DRAINAGE REPORT
FOR
DEL MAR HIGHLANDS ESTATES
AFFORDABLE HOUSING SITE

January 23, 2020

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FOR REVIEW ONLY

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INTRODUCTION

Pardee Homes is proposing to develop the 1.80 acre Del Mar Highlands Estates Affordable Housing Site located at 14163 Old El Camino Real in the city of San Diego (see the Vicinity Map). Civil Sense, Inc. has prepared a grading, utility, and site plan for an amendment to Planned Development No. 1783449 and Site Development Permit No. 1828039.

The site has been mass graded into a gently sloping pad as part of Del Mar Highlands Estates Parcel A. Parcel A is developed with three apartment buildings and is immediately west of the site. The current affordable housing project proposes 26 multi-family affordable dwelling units in five buildings, access drives, parking, and landscaping.

Vicinity Map

Under existing, pre-project conditions, the site runoff sheet flows in a southerly to southeasterly direction over the mass graded pad towards a desilting basin at the southeast corner of the pad. The pad is undeveloped and supports weeds, grasses, and brush. Under post-project conditions, the site runoff is conveyed in private drainage facilities to a proposed Modular Wetland System Linear for pollutant control and vault for flow control. These BMPs are located at the southeast corner of the pad. Under both existing and proposed conditions, the runoff is conveyed away from the site in an existing 18-inch RCP. The runoff ultimately flows into Gonzales Canyon Creek south of the site, then northwest to the nearby San Dieguito River, San Dieguito Lagoon, and then Pacific Ocean. This drainage report has been prepared in support of Civil Sense, Inc.'s preliminary grading, utility, and site plan.

HYDROLOGIC RESULTS

The overall study area covers 1.84 acres so the City of San Diego's January 2017, *Drainage Design Manual's* (Manual) rational method procedure was the basis for the existing and proposed condition hydrologic analyses. The *Manual* states that "the underground storm drain system shall be based upon a 50-year frequency storm," and "the combination of storm drain system capacity and overflow will be able to carry the 100-year frequency storm. . . ." Since the site is so small, there will be minimal differences between the 50- and 100-year flow rates, so 100-year analyses are being performed. The CivilDesign Rational Method Hydrology Program is based on the City criteria and was used for the analyses. The rational method input parameters are summarized below and the supporting data is included in Appendix A:

- Intensity-Duration-Frequency: The City's 100-year Intensity-Duration-Frequency curve from the *Drainage Design Manual* was used.

- Drainage area: The existing condition drainage area was delineated from the project's topographic mapping. The existing condition drainage area flows into the southeasterly desilting basin.

  Under proposed conditions, storm runoff is conveyed by private drainage facilities to BMPs that will essentially replace the desilting basin. The overall proposed condition drainage basin has been subdivided into subbasins to reflect the flow patterns. The overall existing and proposed condition drainage areas were set equal to allow a comparison of results.

- Hydrologic soil groups: The soil group within the site is entirely 'D' according to the City criteria.

- Runoff coefficients: Under existing conditions, the site is an undeveloped, mass graded pad, so the rural land use category was assigned. For proposed conditions, the project was modeled with the multi-units land use category.

Condition	Area, acres	Q, cfs
Existing	1.84	1.0
Proposed	1.84	4.3

Table 1. Comparison of 100-Year Rational Method Results

The existing and proposed condition rational method results are included in Appendix A and summarized in Table 1. Table 1 shows that the project will increase the overall flow rate from 1.0 to 4.3 cfs. The vault will be used to provide detention. An initial detention analysis was performed to estimate the storage volume needed to attenuate the 100-year flow by 3.3 cfs. The proposed condition peak flow was converted to a hydrograph using the County's rational method hydrograph procedure. The hydrograph was entered into HEC-1 for the detention analysis. The HEC-1 results are included in Appendix A and show that at least 0.146 acre-feet (6,360 cubic feet) of storage is needed. This volume is available in the vault.

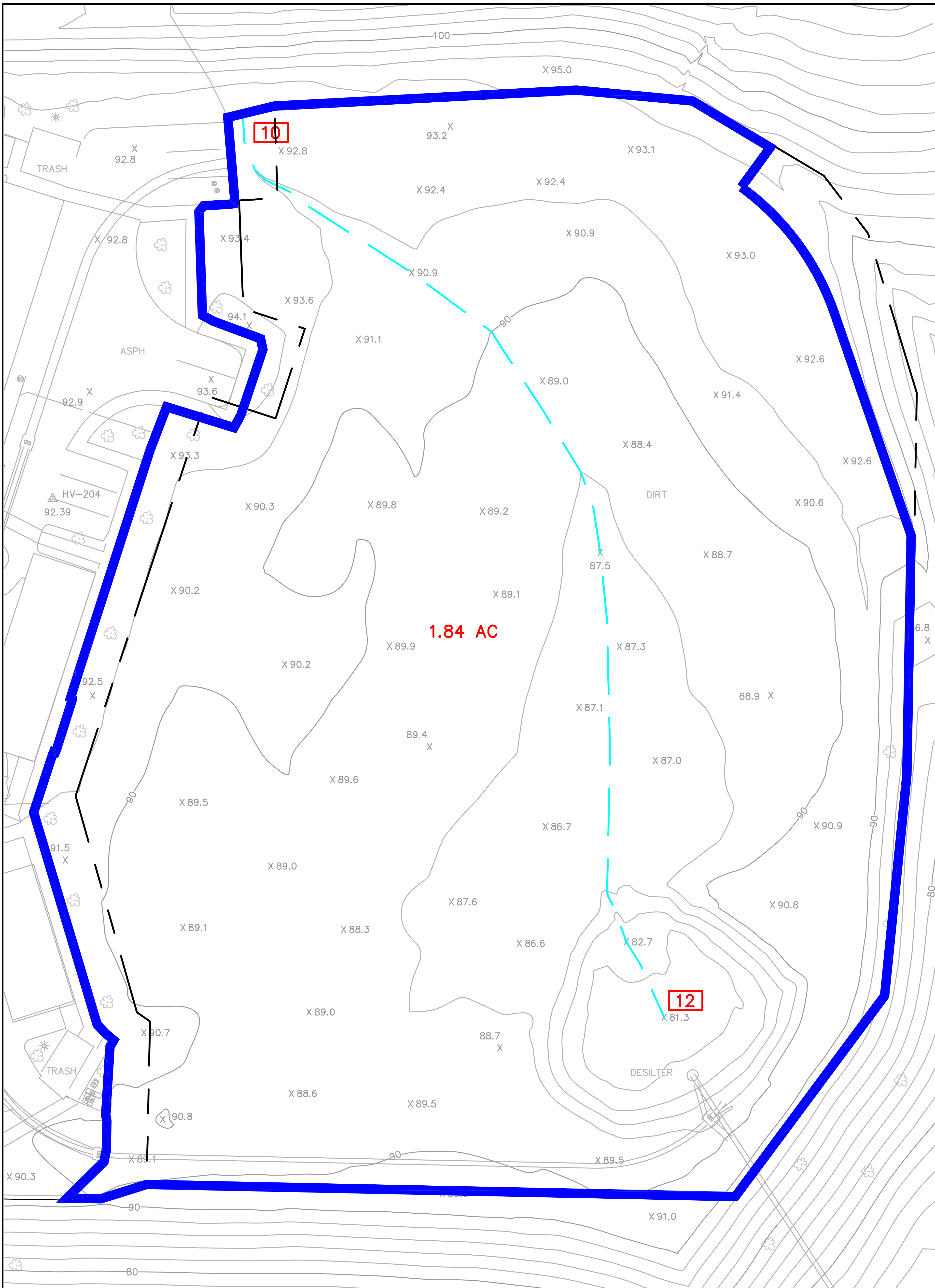
CONCLUSION

The analyses in this drainage report show that the project will cause a small increase in the overall 100-year flow rate. The increase can be attenuated in the proposed vault.

There are no waters of the US at or in the immediate vicinity of the site. Therefore, neither a Federal Clean Water Act Section 401 (Regional Water Quality Control Board) nor 404 permit (US Army Corps of Engineers) are required.

APPENDIX A

HYDROLOGIC RESULTS



LEGEND:

DRAINAGE BASIN BOUNDARY

OVERLAND FLOW PATH

3.62 AC DRAINAGE BASIN AREA

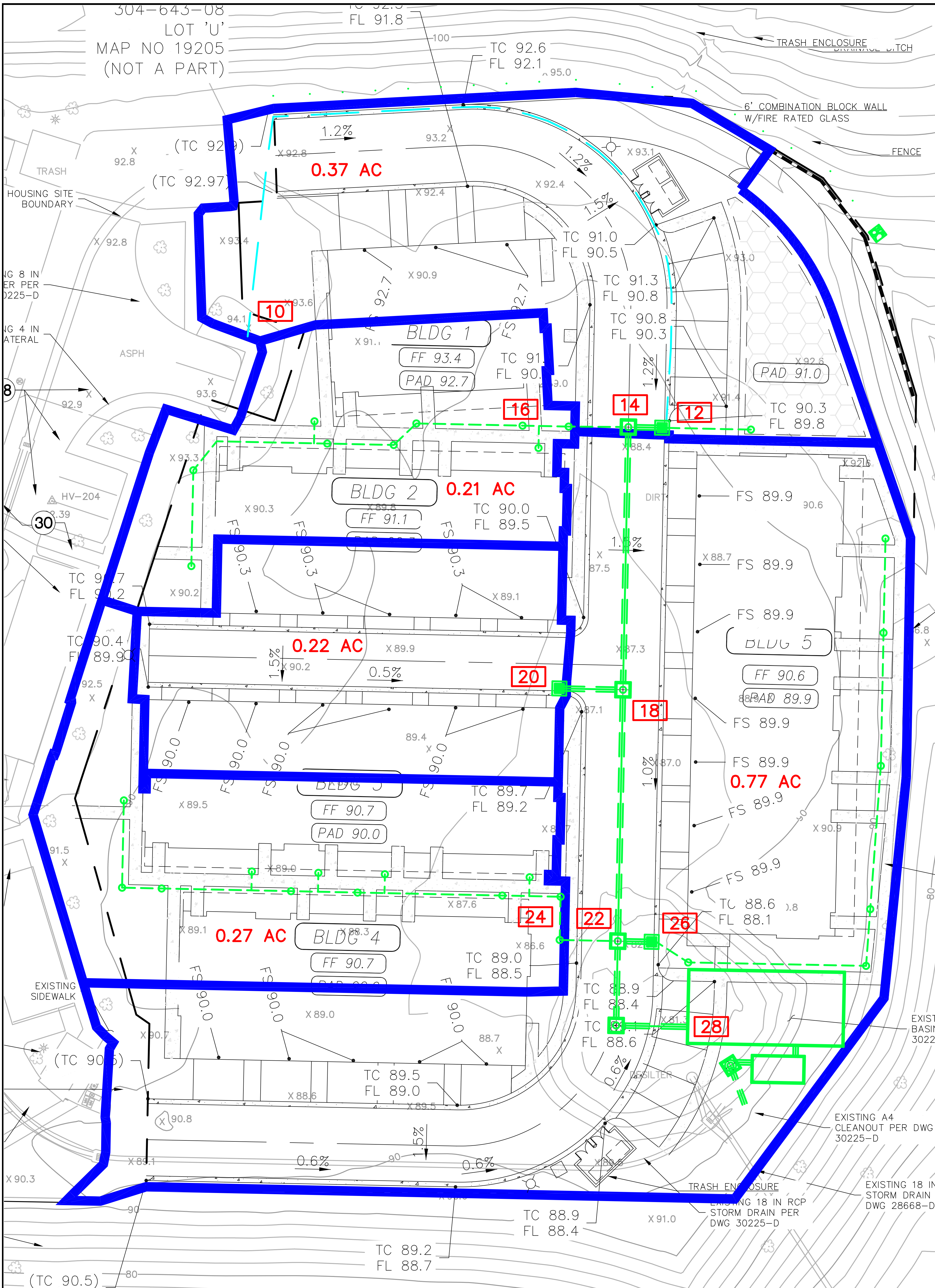
10 RATIONAL METHOD NODE NUMBER

1" = 30'

0 30

EXISTING CONDITION

RATIONAL METHOD WORK MAP



LEGEND:

DRAINAGE BASIN BOUNDARY

OVERLAND FLOW PATH

PROPOSED DRAINAGE FACILITY

3.62 AC DRAINAGE BASIN AREA

10 RATIONAL METHOD NODE NUMBER

1" = 30'

0 30

PROPOSED CONDITION
RATIONAL METHOD WORK MAP

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C)
	Soil Type [1]
Residential:	
Single Family	0.55
Multi-Units	0.70
Mobile Homes	0.65
Rural (lots greater than ½ acre)	0.45
Commercial [2]	
80% Impervious	0.85
Industrial [2]	
90% Impervious	0.95

Note:
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness			=	50%
Tabulated imperviousness			=	80%
Revised C	=	(50/80) x 0.85	=	0.53

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

A.1.3. Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the T_C for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_C calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

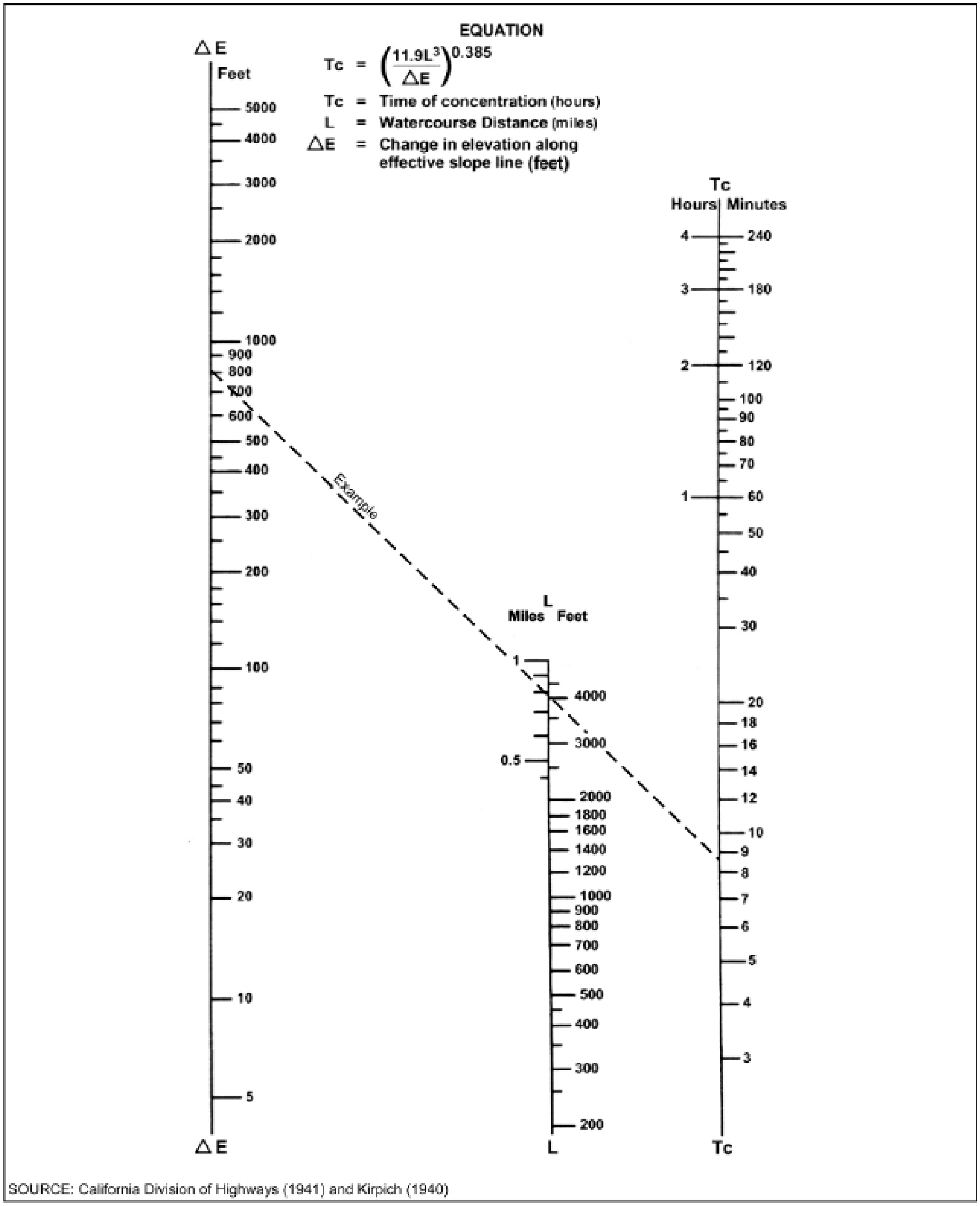


Figure A-2. Nomograph for Determination of T_c for Natural Watersheds

<u>**Note**</u>: Add ten minutes to the computed time of concentration from Figure A-2.

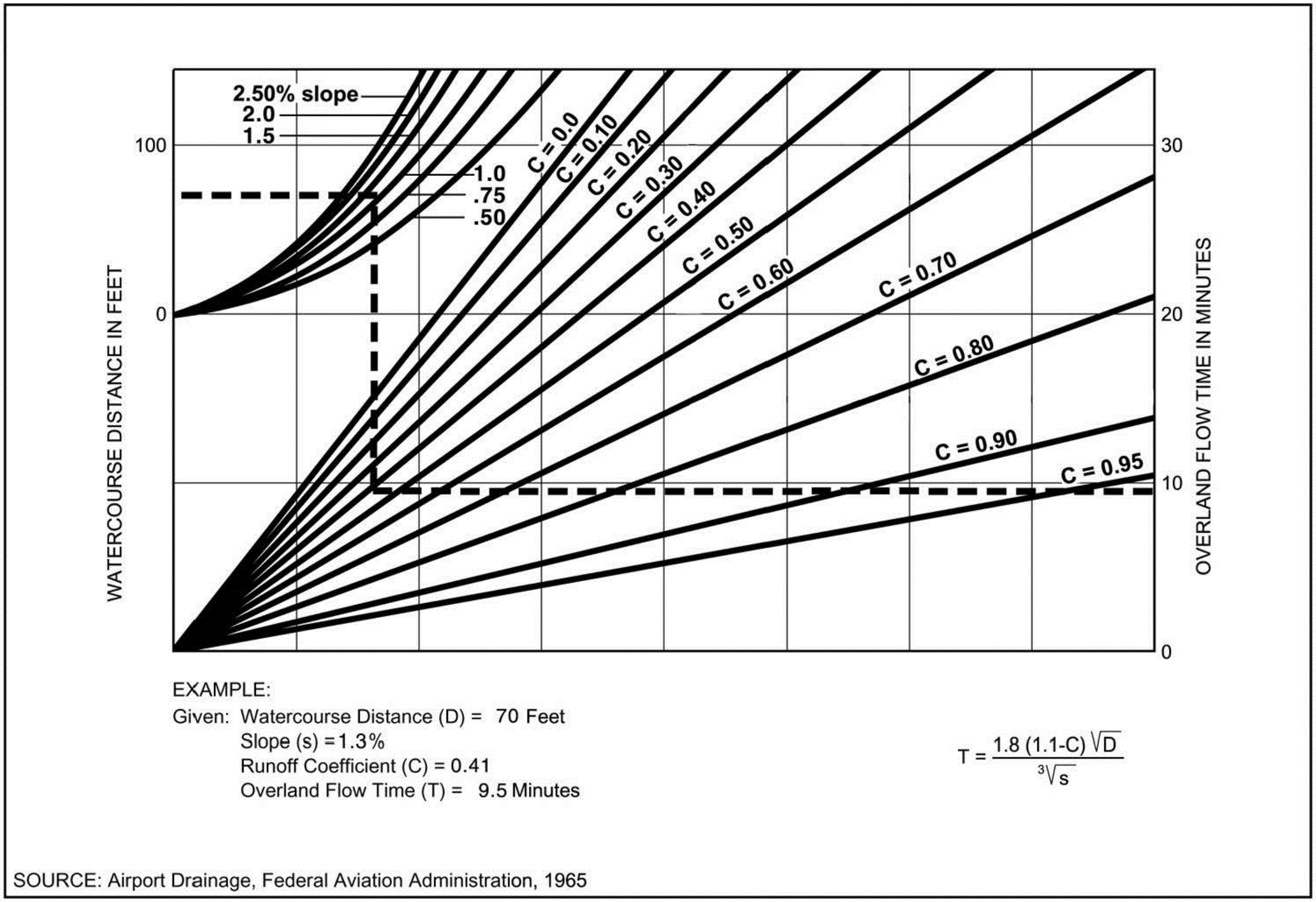
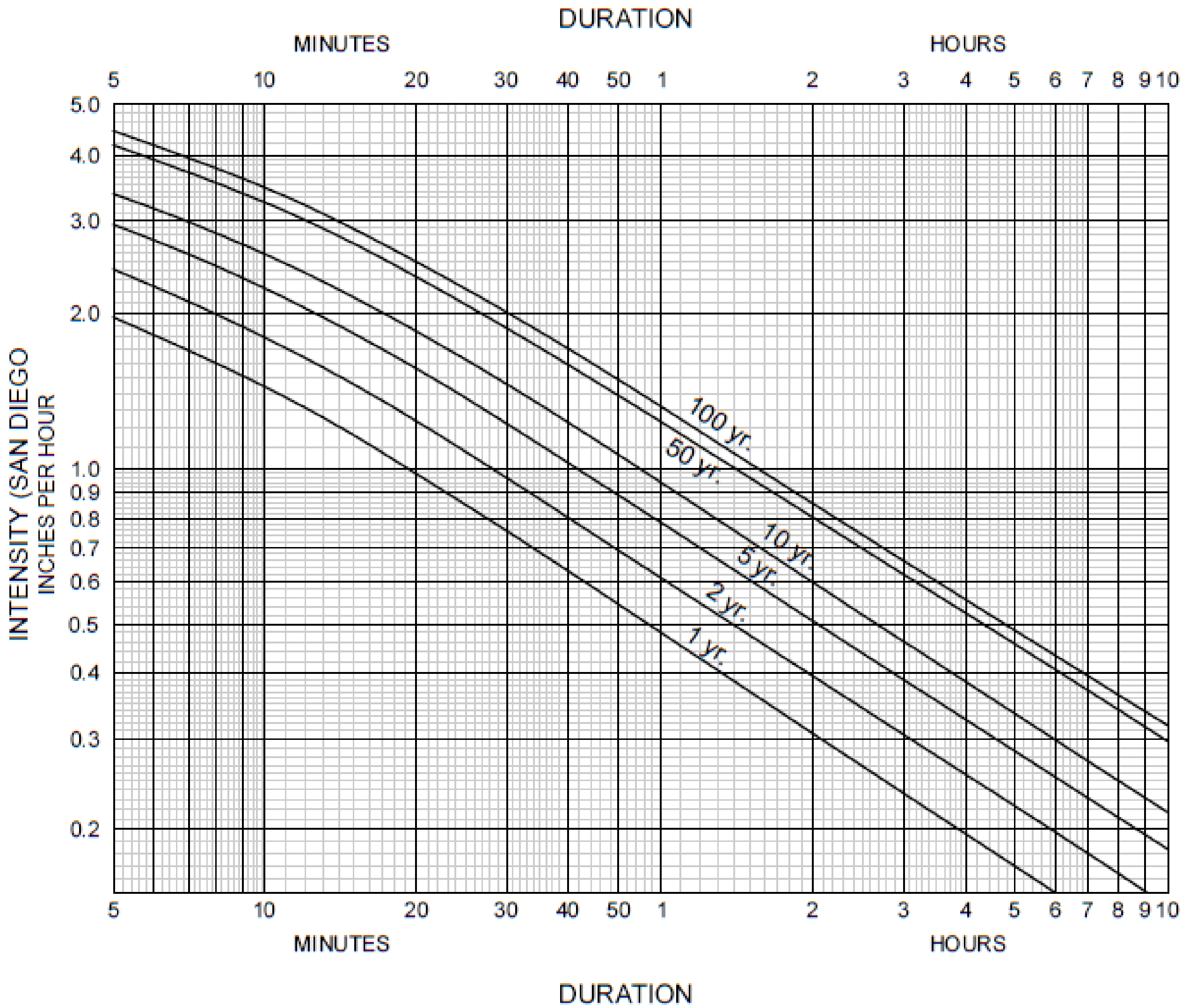


Figure A-4. Rational Formula – Overland Time of Flow Nomograph

Note: Use formula for watercourse distances in excess of 100 feet.



ELEV.	FACTOR
0-1500	1.00
1500-3000	1.25
3000-4000	1.42
4000-5000	1.60
5000-6000	1.7
DESERT	1.25

TO OBTAIN CORRECT INTENSITY, MULTIPLY INTENSITY ON CHART BY FACTOR FOR DESIGN ELEVATION.

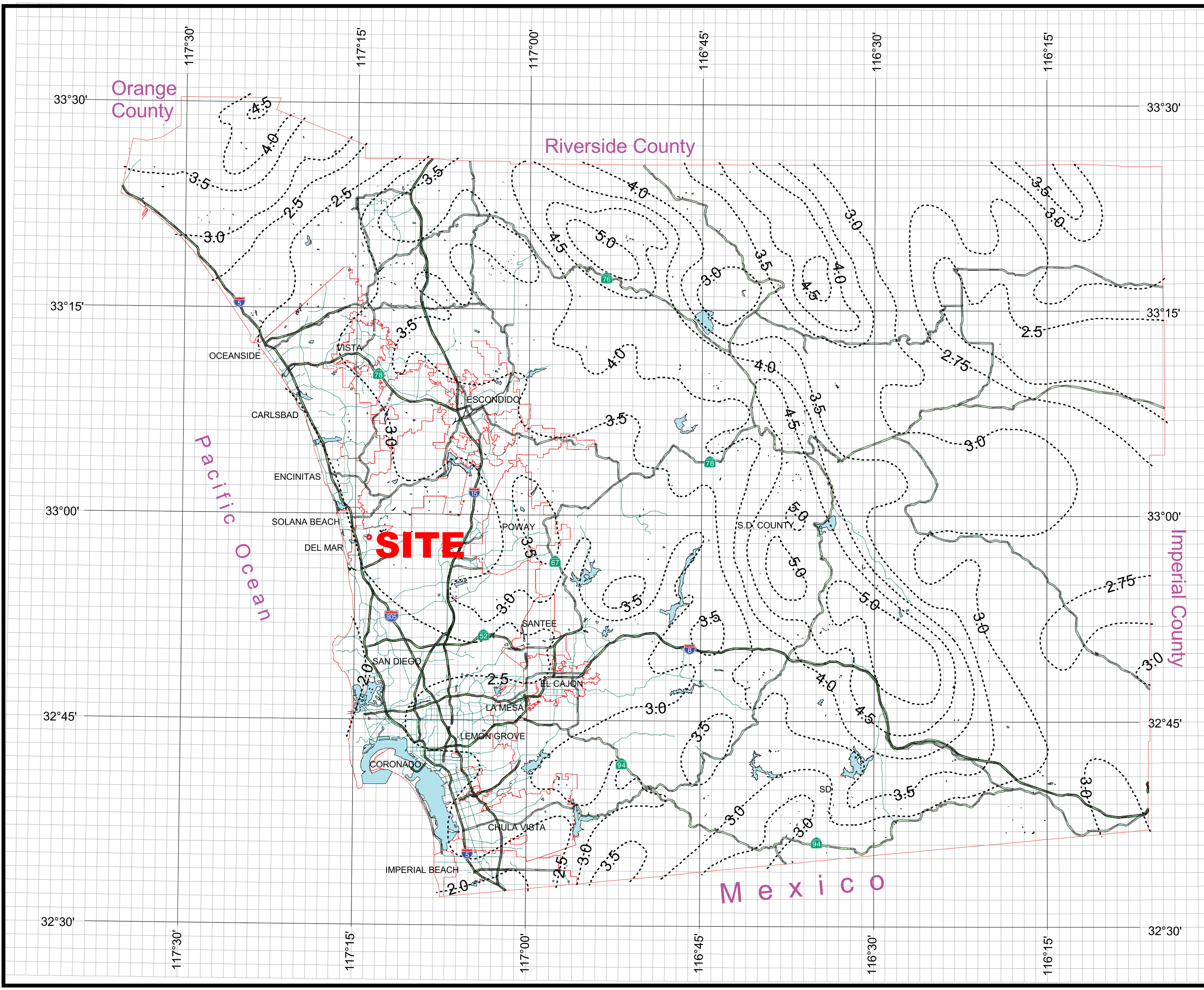
RAINFALL

INTENSITY - DURATION - FREQUENCY CURVES

FOR

COUNTY OF SAN DIEGO

Figure A-1. Intensity-Duration-Frequency Design Chart



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

SITE

P6=2.6"

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

```
          San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.4

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
     Rational Hydrology Study        Date: 01/23/20
------------------------------------------------------------------------
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Del Mar Highlands Estates
Existing Conditions
100-Year Flow Rate

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------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4028

------------------------------------------------------------------------
Rational hydrology study storm event year is     1.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      10.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)+10
min.
Initial subarea flow distance  =  342.000(Ft.)
Highest elevation =   93.500(Ft.)
Lowest elevation =   81.300(Ft.)
Elevation difference =   12.200(Ft.)
TC=[(11.9*0.0648^3)/( 12.20)]^.385=  2.52 + 10 min. =    12.52 min.
Rainfall intensity (I) =      1.226(In/Hr) for a     1.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      1.015(CFS)
Total initial stream area =        1.840(Ac.)
End of computations, total study area =           1.840 (Ac.)
```

```
          San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2005 Version 6.4

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
     Rational Hydrology Study        Date: 01/23/20
------------------------------------------------------------------------
```

Del Mar Highlands Estates
Proposed Conditions
100-Year Flow Rate

```
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4028

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      10.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MULTI - UNITS area type                    ]
Initial subarea flow distance  =  270.000(Ft.)
Highest elevation =   94.100(Ft.)
Lowest elevation =   89.800(Ft.)
Elevation difference =    4.300(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    10.13 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7000)*( 270.000^.5)/( 1.593^(1/3)]=  10.13
Rainfall intensity (I) =      3.358(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.700
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Subarea runoff =      0.870(CFS)
Total initial stream area =        0.370(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      12.000 to Point/Station      14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =    89.800(Ft.)
Downstream point/station elevation =    89.100(Ft.)
Pipe length  =     7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.870(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.870(CFS)
Normal flow depth in pipe =    2.96(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    5.48(In.)
Pipe flow velocity =      8.99(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    10.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      16.000 to Point/Station      14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MULTI - UNITS area type                     ]
Time of concentration =    10.14 min.
Rainfall intensity =      3.357(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.700
Subarea runoff =      0.493(CFS) for    0.210(Ac.)
Total runoff =      1.363(CFS)   Total area =        0.58(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.000 to Point/Station      18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =    89.100(Ft.)
Downstream point/station elevation =    88.300(Ft.)
Pipe length  =    80.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.363(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.363(CFS)
Normal flow depth in pipe =    6.22(In.)
Flow top width inside pipe =    8.31(In.)
Critical Depth =    6.45(In.)
Pipe flow velocity =      4.18(Ft/s)
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Travel time through pipe =    0.32 min.
Time of concentration (TC) =    10.46 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      20.000 to Point/Station      18.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MULTI - UNITS area type                     ]
Time of concentration =    10.46 min.
Rainfall intensity =      3.319(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.700
Subarea runoff =      0.511(CFS) for    0.220(Ac.)
Total runoff =      1.874(CFS)   Total area =        0.80(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      18.000 to Point/Station      22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =    88.300(Ft.)
Downstream point/station elevation =    87.500(Ft.)
Pipe length  =    76.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.874(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.874(CFS)
Normal flow depth in pipe =    6.09(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =    7.00(In.)
Pipe flow velocity =      4.68(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =    10.73 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      24.000 to Point/Station      22.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MULTI - UNITS area type                     ]
Time of concentration =    10.73 min.
Rainfall intensity =      3.289(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.700
Subarea runoff =      0.622(CFS) for    0.270(Ac.)
Total runoff =      2.496(CFS)   Total area =        1.07(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station      22.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MULTI - UNITS area type                    ]
Time of concentration =    10.73 min.
Rainfall intensity =      3.289(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.700
Subarea runoff =      1.773(CFS) for    0.770(Ac.)
Total runoff =      4.269(CFS)   Total area =        1.84(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station      28.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =    87.500(Ft.)
Downstream point/station elevation =    87.000(Ft.)
Pipe length  =    48.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.269(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.269(CFS)
Normal flow depth in pipe =    8.79(In.)
Flow top width inside pipe =   14.78(In.)
Critical Depth =   10.04(In.)
Pipe flow velocity =      5.71(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    10.87 min.
End of computations, total study area =           1.840 (Ac.)
```

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   23JAN20  TIME  20:56:35  *
*                                      *
****************************************
```

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

                      *DIAGRAM
*** FREE ***
           1          ID   DEL MAR HIGHLANDS ESTATES
           2          ID   CONCEPTUAL SINGLE SUBAREA DETENTION ANALYSIS
           3          ID   100-YEAR STORM EVENT
           4          IT       2 01JAN90    1200     200

           5          KK    SITE
           6          KM   RATIONAL METHOD HYDROGRAPH PROGRAM
           7          KM   100-YEAR, 6-HOUR RAINFALL IS 2.6 INCHES
           8          KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.70
           9          KM   RATIONAL METHOD TIME OF CONCENTRATION IS 10.87 MINUTES
          10          BA  0.0029
          11          IN      11 01JAN90    1153
          12          QI       0     0.2     0.2     0.2     0.2     0.2     0.2     0.2     0.3     0.3
          13          QI     0.3     0.3     0.3     0.3     0.4     0.4     0.4     0.5     0.5     0.6
          14          QI     0.7     1.1     2.5     4.3     0.8     0.6     0.4     0.4     0.3     0.3
          15          QI     0.3     0.2     0.2     0.2       0       0       0       0       0       0
          16          QI       0       0       0       0       0

          17          KK  DETAIN
          18          RS       1    STOR      -1
          19          SV       0   0.146
          20          SQ       0     1.0
          21          SE     100     101
          22          ZZ
```

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

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

   5        SITE
               V
               V
  17      DETAIN

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

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*****************************************                                                    ***************************************
*                                       *                                                    *                                     *
*   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   23JAN20  TIME  20:56:35   *                                                    *          (916) 756-1104             *
*                                       *                                                    *                                     *
*****************************************                                                    ***************************************



                          DEL MAR HIGHLANDS ESTATES
                          CONCEPTUAL SINGLE SUBAREA DETENTION ANALYSIS
                          100-YEAR STORM EVENT

    IT          HYDROGRAPH TIME DATA
                      NMIN          2  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1JAN90  STARTING DATE
                     ITIME       1200  STARTING TIME
                        NQ        200  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     1JAN90  ENDING DATE
                    NDTIME       1838  ENDING TIME
                    ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .03 HOURS
                     TOTAL TIME BASE    6.63 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


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


            **************
            *            *
   5 KK     *     SITE   *
            *            *
            **************
                          RATIONAL METHOD HYDROGRAPH PROGRAM
                          100-YEAR, 6-HOUR RAINFALL IS 2.6 INCHES
                          RATIONAL METHOD RUNOFF COEFFICIENT IS 0.70
                          RATIONAL METHOD TIME OF CONCENTRATION IS 10.87 MINUTES

  11 IN         TIME DATA FOR INPUT TIME SERIES
                     JXMIN         11  TIME INTERVAL IN MINUTES
                    JXDATE     1JAN90  STARTING DATE
                    JXTIME       1153  STARTING TIME

              SUBBASIN RUNOFF DATA

  10 BA         SUBBASIN CHARACTERISTICS
                     TAREA        .00  SUBBASIN AREA

                                                                ***

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

                                                  HYDROGRAPH AT STATION     SITE

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

DA MON HRMN	ORD	FLOW	*	DA MON HRMN	ORD	FLOW	*	DA MON HRMN	ORD	FLOW	*	DA MON HRMN	ORD	FLOW
1 JAN 1200	1	0.	*	1 JAN 1340	51	0.	*	1 JAN 1520	101	1.	*	1 JAN 1700	151	0.
1 JAN 1202	2	0.	*	1 JAN 1342	52	0.	*	1 JAN 1522	102	1.	*	1 JAN 1702	152	0.
1 JAN 1204	3	0.	*	1 JAN 1344	53	0.	*	1 JAN 1524	103	1.	*	1 JAN 1704	153	0.
1 JAN 1206	4	0.	*	1 JAN 1346	54	0.	*	1 JAN 1526	104	1.	*	1 JAN 1706	154	0.
1 JAN 1208	5	0.	*	1 JAN 1348	55	0.	*	1 JAN 1528	105	1.	*	1 JAN 1708	155	0.
1 JAN 1210	6	0.	*	1 JAN 1350	56	0.	*	1 JAN 1530	106	1.	*	1 JAN 1710	156	0.
1 JAN 1212	7	0.	*	1 JAN 1352	57	0.	*	1 JAN 1532	107	1.	*	1 JAN 1712	157	0.
1 JAN 1214	8	0.	*	1 JAN 1354	58	0.	*	1 JAN 1534	108	1.	*	1 JAN 1714	158	0.
1 JAN 1216	9	0.	*	1 JAN 1356	59	0.	*	1 JAN 1536	109	1.	*	1 JAN 1716	159	0.
1 JAN 1218	10	0.	*	1 JAN 1358	60	0.	*	1 JAN 1538	110	1.	*	1 JAN 1718	160	0.
1 JAN 1220	11	0.	*	1 JAN 1400	61	0.	*	1 JAN 1540	111	1.	*	1 JAN 1720	161	0.
1 JAN 1222	12	0.	*	1 JAN 1402	62	0.	*	1 JAN 1542	112	1.	*	1 JAN 1722	162	0.
1 JAN 1224	13	0.	*	1 JAN 1404	63	0.	*	1 JAN 1544	113	1.	*	1 JAN 1724	163	0.
1 JAN 1226	14	0.	*	1 JAN 1406	64	0.	*	1 JAN 1546	114	1.	*	1 JAN 1726	164	0.
1 JAN 1228	15	0.	*	1 JAN 1408	65	0.	*	1 JAN 1548	115	2.	*	1 JAN 1728	165	0.
1 JAN 1230	16	0.	*	1 JAN 1410	66	0.	*	1 JAN 1550	116	2.	*	1 JAN 1730	166	0.
1 JAN 1232	17	0.	*	1 JAN 1412	67	0.	*	1 JAN 1552	117	2.	*	1 JAN 1732	167	0.
1 JAN 1234	18	0.	*	1 JAN 1414	68	0.	*	1 JAN 1554	118	2.	*	1 JAN 1734	168	0.
1 JAN 1236	19	0.	*	1 JAN 1416	69	0.	*	1 JAN 1556	119	3.	*	1 JAN 1736	169	0.
1 JAN 1238	20	0.	*	1 JAN 1418	70	0.	*	1 JAN 1558	120	3.	*	1 JAN 1738	170	0.
1 JAN 1240	21	0.	*	1 JAN 1420	71	0.	*	1 JAN 1600	121	3.	*	1 JAN 1740	171	0.
1 JAN 1242	22	0.	*	1 JAN 1422	72	0.	*	1 JAN 1602	122	4.	*	1 JAN 1742	172	0.
1 JAN 1244	23	0.	*	1 JAN 1424	73	0.	*	1 JAN 1604	123	4.	*	1 JAN 1744	173	0.
1 JAN 1246	24	0.	*	1 JAN 1426	74	0.	*	1 JAN 1606	124	4.	*	1 JAN 1746	174	0.
1 JAN 1248	25	0.	*	1 JAN 1428	75	0.	*	1 JAN 1608	125	4.	*	1 JAN 1748	175	0.
1 JAN 1250	26	0.	*	1 JAN 1430	76	0.	*	1 JAN 1610	126	3.	*	1 JAN 1750	176	0.
1 JAN 1252	27	0.	*	1 JAN 1432	77	0.	*	1 JAN 1612	127	2.	*	1 JAN 1752	177	0.
1 JAN 1254	28	0.	*	1 JAN 1434	78	0.	*	1 JAN 1614	128	2.	*	1 JAN 1754	178	0.
1 JAN 1256	29	0.	*	1 JAN 1436	79	0.	*	1 JAN 1616	129	1.	*	1 JAN 1756	179	0.
1 JAN 1258	30	0.	*	1 JAN 1438	80	0.	*	1 JAN 1618	130	1.	*	1 JAN 1758	180	0.
1 JAN 1300	31	0.	*	1 JAN 1440	81	0.	*	1 JAN 1620	131	1.	*	1 JAN 1800	181	0.
1 JAN 1302	32	0.	*	1 JAN 1442	82	0.	*	1 JAN 1622	132	1.	*	1 JAN 1802	182	0.
1 JAN 1304	33	0.	*	1 JAN 1444	83	0.	*	1 JAN 1624	133	1.	*	1 JAN 1804	183	0.
1 JAN 1306	34	0.	*	1 JAN 1446	84	0.	*	1 JAN 1626	134	1.	*	1 JAN 1806	184	0.
1 JAN 1308	35	0.	*	1 JAN 1448	85	0.	*	1 JAN 1628	135	1.	*	1 JAN 1808	185	0.
1 JAN 1310	36	0.	*	1 JAN 1450	86	0.	*	1 JAN 1630	136	1.	*	1 JAN 1810	186	0.
1 JAN 1312	37	0.	*	1 JAN 1452	87	0.	*	1 JAN 1632	137	1.	*	1 JAN 1812	187	0.
1 JAN 1314	38	0.	*	1 JAN 1454	88	0.	*	1 JAN 1634	138	0.	*	1 JAN 1814	188	0.
1 JAN 1316	39	0.	*	1 JAN 1456	89	0.	*	1 JAN 1636	139	0.	*	1 JAN 1816	189	0.
1 JAN 1318	40	0.	*	1 JAN 1458	90	0.	*	1 JAN 1638	140	0.	*	1 JAN 1818	190	0.
1 JAN 1320	41	0.	*	1 JAN 1500	91	1.	*	1 JAN 1640	141	0.	*	1 JAN 1820	191	0.
1 JAN 1322	42	0.	*	1 JAN 1502	92	1.	*	1 JAN 1642	142	0.	*	1 JAN 1822	192	0.
1 JAN 1324	43	0.	*	1 JAN 1504	93	1.	*	1 JAN 1644	143	0.	*	1 JAN 1824	193	0.
1 JAN 1326	44	0.	*	1 JAN 1506	94	1.	*	1 JAN 1646	144	0.	*	1 JAN 1826	194	0.
1 JAN 1328	45	0.	*	1 JAN 1508	95	1.	*	1 JAN 1648	145	0.	*	1 JAN 1828	195	0.
1 JAN 1330	46	0.	*	1 JAN 1510	96	1.	*	1 JAN 1650	146	0.	*	1 JAN 1830	196	0.
1 JAN 1332	47	0.	*	1 JAN 1512	97	1.	*	1 JAN 1652	147	0.	*	1 JAN 1832	197	0.
1 JAN 1334	48	0.	*	1 JAN 1514	98	1.	*	1 JAN 1654	148	0.	*	1 JAN 1834	198	0.
1 JAN 1336	49	0.	*	1 JAN 1516	99	1.	*	1 JAN 1656	149	0.	*	1 JAN 1836	199	0.
1 JAN 1338	50	0.	*	1 JAN 1518	100	1.	*	1 JAN 1658	150	0.	*	1 JAN 1838	200	0.

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	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	6.63-HR
+	(CFS)	(HR)					
			(CFS)				
+	4.	4.10		1.	1.	1.	1.
			(INCHES)	1.786	1.791	1.791	1.791
			(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .00 SQ MI

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          **************
          *            *
   17 KK  *   DETAIN   *
          *            *
          **************

             HYDROGRAPH ROUTING DATA

   18 RS        STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X        .00 WORKING R AND D COEFFICIENT

   19 SV          STORAGE          .0        .1

   20 SQ        DISCHARGE          0.        1.

   21 SE        ELEVATION      100.00    101.00

                                                                               ***

 WARNING --- ROUTED OUTFLOW (      1.) IS GREATER THAN MAXIMUM OUTFLOW (      1.) IN STORAGE-OUTFLOW TABLE

 WARNING --- ROUTED OUTFLOW (      1.) IS GREATER THAN MAXIMUM OUTFLOW (      1.) IN STORAGE-OUTFLOW TABLE

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HYDROGRAPH AT STATION DETAIN

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	JAN	1200	1	0.	.0	100.1	*	1	JAN	1414	68	0.	.0	100.2	*	1	JAN	1628	135	1.	.1	101.0
1	JAN	1202	2	0.	.0	100.1	*	1	JAN	1416	69	0.	.0	100.2	*	1	JAN	1630	136	1.	.1	101.0
1	JAN	1204	3	0.	.0	100.1	*	1	JAN	1418	70	0.	.0	100.2	*	1	JAN	1632	137	1.	.1	101.0
1	JAN	1206	4	0.	.0	100.1	*	1	JAN	1420	71	0.	.0	100.2	*	1	JAN	1634	138	1.	.1	100.9
1	JAN	1208	5	0.	.0	100.1	*	1	JAN	1422	72	0.	.0	100.2	*	1	JAN	1636	139	1.	.1	100.9
1	JAN	1210	6	0.	.0	100.1	*	1	JAN	1424	73	0.	.0	100.2	*	1	JAN	1638	140	1.	.1	100.9
1	JAN	1212	7	0.	.0	100.1	*	1	JAN	1426	74	0.	.0	100.2	*	1	JAN	1640	141	1.	.1	100.9
1	JAN	1214	8	0.	.0	100.1	*	1	JAN	1428	75	0.	.0	100.2	*	1	JAN	1642	142	1.	.1	100.9
1	JAN	1216	9	0.	.0	100.1	*	1	JAN	1430	76	0.	.0	100.2	*	1	JAN	1644	143	1.	.1	100.9
1	JAN	1218	10	0.	.0	100.1	*	1	JAN	1432	77	0.	.0	100.2	*	1	JAN	1646	144	1.	.1	100.9
1	JAN	1220	11	0.	.0	100.1	*	1	JAN	1434	78	0.	.0	100.2	*	1	JAN	1648	145	1.	.1	100.9
1	JAN	1222	12	0.	.0	100.1	*	1	JAN	1436	79	0.	.0	100.2	*	1	JAN	1650	146	1.	.1	100.9
1	JAN	1224	13	0.	.0	100.1	*	1	JAN	1438	80	0.	.0	100.3	*	1	JAN	1652	147	1.	.1	100.9
1	JAN	1226	14	0.	.0	100.1	*	1	JAN	1440	81	0.	.0	100.3	*	1	JAN	1654	148	1.	.1	100.9
1	JAN	1228	15	0.	.0	100.1	*	1	JAN	1442	82	0.	.0	100.3	*	1	JAN	1656	149	1.	.1	100.8
1	JAN	1230	16	0.	.0	100.1	*	1	JAN	1444	83	0.	.0	100.3	*	1	JAN	1658	150	1.	.1	100.8
1	JAN	1232	17	0.	.0	100.1	*	1	JAN	1446	84	0.	.0	100.3	*	1	JAN	1700	151	1.	.1	100.8
1	JAN	1234	18	0.	.0	100.1	*	1	JAN	1448	85	0.	.0	100.3	*	1	JAN	1702	152	1.	.1	100.8
1	JAN	1236	19	0.	.0	100.1	*	1	JAN	1450	86	0.	.0	100.3	*	1	JAN	1704	153	1.	.1	100.8
1	JAN	1238	20	0.	.0	100.1	*	1	JAN	1452	87	0.	.0	100.3	*	1	JAN	1706	154	1.	.1	100.8
1	JAN	1240	21	0.	.0	100.1	*	1	JAN	1454	88	0.	.0	100.3	*	1	JAN	1708	155	1.	.1	100.8
1	JAN	1242	22	0.	.0	100.2	*	1	JAN	1456	89	0.	.0	100.3	*	1	JAN	1710	156	1.	.1	100.8
1	JAN	1244	23	0.	.0	100.2	*	1	JAN	1458	90	0.	.0	100.3	*	1	JAN	1712	157	1.	.1	100.8
1	JAN	1246	24	0.	.0	100.2	*	1	JAN	1500	91	0.	.0	100.3	*	1	JAN	1714	158	1.	.1	100.8
1	JAN	1248	25	0.	.0	100.2	*	1	JAN	1502	92	0.	.0	100.3	*	1	JAN	1716	159	1.	.1	100.8
1	JAN	1250	26	0.	.0	100.2	*	1	JAN	1504	93	0.	.0	100.3	*	1	JAN	1718	160	1.	.1	100.7
1	JAN	1252	27	0.	.0	100.2	*	1	JAN	1506	94	0.	.0	100.3	*	1	JAN	1720	161	1.	.1	100.7
1	JAN	1254	28	0.	.0	100.2	*	1	JAN	1508	95	0.	.0	100.3	*	1	JAN	1722	162	1.	.1	100.7
1	JAN	1256	29	0.	.0	100.2	*	1	JAN	1510	96	0.	.0	100.3	*	1	JAN	1724	163	1.	.1	100.7
1	JAN	1258	30	0.	.0	100.2	*	1	JAN	1512	97	0.	.0	100.3	*	1	JAN	1726	164	1.	.1	100.7
1	JAN	1300	31	0.	.0	100.2	*	1	JAN	1514	98	0.	.0	100.3	*	1	JAN	1728	165	1.	.1	100.7
1	JAN	1302	32	0.	.0	100.2	*	1	JAN	1516	99	0.	.0	100.3	*	1	JAN	1730	166	1.	.1	100.7
1	JAN	1304	33	0.	.0	100.2	*	1	JAN	1518	100	0.	.0	100.3	*	1	JAN	1732	167	1.	.1	100.7
1	JAN	1306	34	0.	.0	100.2	*	1	JAN	1520	101	0.	.0	100.3	*	1	JAN	1734	168	1.	.1	100.7
1	JAN	1308	35	0.	.0	100.2	*	1	JAN	1522	102	0.	.0	100.3	*	1	JAN	1736	169	1.	.1	100.7
1	JAN	1310	36	0.	.0	100.2	*	1	JAN	1524	103	0.	.0	100.3	*	1	JAN	1738	170	1.	.1	100.7

1 JAN 1312	37	0.	.0	100.2 *	1 JAN 1526	104	0.	.0	100.3 *	1 JAN 1740	171	1.	.1	100.7
1 JAN 1314	38	0.	.0	100.2 *	1 JAN 1528	105	0.	.1	100.3 *	1 JAN 1742	172	1.	.1	100.6
1 JAN 1316	39	0.	.0	100.2 *	1 JAN 1530	106	0.	.1	100.4 *	1 JAN 1744	173	1.	.1	100.6
1 JAN 1318	40	0.	.0	100.2 *	1 JAN 1532	107	0.	.1	100.4 *	1 JAN 1746	174	1.	.1	100.6
1 JAN 1320	41	0.	.0	100.2 *	1 JAN 1534	108	0.	.1	100.4 *	1 JAN 1748	175	1.	.1	100.6
1 JAN 1322	42	0.	.0	100.2 *	1 JAN 1536	109	0.	.1	100.4 *	1 JAN 1750	176	1.	.1	100.6
1 JAN 1324	43	0.	.0	100.2 *	1 JAN 1538	110	0.	.1	100.4 *	1 JAN 1752	177	1.	.1	100.6
1 JAN 1326	44	0.	.0	100.2 *	1 JAN 1540	111	0.	.1	100.4 *	1 JAN 1754	178	1.	.1	100.6
1 JAN 1328	45	0.	.0	100.2 *	1 JAN 1542	112	0.	.1	100.4 *	1 JAN 1756	179	1.	.1	100.6
1 JAN 1330	46	0.	.0	100.2 *	1 JAN 1544	113	0.	.1	100.4 *	1 JAN 1758	180	1.	.1	100.6
1 JAN 1332	47	0.	.0	100.2 *	1 JAN 1546	114	0.	.1	100.4 *	1 JAN 1800	181	1.	.1	100.6
1 JAN 1334	48	0.	.0	100.2 *	1 JAN 1548	115	0.	.1	100.4 *	1 JAN 1802	182	1.	.1	100.6
1 JAN 1336	49	0.	.0	100.2 *	1 JAN 1550	116	0.	.1	100.5 *	1 JAN 1804	183	1.	.1	100.6
1 JAN 1338	50	0.	.0	100.2 *	1 JAN 1552	117	1.	.1	100.5 *	1 JAN 1806	184	1.	.1	100.5
1 JAN 1340	51	0.	.0	100.2 *	1 JAN 1554	118	1.	.1	100.5 *	1 JAN 1808	185	1.	.1	100.5
1 JAN 1342	52	0.	.0	100.2 *	1 JAN 1556	119	1.	.1	100.6 *	1 JAN 1810	186	1.	.1	100.5
1 JAN 1344	53	0.	.0	100.2 *	1 JAN 1558	120	1.	.1	100.6 *	1 JAN 1812	187	1.	.1	100.5
1 JAN 1346	54	0.	.0	100.2 *	1 JAN 1600	121	1.	.1	100.7 *	1 JAN 1814	188	1.	.1	100.5
1 JAN 1348	55	0.	.0	100.2 *	1 JAN 1602	122	1.	.1	100.7 *	1 JAN 1816	189	0.	.1	100.5
1 JAN 1350	56	0.	.0	100.2 *	1 JAN 1604	123	1.	.1	100.8 *	1 JAN 1818	190	0.	.1	100.5
1 JAN 1352	57	0.	.0	100.2 *	1 JAN 1606	124	1.	.1	100.8 *	1 JAN 1820	191	0.	.1	100.5
1 JAN 1354	58	0.	.0	100.2 *	1 JAN 1608	125	1.	.1	100.9 *	1 JAN 1822	192	0.	.1	100.5
1 JAN 1356	59	0.	.0	100.2 *	1 JAN 1610	126	1.	.1	100.9 *	1 JAN 1824	193	0.	.1	100.5
1 JAN 1358	60	0.	.0	100.2 *	1 JAN 1612	127	1.	.1	101.0 *	1 JAN 1826	194	0.	.1	100.5
1 JAN 1400	61	0.	.0	100.2 *	1 JAN 1614	128	1.	.1	101.0 *	1 JAN 1828	195	0.	.1	100.4
1 JAN 1402	62	0.	.0	100.2 *	1 JAN 1616	129	1.	.1	101.0 *	1 JAN 1830	196	0.	.1	100.4
1 JAN 1404	63	0.	.0	100.2 *	1 JAN 1618	130	1.	.1	101.0 *	1 JAN 1832	197	0.	.1	100.4
1 JAN 1406	64	0.	.0	100.2 *	1 JAN 1620	131	1.	.1	101.0 *	1 JAN 1834	198	0.	.1	100.4
1 JAN 1408	65	0.	.0	100.2 *	1 JAN 1622	132	1.	.1	101.0 *	1 JAN 1836	199	0.	.1	100.4
1 JAN 1410	66	0.	.0	100.2 *	1 JAN 1624	133	1.	.1	101.0 *	1 JAN 1838	200	0.	.1	100.4
1 JAN 1412	67	0.	.0	100.2 *	1 JAN 1626	134	1.	.1	101.0 *					
				*					*					

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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR      6.63-HR
+   (CFS)       (HR)
                            (CFS)
+       1.      4.27                   0.          0.          0.          0.
                          (INCHES)   1.484       1.530       1.530       1.530
                           (AC-FT)     0.          0.          0.          0.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                      6-HR        24-HR       72-HR      6.63-HR
+  (AC-FT)      (HR)
       0.       4.27                   0.          0.          0.          0.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                      6-HR        24-HR       72-HR      6.63-HR
+   (FEET)      (HR)
    101.00      4.27                 100.46      100.43      100.43      100.43

                           CUMULATIVE AREA =     .00 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	SITE	4.3	4.10	1.	1.	1.	.00		
+	ROUTED TO	DETAIN	1.0	4.27	0.	0.	0.	.00		
+									101.00	4.27

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