS #3 CHANNEL ONLY ON BOTTOM OF CHANNEL & WEST BANK

BOTTOM = (90')(274' + 444' + 106') + (90 + 12')/2 (88 + 566') = 71,514 SF

SIDES = ½ (44')(566') + (90')(444' + 106') + 90 (274') = 50,612 SF

TOTAL = 50,612 SF + 71,514 SF = 122,126 SF ≈ 2.8 AC

NOTE:
COMPARE WITH PLANS QTYS

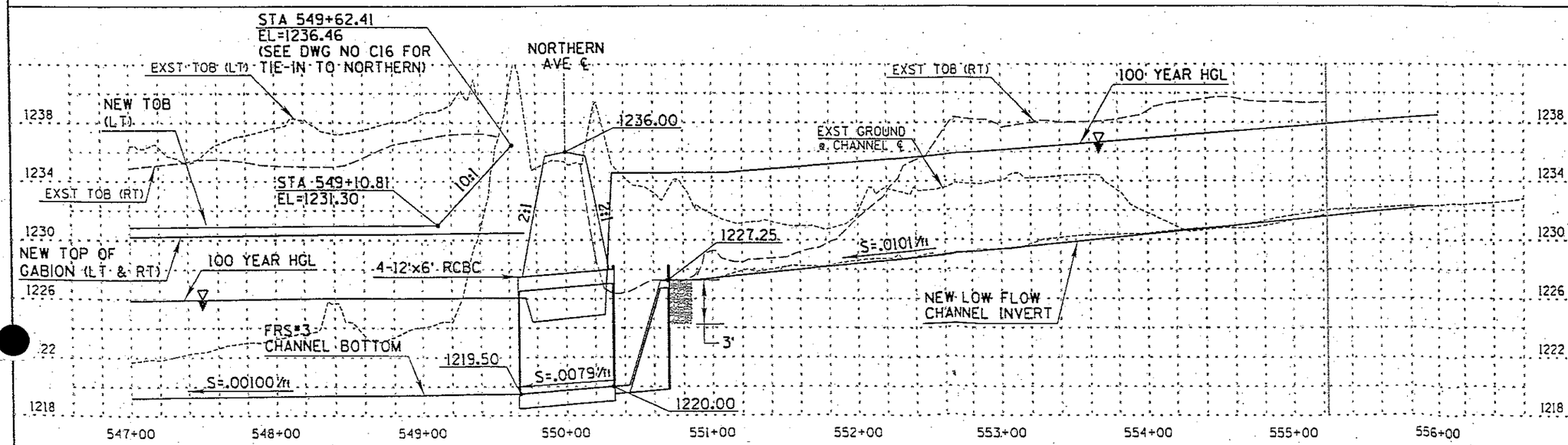


NOTE

SEE DWG NO G4 FOR CURVE DATA IN WASH

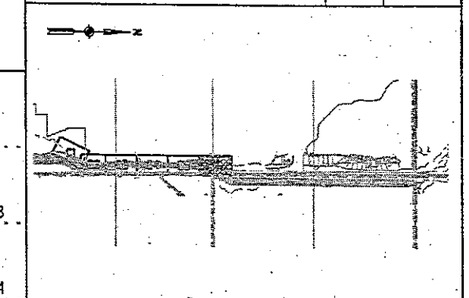
WASH LOW FLOW CHANNEL

STATION	OFFSET	ELEVATION	DESCRIPTION
550+68.89	22.22 R	1227.25	BEGIN RT
550+69.42	51.33 L	1227.71	BEGIN LT
551+00.00	22.49 R	1227.27	
551+00.00	47.20 L	1227.39	
551+06.89	22.24 R	1227.34	PT RT
551+07.81	45.93 L	1227.37	PT LT
551+15.19	22.00 R	1227.42	PC RT
551+15.19	45.24 L	1227.42	PC LT
551+50.00	20.09 R	1227.78	
551+50.00	42.99 L	1227.78	
552+00.00	19.01 R	1228.29	
552+00.00	37.40 L	1228.29	
552+47.16	17.68 R	1228.77	PT RT
552+47.16	33.04 L	1228.77	PT LT
552+50.00	17.61 R	1228.80	
552+50.00	32.78 L	1228.80	
553+00.00	15.99 R	1229.31	
553+00.00	28.16 L	1229.31	
553+33.37	14.90 R	1229.65	PC RT
553+33.37	25.07 L	1229.65	PC LT
553+50.00	14.36 R	1229.82	
553+50.00	23.51 L	1229.82	
554+00.00	12.73 R	1230.33	
554+00.00	19.19 L	1230.33	
554+50.00	11.11 R	1230.84	
554+50.00	14.87 L	1230.84	
555+00.00	8.75 R	1231.35	
555+00.00	10.56 L	1231.35	
555+11.81	9.20 R	1231.47	PT RT
555+11.81	9.52 L	1231.47	PT LT
555+23.00	8.83 R	1231.59	END RT
555+23.65	8.83 L	1231.59	END LT



☐ REMOVE ☐

○ CONSTRUCT ○		
① 9" RENO MATTRESS BANK PROTECTION PER TYP SEC, DWG NO G7	CY	CY
③ FRS#3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET	CY	CY
④ O&M RAMP PER DET#XX DWG NO D2	EA	1
⑤ O&M ROAD PER TYPICAL SECTION DWG NO D2	SY	SY
⑥ ADJUST NORTHERN AVE RDWY PROFILE PER DET. SHT #		
• EMBANKMENT	CY	CY
• SUBGRADE	SY	CY
⑦ DROP INLET PER DETAILS DWG NO DSXX	SY	SY
⑧ COMPACTED FILL/ EMBANKMENT PER TYP SECTION (550+69) DWG NO G6	CY	SY



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

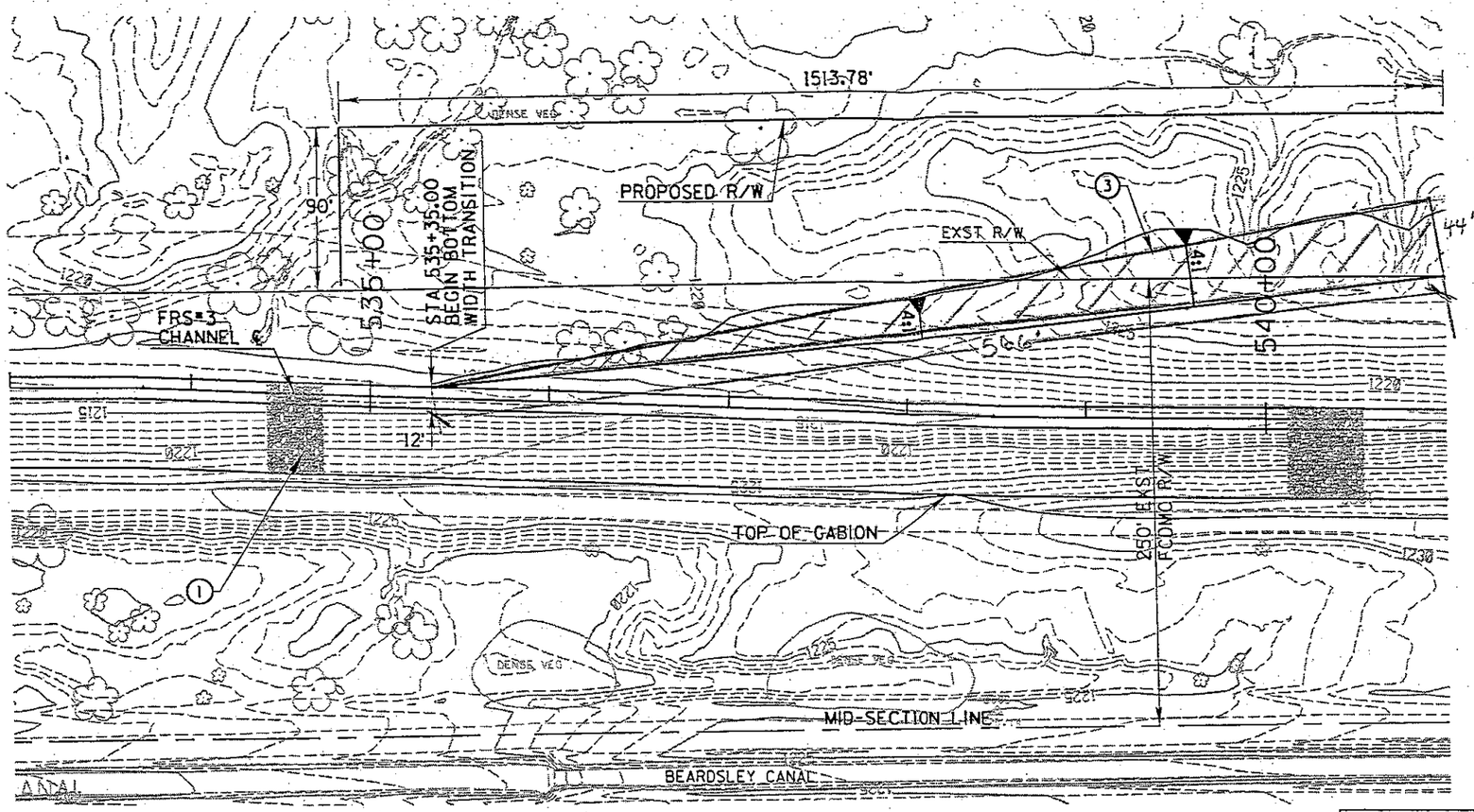
WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY 60% NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

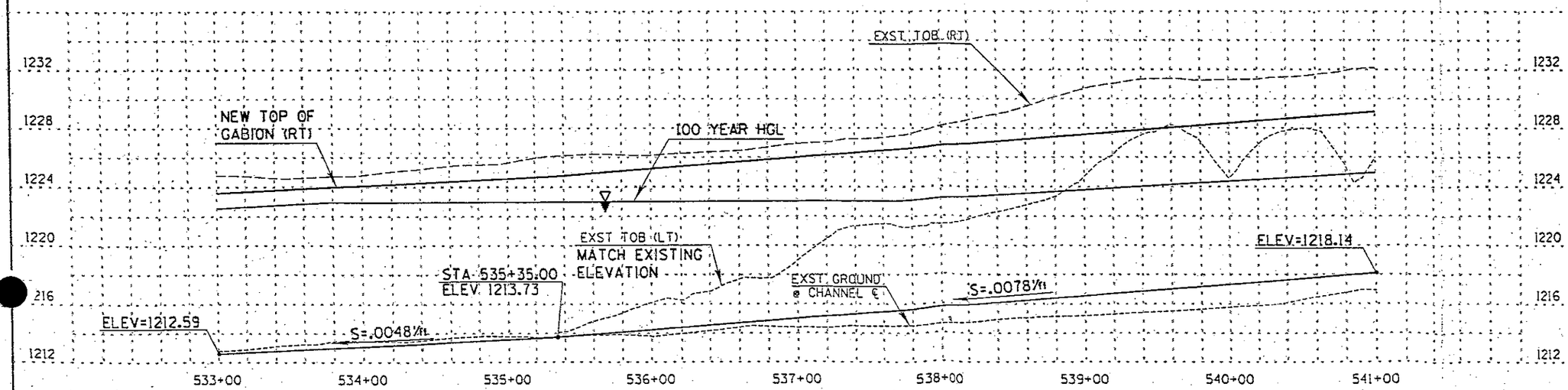
KIRKHAM MICHAEL

DRAWING NO. C6 | FRS#3 / BEARDSLEY WASH STA 547+00 TO STA 555+00 | SHEET OF XXX



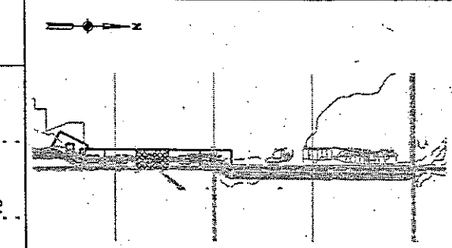
TWO WORKING DAYS BEFORE YOU DIG, CALL 602-263-1100 BLUE STAKE

20 0 20 40
Scale In Feet



REMOVE		

CONSTRUCT		
1 12" GABION MATTRESS BANK PROTECTION PER TYP SEC, DWG NO G7	CY	
3 FRS#3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET	CY	



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

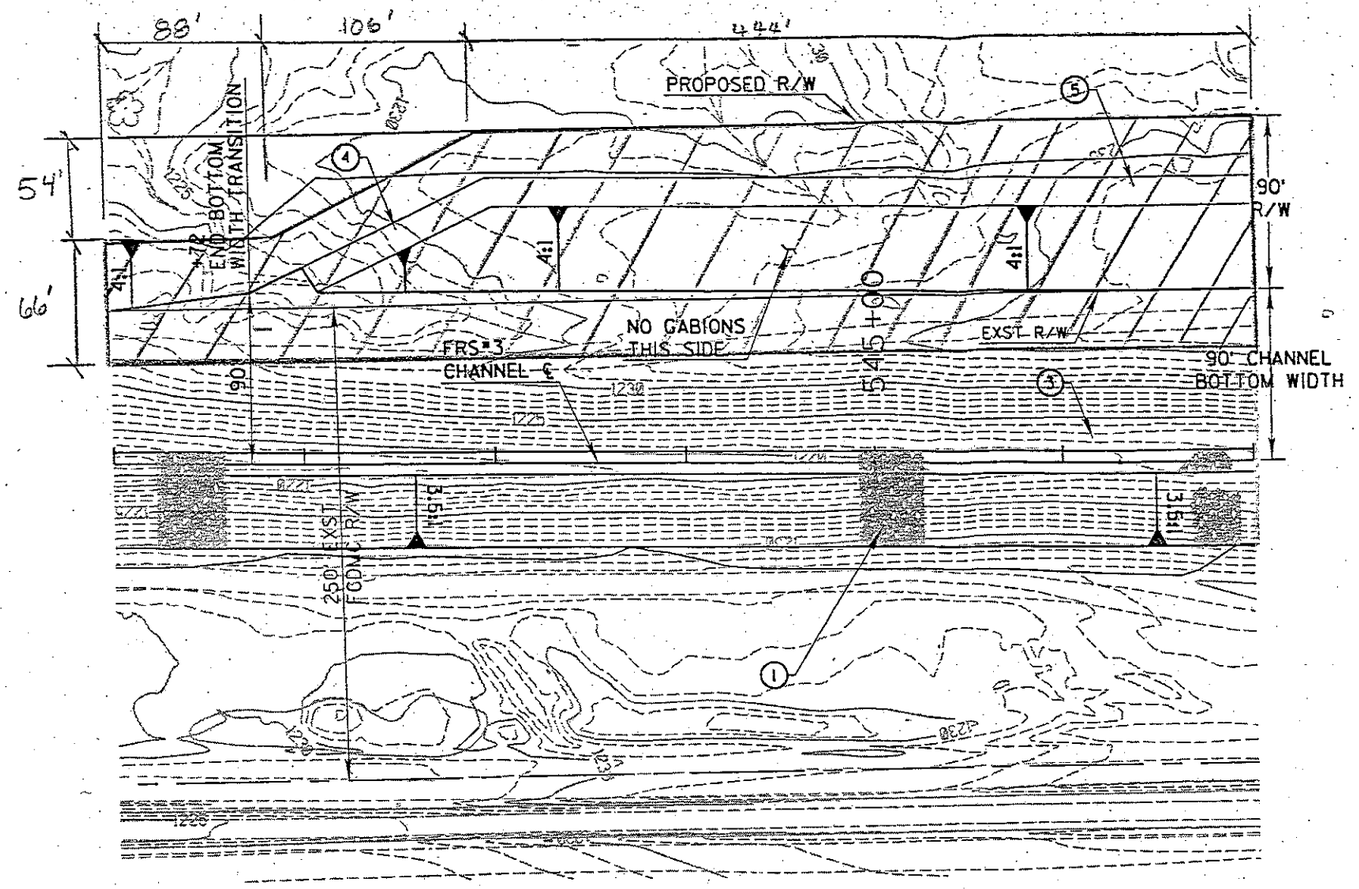
WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

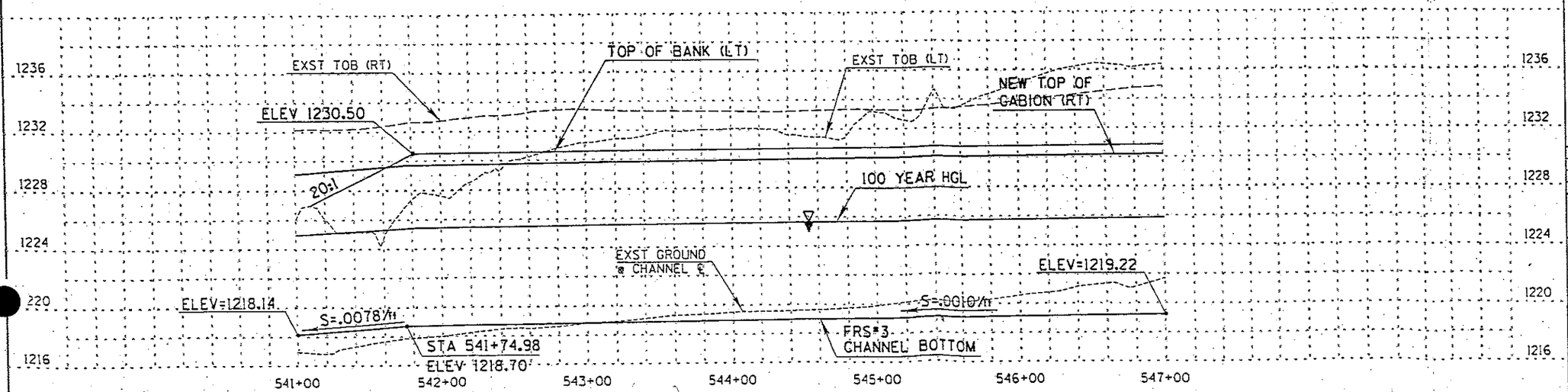
PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

DRAWING NO. C4 | FRS#3 CHANNEL STA 533+00 TO STA 541+00 | SHEET OF XXX





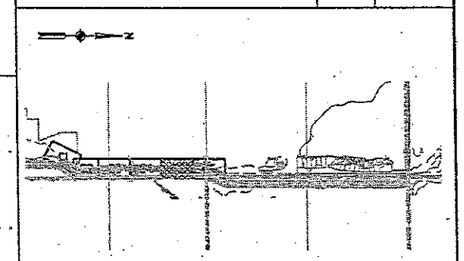
TWO WORKING DAYS BEFORE YOU DIG, CALL 602-263-1100 BLUE STAKE

20 0 20 40
Scale In Feet

☐ REMOVE ☐

○ CONSTRUCT ○

① 12" GABION MATTRESS BANK PROTECTION PER TYP SEC, DWG NO G7	CY	CY
③ FRS#3 CHANNEL EXCAVATION PER TYP. SECTION, DWG NO G7 AND DETAILS THIS SHEET	CY	CY
④ O&M RAMP PER DET#XX DWG NO D2	EA	1
⑤ O&M ROAD PER TYPICAL SECTION DWG NO D2	SY	SY



SHEET INDEX MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

WHITE TANKS RETARDING STRUCTURE #3
NORTH INLET CHANNEL
PROJECT CONTROL NO. 470-04-31

PRELIMINARY
60%
NOT FOR CONSTRUCTION OR RECORDING

	BY	DATE
DESIGNED	ACC/JKK	03/05
DRAWN	JB/JP	03/05
CHECKED	BJL	03/05

KIRKHAM MICHAEL

DRAWING NO. C5 | FRS#3 CHANNEL STA 539+00 TO STA 547+00 | SHEET OF XXX

Triangle Volume

Triangle Volume Report

al Surface: EG-3
gn Surface: dirt2

Mode: Entire Surface
Cut Factor: 1.0
Fill Factor: 1.0

Cut: 6458846.4 cu ft
Fill: 37926.8 cu ft
Net: 6420919.6 cu ft

Cut: 239216.5 cu yd
Fill: 1404.7 cu yd
Net: 237811.8 cu yd

North Inlet Channel

End-Area Volume Report

Original Surface: EG-3
Design Surface: dirt2

Cut Factor: 1.000000
Fill Factor: 1.000000

Cut: 239037.6 cu yd
Fill: 1214.2 cu yd
Net: 237823.4 cu yd

KIRKHAM MICHAEL
CONSULTING ENGINEERS

Job Number

Sheet 1 of 1

Project NORTH INLET CHANNEL Date 3/18/05

Subject SHOTCRETE QUANTITIES Designed ACC Checked

⇒ BEARDSLEY CANAL AREA PER L.F. $= 2(\sqrt{6^2+6^2})(1') + (5')(1')$
$= 21.97$ SF/LF ≈ 2.44 SY/LF

LENGTH OF CANAL R & R = 300 FT (180 FT @ NORTHERN & 120 FT @ OLIVE)

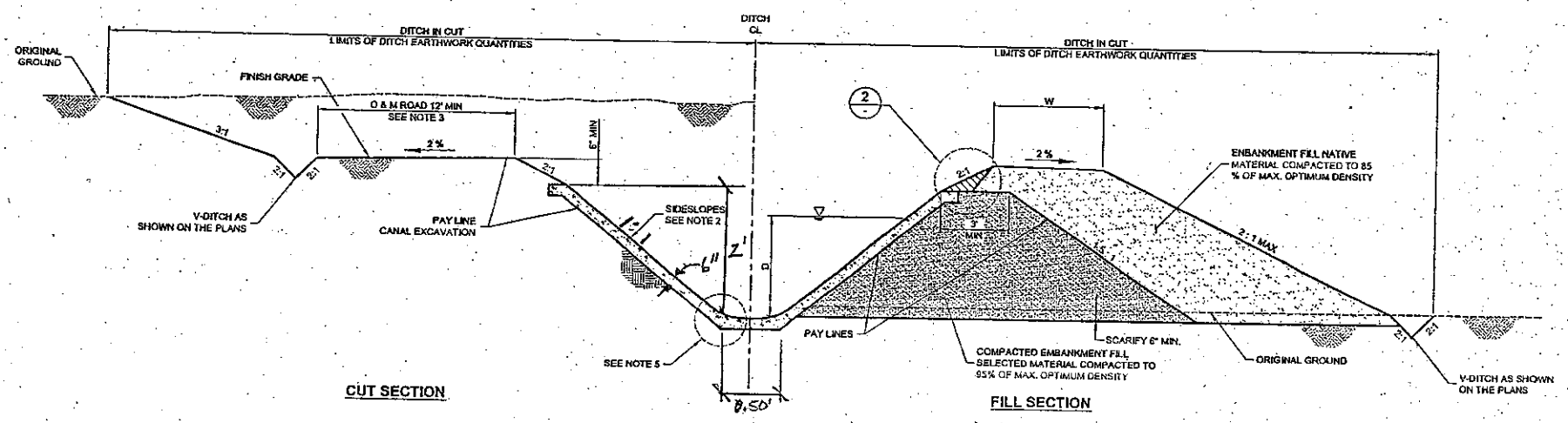
TOTAL AREA OF CANAL REPLACEMENT = (2.44 SY/LF)(300 LF)
$= 732.35$ SY

⇒ LATERAL CANAL AREA PER L.F. $= 2(\sqrt{2^2+2^2})(1') + (0.5)(1')$
$= 6.16$ SF/LF ≈ 0.68 SY/LF

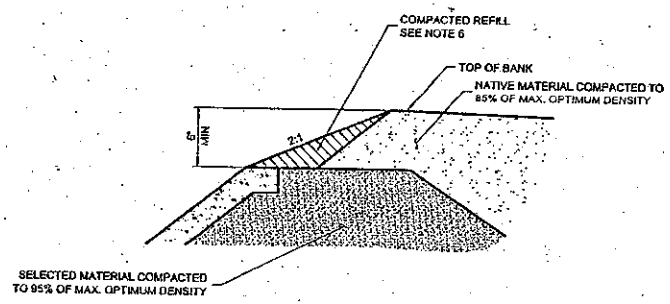
LENGTH OF CANAL R & R = 80 LF (AT OLIVE AVE.)

TOTAL CANAL REPLACEMENT = (80 LF)(0.68 SY/LF)
$= 54.73$ SY

LATERAL CANAL



TYPICAL CONCRETE DITCH BANK DETAILS
N.T.S.



BANK DETAIL 2
N.T.S.

EMBANKMENT TABLE

OPERATING DEPTH "D"	TOP OF BANK "W"
0' TO 2'	3'
2' TO 6'	6'

NOTES:

1. IF FILL IS BELOW CANAL INVERT ENTIRE EMBANKMENT AREA IS TO BE COMPACTED EMBANKMENT, SEE SPECIFICATIONS.
2. FOR HYDRAULIC PROPERTIES AND DIMENSIONS OF DITCH LINING, SEE TYPICAL SECTION ON THE PLANS.
3. CONTRACTOR TO PROVIDE A SINGLE 12' O&M ROAD ON EITHER SIDE OF THE DITCH AS SHOWN ON THE PLANS, OR DIRECTED BY THE ENGINEER. DETAILS PRESENT MINIMUM REQUIREMENTS FOR DITCH INSTALLATIONS. REFER TO THE PLANS FOR ADDITIONAL REQUIREMENTS.
4. VALUES OF W IN EMBANKMENT TABLE ARE MINIMUMS.
5. LONGITUDINAL GROOVE AS SHOWN IN TYPICAL SECTIONS IS REQUIRED WHEN OPERATING DEPTH "D" IS GREATER THAN 4'.
6. OVEREXCAVATION PERMITTED IF NEEDED TO ACCOMMODATE LINING EQUIPMENT. REFILL AND COMPACT, SEE SPECIFICATIONS.
7. SEE SPECIFICATIONS FOR SELECTED MATERIAL REQUIREMENTS.

TYPICAL CONCRETE DITCH BANK DETAILS
Maricopa Water District

102

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DAVEY-CAIRO ENGINEERING, INC.

dce

FCD WHITE TANKS RETARDING STRUCTURES

MARICOPA COUNTY, AZ

DESIGN CALCULATIONS

Prepared by

Kirkham Michael Consulting Engineers
12700 W. Dodge Road
Omaha, NE 68154-8030
402-393-5630

June, 2005

KM 0406915

Registered Professional Engineer (Structural)
CERTIFICATE NO. 21987
STEVEN D. KNEIP
Date Signed 6/22/05
ARIZONA, U.S.A.

KIRKHAM MICHAEL
CONSULTING ENGINEERS
12700 W. Dodge Rd. • PO Box 542030 • Omaha, NE 68154-8030

Job number: 0406915

Sheet 1 of

Project: FCD WHITE TANK

Date: 05/26/05

Subject:

Designed: MCB

Checked: SDK

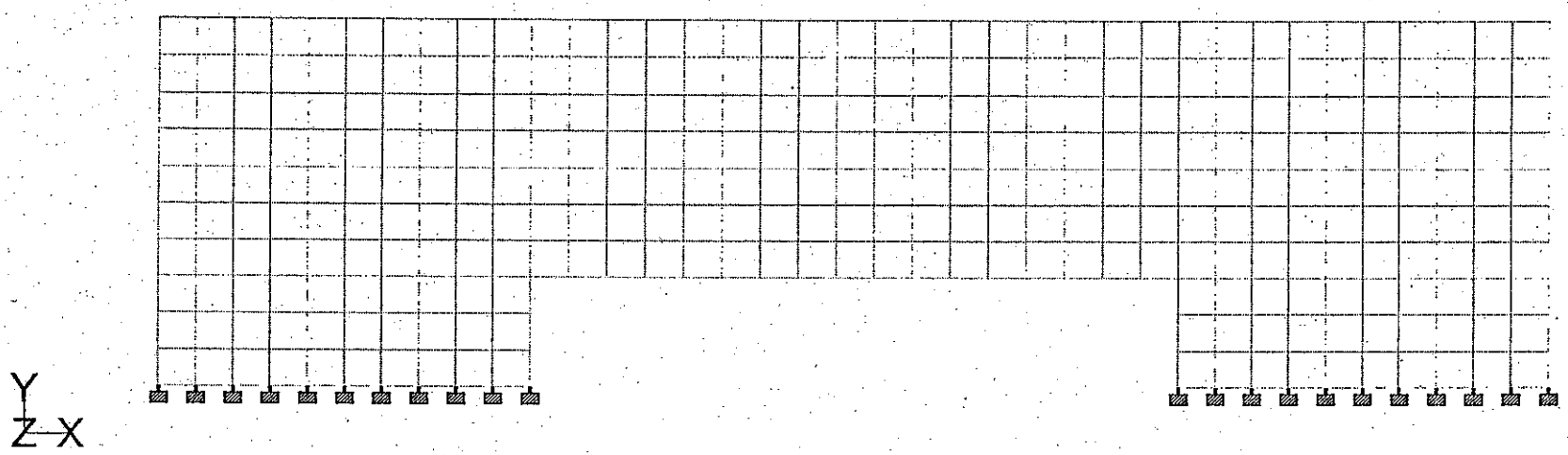
WEIR STRUCTURE DETAIL.

This is a piano slope structure in plan. There are cantilever retaining walls in three sides and short cutoff wall on one side. In the deepest end the retaining walls are 21 ft height. The structure is connected to an outlet structure. The retaining walls design for height of fill and 2'-0" of surcharge. In most cases ADOT Standard detail is used for the retaining walls.

The outlet opening is about 35 ft in length. The retaining walls for this area can not have a foundation, so a structure beam is design over the opening to support the horizontal soil load.

A preliminary STAAD Model is developed to see the influence of load to the surrounding walls. The load influence is at least two feet on the wall and stress concentration is very high. So a Pedestal is designed to support the beams.

Software licensed to Kirkham Michael	Job No	Sheet No 1	Rev
	Part		
Job Title	Ref		
	By	Date 27-May-05	Chd
Client	File Structure1.std	Date/Time 27-May-2005 15:01	



Load 1

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ENGINEER DATE 27-May-05
END JOB INFORMATION
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UNIT FEET KIP
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ELEMENT PROPERTY
1 TO 319 THICKNESS 1.67
UNIT INCHES KIP
CONSTANTS
E 3150 MEMB 1 TO 319
POISSON 0.17 MEMB 1 TO 319
DENSITY 8.68e-005 MEMB 1 TO 319
ALPHA 5.5e-006 MEMB 1 TO 319
UNIT FEET KIP
SUPPORTS
1 TO 4 12 15 17 19 21 23 25 27 29 261 264 266 268 270 272 274 276 278 FIXED
LOAD 1 SOIL PRESSURE
ELEMENT LOAD
1 TO 10 220 TO 229 PR -1.3
11 TO 20 230 TO 239 PR -1.17
[illegible]TO 30 240 TO 249 PR -1.04
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51 TO 60 135 TO 151 270 TO 279 PR -0.65
61 TO 70 152 TO 168 280 TO 289 PR -0.52
71 TO 80 169 TO 185 290 TO 299 PR -0.39
81 TO 90 186 TO 202 300 TO 309 PR -0.26
91 TO 100 203 TO 219 310 TO 319 PR -0.065
PERFORM ANALYSIS
FINISH
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Software licensed to Kirkham Michael	Job No	Sheet No 1	Rev
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Job Title	Ref		
	By	Date 27-May-05	Chd
Client	File Structure1.std	Date/Time 27-May-2005 15:01	

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kip-in/in

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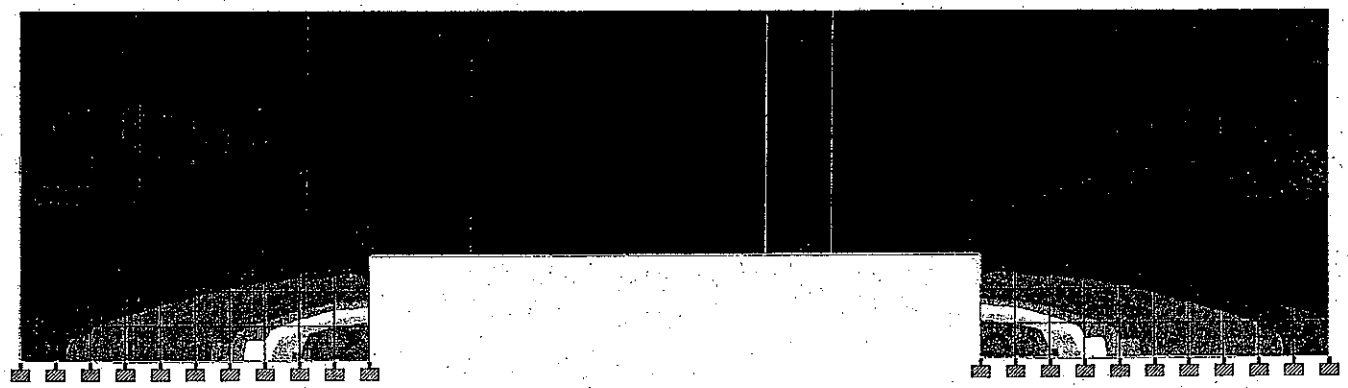

Load 1

Software licensed to Kirkham Michael	Job No	Sheet No 1	Rev
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kip-in/in

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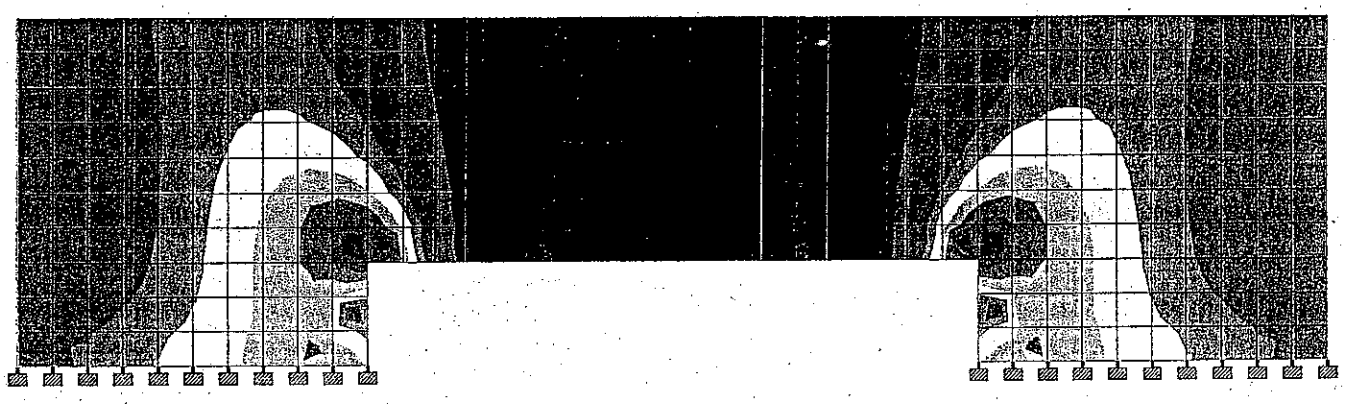

Load 1

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CONSULTING ENGINEERS
12700 W. Dodge Rd. • PO Box 542030 • Omaha, NE 68154-8030

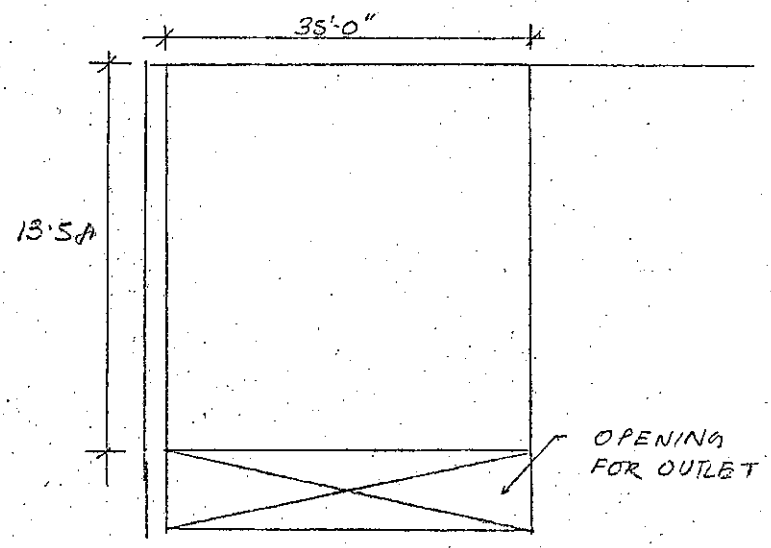
Job number: 0406915

Sheet 8 of

Project: FCD WHITE TANK Date: 05/26/05

Subject: Designed: MCB Checked: SMK

DESIGN OF RETAINING WALL OVER OUTLET



Retaining wall over the outlet is modified. The wall is design as horizontally spanned beam. Reaction of the horizontal span is transferred to the foundation of the supporting retaining wall.

w/ of the back fill = 120 pcf

Angle of internal friction Backfill 33.25°

Sin 33.25 = 0.54

Equivalent hydraulic = 120 × 0.54 = 64.8 #/cu ft

use 65 #/cu ft

Consider 2 ft of surcharge

Total height of fill = 13.5 + 2 ft = 15.5 ft

base pressure = 15.5 × 65 = 1007.5 #/ft

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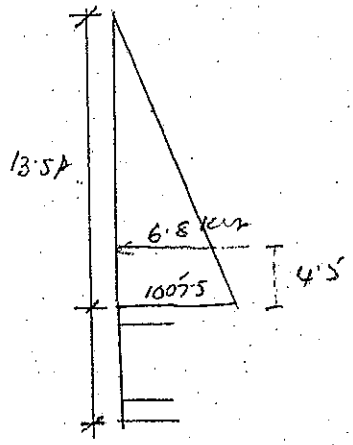
Sheet 9 of

Project: FCD WHITE TANK Date: 05/26/05

Subject: Designed: MCB Checked: SDK



Base force $= \frac{1}{2} \times 1007.5 \times 13.5$

$= 6.8$ kip/ft

$B.M = \frac{wL^2}{8} = \frac{6.8 \times (35)^2}{8}$

$= 1041.25$ k/ft

Factored moment $= 1.7 \times 1041.25$

$= 1770.12$ k/ft

$A_s = 19.74$ in^2

Provide 2/3 of reinforcement at bottom 1/3 of the wall.

$19.74 \times \frac{2}{3} = 13.16$ in^2

Bottom $\frac{1}{3} = 13.5 \times \frac{1}{3} = 4.5$ ft

Use #8 rebar $\frac{13.16}{0.79} = 16.65$

$\frac{4.5 \times 12}{16.65} = 3.24$ in (to close)

Use #9 rebar $\frac{13.16}{1.0} = 13.16$

$\frac{4.5 \times 12}{13.16} = 4.10$

Use #9 @ 4" for bottom 4.5 ft of wall

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Job number: 04 06915

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Project: FCD WHITE TANK Date: 05/26/05

Subject: Designed: MCB Checked: SDK

Total # of bars = $\frac{4.5 \times 12}{4} = 13.5$

Area = 13.5 in²

Remaining 19.74 − 13.5 = 6.24.

Use #6 $\frac{6.24}{0.44} = 14.18$

$\frac{(13.5 - 4.5) \times 12}{14.18} = 7.61$

Use #6 @ 6" for outward

Check shear

$\frac{6.8 \times 35}{2} = 119$ Kips ✓

Factored shear = 1.7 × 119 = 202.3 Kip

$V_c = 2\sqrt{f_c'}\, b d = 2\sqrt{3000} \times (45 \times 12) \times 21/1000 = 124.22$ Kip

Shear reinforcement needed.

$0.85 V_c = 0.85 \times 124.22 = 105.59$ Kip

$V_s = \frac{V_u}{\phi} - V_c = \frac{202.3}{0.85} - 124.22 = 113.78$ Kip ✓

$V_s = \frac{A_v f_y d}{s}$

Req'd $A_v = \frac{V_s\, s}{f_y d} = \frac{113.78 \times 12}{60 \times 21} = 1.08$ in² ✓

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Job number: 0406915

Sheet 11 of

Project: FCD WHITE TANK Date: 05/26/05

Subject: Designed: MCB Checked: SDK

Use 4-legged #5 @ 12"

Additional load on cantilever

$\frac{35}{2} \times 6.8 \times 11.5 = 1368.5$ Kft

Factored moment = $1.7 \times 1368.5 = 2326.45$ Kft

Provide a 3'×3'-0" pilaster to carry the load.

Soil load on pilaster

$21 \times 65 = 1365$ #/ft

$= 1.365$ K/ft

$\frac{1}{2} \times 1.365 \times 21 = 14.33$ Kip

$B.M = 14.33 \times \frac{21}{3} = 100.31$ Kft

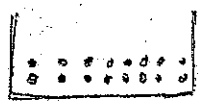
for 3 ft width = $100.31 \times 3 = 300.93$ Kft

factored moment = $1.7 \times 300.62 = 511.05$ Kft

Total moment = $511.05 + 2326.45 = 2837.5$ Kft

$A_s = 23.0$ in²

16 - # 11 bars. two layer



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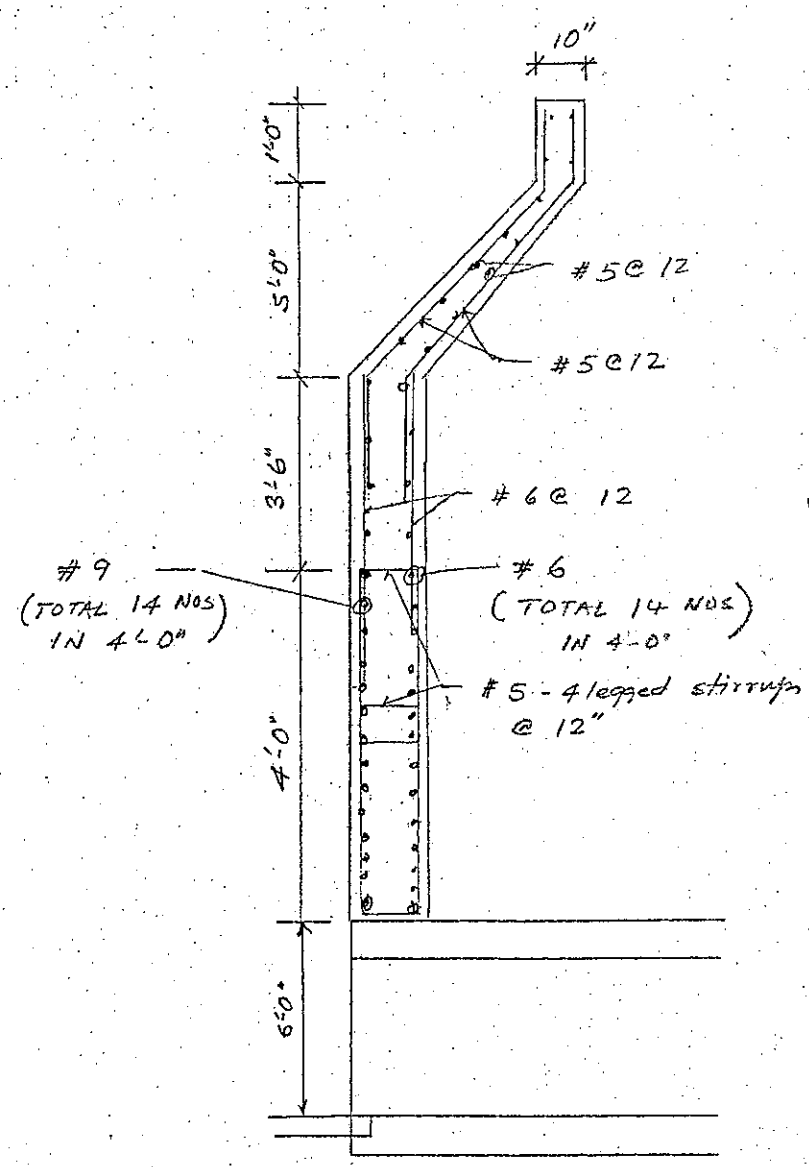
Job number: 0406915

Sheet 12 of

Project: FCO WHITE TANK Date: 05/26/05

Subject: Designed: MCB Checked: SDK



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Job number: 0406915

Sheet 13 of

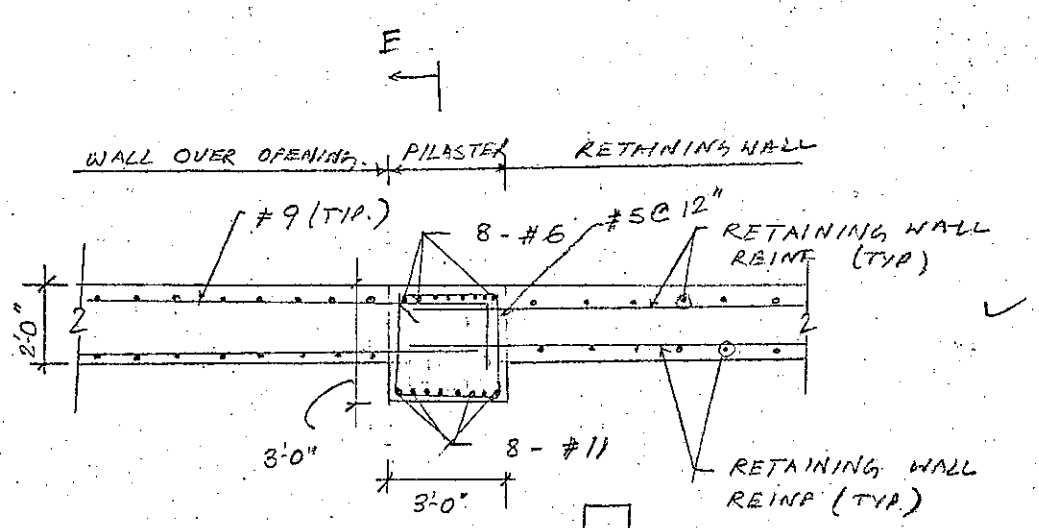
Project: ECD WHITE TANK

Date: 05/26/05

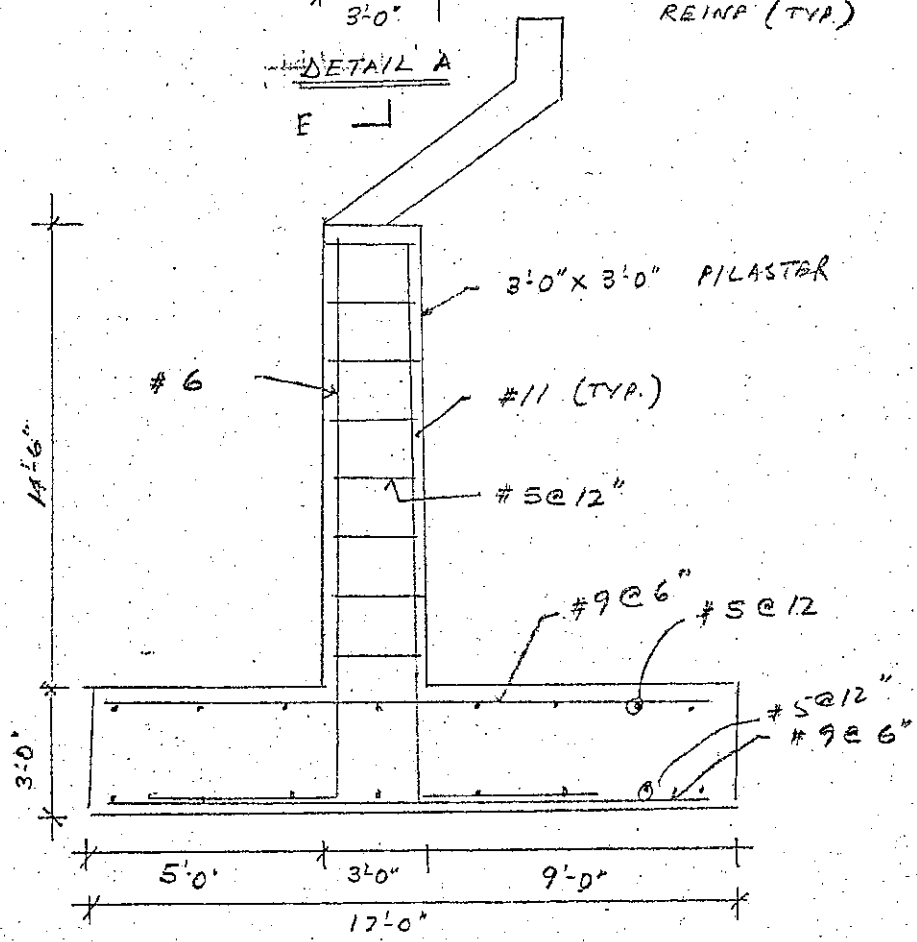
Subject:

Designed: MCB

Checked: SDK



DETAIL A



SECTION E-E

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Job number: 0406915

Sheet 14 of

Project: FCD WHITE TANK

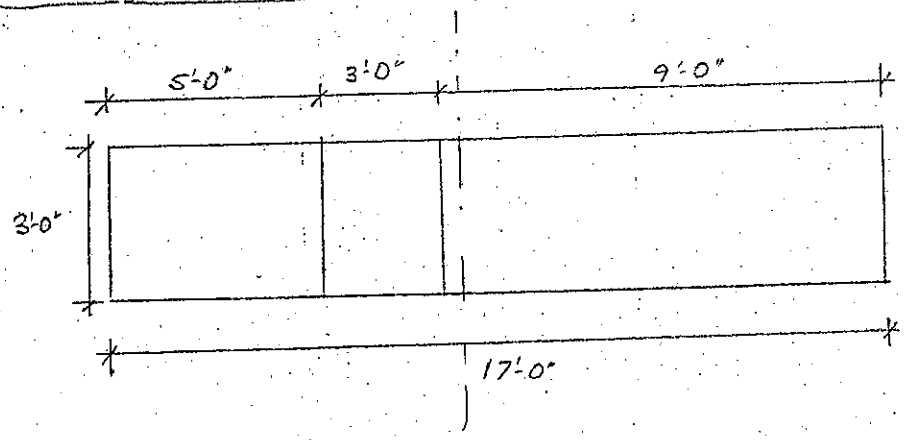
Date: 05/26/05

Subject:

Designed: MCB

Checked: SDK

PILASTER FOUNDATION



Applied moment 2345 K/ft

Service load moment = $\frac{2345}{1.7}$ = 1379 K/ft

Moment of inertia about wall centre

$\frac{1}{12} \times 3 \times (17)^3 + 3 \times 17 \times (2)^2 = 1432.25\ ft^4$

stress at toe = $\frac{1379 \times 6.5}{1432.25}$ = 6.25 K/ft

Moment at end of wall = $\frac{6.25 \times 5^2}{2}$ = 78.125 K/ft

Factored moment = 1.7 × 78.125 = 132.81 K/ft

#9 @ 6" o.c.

Design of HEEL Reinforcement

Soil unit wt = 120 #/cuft

height = 21 ft

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Job number: 0406915

Sheet 15 of

Project: FCD WHITE TANK

Date: 05/26/05

Subject:

Designed: MCB

Checked: SDK

Soil column weight = 120 x 21 = 2520 #/sq ft

= 2.52 kip/sq ft

for 3 ft width = 2.52 x 3 = 7.56 kip/ft

$\frac{wL^2}{2} = \frac{7.56 \times 9^2}{2} = 306.18$ k ft

Factored load = 1.7 x 306.18 = 520.51 k ft

Reqd = 3.6 in²

#9 @ 6" = 7 in² > 3.6 in² (o.k.)

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Job number: 0406915

Sheet 16 of

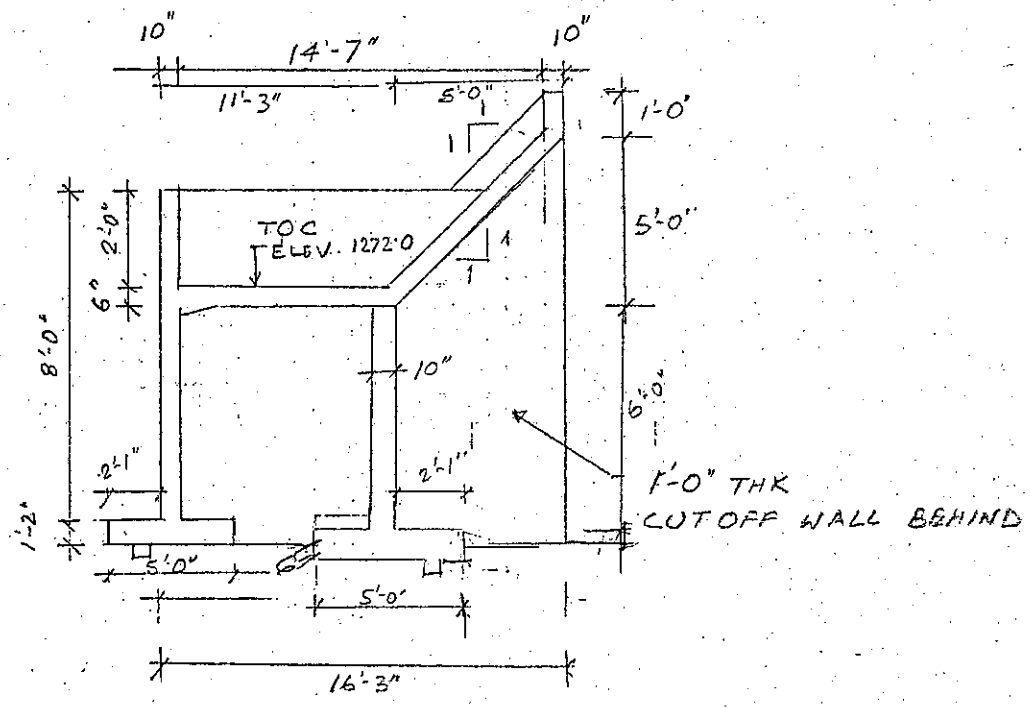
Project: ECD WHITE TANK

Date: 05/26/05

Subject:

Designed: MCB

Checked: SDK



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Job number: 0406915

Sheet 17 of

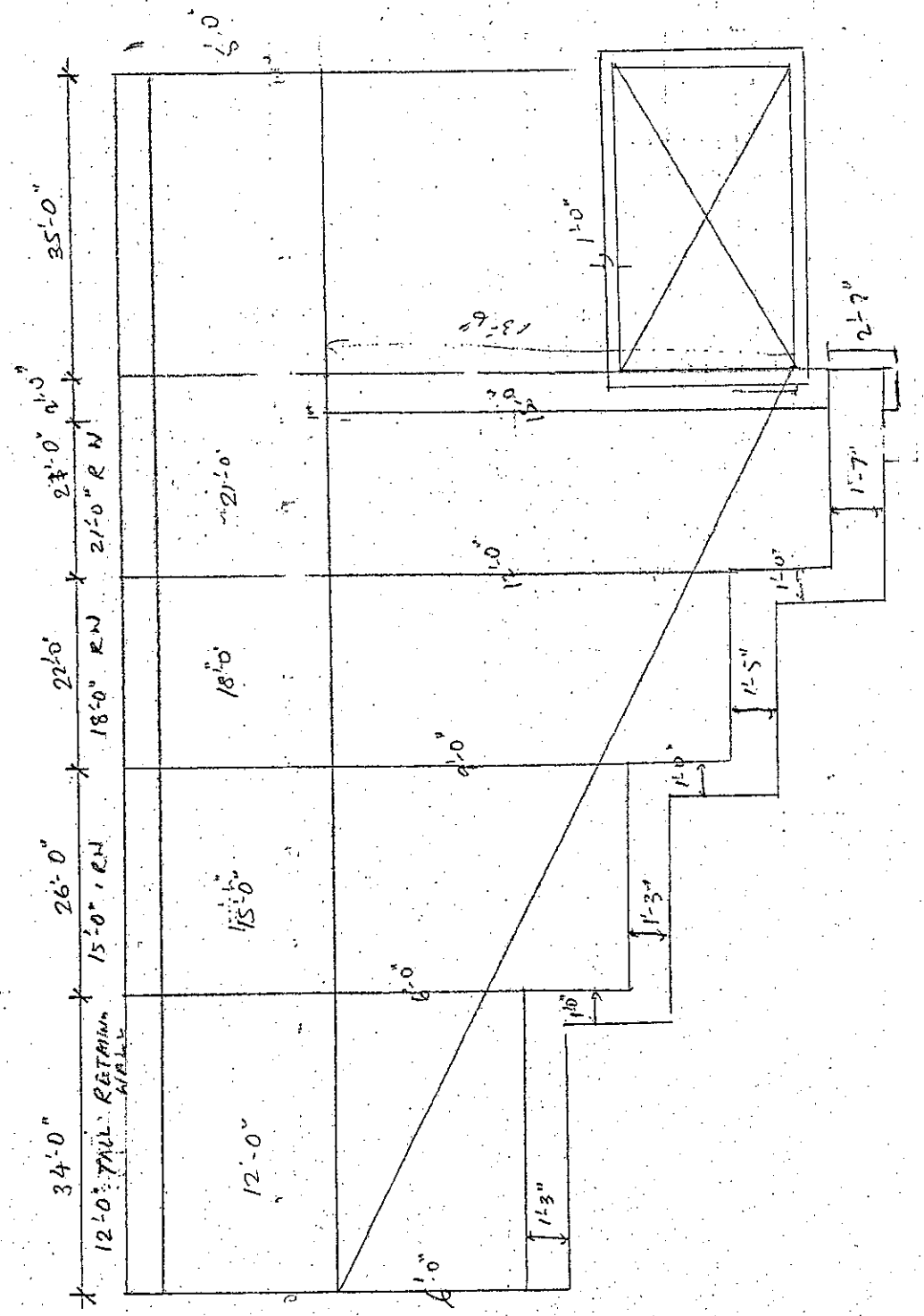
Project: FCD WHITE TANK

Date: 05/26/05

Subject:

Designed: MLR

Checked: SDL



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Job number: 0406915

Sheet 18 of

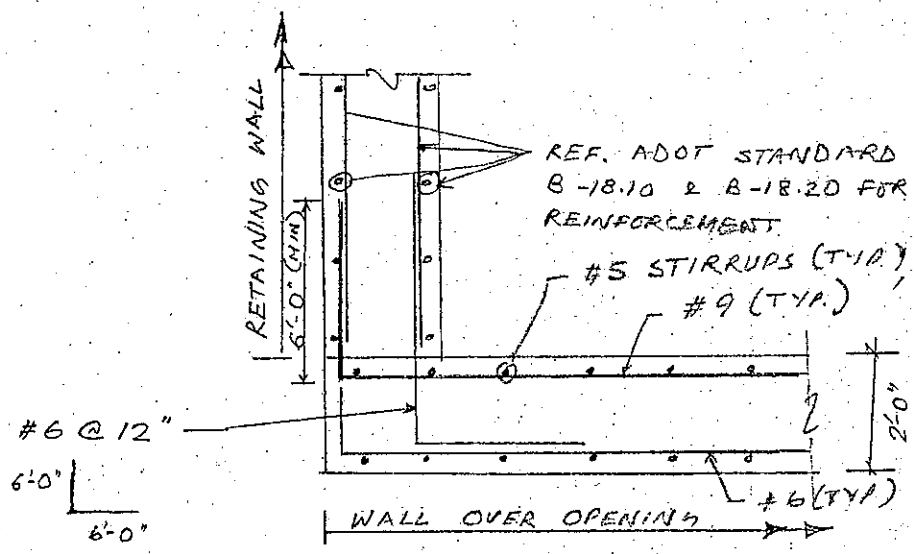
Project: FCD WHITE TANK

Date: 05/27/05

Subject:

Designed: MCB

Checked: SDK



SECTION J/SX

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Job number: 0406915

Sheet 19 of

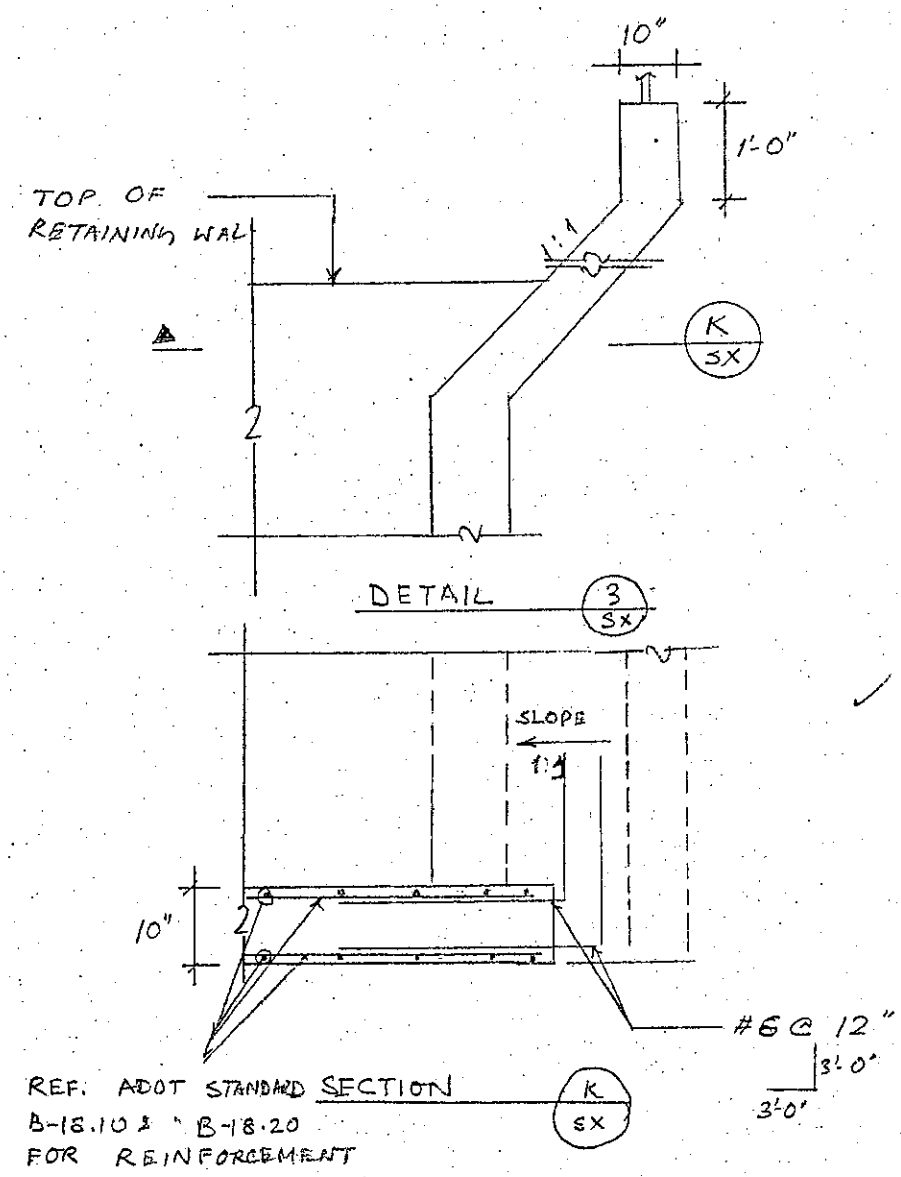
Project: FCD WHITE TANK

Date: 06/05/05

Subject:

Designed: MCB

Checked: SDK



REF. ADOT STANDARD SECTION K/SX
B-18.10 & B-18.20
FOR REINFORCEMENT

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Job number: 0406915

Sheet 20 of

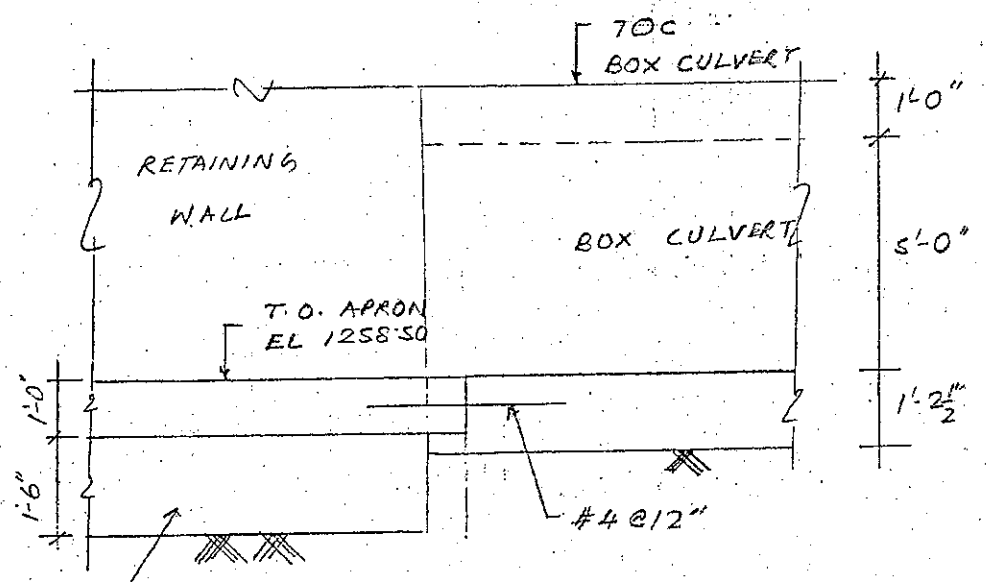
Project: FCD WHITE TANK

Date: 06/06/05

Subject:

Designed: MCB

Checked: SDK



NOTE: OTHER REINFORCEMENT NOT SHOWN FOR CLARITY.

DETAIL 4/SX

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Job number: 0406915

Sheet 21 of

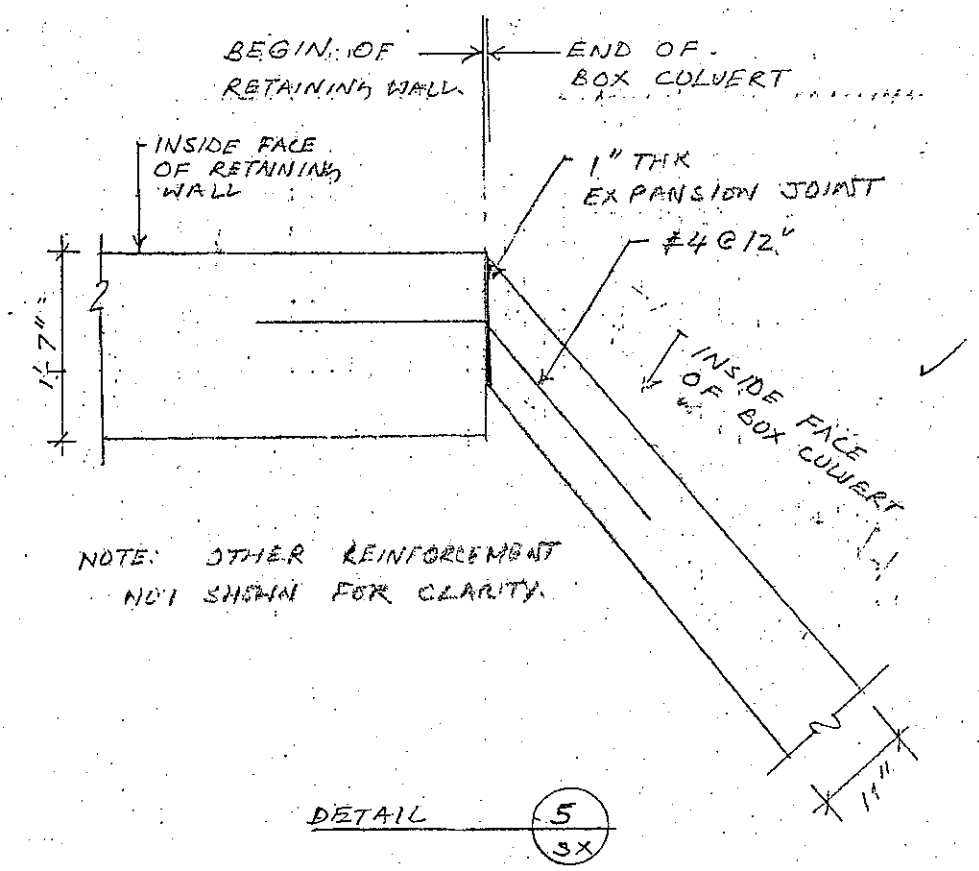
Project: FCD WHITE TANK

Date: 06/04/05

Subject:

Designed:

Checked: SDR



NOTE: OTHER REINFORCEMENT NOT SHOWN FOR CLARITY.

DETAIL 5/3X

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12700 W. Dodge Rd. • PO Box 542030 • Omaha, NE 68154-8030

Job number: 040 6915

Sheet 1 of

Project: FCD WHITE TANK

Date: 06/08/05

Subject:

Designed: MCB

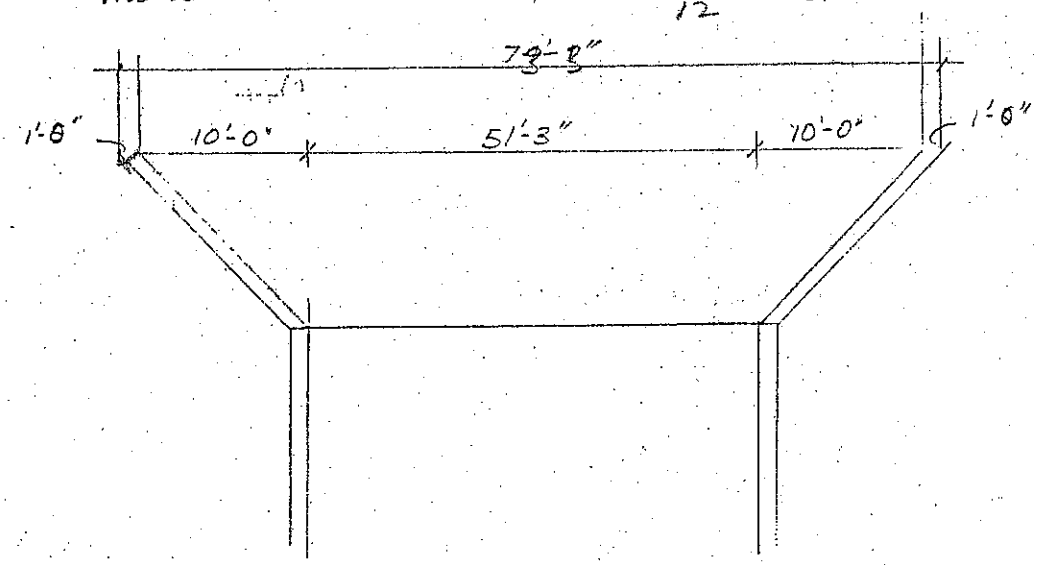
Checked: SDK

WASH DROP STRUCTURE

BOX CULVERT 4 - 12'-0" x 6'-0"

Overall width = $12 \times 4 + 5 \times \frac{13}{12} = 53'-5"$

Inside width = $12 \times 4 + 3 \times \frac{13}{12} = 51'-3"$



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Job number: 0406915

Sheet 2 of

Project: FCD WHITE TANK Date: 06/09/05

Subject: Designed: MCR Checked: SDL

NORTHER WASH DROP STRUCTURE

BOX SIZE 53'-5" (OUT TO OUT)

BOX SIZE WITH LIP = 54'-1" (OUT TO OUT)

BOX height = 8'-3"

BOX Length = 67'-0"

BOX inside dimension = $53'41 - \left(2 \times \frac{13}{12}\right)$

$= 51'-3"$

BOX floor elevation = 1220.00

BOX roof elevation = $1220 + 6'-0" + \frac{12.5}{12}$

$= 1227.041 \approx 1227'-0\frac{1}{2}"$

Retaining wall top elevation = 1228.25

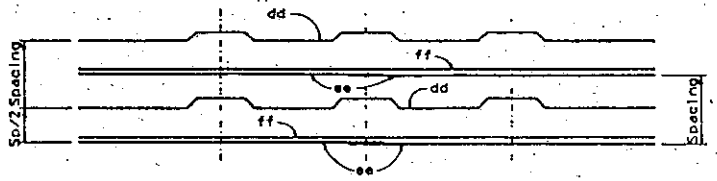
Diff = $1228.25 - 1227-0\frac{1}{2}"$

$= 1'-2\frac{1}{2}"$

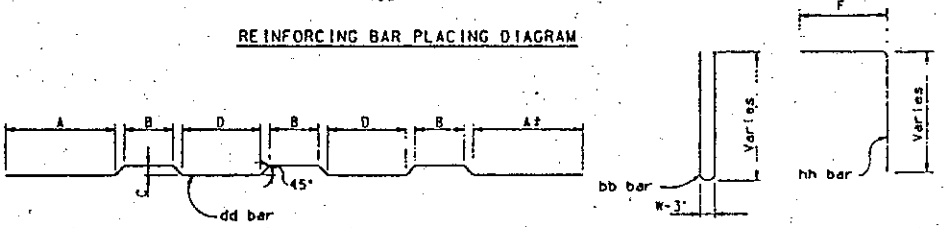
So height of headwall $1'-2\frac{1}{2}"$

TABLE I 0'-10' FILL																																			
				aa		bb		cc	dd							ee			ff			gg	hh			
Span "S"	Height "H"	Top Slab "T"	Walls "W"	Spacing	Length	Spacing	Length	Number +	Bar Size	Spacing	Length	A	B	C	D	Bar Size	Spacing	Length	Bar Size	Spacing	Length	Number +	Bar Size	Spacing	Length	F
6'	3'	9½"	8"	12"	6'-4	12"	8'-9	88	5	14"	27'-3	4'-1	2'-7	6½"	3'-1	5	14"	10'-0	5	14"	26'-11	40	4	7"	5'-1	2'-5
	4'	9½"	8"	12"	5'-4	12"	10'-9	98	5	14"	27'-3	4'-1	2'-7	6½"	3'-1	5	14"	10'-0	5	14"	26'-11	40	4	7"	5'-2	2'-5
	5'	9½"	8"	12"	6'-4	12"	12'-9	98	5	14"	27'-3	4'-1	2'-7	6½"	3'-1	5	14"	10'-0	5	14"	26'-11	40	4	7"	5'-1	2'-5
	6'	9½"	8"	12"	7'-4	12"	14'-9	108	5	14"	27'-3	4'-1	2'-7	6½"	3'-1	5	14"	10'-0	5	14"	26'-11	40	4	7"	5'-7	2'-5
	7'	9½"	8"	12"	8'-4	12"	16'-9	118	5	13"	27'-3	4'-1	2'-7	6½"	3'-1	5	13"	10'-0	5	13"	26'-11	40	4	6½"	7'-1	2'-5
8'	3'	9½"	8"	12"	6'-4	12"	8'-9	88	6	14"	35'-4	4'-1	2'-8	6½"	4'-2	6	14"	10'-3	6	14"	35'-4	56	6	7"	5'-4	2'-6
	4'	9½"	8"	12"	5'-4	12"	10'-9	98	6	14"	35'-4	4'-1	2'-8	6½"	4'-2	6	14"	10'-3	6	14"	35'-4	56	6	7"	5'-0	2'-6
	5'	9½"	8"	12"	6'-4	12"	12'-9	98	6	14"	35'-4	4'-1	2'-8	6½"	4'-2	6	14"	10'-3	6	14"	35'-4	56	6	7"	5'-6	2'-6
	6'	9½"	8"	12"	7'-4	12"	14'-9	108	6	14"	35'-4	4'-1	2'-8	6½"	4'-2	6	14"	10'-3	6	14"	35'-4	56	6	7"	6'-11	2'-6
	7'	9½"	8"	12"	8'-4	12"	16'-9	118	6	13"	35'-4	4'-1	2'-8	6½"	4'-2	6	13"	10'-3	6	13"	35'-4	56	5	6½"	7'-5	2'-6
	8'	9½"	8"	12"	9'-4	12"	18'-9	118	6	13"	35'-4	4'-1	2'-8	6½"	4'-2	6	13"	10'-3	6	13"	35'-4	56	6	6½"	8'-0	2'-6
10'	3'	10½"	11"	12"	6'-4	12"	9'-2	88	7	17"	44'-2	7'-1	4'-8	7½"	5'-2	5	17"	22'-8	7	17"	44'-2	64	6	8½"	6'-1	3'-0
	4'	10½"	11"	12"	5'-4	12"	11'-2	98	7	17"	44'-2	7'-1	4'-8	7½"	5'-2	5	17"	22'-8	7	17"	44'-2	64	6	8½"	6'-1	3'-0
	5'	10½"	11"	12"	6'-4	12"	13'-2	98	6	12"	44'-2	7'-1	4'-8	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	8"	6'-8	2'-8
	6'	10½"	11"	12"	7'-4	12"	15'-2	108	6	12"	44'-2	7'-1	4'-8	7½"	5'-2	5	12"	22'-8	6	12"	44'-2	64	5	8"	7'-2	2'-8
	7'	10½"	11"	12"	8'-4	12"	17'-2	118	7	15"	44'-2	7'-1	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	7'-9	2'-8
	8'	10½"	11"	12"	9'-4	12"	19'-2	118	7	15"	44'-2	7'-1	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	8'-3	2'-8
	9'	10½"	11"	12"	10'-4	12"	21'-2	128	7	15"	44'-2	7'-1	4'-8	7½"	5'-2	5	15"	22'-8	7	15"	44'-2	64	6	7½"	8'-4	2'-8
	10'	10½"	11"	12"	11'-4	12"	23'-2	138	7	14"	44'-2	7'-1	4'-8	7½"	5'-2	5	14"	22'-8	7	14"	44'-2	64	6	7"	8'-3	2'-8
12'	8'	12½"	13"	12"	9'-10	12"	20'-0	118	7	13"	53'-0	8'-1	5'-6	8½"	6'-2	5	13"	27'-0	7	13"	53'-0	88	6	6½"	8'-7	2'-10
	9'	12½"	13"	12"	10'-10	12"	22'-0	128	8	16"	53'-0	8'-1	5'-6	8½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	6	8"	9'-1	2'-10
	10'	12½"	13"	12"	11'-10	12"	24'-0	138	8	16"	53'-0	8'-1	5'-6	8½"	6'-2	5	16"	27'-0	8	16"	53'-0	88	6	8"	9'-7	2'-10
	11'	12½"	13"	12"	12'-10	12"	26'-0	138	8	12"	53'-0	8'-1	5'-6	8½"	6'-2	6	12"	27'-0	7	12"	53'-0	88	6	8"	10'-1	2'-10
	12'	12½"	13"	12"	13'-10	12"	28'-0	148	8	12"	53'-0	8'-1	5'-6	8½"	6'-2	5	12"	27'-0	7	12"	53'-0	88	6	8"	10'-7	2'-10

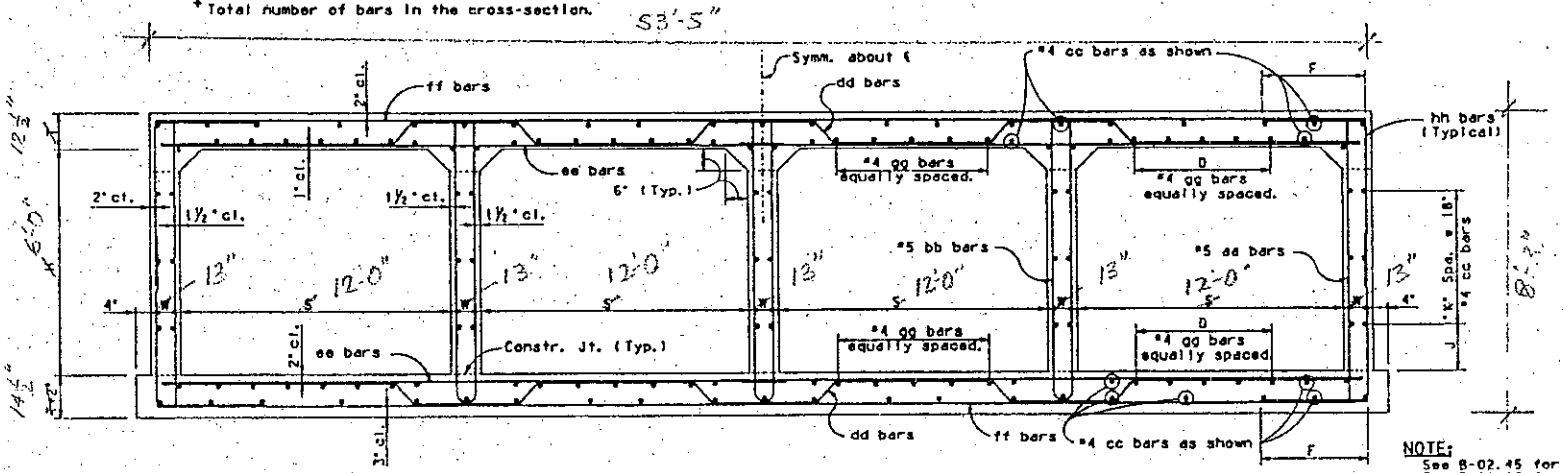
+ Total number of bars in the cross-section.



REINFORCING BAR PLACING DIAGRAM



BENDS



Height "H"	"J" Dim.	"K" Spaces
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11	12"	6
12'	9"	7

NOTE:
See B-02.45 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.10 for Quantities.

TYPICAL SECTION

NOTE:
Reinforcing shown is for placement location only.
Use the appropiate table to determine the reinforcing requirements.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 4-92
APPROVED FOR DISTRIBUTION	FOUR BARREL BOX CULVERT	STANDARD NO. B-02.40

KIRKHAM MICHAEL
CONSULTING ENGINEERS
12700 W. Dodge Rd. • PO Box 542030 • Omaha, NE 68154-8030

Job number: 040691S

Sheet 4 of

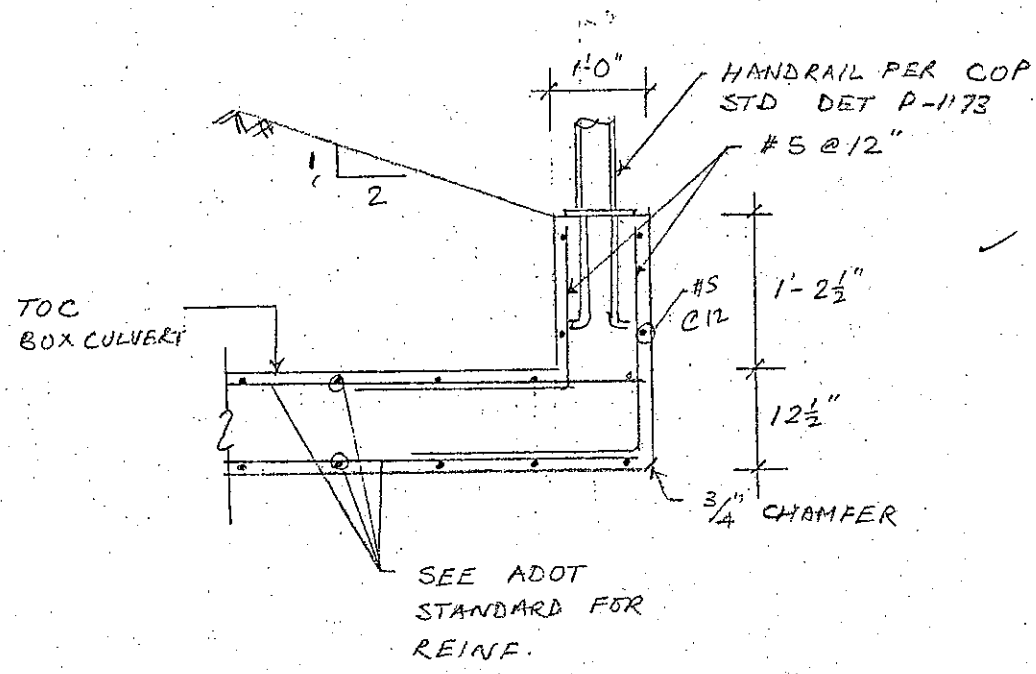
Project: FCD WHITE TANK

Date: 06/09/05

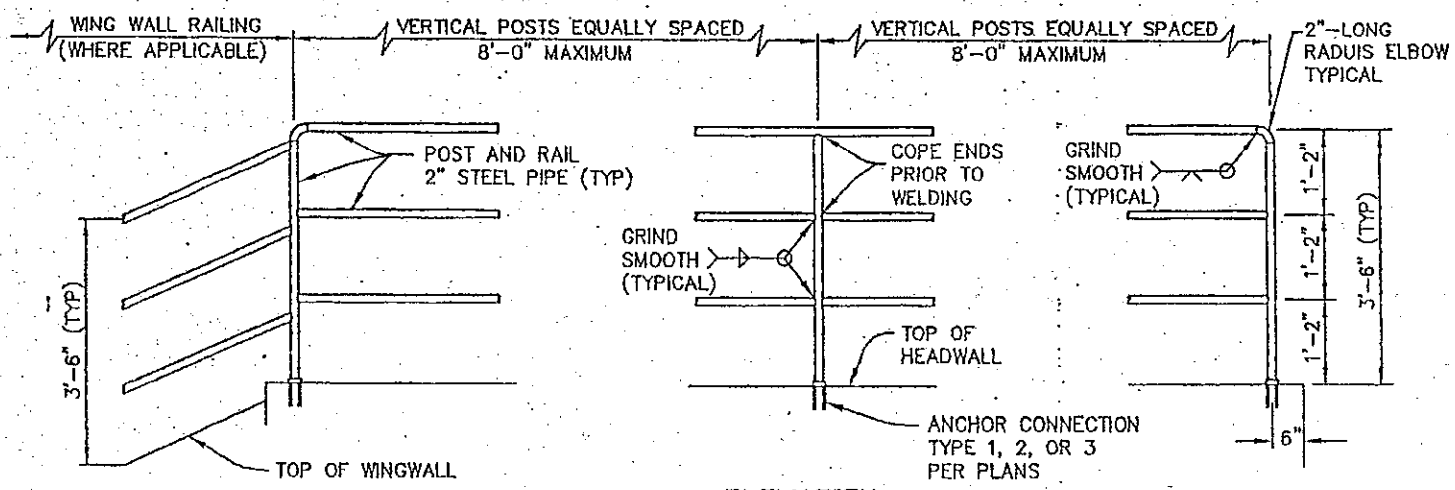
Subject:

Designed: MCB

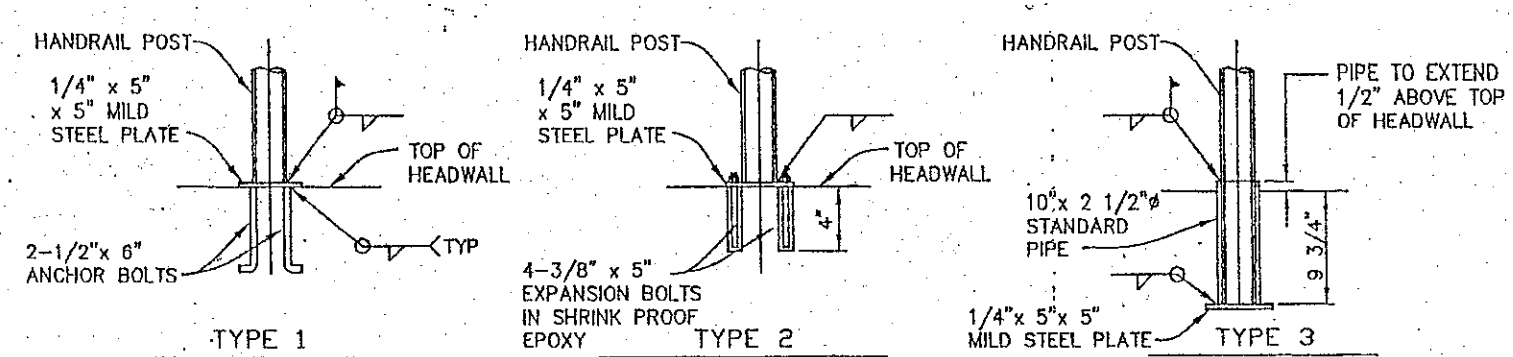
Checked: SDM



SECTION



ELEVATION



TYPE 1
ANCHOR PLATE DETAIL

TYPE 2
EXPANSION BOLT DETAIL

TYPE 3
PIPE SLEEVE DETAIL

CONSTRUCTION NOTES

1. 2" ROUND TUBE STEEL (ASTM 500 GRADE B1 GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 WELD 3/8" THICK ALL AROUND. SHOP PRIME WITH RUST INHIBITING PRIMER (FIELD REPAIR PRIMER AS NEEDED).
2. PAINT HANDRAIL PER MAG SPECIFICATIONS SECTION 530. COLOR PER PLANS.
3. VERTICAL POSTS TO BE EVENLY SPACED.
4. HANDRAILS TO BE PLACED ON ALL HEADWALLS AND AT THE BACK OF SCUPPERS.

DETAIL NO.	City of Phoenix STANDARD DETAIL	HANDRAIL DETAIL	APPROVED FOR CITY ENGINEER	8-6-99 DATE	DETAIL NO.
P1173					P1173

KIRKHAM MICHAEL
CONSULTING ENGINEERS
12700 W. Dodge Rd. • PO Box 542030 • Omaha, NE 68154-8030

Job number: 0206915

Sheet 6 of

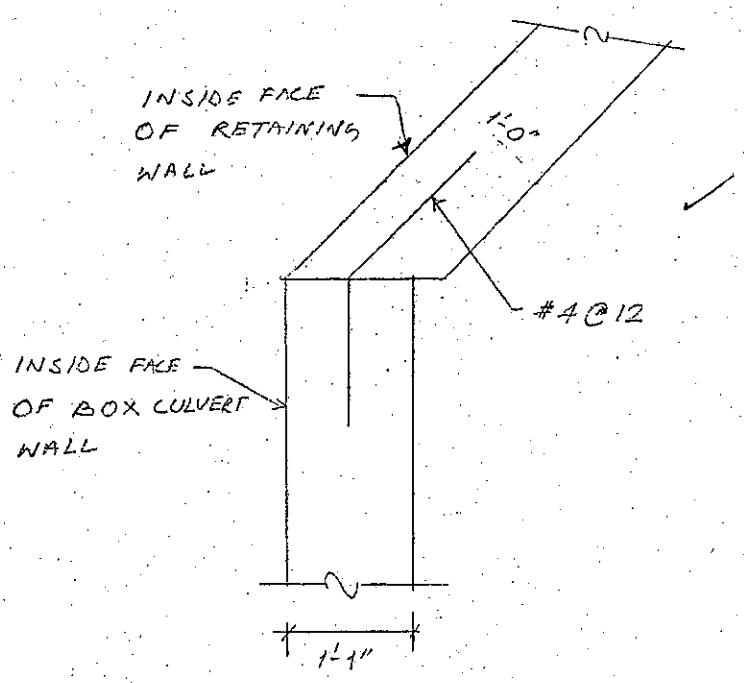
Project: FCD WHITE TANK

Date: 06/08/05

Subject:

Designed: MCB

Checked: SOM



DETAIL 2 / ST4

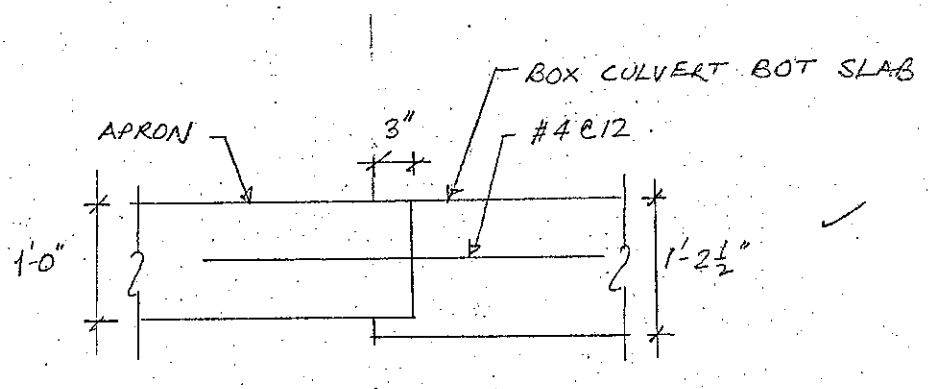
KIRKHAM MICHAEL
CONSULTING ENGINEERS
12700 W. Dodge Rd. • PO Box 542030 • Omaha, NE 68154-8030

Job number: 040691S

Sheet 7 of

Project: FCD WHITE TANK Date: 06/08/05

Subject: Designed: MCB Checked: SDK



SECTION E / ST4

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

2801 W. Durango, Phoenix, Arizona 85009
Fax: (602) 506-8561
Office: (602) 506-8945

E-mail: _____

Date: 1-31-05

COVER SHEET

To: Barry Ling Fax No. 997-5980
Jason Kelley Fax No. _____

From: Bobbie Oliver

Number of pages being sent including Cover Sheet: 2

SUBJECT: NIC Utilities

Comments:

Fax to Barry Barron
997-5992

2005 Conflict Review Response

Qwest
Spirit of Service

DATE 1/18/2005
QWEST LOG# 311334.0664

MEMORANDUM TO: MARICOPA COUNTY FLOOD CONTROL DISTRIC
2801 W. DURANGO STREET
PHOENIX, AZ 85009
ATTN: GARY MAIERS (602) 506-0562

FROM: Qwest Communication
6350 S. Maple Avenue, #125
Tempe, AZ 85283

REGARDING PROJECT: WHITE TANKS FLOOD REATRDING STRUCTURE #3 NORTH INLET CHANNEL PCN (470-04-31)

OLIVE AVE & PERRYIVILLE RD

☐ YOUR PLANS HAVE BEEN RECEIVED BY QWEST AND REVIEWED BY ONE OF OUR ENGINEERS. NO APPARENT CONFLICTS WERE FOUND.

☒ YOUR PLANS HAVE BEEN RECEIVED BY QWEST AND THE FOLLOWING CONFLICTS WERE FOUND:

Following a review of the 30% plans submitted, it has been determined that there are possible conflicts with the proposed project and Qwest facilities. Qwest is unable to determine if conflicts exist due to the lack of information provided for review. Qwest has a 25pr cable which crosses the Beardsley canal at Northern on the north side and a 100pr cable at Olive which also crosses the canal on the north side which appear to be in conflict. Blue staking for location of Qwest facilities must be completed prior to any construction. When crossing Qwest facilities you will be required to pothole to determine the depth and maintain a minimum of 12 inch vertical and horizontal separation from the facilities. Support and protection is required for all Qwest facilities during construction. If you have any questions regarding this review, please contact Matthew Phillips 602-630-1393.

BLUE STAKE BEFORE DIGGING

THIS IS WITHIN THE QWEST SERVING AREA ◉Yes ○No

IF YOU HAVE ANY INQUIRIES, PLEASE CONTACT:

NAME: MATTHEW PHILLIPS 602-630-1393
QWEST PLAN REVIEWER

NAME: HOWARD DENNISTON 602-630-5486
QWEST FIELD ENGINEER

JOB NUMBER:
EST SVC DATE:

HOURS WORKED: 2
SHEETS: 24
REVIEWED AT: 30% PRELIMINARY NOT FOR CONSTRUCTION

1122 Capital of Texas Highway South
Austin, TX 78746
Ph. 512.742.3827 Fax. 512.742.1558
Norman.Garcia@Broadwing.com

Connecting with Customers at the Speed of Light

FLOOD CONTROL DISTRICT
RECEIVED
JAN 21 '05
CH & GM | FINANCE
PIO | LANDS
ADMIN | C & M
REG | P & FM
ENG | FILE
CONTRACTS
ROUTING

January 18, 2005

Gary Maiers
Flood Control District of
Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

RE: White Tanks FRS #3 – North Inlet Channel

Broadwing OSP Operations # SW04296

Dear Gary Maiers,

Thank you for contacting Broadwing Communications, LLC, (formerly IXC Communications) regarding a potential conflict with your proposed work. Broadwing does have fiber optic facilities within the limits of your project. We have enclosed as-built drawings indicating the approximate location of Broadwing fiber cable. Please note for accurate locations of Broadwing fiber optic cable it will necessary for a Broadwing technician to physically locate and mark Broadwing cable. **We request a copy of the design plans for our review as soon as they are available.** Once we receive your plans, we will conduct an investigation and upon completion of our analysis, we will notify you in writing of any conflicts with your construction.

Please send all future correspondence to:
Attn: Norman Garcia
OSP Operations
Broadwing Communications
1122 Capital of Texas Hwy South
Austin, TX 78746

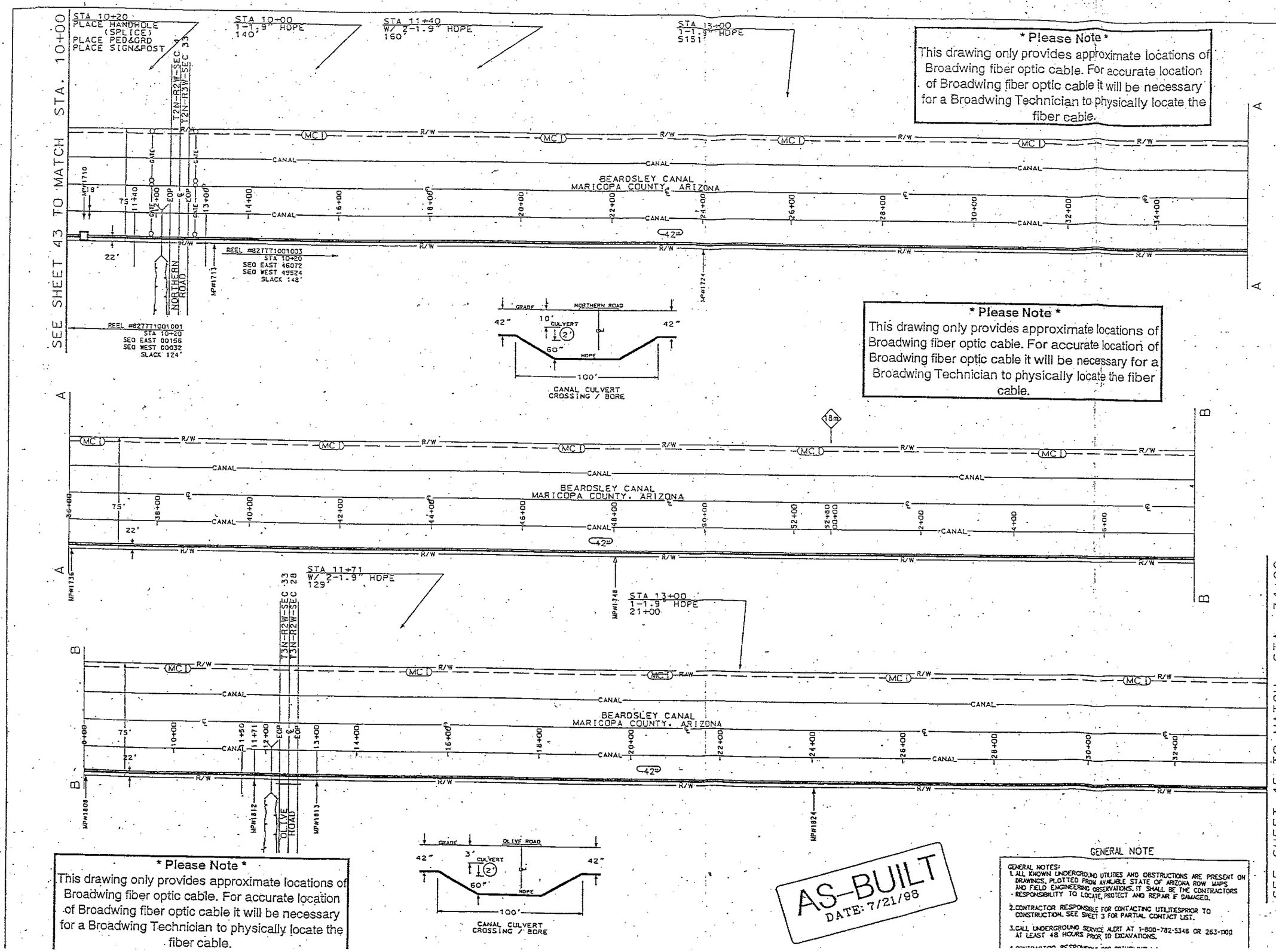
Please place a State of Arizona One-Call (1.800.782.5348) at least 48 hours prior to commencement of work. All Broadwing fiber is marked, should you encounter our cable please immediately call Broadwing Damage Prevention Department at 1-800-441-0223.

Protection of our fiber is of utmost importance. If you have questions or require additional information, please do not hesitate to contact me.

RECEIVED
JAN 31 2005
MIRCHAEL-PHOENIX

Sincerely,

Norman Garcia
OSP Operation - Project Specialist



*** Please Note ***

This drawing only provides approximate locations of Broadwing fiber optic cable. For accurate location of Broadwing fiber optic cable it will be necessary for a Broadwing Technician to physically locate the fiber cable.

*** Please Note ***

This drawing only provides approximate locations of Broadwing fiber optic cable. For accurate location of Broadwing fiber optic cable it will be necessary for a Broadwing Technician to physically locate the fiber cable.

*** Please Note ***

This drawing only provides approximate locations of Broadwing fiber optic cable. For accurate location of Broadwing fiber optic cable it will be necessary for a Broadwing Technician to physically locate the fiber cable.

AS-BUILT
DATE: 7/21/98

GENERAL NOTE

GENERAL NOTES:
1. ALL KNOWN UNDERGROUND UTILITIES AND OBSTRUCTIONS ARE PRESENT ON DRAWINGS, PLOTTED FROM AVAILABLE STATE OF ARIZONA ROW MAPS AND FIELD ENGINEERING OBSERVATIONS. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO LOCATE, PROTECT AND REPAIR IF DAMAGED.
2. CONTRACTOR RESPONSIBLE FOR CONTACTING UTILITIESPRIOR TO CONSTRUCTION. SEE SHEET 3 FOR PARTIAL CONTACT LIST.
3. CALL UNDERGROUND SERVICE ALERT AT 1-800-782-5348 OR 263-1100 AT LEAST 48 HOURS PRIOR TO EXCAVATIONS.

PROJ/WORK NO.: 19525
SPAN NAME: XXX

REV	DESCRIPTION	DATE
X	XXX	X

MATERIAL LIST

DESCRIPTION	QTY.
1.9" HDPE	7969'
SMFOC 12	28772'
HANDHOLE	1

TELCOM ENGINEERING INC. AUSTIN, TEXAS
AN IXC CARRIER, INC. COMPANY

FIBER OPTIC CABLE ROUTE
IXC/MCI PRIMARY ROUTE

	DATE
ENGINEERED BY:	8-6-1997
DRAWN BY: MA TEL	
SCALE :	
HORIZONTAL : 1"-200'	
VERTICAL : NTS	
FILE NAME : 19525-044	
SHEET NO : 44 OF 67	

DISCLAIMER

EXCEPT AS MAY BE OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS SHALL REMAIN THE PROPERTY OF IXC CARRIER GROUP, BOTH BEING ISSUED IN STRICT CONFIDENCE AND SHALL NOT BE REPRODUCED, COPIED OR USED FOR ANY

1/12/05 — UTILITY MEETING w/ GRAY MAILERS et. al.

Broadwing - Ray Lowe - 623-203-5823
MCI
Water District - has cable

East Side ~ 25' east of edge under east edge of service road

Cancelbond's Bonds all the way to US60
96 count fiber - 2" conduit
4 foot deep

Positive Location (wire)

MCI - on west side - Terry

Loma fiber cable - in concrete
as built

Data - International - can't be cut
0.12 db loss @ splice
Lower @ existing splice

SRP - no conflicts - APS
El Paso - no conflict
MUD
Qwest -
APS
MCI
BRW

Pete - contact

Terry Cox - MCI 602-625-4287

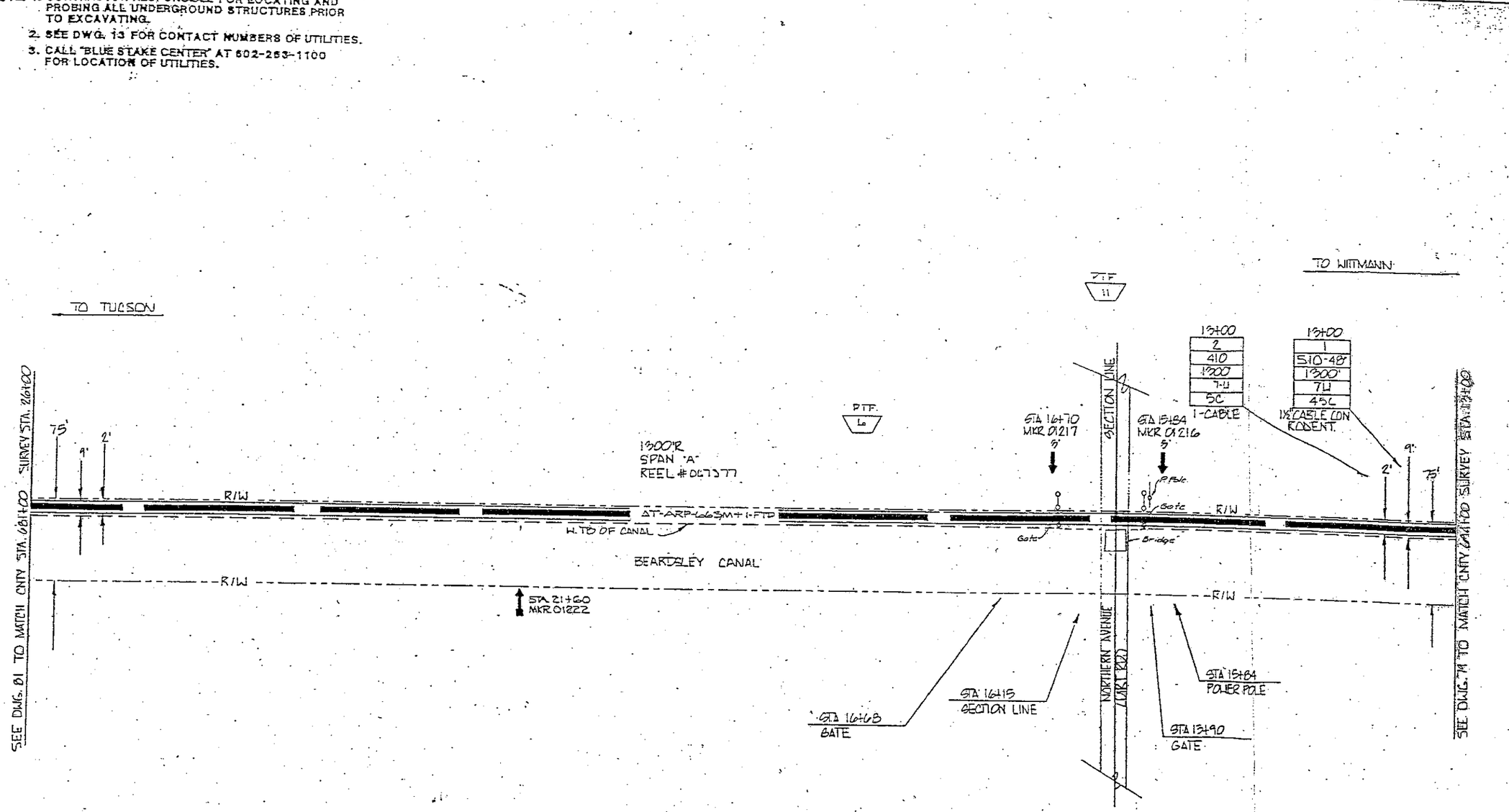
West side of access road on west

4' depth - fiber optics 3" sekonduct

NOTE: 1. CONTRACTOR RESPONSIBLE FOR LOCATING AND PROBING ALL UNDERGROUND STRUCTURES PRIOR TO EXCAVATING.

2. SEE DWG. 13 FOR CONTACT NUMBERS OF UTILITIES.

3. CALL "BLUE STAKE CENTER" AT 602-263-1100 FOR LOCATION OF UTILITIES.



PROJECT: # 05145-02

SPAN: "A"

BUCKEYE TO WITTMANN

MAP FOOTAGE

SURVEY	1300' LF
RAILROAD	LF

MATERIAL LIST	QUANTITY
CABLE	1300'
4" GIP	
4" PVC	
1 1/4" CORR. INDT.	
4" SPLIT GIP	
4" SPLIT PVC	
HH: 3' x 5' x 4'	
MH: 4' x 4' x 4'	
BURI. CA. MKRS.	2
10M STRAND	
10" STEEL CASING	
1½" CABLE CON	1300'
FLAT COMP. MKR.	1

MCI TELECOMMUNICATIONS CORPORATION

LIGHTWAVE SYSTEMS

TITLE: FIBER OPTIC CABLE ROUTE

TUCSON, AZ TO WITTMANN, AZ

DATE: 10/23/87

ENGINEER: ROYDEN

REVISIONS

DATE	DESCRIPTION	INITIAL
2/88	AND CABLE CON	GGB
1-11/88	AS-BUILT	TJS
3/89	REVISION	MMB

EXCEPT AS MAY BE OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS SHALL REMAIN THE PROPERTY OF MCI TELECOMMUNICATIONS CORPORATION, BOTH BEING ISSUED IN STRICT CONFIDENCE AND SHALL NOT BE REPRODUCED, COPIED, OR USED FOR ANY PURPOSE WITHOUT SPECIFIC WRITTEN PERMISSION.

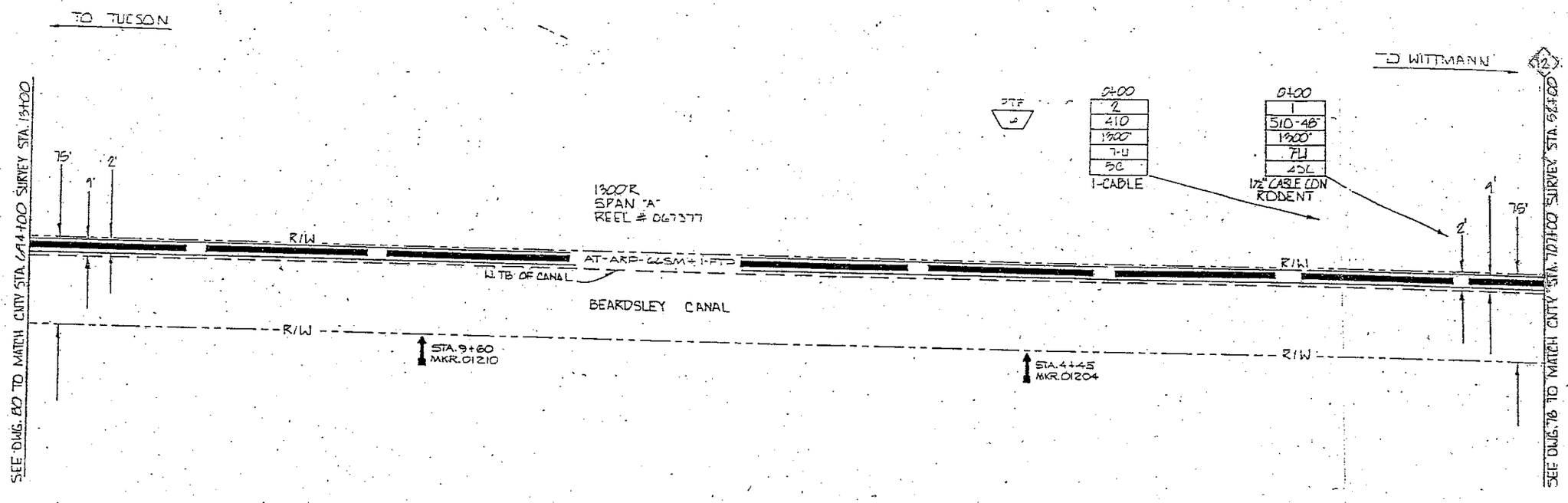
TOLERANCES UNLESS OTHERWISE SPECIFIED:
.XX = ±.03 .XXX = ±.010
ANGLES: ±30' FRACTIONS: ±1/16"

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL:

DEPT. ID: 104 LOC. ID: 041

MP 12 TO MP 13

NOTE: 1. CONTRACTOR RESPONSIBLE FOR LOCATING AND PROBING ALL UNDERGROUND STRUCTURES PRIOR TO EXCAVATING.
2. SEE DWG. 13 FOR CONTACT NUMBERS OF UTILITIES.
3. CALL "BLUE STAKE CENTER" AT 602-263-1100 FOR LOCATION OF UTILITIES.



PROJECT: # 05145-02

SPAN: "A"

BUCKEYE TO WITTMANN

MAP FOOTAGE
SURVEY 1300' LF
RAILROAD LF

MATERIAL LIST	QUANTITY
CABLE	1300'
4" GIP	
4" PVC	
1¼" CORR. INDT.	
4" SPLIT GIP	
4" SPLIT PVC	
HH 3' x 5' x 4'	
MH 4' x 4' x 4'	
BUR. CAB. MKRS.	
TOM STRAND	
10" STEEL CASING	
1½" CABLE CON	1300'
FLAT COMP. MKR.	2

MCI
TELECOMMUNICATIONS CORPORATION
LIGHTWAVE SYSTEMS
TITLE: FIBER OPTIC CABLE ROUTE
TUCSON, AZ TO WITTMANN, AZ

DATE: 10/23/87
ENGINEER: ROYDEN

REVISIONS

DATE	DESCRIPTION	INITIAL
2/88	ADD CABLE CON	[illegible]
[illegible]	[illegible]	[illegible]
3/89	REVISION 8-1	[illegible]

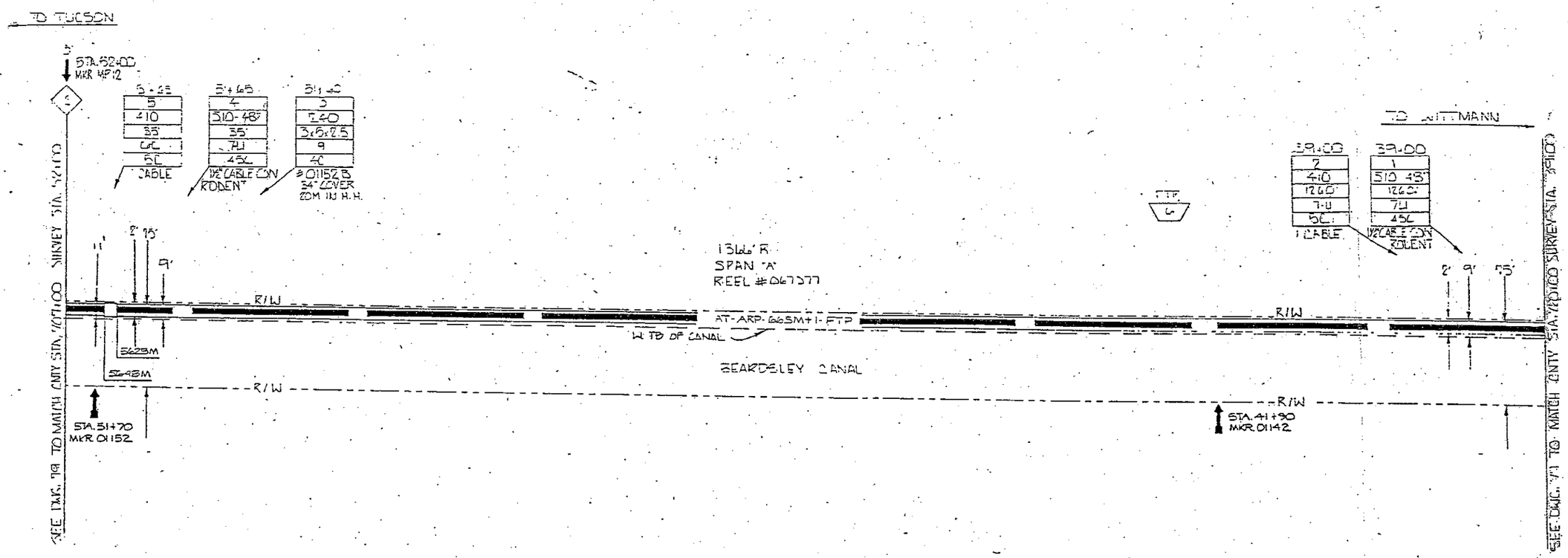
EXCEPT AS MAY BE OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS SHALL REMAIN THE PROPERTY OF MCI TELECOMMUNICATIONS CORPORATION, BOTH BEING ISSUED IN STRICT CONFIDENCE AND MAY NOT BE REPRODUCED, COPIED, OR USED FOR ANY PURPOSE WITHOUT SPECIFIC WRITTEN PERMISSION.

TOLERANCES UNLESS OTHERWISE SPECIFIED:
XX = ±0.03 XXX = ±0.005 XXXX = ±.010
ANGLES = ±30' FRACTIONS = ±1/32"

SCALE
HORIZONTAL 1" = 50'
VERTICAL

DEPT. ID: 1204 LOC. ID: 0401
MP 12 TO MP 13

NOTE: 1. CONTRACTOR RESPONSIBLE FOR LOCATING AND PROBING ALL UNDERGROUND STRUCTURES PRIOR TO EXCAVATING.
2. SEE DWG. 13 FOR CONTACT NUMBERS OF UTILITIES.
3. CALL "BLUE STAKE CENTER" AT 602-263-1100 FOR LOCATION OF UTILITIES.



CONSTRUCTION NOTE:
1. HANDHOLES ARE TO BE BURIED WITH A MINIMUM OF 24" COVER EQUIPPED WITH H-20 LOADING LIDS.

PROJECT: # 05145-02

SPAN: "A"

BUCKEYE TO WITTMANN

MAP FOOTAGE
SURVEY 1300 LF
RAILROAD LF

MATERIAL LIST	QUANTITY
CABLE	1366'
4" GIP	
4" PVC	
1 1/4" CORR. INDT.	
4" SPLIT GIP	
4" SPLIT PVC	
HH 3'x5'x2'5"	1
MH 4'x4'x4'	
BUR. CA. MKRS.	5
10M STRAND	
10" STEEL CASING	
1/2" CABLE CON	1295'
FLAT COMP. MKR.	2

MCI
TELECOMMUNICATIONS CORPORATION
LIGHTWAVE SYSTEMS
TITLE: FIBER OPTIC CABLE ROUTE
TUCSON, AZ TO WITTMANN, AZ

DATE: 10/23/87
ENGINEER: ROYDEN

REVISIONS

DATE	DESCRIPTION	INITIALS
6/88	ADD CABLE CON	JGE
1/89	AS-BUILT	RJ
3/89	REVISED	MAB

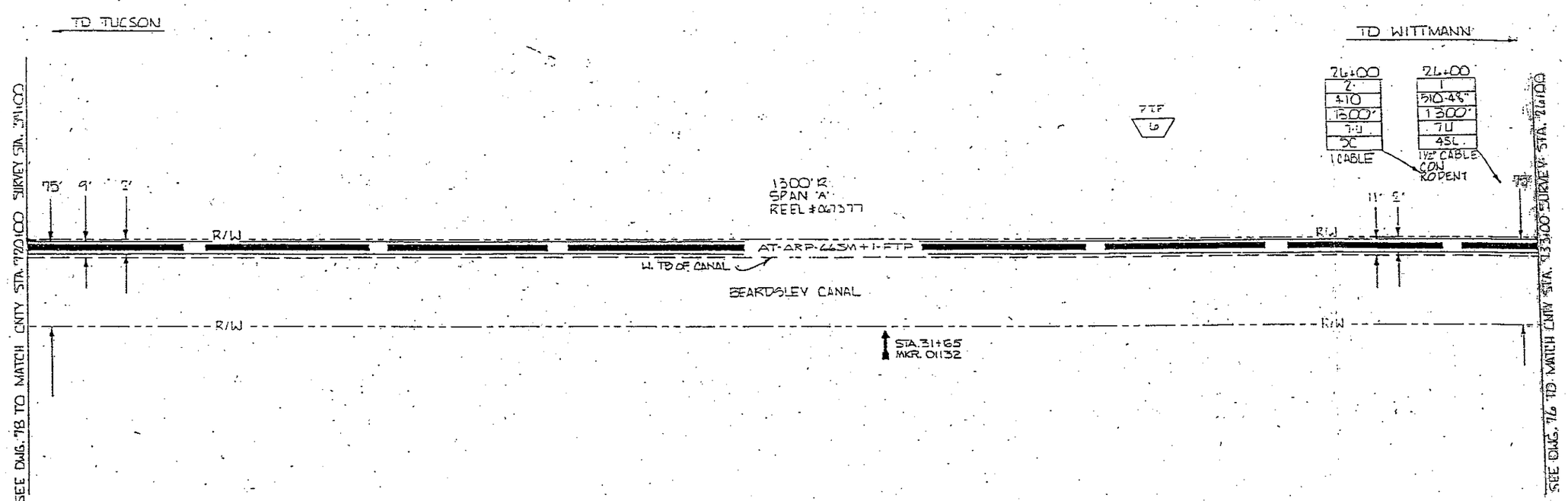
EXCEPT AS MAY BE OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS SHALL REMAIN THE PROPERTY OF MCI TELECOMMUNICATIONS CORPORATION. BOTH SUBMITTED IN STRICT CONFIDENCE AND SHALL NOT BE REPRODUCED, COPIED, OR USED FOR ANY PURPOSE WITHOUT SPECIFIC WRITTEN PERMISSION.

TOLERANCES UNLESS OTHERWISE SPECIFIED
DIMENSIONS ± .XX = ± .010
ANGLES ± 30' FRACTIONS ± 1/32"

SCALE
HORIZONTAL 1" = 50'
VERTICAL

DEPT. ID 104 LOC. ID 04-1
MP 1 TO MP 12

NOTE: 1. CONTRACTOR RESPONSIBLE FOR LOCATING AND PROBING ALL UNDERGROUND STRUCTURES PRIOR TO EXCAVATING.
2. SEE DWG. 13 FOR CONTACT NUMBERS OF UTILITIES.
3. CALL "BLUE STAKE CENTER" AT 602-263-1100 FOR LOCATION OF UTILITIES.



PROJECT: # 05145-02

SPAN: "A"

BUCKEYE TO WITTMANN

MAP FOOTAGE
SURVEY 1300' LF
RAILROAD LF

MATERIAL LIST	QUANTITY
CABLE	1300'
4" GIP	
4" PVC	
1-1/4" CORR. INDT.	
4" SPLIT GIP	
4" SPLIT PVC	
HH/3' x 5' x 4'	
MH/4' x 4' x 4'	
BURI. CA. MKRS.	3
10M STRAND	
10" STEEL CASING	
1½" CABLE CON.	1300'
FLAT COMP. MKR.	1

MCI
TELECOMMUNICATIONS CORPORATION
LIGHTWAVE SYSTEMS
TITLE: FIBER OPTIC CABLE ROUTE
TUCSON, AZ. TO WITTMANN, AZ.

DATE: 10/23/87
ENGINEER ROYDEN

REVISIONS

DATE	DESCRIPTION	INITIAL
2/88	ADD: CABLE CON.	WSB
11/88	REV: QUANT.	DRB
3/89	REV-H.1	WAB

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TOLERANCES UNLESS OTHERWISE SPECIFIED
XX ± 1/32
ANGLES ± 30'
FRACTIONS ± 1/16

SCALE
HORIZONTAL 1" = 50'
VERTICAL

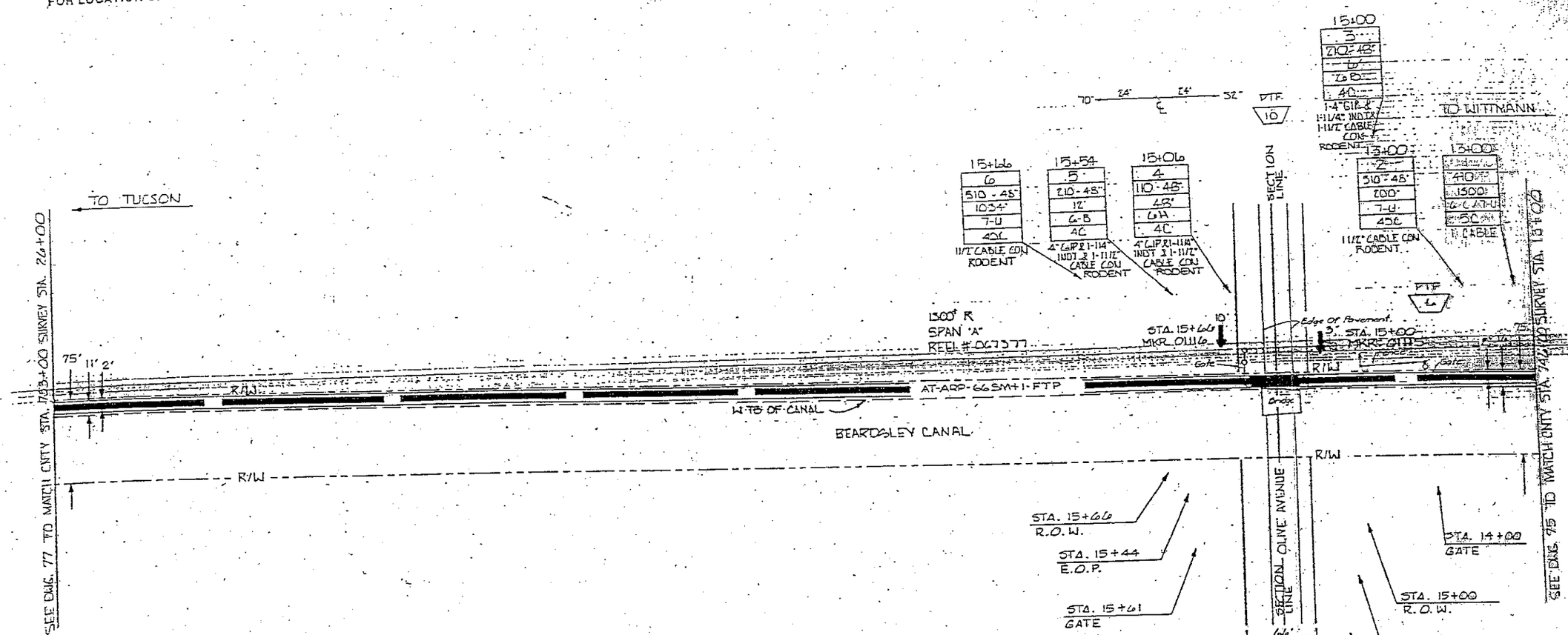
DEPT. ID: 1104 LOC. ID: 0.4.1

MP 11 TO MP 12

SHEET 77 OF

DWG. NO.

NOTE: 1. CONTRACTOR RESPONSIBLE FOR LOCATING AND PROBING ALL UNDERGROUND STRUCTURES PRIOR TO EXCAVATING.
2. SEE DWG. 13 FOR CONTACT NUMBERS OF UTILITIES.
3. CALL "BLUE STAKE CENTER" AT 602-263-1100 FOR LOCATION OF UTILITIES.



PROJECT # OBT50
SPAN
BUCKEYE TO WITTMANN
MAP FOOTAGE
SURVEY 1500'
RAILROAD
MATERIAL LIST QUAN
CABLE
4" GIP
4" PVC
1 1/4" CORR INDT
4" SPLIT GIP
4" SPLIT PVC
MH 3' X 5' X 2.5'
MH 4' X 4' X 4'
BURC CA. MKRS.
10M STRAND
10" STEEL CASING
1 1/2" CABLE CON

MCI
TELECOMMUNICATIONS CORPORATION
LIGHTWAVE SYSTEMS
FIBER OPTIC CABLE ROUTE

TITLE

DATE 10/23/87
ENGINEER ROY D
REVISIONS
DATE | DESCRIPTION
4/11/5 | AS-BUILT

EXCEPT AS MAY BE OTHERWISE PROVIDED IN THE CONTRACT, THESE DRAWINGS AND SPECIFICATIONS SHALL REMAIN THE PROPERTY OF TELECOMMUNICATIONS CORPORATION BEING ISSUED IN STRICT CONFIDENCE AND SHALL NOT BE REPRODUCED, COPIED OR USED FOR ANY PURPOSE WITHOUT SPECIFIC WRITTEN PERMISSION.

TOLERANCES UNLESS OTHERWISE SPECIFIED:
X.X = ± .02 X.XX = ± .01 X.XXX = ± .005
ANGLES: ± 30' FRACTIONS ± 1/64

SCALE
HORIZONTAL 1" = 1'
VERTICAL

DEPT. ID: 104 LOC.
MP 11 TO M
SHEET 10 OF
DWG. NO.