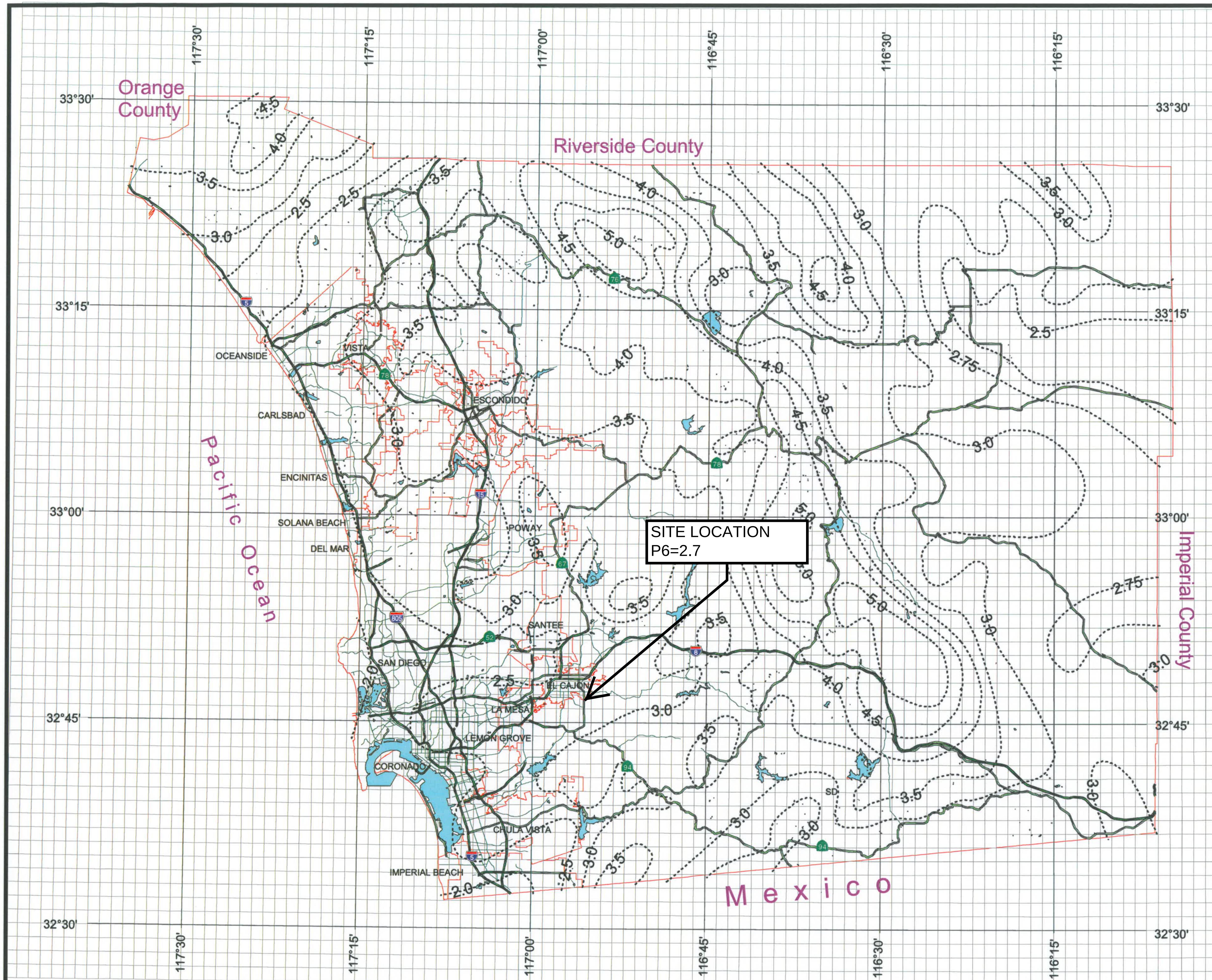


County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

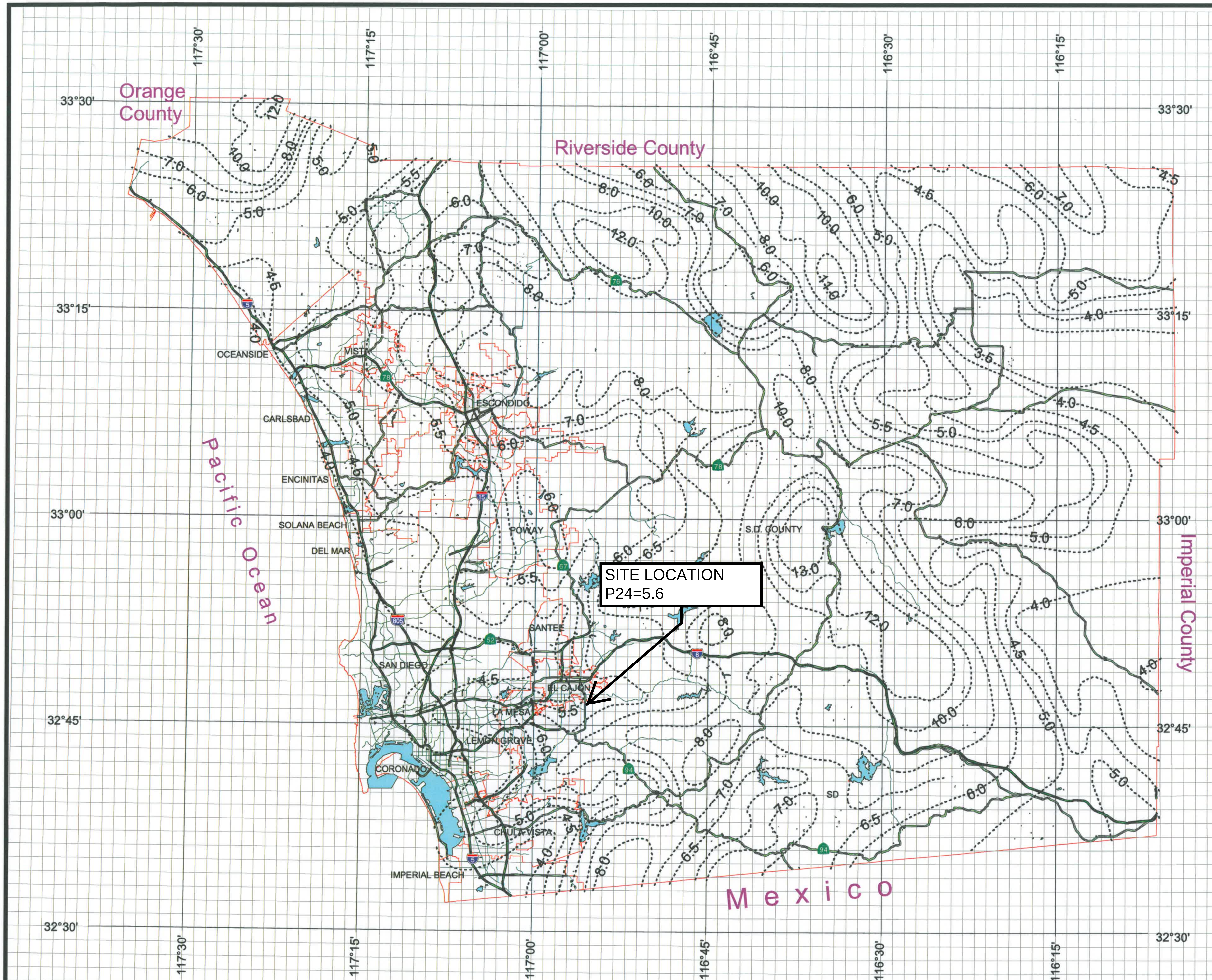
Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N S W E

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

Map Scale: 1:977 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 10, 20, 40, 60

Feet: 0, 45, 90, 180, 270

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 10, Sep 12, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	D	2.8	68.9%
RaB	Ramona sandy loam, 2 to 5 percent slopes	C	1.1	27.7%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes	B	0.1	3.4%
Totals for Area of Interest			**4.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT 3

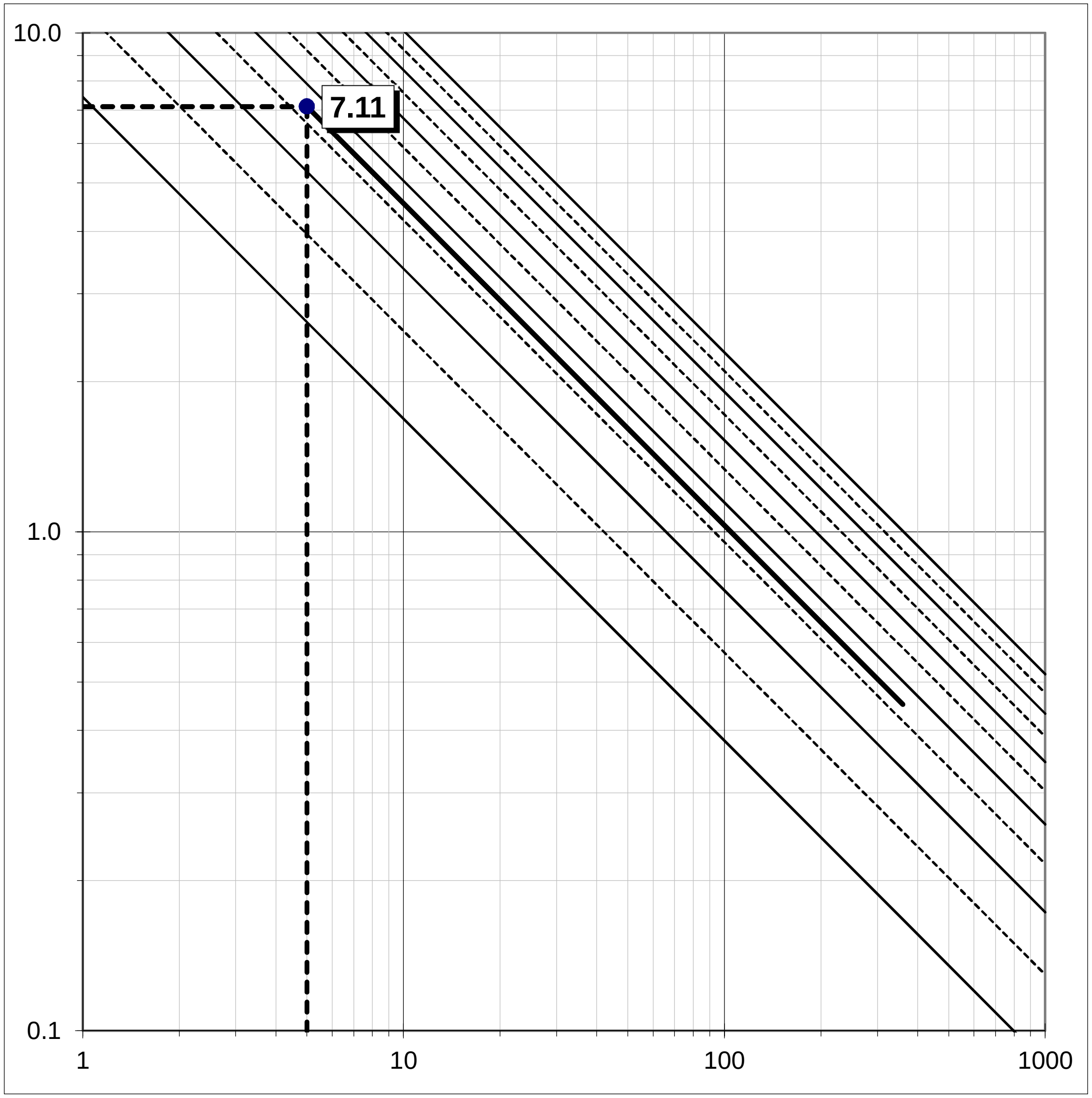
EXISTING HYDROLOGY CALCULATIONS

AREA CALCULATIONS

EXISTING HYDROLOGIC BASINS

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
OFF-1	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	4,065	0.093	4,065	0	0	0	-	0.30	36%	0.11	-
	D	0.35	7,359	0.169	7,359	0	0	0	-	0.35	64%	0.23	-
	Total	-	11,424	0.262	11,424	0	0	0	0.00%	-	100%	0.33	***0.332***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
EX-1	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	8,393	0.193	0	0	0	8,393	-	0.30	11%	0.03	-
	D	0.35	67,314	1.545	0	10,433	0	56,881	-	0.35	89%	0.31	-
	Total	-	75,707	1.738	0	10,433	0	65,274	13.78%	-	100%	0.34	***0.468***



EX-OFF1

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =			
C =	0.33		
Dist. =	51.00	ft.	
slope =	9.800	%	
***T**$_c$ =	5.00	min.	

$$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{S}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T**$_c$ =	#DIV/0!	min.

$$T_C = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency,	**100**	year	
P_6 =	2.7	in.	P_6 must be within
P_{24} =	5.6	in.	45% to 65% of P_{24}.
P_6 / P_{24} =	48%		Adjust P_6 as needed.
Adjusted **P_6**=	2.70	in.	
T_c (**D**) =	5.00	min.	
I =	7.11	in/hr	

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**0.62**	**cfs**
C =	0.33	
I =	7.11	in/hr
A =	0.262	ac.

$$Q = C * I * A$$

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2012 Version 7.9

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 04/12/17
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6313

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

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.700
24 hour precipitation(inches) =  5.600
P6/P24 =    48.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.332 given for subarea
Rainfall intensity (I) =      7.114(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   5.00 min.  Rain intensity =       7.11(In/Hr)
Total area =        0.262(Ac.)  Total runoff =     0.620(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      2.718(CFS)
Depth of flow =   0.167(Ft.), Average velocity =   1.848(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1             0.00              0.40
        2            21.00              0.00
        3            42.00              0.40
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      2.719(CFS)
  '     '         flow top width =     17.576(Ft.)
  '     '     velocity=    1.848(Ft/s)
  '     '         area =      1.471(Sq.Ft)
  '     '         Froude number =     1.126

Upstream point elevation =   545.000(Ft.)
Downstream point elevation =   534.200(Ft.)
Flow length =   284.000(Ft.)
Travel time  =    2.56 min.
Time of concentration =    7.56 min.
Depth of flow =   0.167(Ft.)
Average velocity =   1.848(Ft/s)
Total irregular channel flow =     2.718(CFS)
Irregular channel normal depth above invert elev. =   0.167(Ft.)
Average velocity of channel(s) =   1.848(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.448(In/Hr) for a   100.0 year storm
User specified 'C' value of 0.468 given for subarea
Rainfall intensity =      5.448(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.450  CA =      0.900
Subarea runoff =      4.285(CFS) for      1.738(Ac.)
Total runoff =      4.905(CFS)  Total area =       2.000(Ac.)
Depth of flow =   0.209(Ft.), Average velocity =   2.142(Ft/s)
End of computations, total study area =          2.000 (Ac.)
```

ATTACHMENT 4

PROPOSED HYDROLOGY CALCULATIONS

PHASE 1

AREA CALCULATIONS

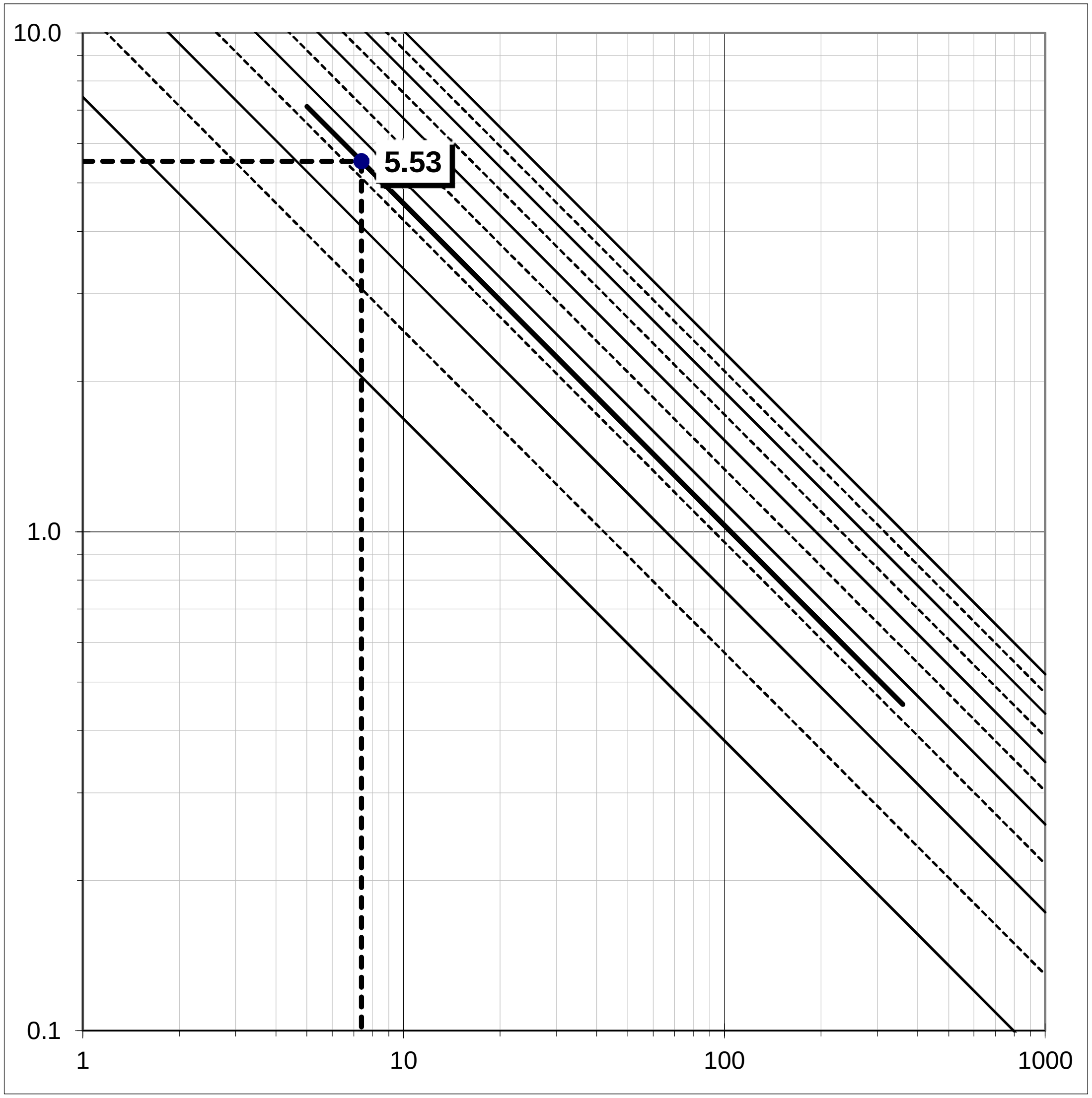
PROPOSED HYDROLOGIC BASINS

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1A	A	0.20	0	0.000	0	0	0	0	-	0.15	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.19	0%	0.00	-
	C	0.30	7,228	0.166	0	0	0	7,228	-	0.23	21%	0.05	-
	D	0.35	26,726	0.614	0	8,361	0	18,365	-	0.26	79%	0.21	-
	Total	-	33,954	0.779	0	8,361	0	25,593	24.62%	-	100%	0.26	***0.477***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1B	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	1,155	0.027	0	0	0	1,155	-	0.30	12%	0.04	-
	D	0.35	8,228	0.189	0	0	0	8,228	-	0.35	88%	0.31	-
	Total	-	9,383	0.215	0	0	0	9,383	0.00%	-	100%	0.34	***0.344***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1C	A	0.20	0	0.000	0	0	0	0	-	0.04	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.05	0%	0.00	-
	C	0.30	0	0.000	0	0	0	0	-	0.06	0%	0.00	-
	D	0.35	19,703	0.452	0	15,497	4,206	0	-	0.07	100%	0.07	-
	Total	-	19,703	0.452	0	15,497	4,206	0	78.65%	-	100%	0.07	***0.783***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1D	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	39	0.001	0	22	0	17	-	0.30	0%	0.00	-
	D	0.35	10,323	0.237	0	54	4,494	5,775	-	0.35	100%	0.35	-
	Total	-	10,362	0.238	0	76	4,494	5,792	0.73%	-	100%	0.35	***0.354***



PR-1A

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.48

Dist. = 125.00 ft.

slope = 4.880 %

$^*T_c$ = 7.39 min.

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

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

$^{**}T_c$ = #DIV/0! min.

$$T_C = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in.

P_{24} = 5.6 in.

P_6 / P_{24} = 48%

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 7.39 min.

I = 5.53 in/hr

P_6 must be within 45% to 65% of P_{24}. Adjust P_6 as needed.

$$I = 7.44P_6D^{-0.645}$$

Basin Flow Calculations

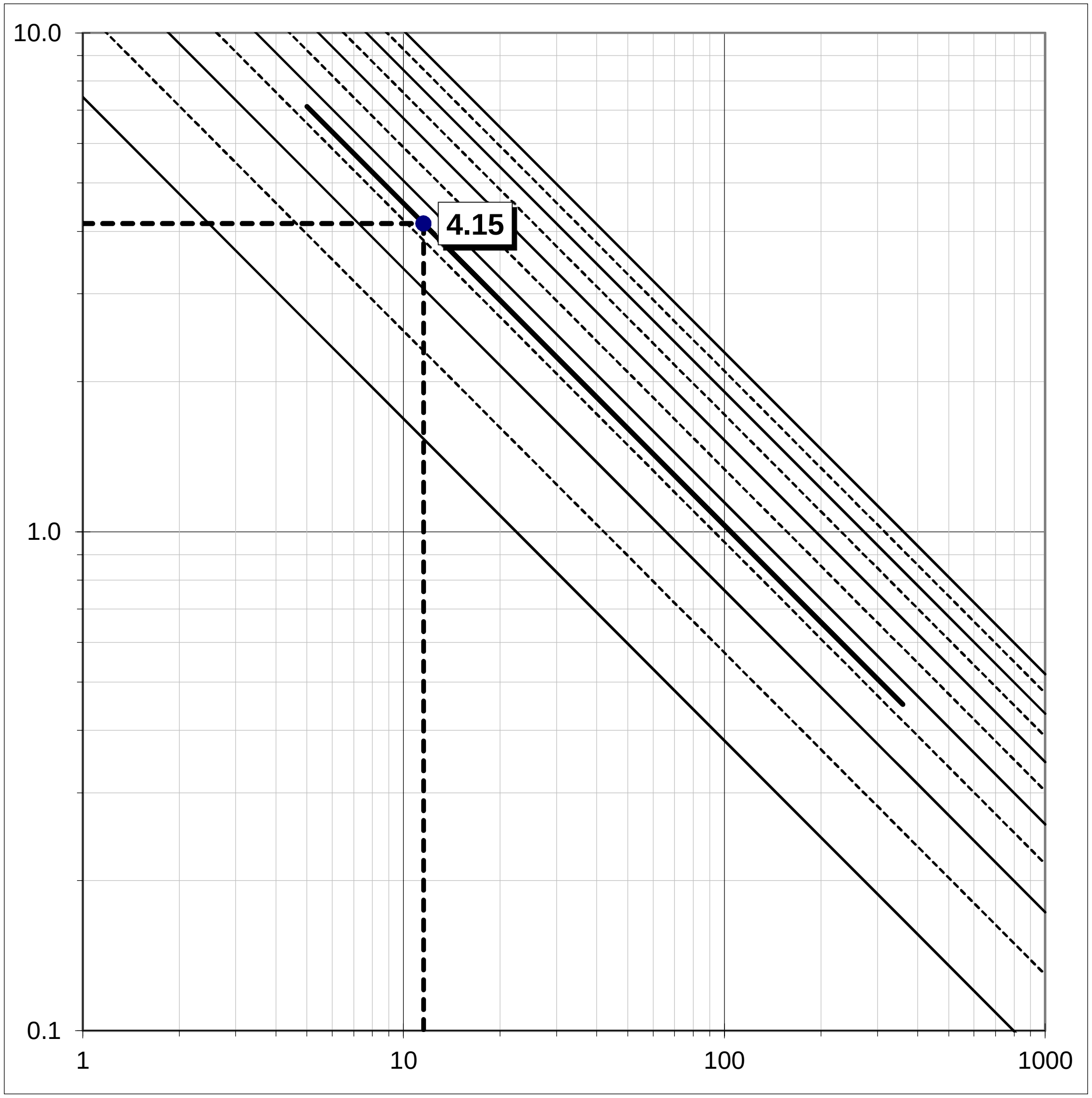
Q = **2.05** **cfs**

C = 0.48

I = 5.53 in/hr

A = 0.779 ac.

$$Q = C * I * A$$



PR-1C

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =			
C =	0.39		
Dist. =	204.00	ft.	
slope =	3.970	%	
***T_c** =	11.54	min.	

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

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T_c** =	#DIV/0!	min.

$$T_C = \left(\frac{11.9 L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

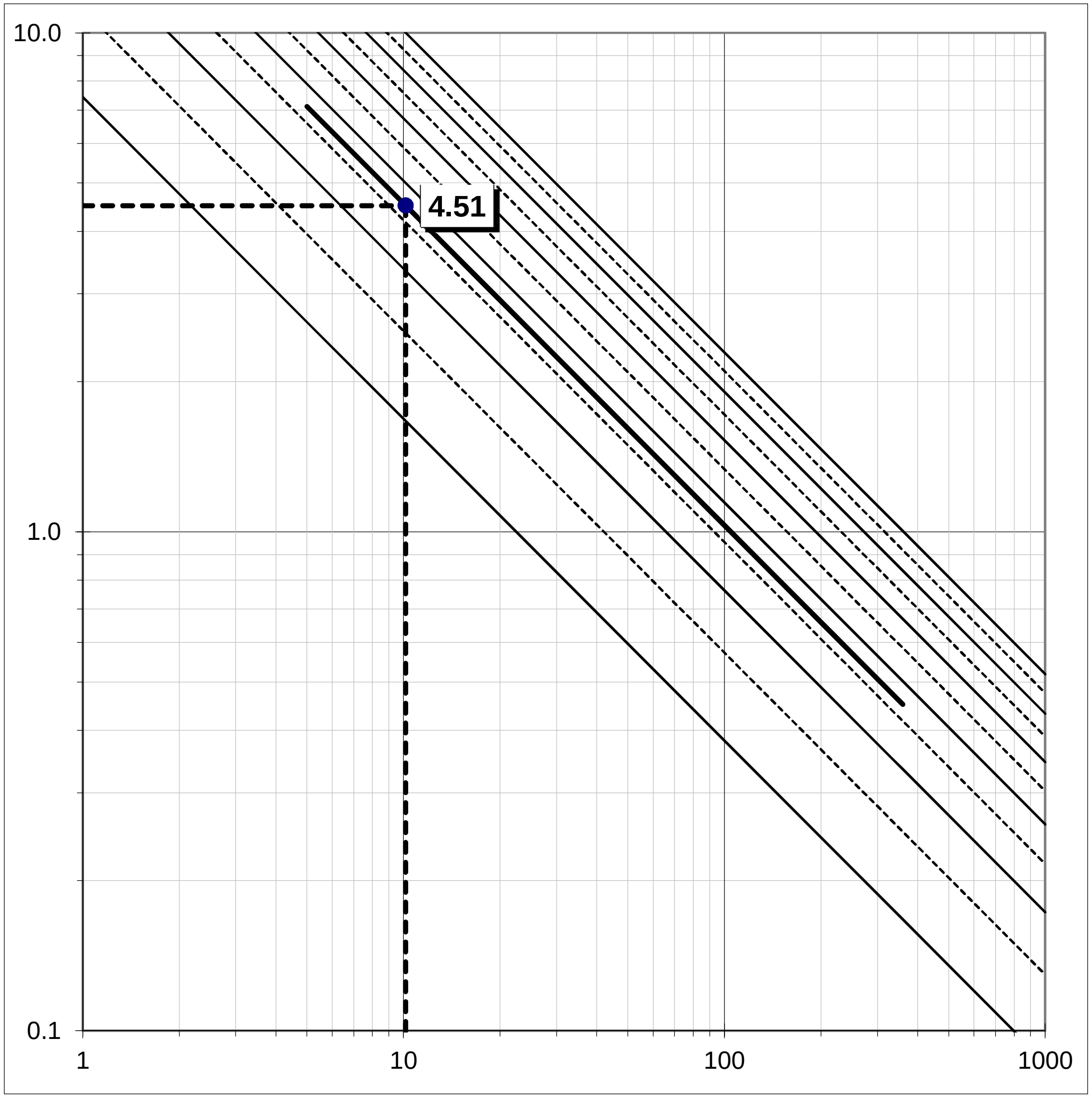
Selected Frequency,	**100**	year	
P_6 =	2.7	in.	P_6 must be within
P_{24} =	5.6	in.	45% to 65% of P_{24}.
P_6 / P_{24} =	48%		Adjust P_6 as needed.
Adjusted **P_6**=	2.70	in.	
T_c (**D**) =	11.54	min.	
I =	4.15	in/hr	

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**0.87**	**cfs**
C =	0.39	
I =	4.15	in/hr
A =	0.537	ac.

$$Q = C * I * A$$



PR-1D

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.40

Dist. = 145.00 ft.

slope = 3.310 %

***T_c** = 10.15 min.

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

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T_c** = #DIV/0! min.

$$T_C = \left(\frac{11.9 L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in.

P_{24} = 5.6 in.

P_6 / P_{24} = 48%

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 10.15 min.

I = 4.51 in/hr

P_6 must be within 45% to 65% of P_{24}. Adjust P_6 as needed.

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q = 0.34 cfs

C = 0.40

I = 4.51 in/hr

A = 0.187 ac.

$$Q = C * I * A$$

```
              San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2012 Version 7.9

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 03/31/17
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6313

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

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.700
24 hour precipitation(inches) =  5.600
P6/P24 =    48.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.477 given for subarea
Rainfall intensity (I) =      5.529(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   7.39 min.  Rain intensity =       5.53(In/Hr)
Total area =        0.779(Ac.)  Total runoff =     2.050(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   538.900(Ft.)
End of street segment elevation =   534.200(Ft.)
Length of street segment  =   178.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  23.000(Ft.)
Distance from crown to crossfall grade break  =   0.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.000
Slope from grade break to crown (v/hz)  =   0.000
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   0.500(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  0.000(In.)
 Manning's N in gutter =  0.0300
 Manning's N from gutter to grade break =  0.0300
 Manning's N from grade break to crown =  0.0300
Estimated mean flow rate at midpoint of street =      2.101(CFS)
Depth of flow =   0.068(Ft.), Average velocity =   1.340(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  23.000(Ft.)
Flow velocity =   1.34(Ft/s)
Travel time =    2.21 min.     TC =    9.60  min.
 Adding area flow to street
Rainfall intensity (I) =      4.669(In/Hr) for a   100.0 year storm
User specified 'C' value of 0.344 given for subarea
Rainfall intensity =      4.669(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.448  CA =      0.446
Subarea runoff =      0.030(CFS) for      0.215(Ac.)
Total runoff =      2.080(CFS)  Total area =       0.994(Ac.)
Street flow at end of street =      2.080(CFS)
Half street flow at end of street =      2.080(CFS)
Depth of flow =   0.068(Ft.), Average velocity =   1.335(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  23.000(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.994(Ac.)
Runoff from this stream =      2.080(CFS)
Time of concentration =    9.60 min.
Rainfall intensity =     4.669(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      103.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.389 given for subarea
Rainfall intensity (I) =      4.148(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  11.54 min.  Rain intensity =       4.15(In/Hr)
Total area =        0.537(Ac.)  Total runoff =     0.870(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.537(Ac.)
Runoff from this stream =      0.870(CFS)
Time of concentration =   11.54 min.
Rainfall intensity =     4.148(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.402 given for subarea
Rainfall intensity (I) =      4.506(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  10.15 min.  Rain intensity =       4.51(In/Hr)
Total area =        0.187(Ac.)  Total runoff =     0.340(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.187(Ac.)
Runoff from this stream =      0.340(CFS)
Time of concentration =   10.15 min.
Rainfall intensity =     4.506(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.080      9.60                 4.669
2        0.870     11.54                 4.148
3        0.340     10.15                 4.506
Qmax(1) =
           1.000 *    1.000 *     2.080) +
           1.000 *    0.832 *     0.870) +
           1.000 *    0.946 *     0.340) + =       3.126
Qmax(2) =
           0.888 *    1.000 *     2.080) +
           1.000 *    1.000 *     0.870) +
           0.921 *    1.000 *     0.340) + =       3.031
Qmax(3) =
           0.965 *    1.000 *     2.080) +
           1.000 *    0.880 *     0.870) +
```

```
          1.000 *    1.000 *     0.340) + =       3.113

Total of 3 main streams to confluence:
Flow rates before confluence point:
       2.080       0.870       0.340
Maximum flow rates at confluence using above data:
        3.126        3.031        3.113
Area of streams before confluence:
        0.994        0.537        0.187


Results of confluence:
Total flow rate =      3.126(CFS)
Time of concentration =     9.604 min.
Effective stream area after confluence  =      1.718(Ac.)
End of computations, total study area =           1.718 (Ac.)
```

PHASE 2

AREA CALCULATIONS

PROPOSED HYDROLOGIC BASINS

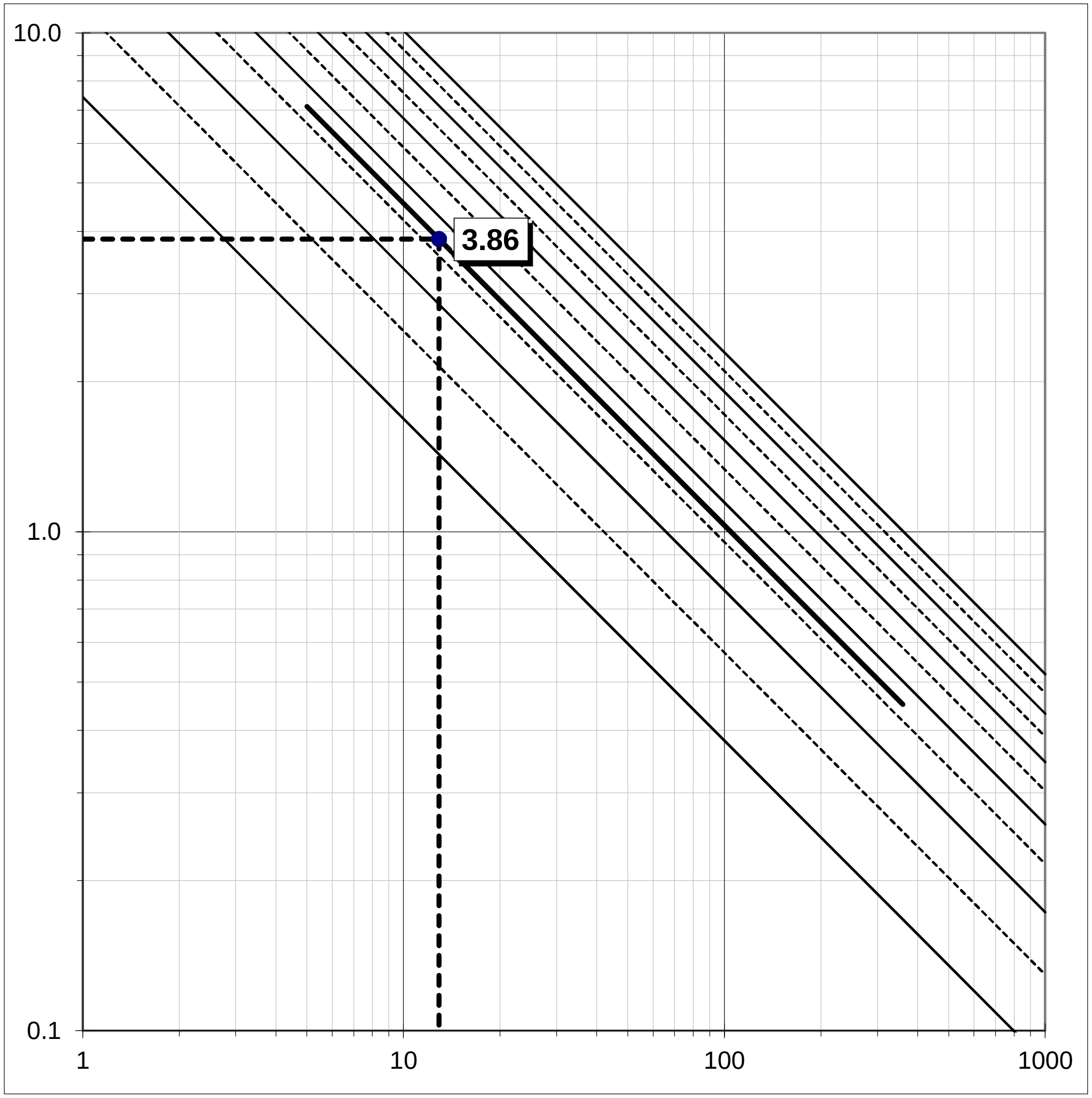
Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
OFF-1	A	0.20	0	0.000	0	0	0	0	-	0.20	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.25	0%	0.00	-
	C	0.30	4,065	0.093	4,065	0	0	0	-	0.30	36%	0.11	-
	D	0.35	7,359	0.169	7,359	0	0	0	-	0.35	64%	0.23	-
	Total	-	11,424	0.262	11,424	0	0	0	0.00%	-	100%	0.33	***0.332***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1A	A	0.20	0	0.000	0	0	0	0	-	0.05	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.06	0%	0.00	-
	C	0.30	4,473	0.103	0	2,079	2,394	0	-	0.07	29%	0.02	-
	D	0.35	10,999	0.253	0	9,857	1,142	0	-	0.08	71%	0.06	-
	Total	-	15,472	0.355	0	11,936	3,536	0	77.15%	-	100%	0.08	***0.771***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1B	A	0.20	0	0.000	0	0	0	0	-	0.03	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.04	0%	0.00	-
	C	0.30	3,875	0.089	0	1,591	2,284	0	-	0.04	13%	0.01	-
	D	0.35	25,479	0.585	0	23,533	1,946	0	-	0.05	87%	0.04	-
	Total	-	29,354	0.674	0	25,124	4,230	0	85.59%	-	100%	0.05	***0.820***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1C	A	0.20	0	0.000	0	0	0	0	-	0.04	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.05	0%	0.00	-
	C	0.30	0	0.000	0	0	0	0	-	0.06	0%	0.00	-
	D	0.35	19,703	0.452	0	15,497	4,206	0	-	0.07	100%	0.07	-
	Total	-	19,703	0.452	0	15,497	4,206	0	78.65%	-	100%	0.07	***0.783***

Basin	Soil Type	Pervious Runoff Coefficient	Total Area SF	Total Area Acres	Natural SF	Impervious SF	Landscape SF	Pervious Pavers SF	% Impervious	C Value Weighted	% Fraction of Site	C Value Fraction	C Value Final
PR-1D	A	0.20	0	0.000	0	0	0	0	-	0.09	0%	0.00	-
	B	0.25	0	0.000	0	0	0	0	-	0.11	0%	0.00	-
	C	0.30	0	0.000	0	0	0	0	-	0.13	0%	0.00	-
	D	0.35	10,366	0.238	0	5,851	4,515	0	-	0.15	100%	0.15	-
	Total	-	10,366	0.238	0	5,851	4,515	0	56.44%	-	100%	0.15	***0.660***



PR-OFF1

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =		
C =	0.33	
Dist. =	206.00	ft.
slope =	3.640	%
***T$_c$** =	12.90	min.

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

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T$_c$** =	#DIV/0!	min.

$$T_C = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

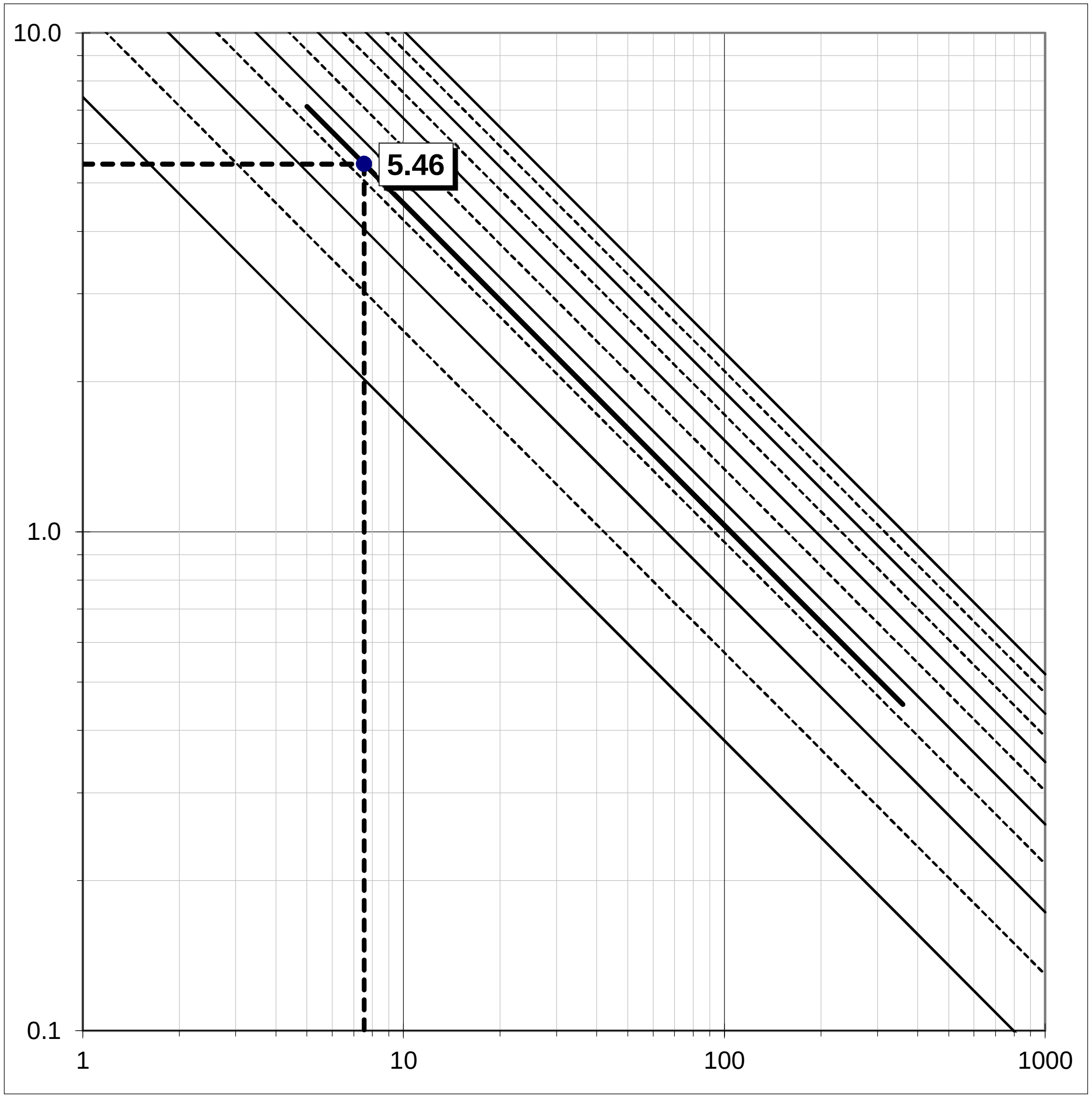
Selected Frequency,	**100**	year	
P_6 =	2.7	in.	P_6 must be within
P_{24} =	5.6	in.	45% to 65% of P_{24}.
P_6 / P_{24} =	48%		Adjust P_6 as needed.
Adjusted **P_6**=	2.70	in.	
T_c (**D**) =	12.90	min.	
I =	3.86	in/hr	

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**0.34**	**cfs**
C =	0.33	
I =	3.86	in/hr
A =	0.262	ac.

$$Q = C * I * A$$



PR-1A

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =		
C =	0.77	
Dist. =	193.00	ft.
slope =	1.300	%
***T_c** =	7.54	min.

$$T_C = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{S}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T_c** =	#DIV/0!	min.

$$T_C = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 =	2.7	in.
P_{24} =	5.6	in.
P_6 / P_{24} =	48%	
Adjusted **P_6**=	2.70	in.
T_c (**D**) =	7.54	min.
I =	5.46	in/hr

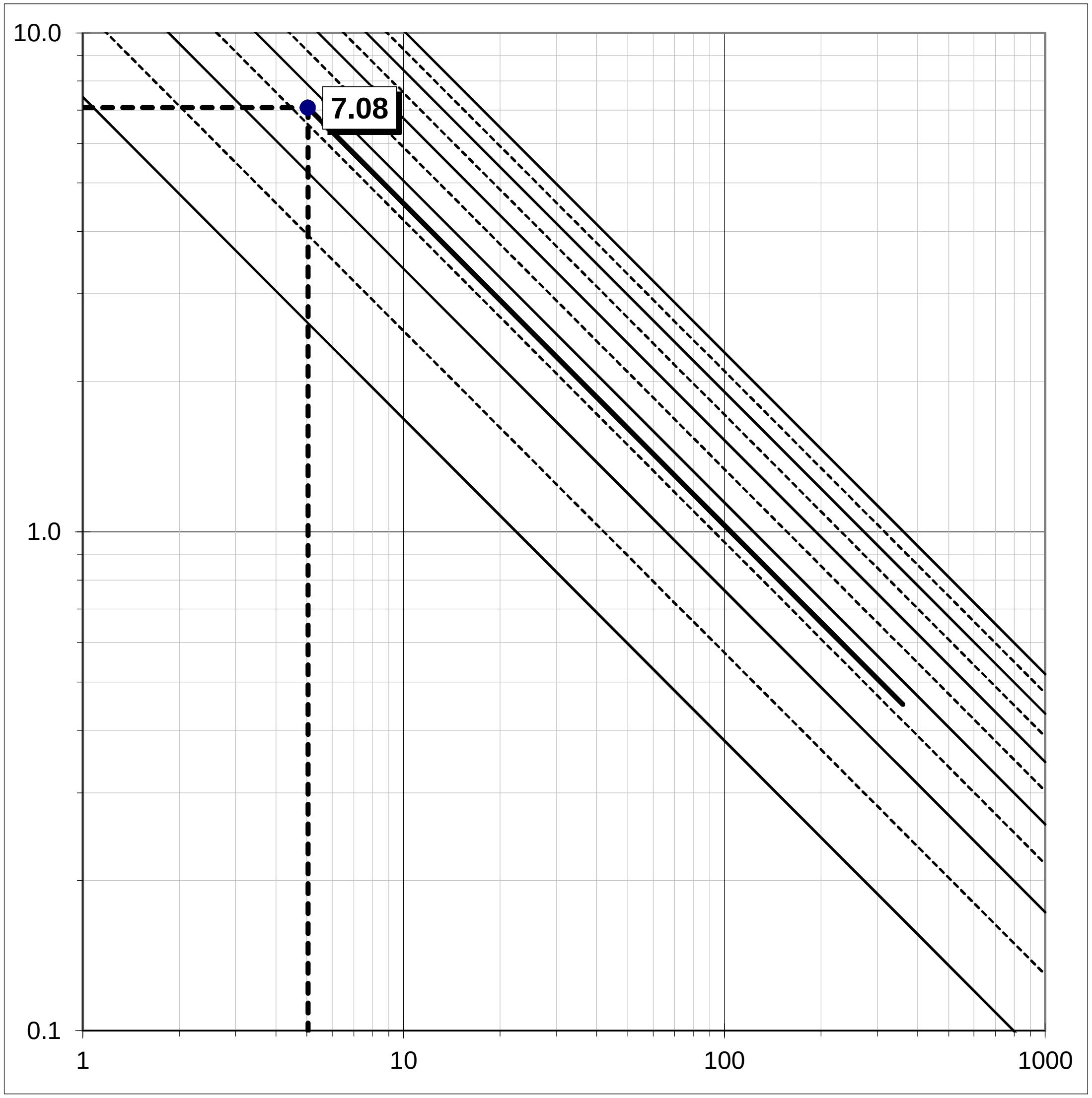
P_6 must be within 45% to 65% of P_{24}. Adjust P_6 as needed.

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**1.49**	**cfs**
C =	0.77	
I =	5.46	in/hr
A =	0.355	ac.

$$Q = C * I * A$$



PR-1B

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =

C = 0.82

Dist. = 180.00 ft.

slope = 2.420 %

***T_c** = 5.04 min.

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

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L = 0 ft

ΔE = 0 ft

****T_c** = #DIV/0! min.

$$T_C = \left(\frac{11.9 L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency, **100** year

P_6 = 2.7 in.

P_{24} = 5.6 in.

P_6 / P_{24} = 48%

Adjusted **P_6**= 2.70 in.

T_c (**D**) = 5.04 min.

I = 7.08 in/hr

P_6 must be within 45% to 65% of P_{24}. Adjust P_6 as needed.

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

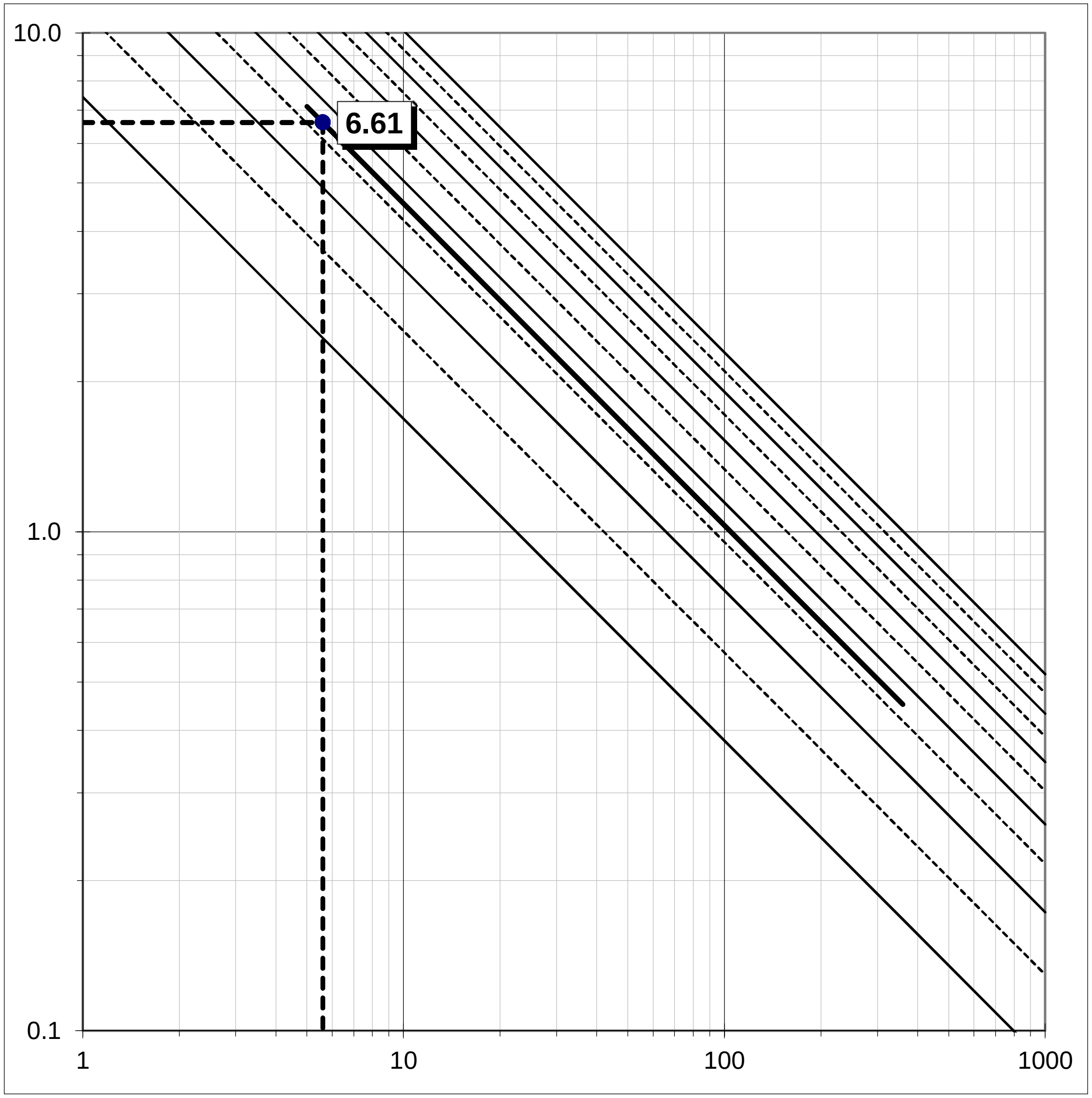
Q = **3.91** **cfs**

C = 0.82

I = 7.08 in/hr

A = 0.674 ac.

$$Q = C * I * A$$



PR-1C

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =			
C =	0.78		
Dist. =	191.00	ft.	
slope =	2.600	%	
***T_c** =	5.60	min.	

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{S}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T_c** =	#DIV/0!	min.

$$T_C = \left(\frac{11.9L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

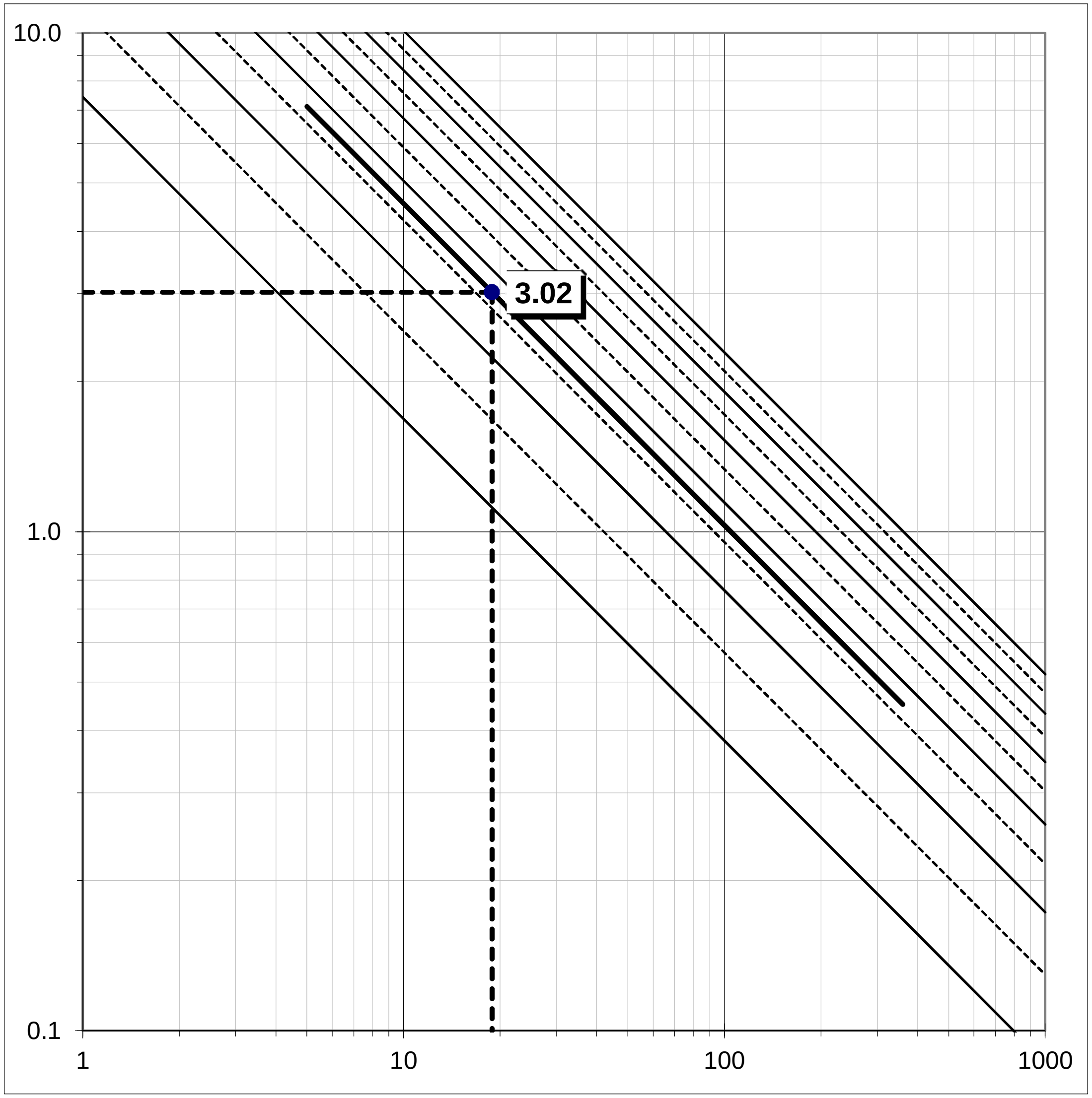
Selected Frequency,	**100**	year	
P_6 =	2.7	in.	P_6 must be within
P_{24} =	5.6	in.	45% to 65% of P_{24}.
P_6 / P_{24} =	48%		Adjust P_6 as needed.
Adjusted **P_6**=	2.70	in.	
T_c (**D**) =	5.60	min.	
I =	6.61	in/hr	

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**2.34**	**cfs**
C =	0.78	
I =	6.61	in/hr
A =	0.452	ac.

$$Q = C * I * A$$



PR-1D

Proposed Conditions

Time of Concentration Calculations

Overland Flow Method

Land Use =		
C =	0.66	
Dist. =	173.00	ft.
slope =	2.100	%
***T$_c$** =	18.87	min.

$$T_C = \frac{1.8(1.1 - C)\sqrt{D}}{\sqrt[3]{S}}$$

* Minimum T_c = 5 Minutes

Natural Watershed (Kirpich)

L =	0	ft
ΔE =	0	ft
****T$_c$** =	#DIV/0!	min.

$$T_C = \left(\frac{11.9 L^3}{\Delta E}\right)^{0.385}$$

** Minimum T_c = 10 Minutes

Basin Intensity Calculations

Selected Frequency,	**100**	year	
P_6 =	2.7	in.	P_6 must be within
P_{24} =	5.6	in.	45% to 65% of P_{24}.
P_6 / P_{24} =	48%		Adjust P_6 as needed.
Adjusted **P_6**=	2.70	in.	
T_c (**D**) =	18.87	min.	
I =	3.02	in/hr	

$$I = 7.44 P_6 D^{-0.645}$$

Basin Flow Calculations

Q =	**0.28**	**cfs**
C =	0.35	
I =	3.02	in/hr
A =	0.238	ac.

$$Q = C * I * A$$

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2012 Version 7.9

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 07/19/17
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6313

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

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.700
24 hour precipitation(inches) =  5.600
P6/P24 =    48.2%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.332 given for subarea
Rainfall intensity (I) =      3.860(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  12.90 min.  Rain intensity =       3.86(In/Hr)
Total area =        0.262(Ac.)  Total runoff =     0.340(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   537.620(Ft.)
Downstream point/station elevation =   534.290(Ft.)
Pipe length  =    66.00(Ft.) Slope =   0.0505  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.340(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.340(CFS)
Normal flow depth in pipe =    2.13(In.)
Flow top width inside pipe =    5.74(In.)
Critical Depth =    3.55(In.)
Pipe flow velocity =      5.45(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =    13.10 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.262(Ac.)
Runoff from this stream =      0.340(CFS)
Time of concentration =   13.10 min.
Rainfall intensity =     3.822(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.771 given for subarea
Rainfall intensity (I) =      5.458(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   7.54 min.  Rain intensity =       5.46(In/Hr)
Total area =        0.355(Ac.)  Total runoff =     1.490(CFS)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   534.400(Ft.)
Downstream point/station elevation =   534.290(Ft.)
Pipe length  =     8.00(Ft.) Slope =   0.0138  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.490(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.490(CFS)
Normal flow depth in pipe =    5.91(In.)
Flow top width inside pipe =    8.55(In.)
Critical Depth =    6.74(In.)
Pipe flow velocity =      4.84(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     7.57 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.355(Ac.)
Runoff from this stream =      1.490(CFS)
Time of concentration =    7.57 min.
Rainfall intensity =     5.445(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        0.340     13.10                 3.822
2        1.490      7.57                 5.445
Qmax(1) =
           1.000 *    1.000 *     0.340) +
           0.702 *    1.000 *     1.490) + =       1.386
Qmax(2) =
           1.000 *    0.578 *     0.340) +
           1.000 *    1.000 *     1.490) + =       1.686

Total of 2 main streams to confluence:
Flow rates before confluence point:
       0.340       1.490
Maximum flow rates at confluence using above data:
        1.386        1.686
Area of streams before confluence:
        0.262        0.355


Results of confluence:
Total flow rate =      1.686(CFS)
Time of concentration =     7.568 min.
Effective stream area after confluence  =      0.617(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   534.290(Ft.)
Downstream point/station elevation =   530.250(Ft.)
Pipe length  =   218.00(Ft.) Slope =   0.0185  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.686(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.686(CFS)
Normal flow depth in pipe =    5.81(In.)
Flow top width inside pipe =    8.61(In.)
Critical Depth =    7.16(In.)
Pipe flow velocity =      5.59(Ft/s)
Travel time through pipe =    0.65 min.
Time of concentration (TC) =     8.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
```

```
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.617(Ac.)
Runoff from this stream =      1.686(CFS)
Time of concentration =    8.22 min.
Rainfall intensity =     5.163(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.783 given for subarea
Rainfall intensity (I) =      6.612(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   5.60 min.  Rain intensity =       6.61(In/Hr)
Total area =        0.452(Ac.)  Total runoff =     2.340(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   534.090(Ft.)
Downstream point/station elevation =   532.080(Ft.)
Pipe length  =   140.00(Ft.) Slope =   0.0144  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.340(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.340(CFS)
Normal flow depth in pipe =    6.34(In.)
Flow top width inside pipe =   11.98(In.)
Critical Depth =    7.86(In.)
Pipe flow velocity =      5.56(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =     6.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.452(Ac.)
Runoff from this stream =      2.340(CFS)
Time of concentration =    6.02 min.
Rainfall intensity =     6.311(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.660 given for subarea
Rainfall intensity (I) =      3.020(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  18.87 min.  Rain intensity =       3.02(In/Hr)
Total area =        0.238(Ac.)  Total runoff =     0.280(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      109.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   532.750(Ft.)
Downstream point/station elevation =   532.080(Ft.)
Pipe length  =     6.00(Ft.) Slope =   0.1117  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.280(CFS)
Nearest computed pipe diameter  =      3.00(In.)
Calculated individual pipe flow  =     0.280(CFS)
Normal flow depth in pipe =    2.33(In.)
Flow top width inside pipe =    2.51(In.)
Critical depth could not be calculated.
Pipe flow velocity =      6.84(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    18.88 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.238(Ac.)
Runoff from this stream =      0.280(CFS)
Time of concentration =   18.88 min.
Rainfall intensity =     3.019(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.340      6.02                 6.311
2        0.280     18.88                 3.019
Qmax(1) =
           1.000 *    1.000 *     2.340) +
           1.000 *    0.319 *     0.280) + =       2.429
Qmax(2) =
           0.478 *    1.000 *     2.340) +
           1.000 *    1.000 *     0.280) + =       1.399

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.340       0.280
Maximum flow rates at confluence using above data:
        2.429       1.399
Area of streams before confluence:
        0.452       0.238
Results of confluence:
Total flow rate =      2.429(CFS)
Time of concentration =     6.020 min.
Effective stream area after confluence =      0.690(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   532.080(Ft.)
Downstream point/station elevation =   531.430(Ft.)
Pipe length  =    44.00(Ft.) Slope =   0.0148  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.429(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.429(CFS)
Normal flow depth in pipe =    6.43(In.)
Flow top width inside pipe =   11.97(In.)
Critical Depth =    8.02(In.)
Pipe flow velocity =      5.67(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     6.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.690(Ac.)
Runoff from this stream =      2.429(CFS)
Time of concentration =    6.15 min.
Rainfall intensity =     6.225(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      114.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
User specified 'C' value of 0.820 given for subarea
Rainfall intensity (I) =      7.077(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   5.04 min.  Rain intensity =       7.08(In/Hr)
Total area =        0.674(Ac.)  Total runoff =     3.910(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station      114.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   532.040(Ft.)
Downstream point/station elevation =   531.430(Ft.)
Pipe length  =    39.00(Ft.) Slope =   0.0156  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.910(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.910(CFS)
Normal flow depth in pipe =    8.72(In.)
Flow top width inside pipe =   10.70(In.)
Critical Depth =   10.08(In.)
Pipe flow velocity =      6.40(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     5.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      112.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.674(Ac.)
Runoff from this stream =      3.910(CFS)
Time of concentration =    5.14 min.
Rainfall intensity =     6.987(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.429      6.15                 6.225
2        3.910      5.14                 6.987
Qmax(1) =
           1.000 *    1.000 *     2.429) +
           0.891 *    1.000 *     3.910) + =       5.913
Qmax(2) =
           1.000 *    0.836 *     2.429) +
           1.000 *    1.000 *     3.910) + =       5.941

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.429       3.910
Maximum flow rates at confluence using above data:
        5.913        5.941
Area of streams before confluence:
        0.690        0.674
Results of confluence:
Total flow rate =      5.941(CFS)
Time of concentration =     5.142 min.
Effective stream area after confluence =      1.364(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   531.430(Ft.)
Downstream point/station elevation =   530.500(Ft.)
Pipe length  =     6.00(Ft.) Slope =   0.1550  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.941(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     5.941(CFS)
Normal flow depth in pipe =    6.75(In.)
Flow top width inside pipe =    7.79(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.71(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     5.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      106.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.364(Ac.)
```

Runoff from this stream = 5.941(CFS)
Time of concentration = 5.15 min.
Rainfall intensity = 6.982(In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	1.686	8.22	5.163
2	5.941	5.15	6.982

```
Qmax(1) =
          1.000 *    1.000 *     1.686) +
          0.740 *    1.000 *     5.941) + =       6.080
Qmax(2) =
          1.000 *    0.626 *     1.686) +
          1.000 *    1.000 *     5.941) + =       6.998
```

Total of 2 main streams to confluence:
Flow rates before confluence point:
1.686 5.941
Maximum flow rates at confluence using above data:
6.080 6.998
Area of streams before confluence:
0.617 1.364

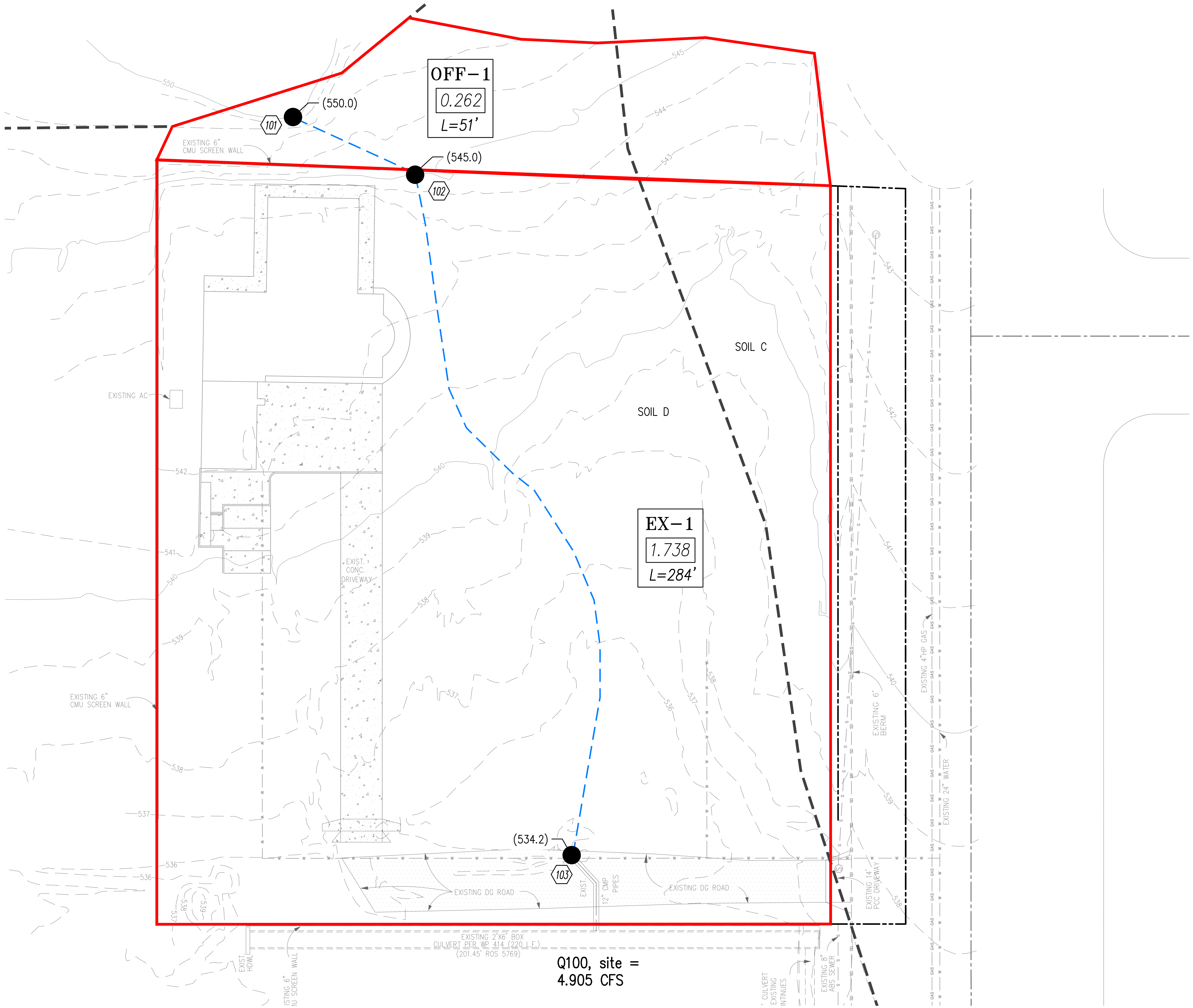
Results of confluence:
Total flow rate = 6.998(CFS)
Time of concentration = 5.148 min.
Effective stream area after confluence = 1.981(Ac.)
End of computations, total study area = 1.981 (Ac.)

ATTACHMENT 5

HYDROLOGY MAP - EXISTING CONDITIONS

ATTACHMENT 5

CONDITIONS



LEGEND

	SUBDIVISION BOUNDARY
200	EXISTING CONTOUR (MAJOR)
	EXISTING CONTOUR (MINOR)
	HYDROLOGIC BASIN BOUNDARY
	HYDROLOGIC FLOW PATH
EX−1	BASIN NUMBER
0.20	AREA (ACRES)
101	NODE NUMBER
(200.00)	ELEVATION (FEET)

20 0 20 40

GRAPHIC SCALE
SCALE: 1" = 20'

Civil Landworks

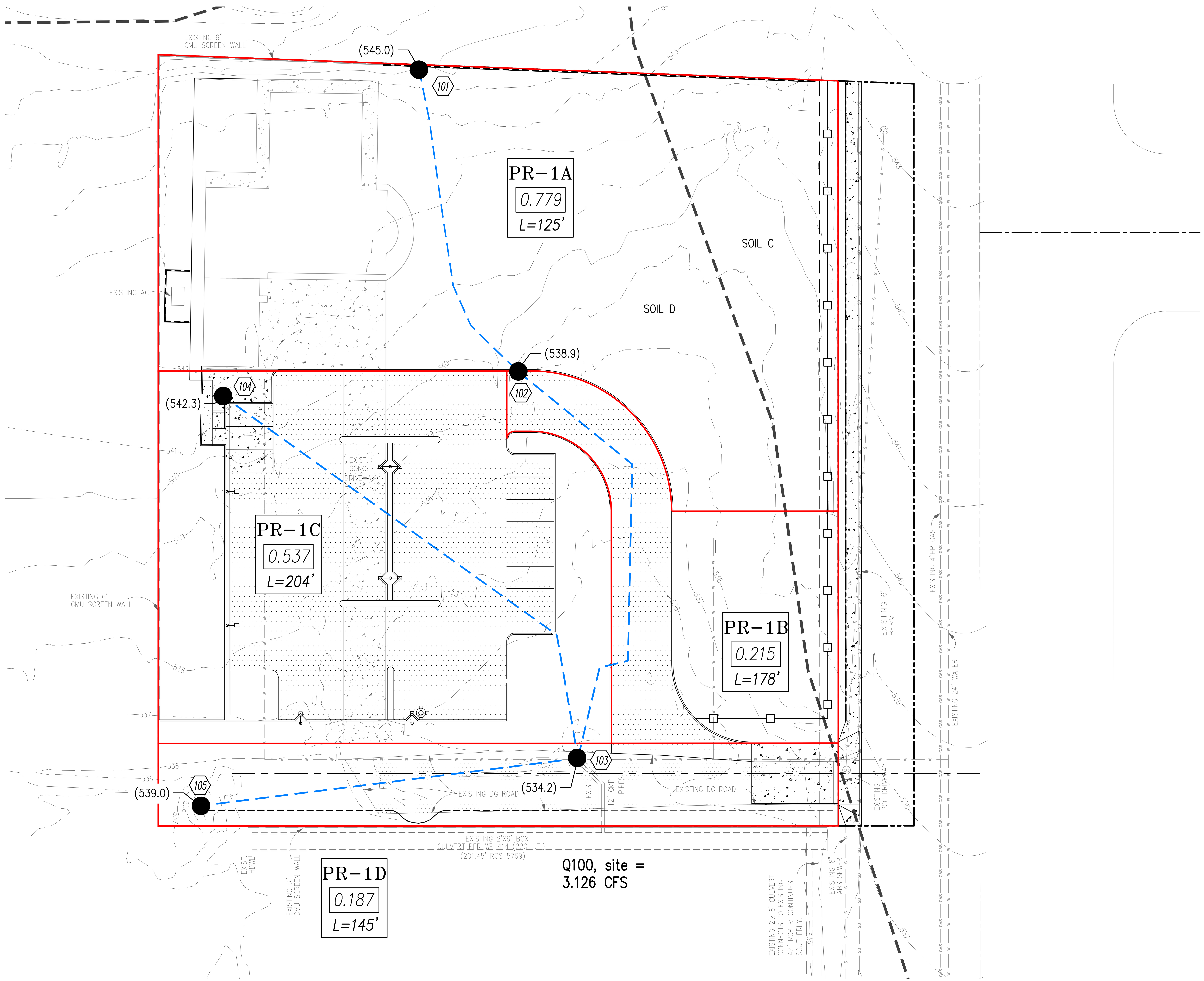
110 COPPERWOOD WAY, SUITE P, OCEANSIDE, CA 92058
PH: 760-908-8745 • info@civillandworks.com

ATTACHMENT 6

HYDROLOGY MAP - PROPOSED CONDITIONS

PHASE 1

ATTACHMENT 6A
PROPOSED HYDROLOGIC CONDITIONS



LEGEND

SUBDIVISION BOUNDARY
EXISTING CONTOUR (MAJOR)
EXISTING CONTOUR (MINOR)
PROPOSED CONTOUR (MAJOR)
PROPOSED CONTOUR (MINOR)
HYDROLOGIC BASIN BOUNDARY
HYDROLOGIC FLOW PATH
STORM DRAIN PIPE FLOW PATH
PR-1 BASIN NUMBER
0.20 AREA (ACRES)
102 NODE NUMBER
(200.00) ELEVATION (FEET)

20 0 20 40
GRAPHIC SCALE
SCALE: 1" = 20'

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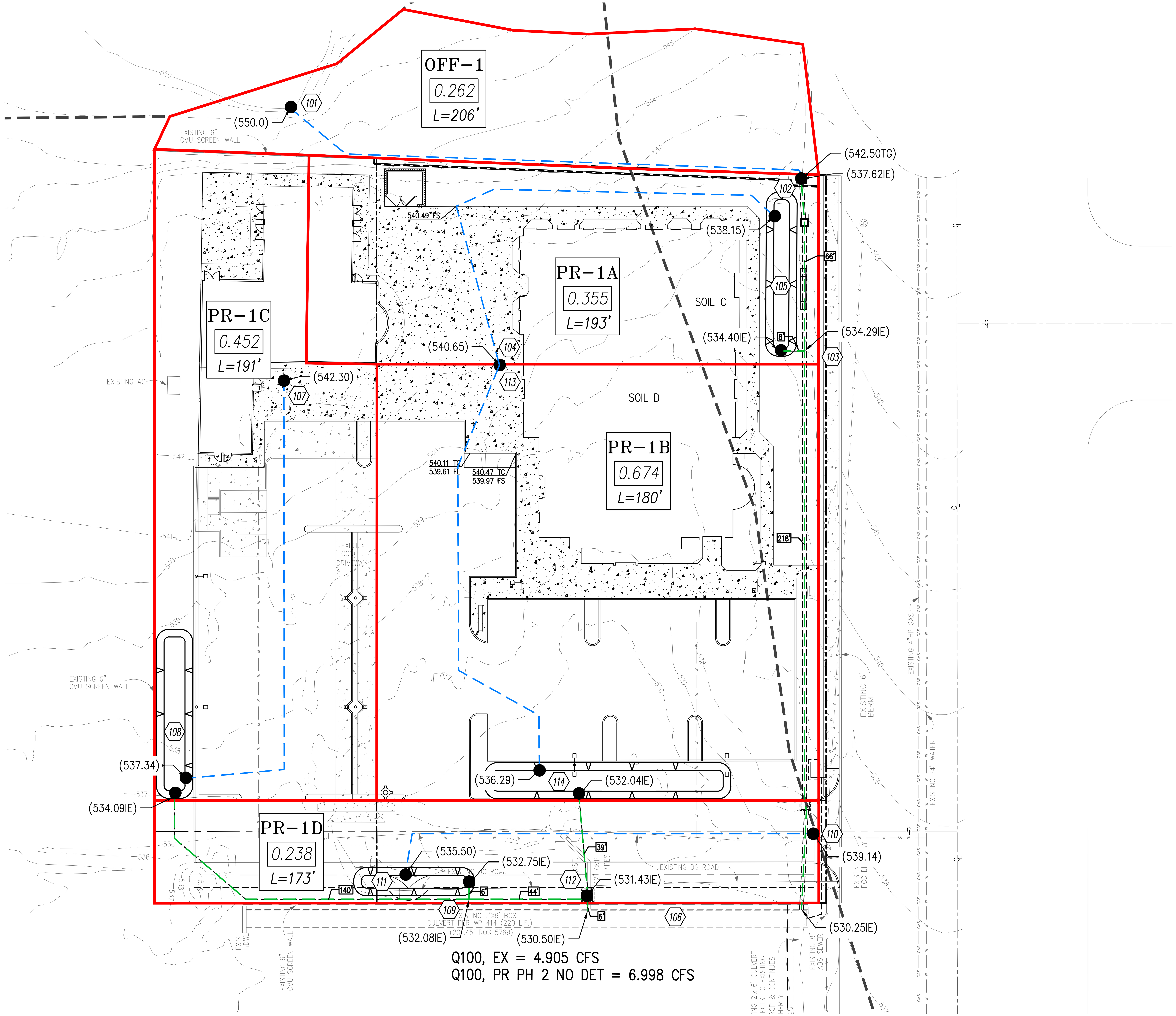
PH: 760-908-8745 • info@civillandworks.com

PHASE 2

ATTACHMENT 6B
PROPOSED HYDROLOGIC CONDITIONS



LEGEND

	SUBDIVISION BOUNDARY
200	EXISTING CONTOUR (MAJOR)
	EXISTING CONTOUR (MINOR)
200	PROPOSED CONTOUR (MAJOR)
	PROPOSED CONTOUR (MINOR)
	HYDROLOGIC BASIN BOUNDARY
	HYDROLOGIC FLOW PATH
	STORM DRAIN PIPE FLOW PATH
PR−1	BASIN NUMBER
0.20	AREA (ACRES)
102	NODE NUMBER
(200.00)	ELEVATION (FEET)

20 0 20 40

GRAPHIC SCALE
SCALE: 1" = 20'

Civil Landworks
110 COPPERWOOD WAY, SUITE P, OCEANSIDE, CA 92058
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Attachment 7

Geotechnical and Groundwater Investigation Report

ATTACHMENT 7

Copy of Project's Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 7.

If hardcopy or CD is not attached, the following information should be provided:

Title:
Prepared By:
Date:

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LIMITED GEOTECHNICAL EVALUATION OF STORM WATER INFILTRATION FEASIBILITY
SAINT GREGORY OF NYASSA GREEK ORTHODOX CHURCH
1454 JAMACHA ROAD
EL CAJON, SAN DIEGO COUNTY, CALIFORNIA 92019
ASSESSOR'S PARCEL NUMBER (APN) 498-320-56-00

FOR

SAINT GREGORY OF NYASSA GREEK ORTHODOX CHURCH
1454 JAMACHA ROAD
EL CAJON, CALIFORNIA 92019

W.O. 7220-A-SC JANUARY 10, 2017

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

5741 Palmer Way • Carlsbad, California 92010 • (760) 438-3155 • FAX (760) 931-0915 • www.geosoilsinc.com

January 10, 2017

W.O. 7220-A-SC

Saint Gregory of Nyassa Greek Orthodox Church
1454 Jamacha Road
El Cajon, California 92019

Attention: Mr. Peter Shenas

Subject: Limited Geotechnical Evaluation of Storm Water Infiltration Feasibility, Saint Gregory of Nyassa Greek Orthodox Church, 1454 Jamacha Road, El Cajon, San Diego County, California 92019, APN 498-320-56-00

Dear Mr. Shenas:

In accordance with your request and authorization, GeoSoils, Inc. (GSI) is providing this summary of our limited geotechnical evaluation of storm water infiltration feasibility at the subject site. The purpose of our study was to evaluate the onsite geologic and geotechnical conditions relative to the feasibility of storm water infiltration for permanent storm water best management practices (BMPs).

SCOPE OF SERVICES

The scope of services performed for this study included:

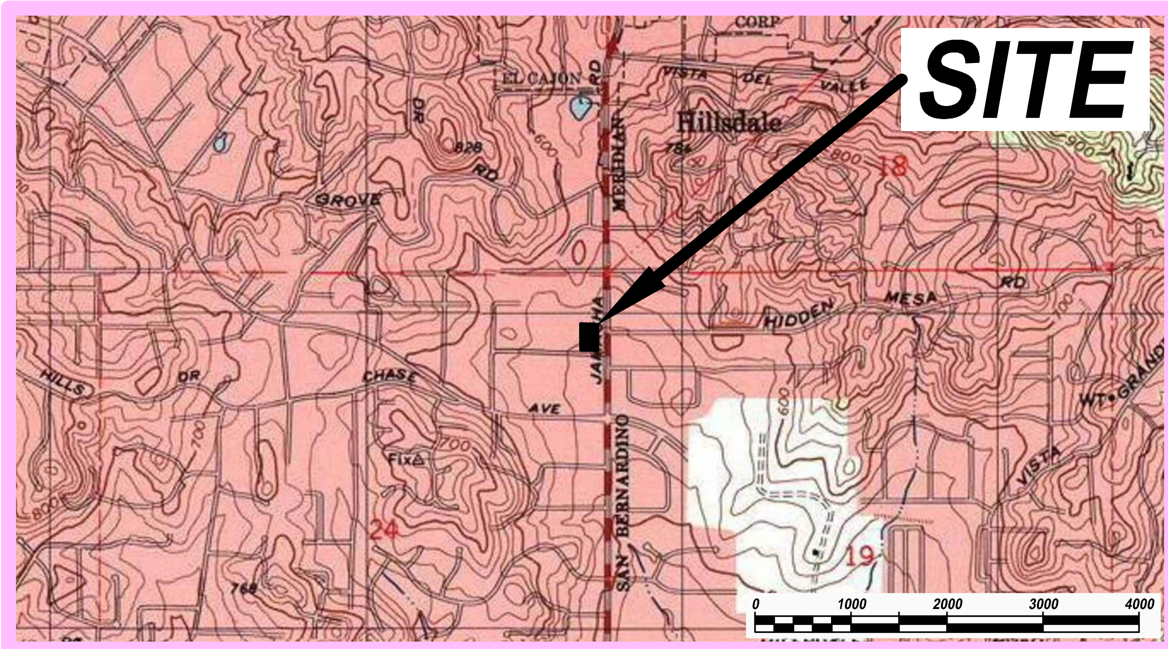
- A review of in-house geologic maps and literature, and readily available soils, groundwater, and environmental data for the subject site and near-vicinity, including United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS) soils infiltration data.

- Analysis of information collected; and

- The preparation of this summary report.

SITE CONDITIONS

The subject site consists of a roughly rectangular-shaped parcel of land located at 1454 Jamacha Road in El Cajon, San Diego County, California (see Figure 1, Site Location Map). The property is bounded by Jamacha Road (State Route 54) to the east, by existing residential development to the north, by relatively vacant land to the west, and by existing commercial/retail development and a nursery/landscape retailer to the south. Topographically, the site is relatively flat-lying to gently sloping to the south.



Base Map: TOPO!® ©2003 National Geographic, U.S.G.S. El Cajon Quadrangle, California -- San Diego Co., 7.5 Minute, dated 1996, current, 2000.

Base Map: Google Maps, Copyright 2017 Google, Map Data Copyright 2017 Google

GeoSoils, Inc.

W.O. **7220-A-SC**

SITE LOCATION MAP

Figure 1

N

The property is located near the axis of a low relief, southerly-flowing natural drainage; considered a tributary within the Sweetwater River watershed. According to Google Earth satellite imagery, site elevations range between approximately 534 and 545 feet (unknown datum), for an overall relief of about 11 feet. With the exception of a relatively newly constructed church building and associated Portland Cement Concrete (PCC) flatwork, near the northwesterly property corner, the site is relatively undeveloped. Site drainage appears to be controlled by sheet-flow runoff, directed to the south. Site vegetation consists of sparse trees and shrubbery.

SITE GEOLOGIC/LITHOLOGIC CONDITIONS

According to regional geologic mapping by Tan (2002), the subject site is underlain by Cretaceous-age plutonic bedrock, consisting of medium-grained, severely weathered tonalite with lesser granodiorite and quartz diorite composition. Based on geomorphology, GSI surmises that the bedrock is mantled by undifferentiated, stream-deposited alluvium and colluvium (topsoil), and locally by artificial fill. Our experience has shown that similar plutonic bedrock has low hydraulic conductivity and is typically a limiting factor in regard to storm water infiltration feasibility.

SOILS

According to soil survey mapping by the United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS), the westerly, approximately two-thirds of the site is mantled by soils belonging to the Placentia sandy loam, 2 to 9 percent slopes. Whereas, the easterly, approximately one-third of the site is mantled by the Ramona sandy loam, 2 to 5 percent slopes. The USDA-NRCS indicates that the infiltration rate of the most limiting layer, within the Placentia sandy loam, 2 to 9 percent slopes, ranges from 0.0 to 0.06 inches per hour (in/hr). The USDA-NRCS reports that the infiltration rate of the most limiting layer, within the Ramona sandy loam, 2 to 5 percent slopes, varies from 0.20 to 0.57 in/hr. Thus, the USDA-NRCS assigns the Placentia sandy loam, 2 to 9 percent slopes to Hydrologic Soil Group (HSG) "D," and the Ramona sandy loam, 2 to 5 percent slopes to HSG "C." Such soil conditions, suggest that infiltration for permanent storm water BMPs at the subject site is typically infeasible.

GROUNDWATER

According to the State of California Department of Water Resources ([CDWR],1967), groundwater was measured and inferred at depths less than 25 feet below the surface in the general site vicinity. A review of an environmental study, performed at 2249 Jamacha Road, El Cajon, California by Avocet Environmental, Inc. ([AEI], 2013), indicated groundwater depths ranging between 25 and 35 feet below the surface of that property. It is the opinion of GSI that the groundwater conditions described by

CDWR (1967) and AEI (2013) are consistent with a perched water table; whereby, the groundwater is resting or perched upon relatively fresh (i.e., less weathered), impermeable bedrock, or contained in fractures, and is not the regional groundwater table (typically not present in crystalline plutonic rock). GSI estimates that the elevation of the regional groundwater table is roughly consistent with sea level.

The subject site is located within the Hillsdale Hydrologic Subarea of the Middle Sweetwater Hydrologic Area of the Sweetwater Hydrologic Unit. According to the California Regional Water Quality Control Board - San Diego Region (1994), beneficial groundwater use within the Middle Sweetwater Hydrologic Area include municipal and domestic supply, agricultural supply, and industrial service supply. Thus, if shallow groundwater conditions do exist at the property, as reported in CDWR (1967) and AEI (2013), insufficient vertical separation, between the permanent storm water BMP and the groundwater table could lead to groundwater contamination because of inadequate filtering of potential contaminants.

ADDITIONAL GEOTECHNICAL CONCERNS

Expansive Soils

Although the scope of this study did not include an evaluation of expansive soils, within the subject property, it is well documented that residual soils, formed through weathering and alteration of plutonic bedrock, can be detrimentally expansive. The shrink/swell effects of expansive soils can damage improvements such as foundations, slab-on-grade floors, pavements, walls, etc. The introduction of infiltrated storm water, if not properly contained, could initiate swelling of expansive soils, especially during the wet season. Conversely, during the dry season, when storm water infiltration would be of limited volume, the drying of expansive soils would lead to shrinking effects. Cyclical shrinking and swelling soils may have damaging repercussions to existing improvements and future improvements.

Perched Water Conditions

As previously indicated, the dense nature of plutonic bedrock, shown to underlie the subject site (Tan, 2002), is not conducive to infiltration. Thus, infiltrated storm water would most likely perch upon the bedrock and begin to mound and migrate laterally, potentially adversely affecting onsite improvements as well as existing improvements on adjoining properties.

Underground Utilities

Given the likelihood for perched water conditions to develop in the event of storm water infiltration, perched water entering into underground utility trenches has the potential to induce settlement of backfill, lead to the migration of fines into open-graded gravels used in the pipe zone (i.e., piping), and cause corrosion of any metal components used in underground utility construction.

CONCLUSIONS

Owing to the above-described factors and concerns, the site is not well suited for storm water infiltration for permanent storm water BMPs; and therefore, is not recommended from a geotechnical perspective, owing to the likelihood of potential adverse effects.

RECOMMENDATIONS

GSI recommends that storm water treatment occur within lined bioretention basins or swales, or subsurface infiltration chambers/galleries. More specifically, we recommend:

- Impermeable liners used in conjunction with bioretention basins should consist of a 30-mil polyvinyl chloride (PVC) membrane that is covered by a minimum of 12 inches of clean soil, free from rocks and debris, with a maximum 4:1 (h:v) slope inclination, or flatter, and meets the following minimum specifications:

  Specific Gravity (ASTM D792): 1.2 (g/cc, min.); Tensile (ASTM D882): 73 (lb/in-width, min); Elongation at Break (ASTM D882): 380 (%, min); Modulus (ASTM D882): 30 (lb/in-width, min.); and Tear Strength (ASTM D1004): 8 (lb/in, min); Seam Shear Strength (ASTM D882) 58.4 (lb/in, min); Seam Peel Strength (ASTM D882) 15 (lb/in, min).

- Subdrains used in bioretention basins should consist of at least 4-inch diameter Schedule 40 or SDR 35 drain pipe with perforations oriented down. The drain pipe should be sleeved with a filter sock.

- Areas adjacent to, or within, the bioretention basins that are subject to inundation should be properly protected against scouring, undermining, and erosion, in accordance with the recommendations of the design engineer.

- If subsurface infiltration galleries/chambers are proposed, the appropriate size, depth interval, and ultimate placement of the detention/infiltration system should be evaluated by the design engineer, and be of sufficient width/depth to achieve optimum performance, based on the infiltration rates provided. In addition, proper debris filter systems will need to be utilized for the infiltration galleries/chambers.

Debris filter systems will need to be self cleaning and periodically and regularly maintained on a regular basis.

- Provisions for the regular and periodic maintenance of any debris filter system is recommended and this condition should be disclosed to all interested/affected parties.

- Infiltrations basins/swales should not be installed within ±8 feet of building foundations utility trenches, and walls, or a 1:1 (h:v) slope (down and away) from the bottom elements of these improvements. Alternatively, deepened foundations and/or pile/pier supported improvements may be used.

- Infiltrations basins/swales should not be installed adjacent to pavement and/or hardscape improvements. Alternatively, deepened/thickened edges and curbs may be utilized in areas adjoining the basin/swale.

- Infiltration systems should be designed using a suitable factor-of-safety (FOS) to account for uncertainties in the known infiltration rates (as generally required by the controlling authorities), and reduction in performance over time. Any designed system will require regular and periodic maintenance, which may include rehabilitation and/or complete replacement of the filter media (e.g., sand, gravel, filter fabrics, topsoils, mulch, etc.) or other components utilized in construction, so that the design life exceeds 15 years.

- Due to the potential for piping and adverse seepage conditions, a burrowing rodent control program should also be implemented onsite.

- All or portions of these systems may be considered attractive nuisances. Thus, consideration of the effects of, or potential for, vandalism should be addressed.

- The potential for surface flooding, in the case of system blockage, should be evaluated by the design engineer.

- Any proposed utility backfill materials (i.e., inlet/outlet piping and/or other subsurface utilities) located within or near the proposed area of the storm water treatment BMP may become saturated. This is due to the potential for piping, water migration, and/or seepage along the utility trench line backfill. Slurry backfill is recommended in the area proposed for storm water treatment.

- If utility trenches cross and/or are proposed near the BMP, cut-off walls or other water barriers will need to be installed to mitigate the potential for piping and excess water entering the utility backfill materials.

- Planned or existing utilities may also be subject to piping of fines into open-graded gravel backfill layers unless separated from overlying or adjoining BMPs by geotextiles and/or slurry backfill.

- The use of storm water treatment BMPs above existing utilities that might degrade/corrode with the introduction of water/seepage should be avoided.

- A vector control program may be necessary as stagnant water contained in storm water treatment BMPs may attract mammals, birds, and insects that carry pathogens.

LIMITATIONS

The conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

If you have any questions or comments regarding this letter, please do not hesitate to contact the undersigned.

Respectfully submitted,

GeoSoils, Inc.

John P. Franklin
Engineering Geologist, CEG 1340

David W. Skelly
Civil Engineer, RCE 47857

Ryan B. Boehmer
Project Geologist

RBB/JPF/DWS/jh

Attachments: Appendix A - References
Appendix B - County of San Diego Worksheet C.4-1

Distribution: (1) Addressee (via email)
(2) JG Consulting and Engineering, Attn: Mr. Jerry Gaughan (via email and US mail)

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

Avocet Environmental, Inc., 2013, Interim remedial action report, Monte Vista Forest Fire Station, 2249 Jamacha Road, El Cajon, California (SAM Case No. H05241-002), Project No. 1338.005, dated August 26.

Birkeland, P.W., 1999, Soils and geomorphology, third edition, Oxford University Press.

California Regional Water Quality Control Board - San Diego Region, 1994, Water Quality Control Plan for the San Diego Basin (9), dated September 8 (amended May 17, 2016).

County of San Diego, 2016, BMP design manual for permanent site design, stormwater treatment, and hydromodification management, February 26.

State of California Department of Water Resources, 1967, Ground water occurrence and quality, San Diego Region, Bulletin 106-2, Vol. II, Plate 8A, dated June.

Tan, S.S., 2002, Geologic map of the El Cajon 7.5' quadrangle, San Diego County, California, 1:24,000-scale.

Twidale, C.R., and Vidal Romaní, J.R., 2005, Landforms and geology of granite terrains, A.A. Balkema Publishers Leiden, the Netherlands.

United States Department of Agriculture - Natural Resources Conservation Service, 2016, Web soil survey, https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm, last modified August 10.

United States Geological Survey, 1967, El Cajon quadrangle, San Diego County, California, 7.5 minute series, 1:24,000 scale, photorevised 1975.

APPENDIX B

COUNTY OF SAN DIEGO WORKSHEET C.4-1

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Condition			Worksheet C.4-1
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?** Note that it is not necessary to investigate each and every criterion in the worksheet if infiltration is precluded. Instead a letter of justification from a geotechnical professional familiar with the local conditions substantiating any geotechnical issues will be required.			
Criteria	**Screening Question**	**Yes**	**No**
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: Infiltration rates were not evaluated because it is our opinion that full storm water infiltration at the subject site is infeasible owing to the site being underlain at shallow depth by plutonic bedrock that is not conducive to infiltration. In addition, soil survey mapping by the USDA - NRCS indicate that low permeability soils occur within the property. Please refer to the report text for further explanation. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		
Provide basis: Not applicable. See response to Criterion No. 1 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet C.4.1 Page 2 of 4			
Criteria	**Screening Question**	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensible evaluation of the factors presented in Appendix C.3.		
Provide basis: Not applicable. See response to Criterion No. 1 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as a change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Not applicable. See response to Criterion No. 1 Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	In the answers to rows 1-4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		**NO**

* To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by [City Engineer] to substantiate findings.

Worksheet C.4.1 Page 3 of 4			
Part 2 - Partial Infiltration vs. No Infiltration Feasibility Screening Criteria **Would infiltration of water in an appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?**			
Criteria	**Screening Question**	**Yes**	**No**
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: As previously stated in our response to Criterion No. 1, the subject site is underlain at shallow depth by plutonic bedrock and soils that are not conducive to infiltration. Thus, it is our opinion that the soil and geologic conditions at the subject site do not allow for infiltration in any appreciable rate or volume. Please refer to the report text for further explanation. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
6	**Can infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X
Provide basis: Groundwater mounding cannot be precluded due to the occurrence of shallow, impermeable bedrock. This condition cannot be mitigated because the movement of subsurface water cannot be accurately predicted. Infiltrated storm water could also exacerbate expansive soil effects and damage underground utilities. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Worksheet C.4.1 Page 4 of 4			
Criteria	**Screening Question**	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: If there is less than 10 feet of vertical separation between the bottom of the permanent storm water BMP and the phreatic surface, there would be insufficient filtering and the introduction of contaminants into the groundwater supply, which has beneficial uses. Please refer to the report text for further explanation. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
8	**Can infiltration be allowed without violating downstream water rights?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		X
Provide basis: Downstream water rights are generally not studied in geotechnical practice. However, if infiltration were to capture surface waters directed into the Sweetwater River watershed, there would be slightly less water entering the Sweetwater River, which may lead the downstream water rights issues, if such rights exist. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 2 Result*	If all answers from row 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		**No Infiltration**

* To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings.