K&S ENGINEERING
Planning Engineering Surveying

HYDROLOGY STUDY

FOR

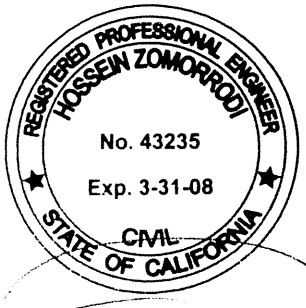
STARCO FOOD MART
S06-026
LOG No. 06-19-021

IN

COUNTY OF SAN DIEGO

JN 05-007

APRIL 17, 2006



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4/17/06
DATE

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1. INTRODUCTION

A. EXISTING CONDITION

The site is located on the north side of Jamacha Boulevard in the County of San Diego, currently the site consists of a vacant pre-graded parcel (0.54Ac), relatively flat with a small slope facing on Jamacha Blvd and Pecos Street. The overland flow path drains southwesterly and southeasterly of the property and the total runoff generated is 0.84CFS

B. PROPOSED CONDITION

The proposed development consist of a gas station with is corresponding food mart, fueling station, trash enclosure and parking areas. The proposed sheet flow drains southwesterly and southeasterly of the property and intercepted by two grated catch basin connected to a curb outlet which will exit to the public curb and gutter. Total runoff generated is 2.48CFS

3. HYDROLOGY DESIGN MODELS

A. *DESIGN METHODS*

THE RATIONAL METHOD IS USED IN THIS HYDROLOGY STUDY; THE RATIONAL FORMULA IS AS FOLLOWS:

Q = CIA, WHERE : Q= PEAK DISCHARGE IN CUBIC FEET/SECOND *

C = RUNOFF COEFFICIENT (DIMENSIONLESS)

I = RAINFALL INTENSITY IN INCHES/HOUR

A = TRIBUTARY DRAINAGE AREA IN ACRES

*1 ACRE INCHES/HOUR = 1.008 CUBIC FEET/SEC

THE OVERLAND METHOD IS ALSO USED IN THIS HYDROLOGY STUDY; THE URBAN AREAS OVERLAND FORMULA IS AS FOLLOWS:

$$T=[1.8(1.1-C)(L)^{(.5)})]/[S(100)]^{.333}$$

L = LENGTH OF WATERSHED

C = COEFFICIENT OF RUNOFF

T = TIME IN MINUTES

S = DIFFERENCE IN ELEVATION DIVIDED BY DE LENGTH OF WATERSHED

B. *DESIGN CRITERIA*

- FREQUENCY, 100 YEAR STORM.
- LAND USE PER SPECIFIC PLAN AND TENTATIVE MAP.
- RAIN FALL INTENSITY PER COUNTY OF SAN DIEGO 2003 HYDROLOGY DESIGN MANUAL.

C. *REFERENCES*

- COUNTY OF SAN DIEGO 2003, HYDROLOGY DESIGN MANUAL.
- COUNTY OF SAN DIEGO 2003 REGIONAL STANDARD DRAWING.
- HAND BOOK OF HYDRAULICS BY BRATER & KING, SIXTH EDITION.

APPENDIX A

(4. HYDROLOGIC CALCULATIONS)

EXISTING CONDITION

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 05/01/06
--------------------------------------------------------------------------
 *********  Hydrology Study Control Information **********

--------------------------------------------------------------------------
Program License Serial Number 4035                  05-007UND
--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.900
24 hour precipitation(inches) =  5.800
P6/P24 =    50.0%
San Diego hydrology manual 'C' values used
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** 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
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  331.600(Ft.)
Lowest elevation =  330.110(Ft.)
Elevation difference =    1.490(Ft.) Slope =  2.980 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   2.98 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.38 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(   2.980^(1/3)]=   9.38
Rainfall intensity (I) =      5.092(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.105(CFS)
Total initial stream area =        0.059(Ac.)


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Process from Point/Station        2.000 to Point/Station        3.000
**** IMPROVED CHANNEL TRAVEL TIME ****
-------------------------------------------------------------------------
Upstream point elevation =   330.110(Ft.)
Downstream point elevation =   328.900(Ft.)
Channel length thru subarea  =    64.000(Ft.)
Channel base width  =    0.000(Ft.)
Slope or 'Z' of left channel bank =  80.000
Slope or 'Z' of right channel bank =  80.000
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Estimated mean flow rate at midpoint of channel =       0.299(CFS)
Manning's 'N'     = 0.035
Maximum depth of channel  =     0.500(Ft.)
Flow(q) thru subarea =       0.299(CFS)
Depth of flow =    0.075(Ft.), Average velocity =    0.657(Ft/s)
Channel flow top width =    12.078(Ft.)

Flow Velocity =     0.66(Ft/s)
Travel time  =     1.62 min.
Time of concentration =    11.01 min.
Critical depth =       0.062(Ft.)
 Adding area flow to channel
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
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =       4.593(In/Hr) for a    100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =       0.097
Subarea runoff =       0.340(CFS) for       0.218(Ac.)
Total runoff =       0.445(CFS)   Total area =       0.277(Ac.)
Depth of flow =    0.088(Ft.), Average velocity =    0.725(Ft/s)
Critical depth =       0.072(Ft.)


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Process from Point/Station        1.000 to Point/Station        4.000
**** 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
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =    50.000(Ft.)
Highest elevation =  331.600(Ft.)
Lowest elevation =  330.650(Ft.)
Elevation difference =     0.950(Ft.) Slope =  1.900 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of    1.90 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  10.05 minutes
TC = [1.8*(1.1-C)*distance(Ft )^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  85.000^.5)/(   1.900^(1/3)]=  10.05
Rainfall intensity (I) =       4.871(In/Hr) for a    100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =       0.053(CFS)
Total initial stream area =        0.031(Ac.)


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Process from Point/Station        4.000 to Point/Station        5.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
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Upstream point elevation =   330.650(Ft.)
Downstream point elevation =   327.500(Ft.)
Channel length thru subarea  =    96.000(Ft.)
Channel base width  =    0.000(Ft.)
Slope or 'Z' of left channel bank =  80.000
Slope or 'Z' of right channel bank =  80.000
Estimated mean flow rate at midpoint of channel =      0.228(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      0.228(CFS)
Depth of flow =   0.062(Ft.), Average velocity =   0.755(Ft/s)
Channel flow top width =    9.841(Ft.)
Flow Velocity =    0.75(Ft/s)
Travel time  =    2.12 min.
Time of concentration =   12.17 min.
Critical depth =      0.055(Ft.)
 Adding area flow to channel
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
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.305(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.083
Subarea runoff =      0.304(CFS) for      0.206(Ac.)
Total runoff =      0.357(CFS)   Total area =       0.237(Ac.)
Depth of flow =   0.073(Ft.), Average velocity =   0.844(Ft/s)
Critical depth =      0.066(Ft.)


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Process from Point/Station        6.000 to Point/Station        7.000
**** 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
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  330.700(Ft.)
Lowest elevation =  329.900(Ft.)
Elevation difference =    0.800(Ft.) Slope =  1.600 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   1.60 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  10.64 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  85.000^.5)/(   1.600^(1/3)]=  10.64
Rainfall intensity (I) =      4.694(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.046(CFS)
Total initial stream area =        0.028(Ac.)
End of computations, total study area =          0.542 (Ac.)
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PROPOSED CONDITION

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            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study        Date: 05/01/06
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

--------------------------------------------------------------------------
Program License Serial Number 4035
--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.300
24 hour precipitation(inches) =  4.600
P6/P24 =    50.0%
San Diego hydrology manual 'C' values used
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** 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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  331.300(Ft.)
Lowest elevation =  330.300(Ft.)
Elevation difference =    1.000(Ft.) Slope =  2.000 %
Top of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.49 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  50.000^.5)/(   0.500^(1/3)]=   4.49
Rainfall intensity (I) =      6.495(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.245(CFS)
Total initial stream area =        0.046(Ac.)


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Process from Point/Station        2.000 to Point/Station        3.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   330.300(Ft.)
Downstream point elevation =   329.780(Ft.)
Channel length thru subarea  =    94.330(Ft.)
Channel base width  =    0.000(Ft.)
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Slope or 'Z' of left channel bank =  80.000
Slope or 'Z' of right channel bank =  80.000
Estimated mean flow rate at midpoint of channel =      0.579(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      0.579(CFS)
Depth of flow =   0.089(Ft.), Average velocity =   0.921(Ft/s)
Channel flow top width =   14.185(Ft.)
Flow Velocity =    0.92(Ft/s)
Travel time  =    1.71 min.
Time of concentration =    6.20 min.
Critical depth =      0.080(Ft.)
 Adding area flow to channel
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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      5.277(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.155
Subarea runoff =      0.573(CFS) for      0.143(Ac.)
Total runoff =      0.818(CFS)   Total area =       0.189(Ac.)
Depth of flow =   0.101(Ft.), Average velocity =   1.004(Ft/s)
Critical depth =      0.092(Ft.)


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Process from Point/Station        3.000 to Point/Station        4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   327.780(Ft.)
Downstream point/station elevation =   327.020(Ft.)
Pipe length  =    24.68(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.818(CFS)
Given pipe size =      6.00(In.)
Calculated individual pipe flow  =     0.818(CFS)
Normal flow depth in pipe =    4.17(In.)
Flow top width inside pipe =    5.52(In.)
Critical Depth =    5.37(In.)
Pipe flow velocity =      5.61(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     6.27 min.


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Process from Point/Station        3.000 to Point/Station        4.000
**** 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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     6.27 min.
Rainfall intensity =      5.237(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
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(Q=KCIA) is C = 0.820  CA =      0.206
Subarea runoff =      0.260(CFS) for      0.062(Ac.)
Total runoff =      1.078(CFS)   Total area =      0.251(Ac.)


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Process from Point/Station        4.000 to Point/Station        5.000
**** IMPROVED CHANNEL TRAVEL TIME ****
----------------------------------------------------------------------------
Covered channel
Upstream point elevation =   327.020(Ft.)
Downstream point elevation =   326.780(Ft.)
Channel length thru subarea  =    12.000(Ft.)
Channel base width  =    3.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =      1.078(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.250(Ft.)
Flow(q) thru subarea =      1.078(CFS)
Depth of flow =   0.068(Ft.), Average velocity =   1.636(Ft/s)
Channel flow top width =   16.508(Ft.)
Flow Velocity =    1.64(Ft/s)
Travel time  =    0.12 min.
Time of concentration =    6.39 min.
Critical depth =      0.080(Ft.)
 Adding area flow to channel
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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
The area added to the existing stream causes a
a lower flow rate of Q =      1.064(CFS)
therefore the upstream flow rate of Q =      1.078(CFS) is being used
Rainfall intensity =      5.172(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.206
Subarea runoff =      0.000(CFS) for      0.000(Ac.)
Total runoff =      1.078(CFS)   Total area =      0.251(Ac.)
Depth of flow =   0.068(Ft.), Average velocity =   1.636(Ft/s)
Critical depth =      0.080(Ft.)


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Process from Point/Station        1.000 to Point/Station        6.000
**** 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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   50.000(Ft.)
Highest elevation =  331.300(Ft.)
Lowest elevation =  330.310(Ft.)
Elevation difference =    0.990(Ft.) Slope =  1.980 %
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```
Top of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of    0.50 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =    4.49 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  50.000^.5)/(   0.500^(1/3)]=    4.49
Rainfall intensity (I) =      6.495(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.234(CFS)
Total initial stream area =        0.044(Ac.)


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Process from Point/Station        6.000 to Point/Station        7.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   330.310(Ft.)
Downstream point elevation =   329.800(Ft.)
Channel length thru subarea  =    80.000(Ft.)
Channel base width  =    0.000(Ft.)
Slope or 'Z' of left channel bank =  80.000
Slope or 'Z' of right channel bank =  80.000
Estimated mean flow rate at midpoint of channel =      0.502(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      0.502(CFS)
Depth of flow =   0.082(Ft.), Average velocity =   0.938(Ft/s)
Channel flow top width =   13.080(Ft.)

Flow Velocity =    0.94(Ft/s)
Travel time  =    1.42 min.
Time of concentration =    5.91 min.
Critical depth =      0.075(Ft.)
 Adding area flow to channel
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
[COMMERCIAL area type                        ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Rainfall intensity =      5.440(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.129
Subarea runoff =      0.466(CFS) for      0.113(Ac.)
Total runoff =      0.700(CFS)   Total area =       0.157(Ac.)
Depth of flow =   0.093(Ft.), Average velocity =   1.020(Ft/s)
Critical depth =      0.086(Ft.)


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Process from Point/Station        7.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   327.050(Ft.)
Downstream point/station elevation =   325.750(Ft.)
Pipe length  =    19.54(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.700(CFS)
Given pipe size =      6.00(In.)
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Calculated individual pipe flow  =     0.700(CFS)
Normal flow depth in pipe =    2.94(In.)
Flow top width inside pipe =    6.00(In.)
Critical Depth =    5.07(In.)
Pipe flow velocity =      7.31(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     5.96 min.


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Process from Point/Station        7.000 to Point/Station        8.000
**** 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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Time of concentration =     5.96 min.
Rainfall intensity =      5.414(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.187
Subarea runoff =      0.312(CFS) for      0.071(Ac.)
Total runoff =      1.012(CFS)   Total area =       0.228(Ac.)


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Process from Point/Station        8.000 to Point/Station        9.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Covered channel
Upstream point elevation =   325.750(Ft.)
Downstream point elevation =   325.510(Ft.)
Channel length thru subarea  =    12.000(Ft.)
Channel base width  =    3.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =      1.012(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.208(Ft.)
Flow(q) thru subarea =      1.012(CFS)
Depth of flow =   0.066(Ft.), Average velocity =   1.610(Ft/s)
Channel flow top width =   16.139(Ft.)
Flow Velocity =    1.61(Ft/s)
Travel time  =    0.12 min.
Time of concentration =    6.08 min.
Critical depth =      0.078(Ft.)
 Adding area flow to channel
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
[COMMERCIAL area type                          ]
(General Commercial    )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
The area added to the existing stream causes a
a lower flow rate of Q =      0.999(CFS)
therefore the upstream flow rate of Q =      1.012(CFS) is being used
Rainfall intensity =      5.342(In/Hr) for a   100.0 year storm
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Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.820  CA =      0.187
Subarea runoff =       0.000(CFS) for      0.000(Ac.)
Total runoff =       1.012(CFS)   Total area =       0.228(Ac.)
Depth of flow =   0.066(Ft.), Average velocity =   1.610(Ft/s)
Critical depth =       0.078(Ft.)


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Process from Point/Station        7.000 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
[COMMERCIAL area type                          ]
(General Commercial     )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   65.000(Ft.)
Highest elevation =  329.800(Ft.)
Lowest elevation =  326.300(Ft.)
Elevation difference =    3.500(Ft.) Slope =  5.385 %
Top of Initial Area Slope adjusted by User to  5.300 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of   5.30 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.74 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  90.000^.5)/(   5.300^(1/3)]=   2.74
Rainfall intensity (I) =      8.927(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.315(CFS)
Total initial stream area =        0.043(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** 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
[COMMERCIAL area type                          ]
(General Commercial     )
Impervious value, Ai = 0.850
Sub-Area C Value = 0.820
Initial subarea total flow distance  =   28.860(Ft.)
Highest elevation =  330.200(Ft.)
Lowest elevation =  329.910(Ft.)
Elevation difference =    0.290(Ft.) Slope =  1.005 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 General Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.90 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8200)*(  60.000^.5)/(   1.000^(1/3)]=   3.90
```

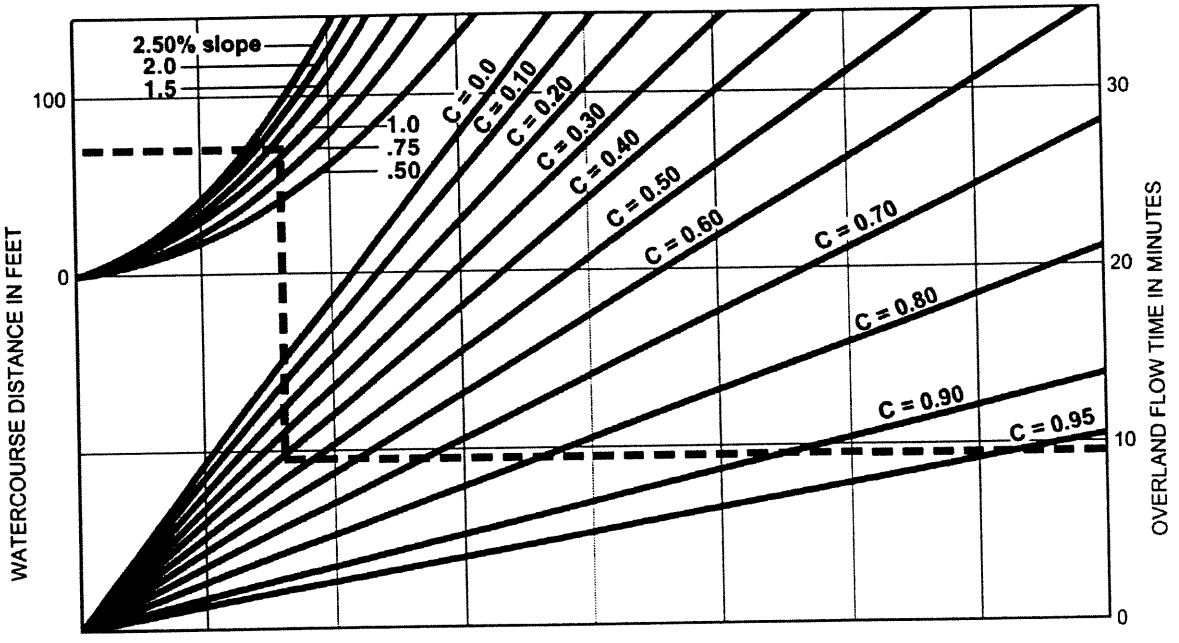
Rainfall intensity (I) = 7.109(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff = 0.076(CFS)
Total initial stream area = 0.013(Ac.)
End of computations, total study area = 0.535 (Ac.)

APPENDIX B

(5. TABLES AND CHARTS)

Average Values of Roughness Coefficient (Manning's n)

Type of Waterway	Roughness Coefficient (n)
1. Closed Conduits (1)	
Steel (not lined)	0.015
Cast Iron	0.015
Aluminum	.021
Corrugated Metal (not lined)	0.024
Corrugated Metal (2) (smooth asphalt quarterlining)	0.021
Corrugated Metal (2) (smooth asphalt half lining)	0.018
Corrugated Metal (smooth asphalt full lining)	0.012
Concrete RCP	0.012
Clay (sewer)	0.013
Asbestos Cement & PVC	0.011
Drain Tile (terra cotta)	0.015
Cast-in-place Pipe	0.015
Reinforced Concrete Box	0.014
2. Open Channels (1)	
a. Unlined	
Clay Loam	0.023
Sand	0.020
b. Revetted	
Gravel	0.030
Rock	0.040
Pipe and Wire	0.025
Sacked Concrete	0.025
c. Lined	
Concrete (poured)	0.014
Air Blown Mortar (3)	0.016
Asphaltic Concrete or Bituminous Plant Mix	0.018
d. Vegetated (5)	
Grass lined, maintained	.035
Grass and Weeds	.045
Grass lined with concrete low flow channel	.032
3. Pavement and Gutters (1)	
Concrete	0.015
Bituminous (plant-mixed)	0.016



EXAMPLE:
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service

Table 7-14. Values of K' for Circular Channels in the Formula

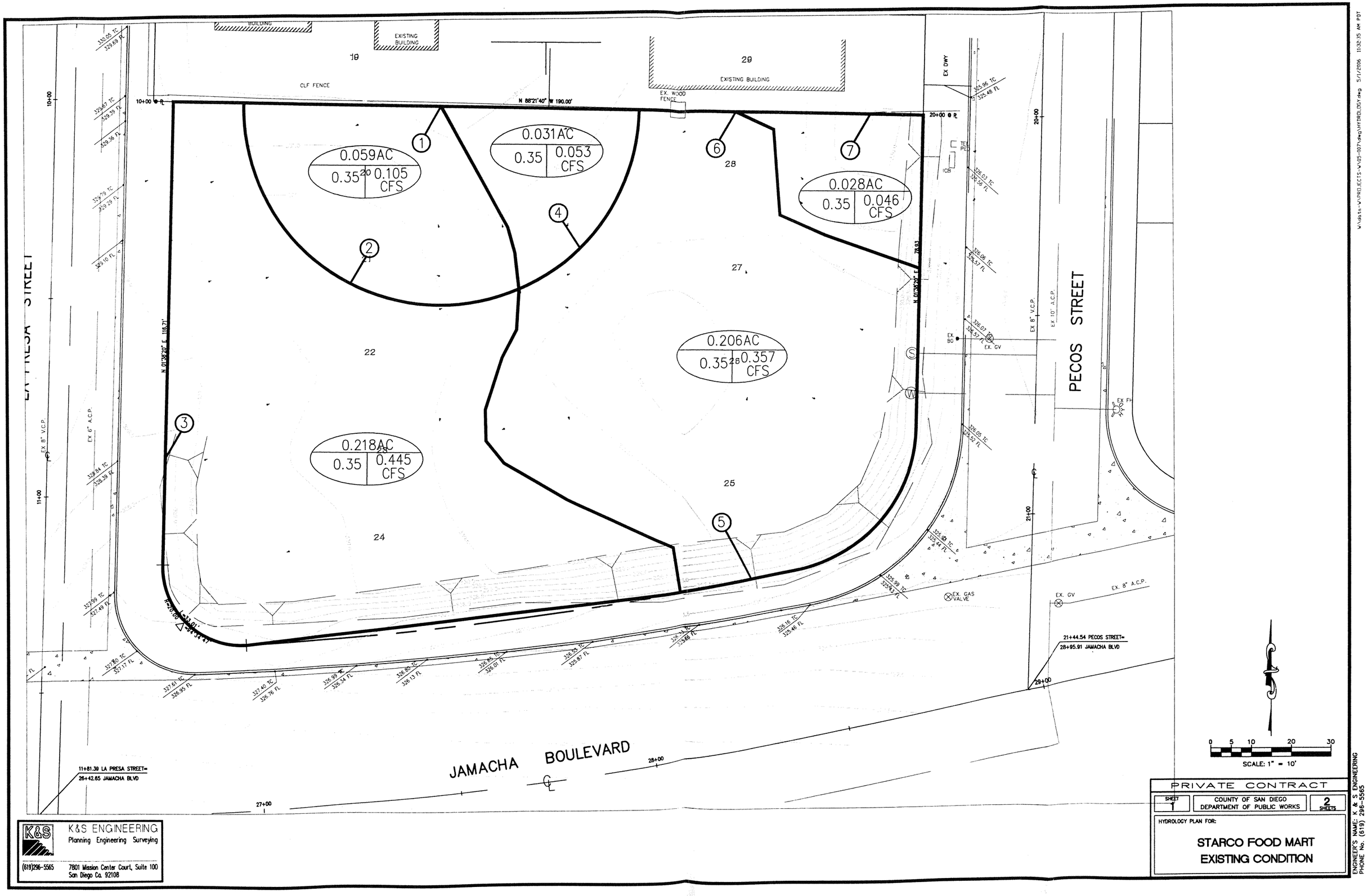
$$Q = \frac{K'}{n} d^{8/3} s^{1/2}$$

D = depth of water d = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0		.00007	.00031	.00074	.00138	.00222	.00328	.00455	.00604	.00775
.1	.00967	.0118	.0142	.0167	.0195	.0225	.0257	.0291	.0327	.0366
.2	.0406	.0448	.0492	.0537	.0585	.0634	.0686	.0738	.0793	.0849
.3	.0907	.0966	.1027	.1089	.1153	.1218	.1284	.1352	.1420	.1490
.4	.1561	.1633	.1705	.1779	.1854	.1929	.2005	.2082	.2160	.2238
.5	.232	.239	.247	.255	.263	.271	.279	.287	.295	.303
.6	.311	.319	.327	.335	.343	.350	.358	.366	.373	.380
.7	.388	.395	.402	.409	.416	.422	.429	.435	.441	.447
.8	.453	.458	.463	.468	.473	.477	.481	.485	.488	.491
.9	.494	.496	.497	.498	.498	.498	.496	.494	.489	.483
1.0	.463									

APPENDIX C

(6. HYDROLOGY MAP)



K&S ENGINEERING
Planning Engineering Surveying

(619)296-5565 7801 Mission Center Court, Suite 100 San Diego Ca. 92108

PRIVATE CONTRACT

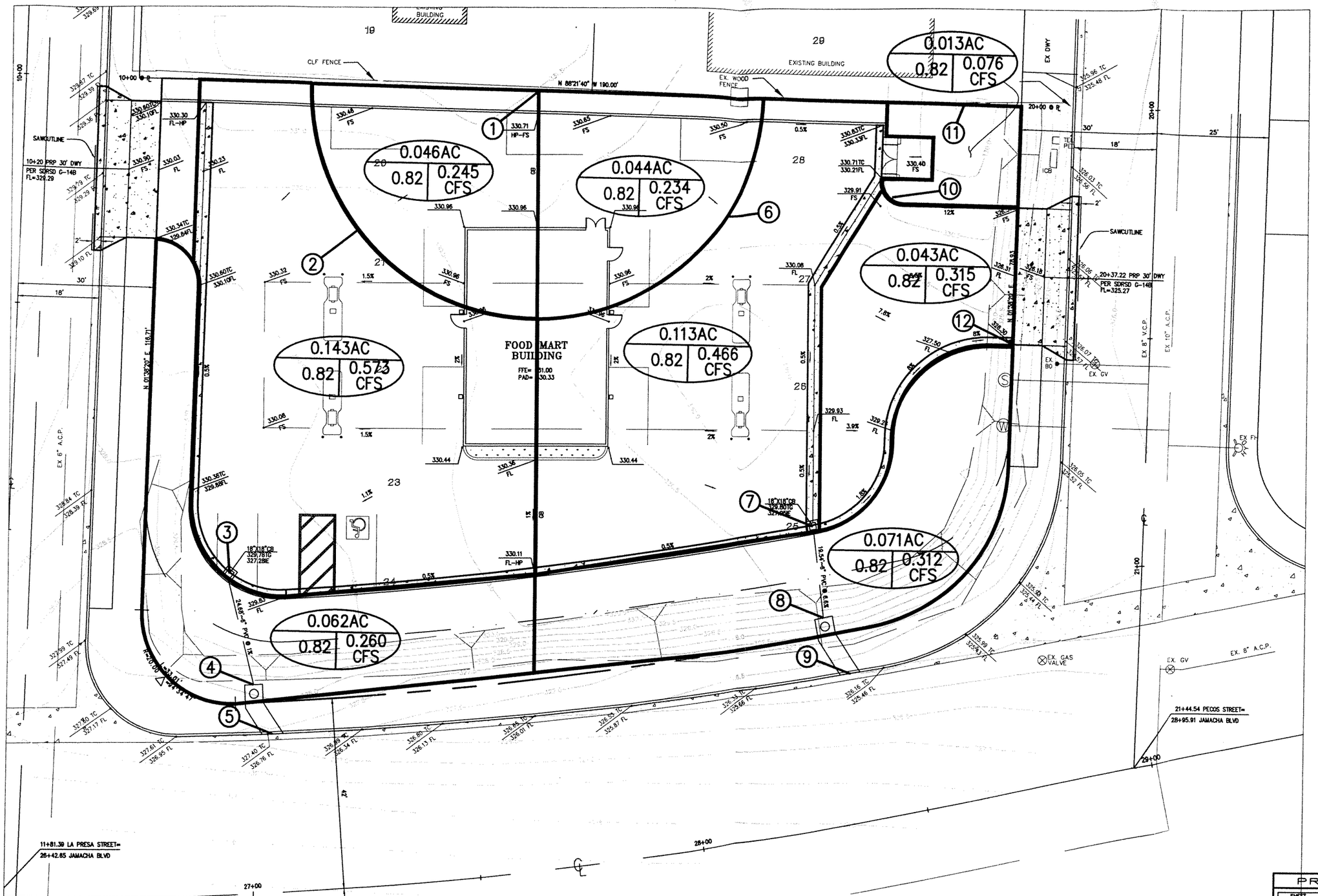
SHEET 1	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	2 SHEETS

HYDROLOGY PLAN FOR:

STARCO FOOD MART
EXISTING CONDITION

ENGINEER'S NAME: K & S ENGINEERING
PHONE No. (619) 296-5565

W:\data-W\PROJECTS-W\05-007\dwg\HYDROLOGY.dwg 5/1/2006 11:32:35 AM PDT



K&S ENGINEERING
Planning Engineering Surveying

(619)296-5565 7801 Mission Center Court, Suite 100 San Diego Ca. 92108

PRIVATE CONTRACT

SHEET 2 | COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS | 2 SHEETS

HYDROLOGY PLAN FOR:

STARCO FOOD MART

PROPOSED CONDITION

ENGINEER'S NAME: K & S ENGINEERING
PHONE No. (619) 296-5565

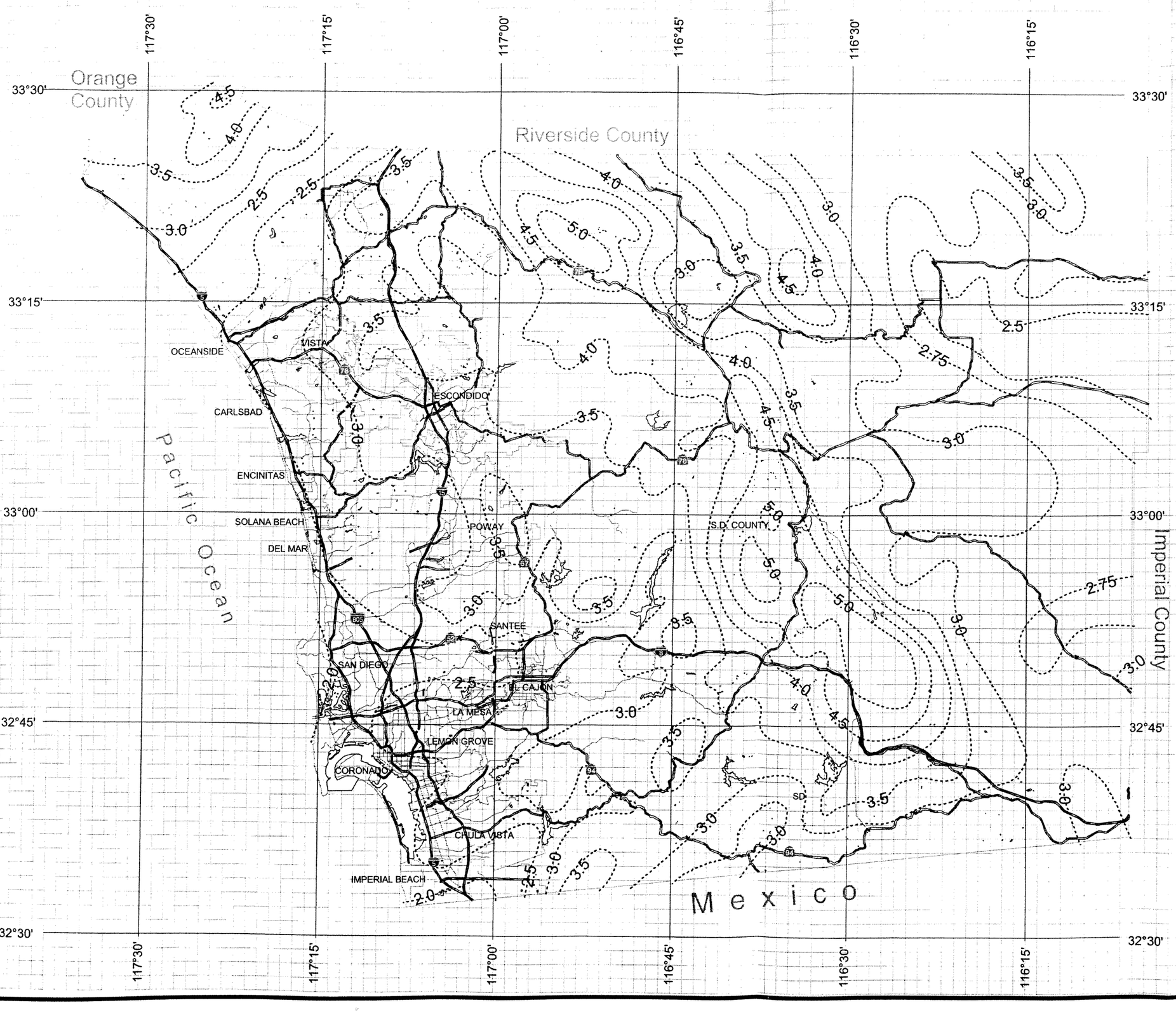
N:\data\VVPROJECTS\VVDS-007\dwg\HYDROLOGY.dwg 5/1/2006 11:32:35 AM PDT

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



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3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'

33°30' 33°15' 33°00' 32°45' 32°30'

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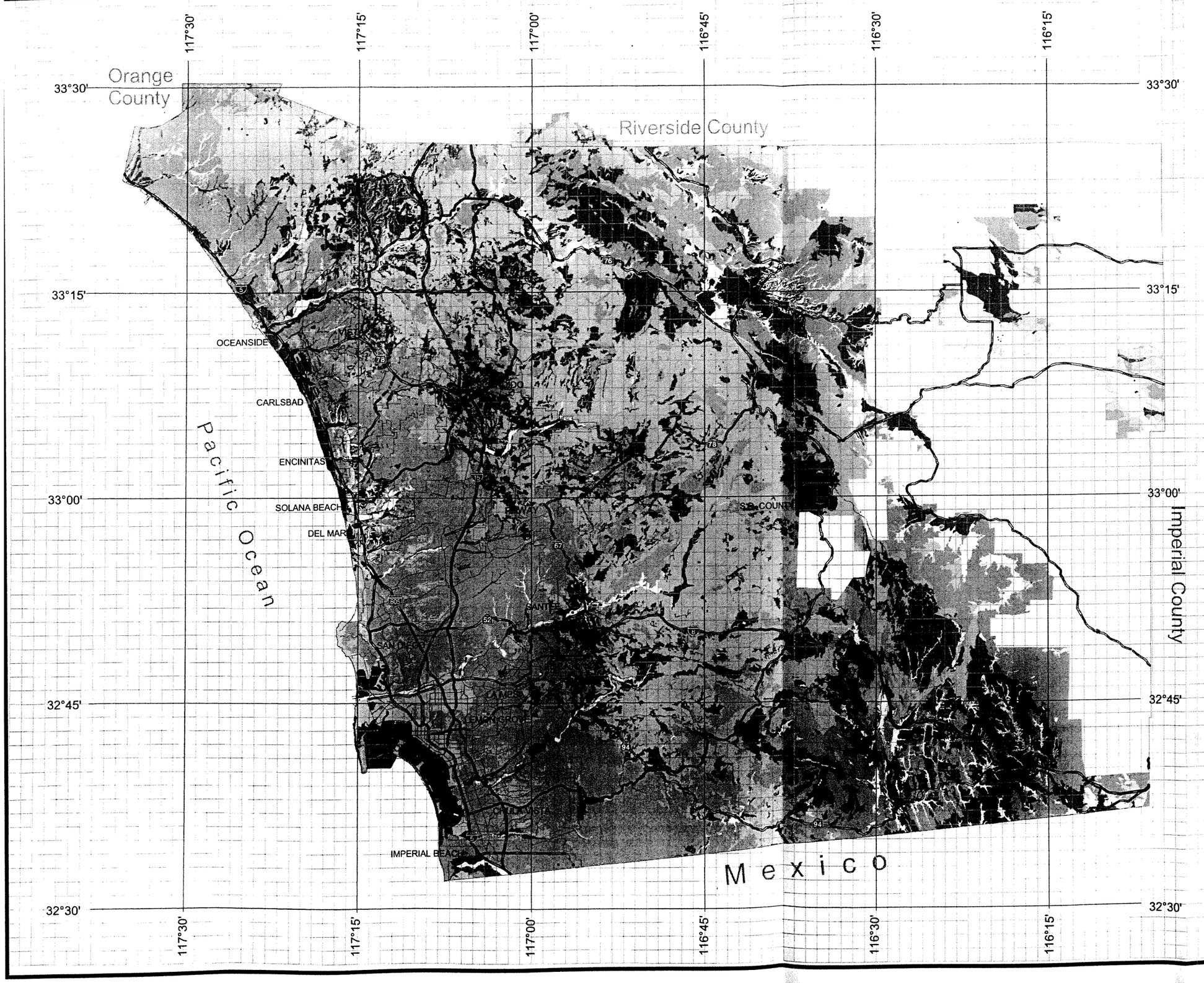
County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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ATTACHMENT G

OPERATION AND MAINTENANCE PROGRAM FOR TREATMENT BMP

BMP OPERATIONT & MAINTENANCE	LABOR			EQUIPMENT				MATERIALS		TOTAL COST
ITEM	Per Hrs.	Rate	Cost	Type	Days	Rate	Cost	Item	Cost	
FILTER INSERTS	24.0	43.63	$1,047.12	Sedan	2.0	21.28	$42.56	New Adsorbent, Testing & Disposal	$115.00	$1,204.68
									O&M TOTAL	**$1,204.68**

ATTACHMENT H

CERTIFICATION SHEET

This Stormwater Management Plan has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

H. Zomorrodi

HOSSEIN ZOMORRODI
REGISTERED CIVIL ENGINEER

1/25/07

DATE