MERGE 56 DEVELOPMENT PROJECT

SAN DIEGO, CALIFORNIA

FINAL ENVIRONMENTAL IMPACT REPORT

TECHNICAL APPENDIX G

SCH NO. 2014071065

PROJECT NO. 360009

DECEMBER 2017

Prepared for:

City of San Diego
Development Services Department
Land Development Review
1222 First Avenue, MS 501
San Diego, CA 92101-4155

APPENDIX G

Drainage Study and
Storm Water Quality Report

DRAINAGE REPORT FOR

MERGE 56

VESTING TENTATIVE MAP

May 12, 2015

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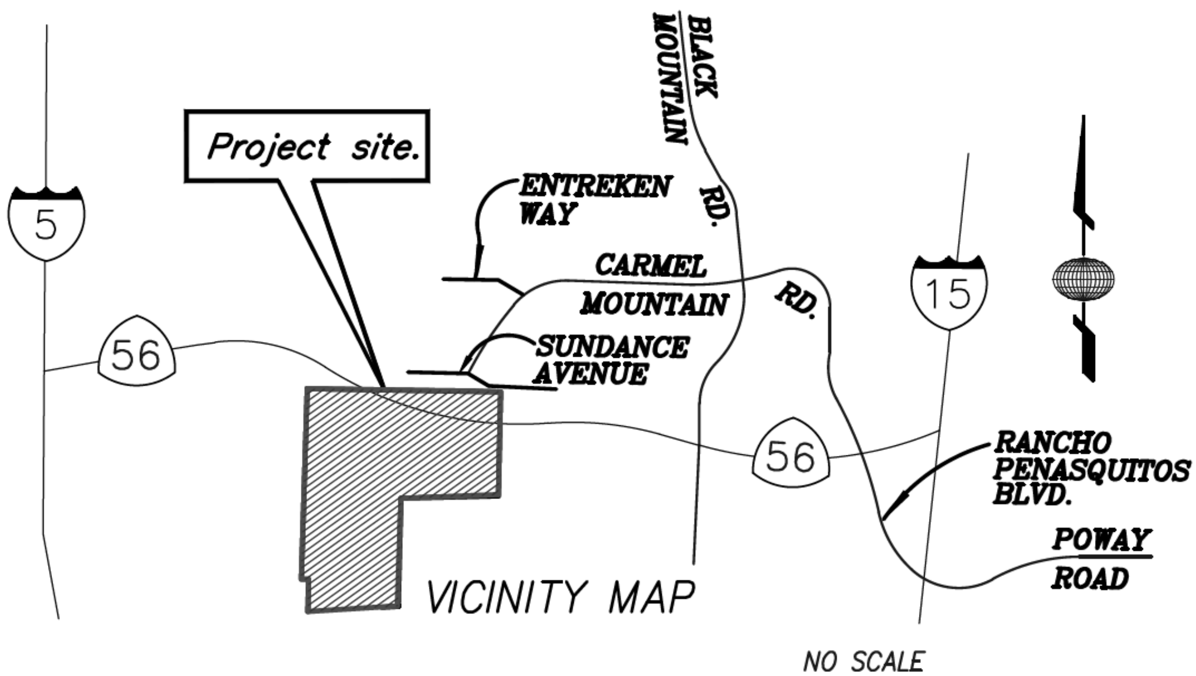
APPENDIX

MAP POCKET

INTRODUCTION

The Merge 56 (aka Rhodes Crossing) Vesting Tentative Map is being designed by Latitude 33. The overall project is located south of State Route 56 and east of the future extension of Camino Del Sur in the city of San Diego (see Vicinity Map). The project proposes to connect the northerly segment of Camino Del Sur from Torrey Santa Fe Road to the southerly segment near Dormouse Road. The project will also extend Carmel Mountain Road southwesterly to the proposed Camino Del Sur extension. Finally, the project will create a mixed-use development (commercial, single-family residential, and possibly some multi-family residential) north of the future intersection of Camino Del Sur and Carmel Mountain Road.



Vicinity Map

This preliminary drainage report provides preliminary drainage information for the VTM. The drainage information includes new rational method analyses for the mixed-use development. In addition, a summary of Latitude 33's prior drainage analyses for the project areas beyond the mixed-use development are provided. Latitude 33's prior drainage analyses are included in the following reports:

- January 2001, *Drainage Study for Camino Ruiz* (aka Camino Del Sur), *South of Carmel Mountain Road*
- January 22, 2004, *Preliminary Drainage Study*, *Rhodes Crossing*
- August 28, 2006, *Drainage Study*, *Rhodes Crossing*, *Camino del Sur & Camel Mountain Roadway Plans.*

The first two reports contain entitlement-level analyses, so the results from these reports are included herein. The January 2001 report analyzes the southerly segment of Camino Del Sur including two proposed detention basins. The “Camino Del Sur, San Diego, California, Developed Drainage Basin Exhibit” from the January 2001 report is included in the map pocket. The January 2004 report analyzes the project area north of the January 2001 report coverage. The “Rhodes Crossing Exhibit ‘B’ Proposed Drainage Conditions” exhibit from the January 2004 report is included in the map pocket. Both exhibits contain the preliminary drainage basin boundaries and hydrologic results performed by Latitude 33. Therefore, additional analyses have not been performed for these areas. The current project proposes to reduce the number of lanes in Camino Del Sur and Carmel Mountain Road by up to one lane in each direction. Therefore, the prior analyses should yield somewhat conservative proposed condition results for entitlement purposes since the actual roadway paving will be less.

Since the mixed-use site plan has been revised from what is shown in the January 2004 report, this report contains updated analyses reflecting the revision. The analyses in this report are for entitlement purposes only and intended to demonstrate feasibility of the proposed drainage system. The following outlines the analyses.

HYDROLOGIC RESULTS

The overall drainage basin covers 35.65 acres so the City of San Diego’s 1984 *Drainage Design Manual’s* rational method procedure was the basis for the proposed condition 100-year hydrologic analysis. An existing condition analysis is contained in the prior 2004 (and 2006) reports. The CivilDesign Rational Method Hydrology Program is based on the City criteria and was used for the analyses. The rational method input parameters are summarized below and the supporting data is included in Appendix A:

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

- Drainage area: The proposed condition drainage basins were delineated using Latitude 33’s Vesting Tentative Map grading. The drainage basin boundaries and grading are shown on the Existing Condition Rational Method Work Map in the map pocket.

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

- Runoff coefficients: The proposed condition runoff coefficients were based on the single-family residential category for the single-family residential areas, the multi-units category for the townhomes, and the commercial category for the commercial development.

- Flow lengths and elevations: The flow lengths and elevations were obtained from the Vesting Tentative Map grading.

The rational method results are included in Appendix A and summarized in Table 1. Storm runoff discharges from the mixed-use area from a single storm drain outlet into a natural area near the northwest corner of the site (see the Proposed Condition Rational Method Work Map). Table 1 indicates that the flow rates are in a range that can be conveyed by typical storm drain facilities. The rational method results contain normal depth Pipeflow routines showing that the conceptual pipe sizes do not exceed 42 inches in diameter, which is not excessive.

Rational Method Node	Drainage Area, ac	Proposed Condition 100-Year Flow Rate, cfs
68	35.65	77

Table 1. Rational Method Results at Project Discharge Locations

CONCLUSION

Preliminary hydrologic analyses have been performed for the Merge 56 Vesting Tentative Map by Latitude 33. The mixed-use area rational method analyses prepared for this report show that proposed condition 100-year flow rates are within a range that can be handled by typical storm drain facilities. Therefore, the drainage design for the mixed-use area is feasible. In addition, Latitude 33's hydrologic exhibits created for their preliminary analyses of the remainder of the site are included in the map pocket. These exhibits provide flow rates and proposed detention basin locations that were assessed and deemed feasible by Latitude 33.

APPENDIX A

RATIONAL METHOD RESULTS

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

Land Use	Coefficient, C Soil Type (1)
Residential:	D
Single Family	.55
Multi-Units	.70
Mobile Homes	.65
Rural (lots greater than 1/2 acre)	.45
Commercial (2) 80% Impervious	.85
Industrial (2) 90% Impervious	.95

NOTES:

(1) Type D soil to be used for all areas.

(2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

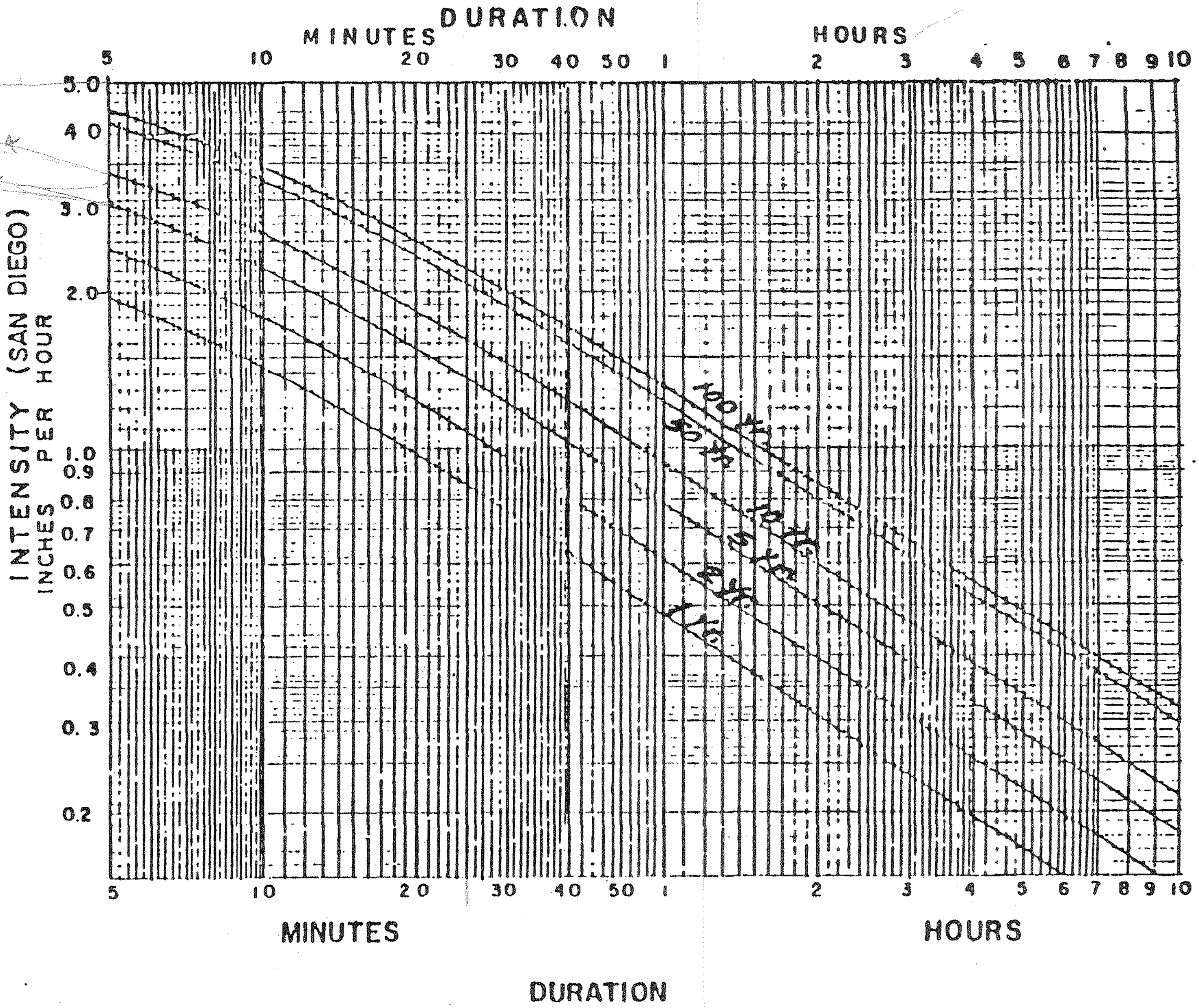
Actual imperviousness = 50%

Tabulated imperviousness = 80%

$$\text{Revised C} = \frac{50}{80} \times 0.85 = 0.53$$

ELEV.	FACTOR
0–1500	1.00
1500–3000	1.25
3000–4000	1.42
4000–5000	1.60
5000–6000	1.70
DESERT	1.25

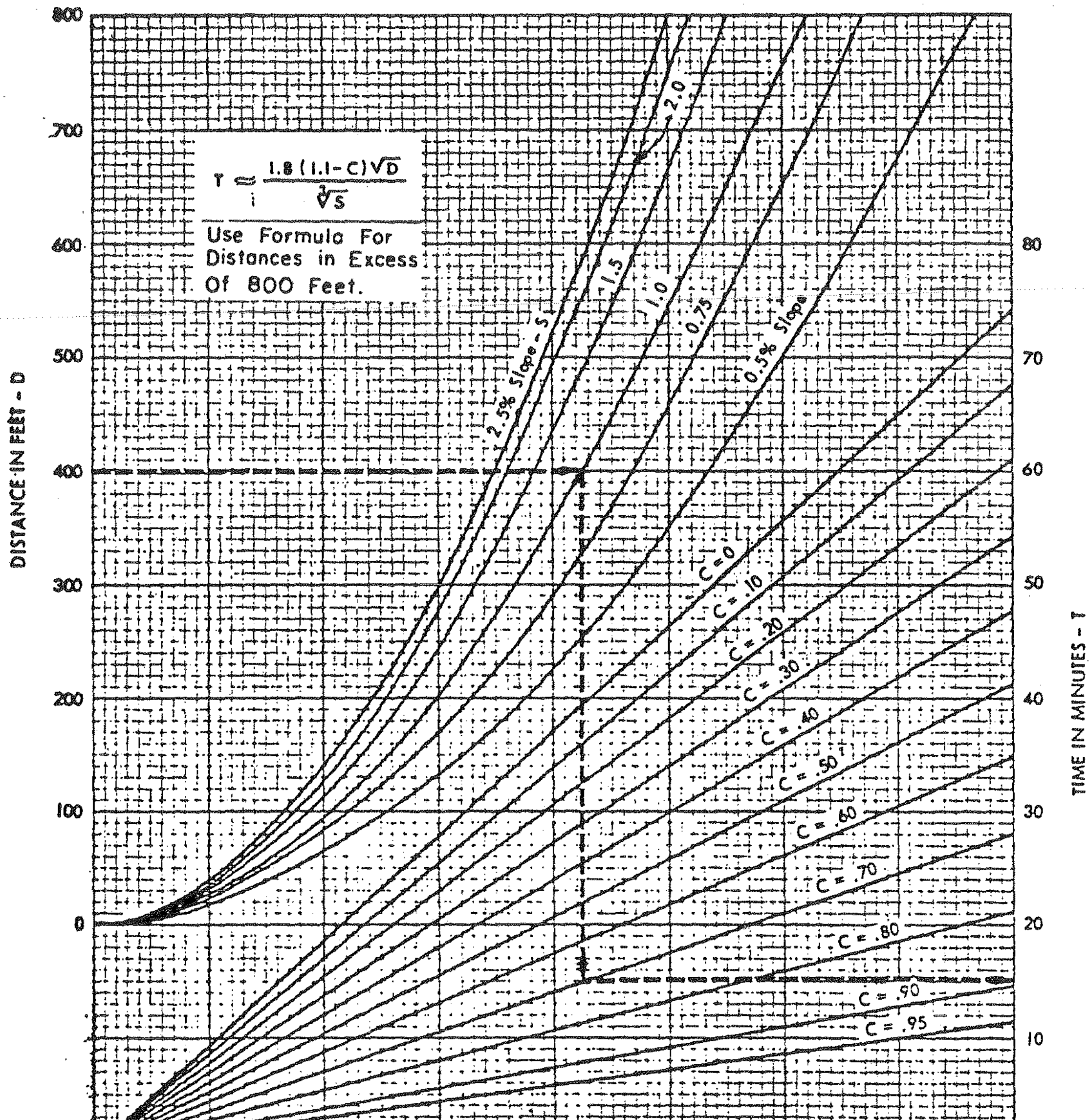
To obtain correct intensity, multiply intensity on chart by factor for design elevation.



RAINFALL
INTENSITY - DURATION - FREQUENC
CURVES
for
COUNTY OF SAN DIEGO

APPENDIX I-

URBAN AREAS OVERLAND TIME OF FLOW CURVES



Surface Flow Time Curves

EXAMPLE:

GIVEN: LENGTH OF FLOW = 400 FT.
SLOPE = 1.0 %
COEFFICIENT OF RUNOFF C = .70

READ: OVERLAND FLOWTIME = 15 MINUTES

```
          San Diego County Rational Hydrology Program

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

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
     Rational Hydrology Study        Date: 05/13/15
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Merge 56
Vesting Tentative Map
Proposed Conditions
100-Year Flow Rate

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

Program License Serial Number 4028

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

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


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      10.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                     ]
Initial subarea flow distance  =  103.000(Ft.)
Highest elevation =  395.200(Ft.)
Lowest elevation =  394.200(Ft.)
Elevation difference =    1.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    10.15 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 103.000^.5)/( 0.971^(1/3)]=  10.15
Rainfall intensity (I) =      3.356(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.222(CFS)
Total initial stream area =       0.120(Ac.)
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Process from Point/Station      12.000 to Point/Station      14.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   395.200(Ft.)
End of street segment elevation =   393.600(Ft.)
Length of street segment  =   173.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   6.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.031(CFS)
Depth of flow =   0.299(Ft.), Average velocity =   1.825(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.205(Ft.)
Flow velocity =   1.83(Ft/s)
Travel time =    1.58 min.     TC =   11.73  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                     ]
Rainfall intensity =      3.185(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.433(CFS) for    1.960(Ac.)
Total runoff =      3.655(CFS)   Total area =        2.08(Ac.)
Street flow at end of street =      3.655(CFS)
Half street flow at end of street =      3.655(CFS)
Depth of flow =   0.350(Ft.), Average velocity =   2.160(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


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Process from Point/Station      14.000 to Point/Station      16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   393.600(Ft.)
Downstream point/station elevation =   392.000(Ft.)
Pipe length  =   160.00(Ft.)   Manning's N = 0.013
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No. of pipes = 1  Required pipe flow  =     3.655(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.655(CFS)
Normal flow depth in pipe =    8.07(In.)
Flow top width inside pipe =   14.96(In.)
Critical Depth =    9.27(In.)
Pipe flow velocity =      5.43(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    12.22 min.


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Process from Point/Station       18.000 to Point/Station       16.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    12.22 min.
Rainfall intensity =      3.137(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.588(CFS) for    0.920(Ac.)
Total runoff =      5.242(CFS)   Total area =       3.00(Ac.)


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Process from Point/Station       16.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   392.000(Ft.)
Downstream point/station elevation =   388.000(Ft.)
Pipe length  =   373.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.242(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.242(CFS)
Normal flow depth in pipe =   10.00(In.)
Flow top width inside pipe =   14.14(In.)
Critical Depth =   11.14(In.)
Pipe flow velocity =      6.03(Ft/s)
Travel time through pipe =    1.03 min.
Time of concentration (TC) =    13.25 min.


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Process from Point/Station       20.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                     ]
Time of concentration =    13.25 min.
Rainfall intensity =      3.045(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.818(CFS) for    2.280(Ac.)
Total runoff =      9.061(CFS)   Total area =        5.28(Ac.)


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Process from Point/Station      20.000 to Point/Station      22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   388.000(Ft.)
Downstream point/station elevation =   384.000(Ft.)
Pipe length  =   179.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.061(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.061(CFS)
Normal flow depth in pipe =   11.53(In.)
Flow top width inside pipe =   12.65(In.)
Critical Depth =   13.89(In.)
Pipe flow velocity =      8.94(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =    13.58 min.


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Process from Point/Station      22.000 to Point/Station      22.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                     ]
Time of concentration =    13.58 min.
Rainfall intensity =      3.017(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.207(CFS) for    1.330(Ac.)
Total runoff =     11.267(CFS)   Total area =        6.61(Ac.)


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Process from Point/Station      22.000 to Point/Station      24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   384.000(Ft.)
Downstream point/station elevation =   382.800(Ft.)
Pipe length  =    47.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.267(CFS)
Nearest computed pipe diameter  =     18.00(In.)
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Calculated individual pipe flow  =    11.267(CFS)
Normal flow depth in pipe =   10.79(In.)
Flow top width inside pipe =   17.64(In.)
Critical Depth =   15.40(In.)
Pipe flow velocity =     10.18(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    13.66 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.610(Ac.)
Runoff from this stream =     11.267(CFS)
Time of concentration =   13.66 min.
Rainfall intensity =     3.010(In/Hr)


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Process from Point/Station       30.000 to Point/Station       32.000
**** 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
[SINGLE FAMILY area type                     ]
Initial subarea flow distance  =  112.000(Ft.)
Highest elevation =  398.400(Ft.)
Lowest elevation =  397.300(Ft.)
Elevation difference =    1.100(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    10.54 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 112.000^.5)/( 0.982^(1/3)]=  10.54
Rainfall intensity (I) =      3.311(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.182(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station       32.000 to Point/Station       34.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   398.400(Ft.)
End of street segment elevation =   395.000(Ft.)
Length of street segment  =   247.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
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Distance from crown to crossfall grade break  =   6.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.438(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   1.968(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.121(Ft.)
Flow velocity =   1.97(Ft/s)
Travel time =    2.09 min.     TC =   12.63  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                     ]
Rainfall intensity =      3.099(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.352(CFS) for    1.380(Ac.)
Total runoff =      2.534(CFS)   Total area =        1.48(Ac.)
Street flow at end of street =      2.534(CFS)
Half street flow at end of street =      2.534(CFS)
Depth of flow =   0.301(Ft.), Average velocity =   2.238(Ft/s)
Flow width (from curb towards crown)=  10.300(Ft.)


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Process from Point/Station       34.000 to Point/Station       36.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   395.000(Ft.)
Downstream point/station elevation =   392.100(Ft.)
Pipe length  =    94.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.534(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.534(CFS)
Normal flow depth in pipe =    6.50(In.)
Flow top width inside pipe =    8.06(In.)
Critical Depth =    8.34(In.)
Pipe flow velocity =      7.41(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =    12.84 min.


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Process from Point/Station       38.000 to Point/Station       36.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    12.84 min.
Rainfall intensity =      3.080(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.304(CFS) for    0.770(Ac.)
Total runoff =      3.839(CFS)   Total area =        2.25(Ac.)


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Process from Point/Station       36.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   392.100(Ft.)
Downstream point/station elevation =   391.100(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.839(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.839(CFS)
Normal flow depth in pipe =    7.84(In.)
Flow top width inside pipe =   11.42(In.)
Critical Depth =    9.99(In.)
Pipe flow velocity =      7.06(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    12.96 min.


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Process from Point/Station       42.000 to Point/Station       40.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    12.96 min.
Rainfall intensity =      3.070(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      0.456(CFS) for    0.270(Ac.)
Total runoff =      4.295(CFS)   Total area =        2.52(Ac.)


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Process from Point/Station       40.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
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____________________________________________________________________
Upstream point/station elevation =   391.100(Ft.)
Downstream point/station elevation =   382.800(Ft.)
Pipe length  =   464.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.295(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.295(CFS)
Normal flow depth in pipe =    8.91(In.)
Flow top width inside pipe =   10.50(In.)
Critical Depth =   10.45(In.)
Pipe flow velocity =      6.87(Ft/s)
Travel time through pipe =    1.13 min.
Time of concentration (TC) =    14.09 min.


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Process from Point/Station       40.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.520(Ac.)
Runoff from this stream =      4.295(CFS)
Time of concentration =   14.09 min.
Rainfall intensity =     2.976(In/Hr)
Summary of stream data:

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


1       11.267     13.66            3.010
2        4.295     14.09            2.976
Qmax(1) =
        1.000 *    1.000 *    11.267) +
        1.000 *    0.970 *     4.295) + =      15.431
Qmax(2) =
        0.988 *    1.000 *    11.267) +
        1.000 *    1.000 *     4.295) + =      15.432

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.267       4.295
Maximum flow rates at confluence using above data:
       15.431       15.432
Area of streams before confluence:
        6.610        2.520
Results of confluence:
Total flow rate =     15.432(CFS)
Time of concentration =    14.087 min.
Effective stream area after confluence =      9.130(Ac.)
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Process from Point/Station       24.000 to Point/Station       44.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   382.800(Ft.)
Downstream point/station elevation =   380.500(Ft.)
Pipe length  =   223.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.432(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    15.432(CFS)
Normal flow depth in pipe =   16.50(In.)
Flow top width inside pipe =   17.23(In.)
Critical Depth =   17.44(In.)
Pipe flow velocity =      7.62(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    14.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       46.000 to Point/Station       44.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    14.58 min.
Rainfall intensity =      2.937(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.554(CFS) for    2.200(Ac.)
Total runoff =     18.986(CFS)   Total area =       11.33(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       48.000 to Point/Station       44.000
**** 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                        ]
Time of concentration =    14.58 min.
Rainfall intensity =      2.937(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =     11.460(CFS) for    4.590(Ac.)
Total runoff =     30.445(CFS)   Total area =       15.92(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       44.000 to Point/Station       49.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   376.500(Ft.)
Downstream point/station elevation =   373.000(Ft.)
Pipe length  =   345.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    30.445(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    30.445(CFS)
Normal flow depth in pipe =   21.56(In.)
Flow top width inside pipe =   21.66(In.)
Critical Depth =   22.89(In.)
Pipe flow velocity =      8.94(Ft/s)
Travel time through pipe =    0.64 min.
Time of concentration (TC) =    15.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      44.000 to Point/Station      49.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     15.920(Ac.)
Runoff from this stream =     30.445(CFS)
Time of concentration =   15.22 min.
Rainfall intensity =     2.889(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      50.000 to Point/Station      52.000
**** 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                        ]
Initial subarea flow distance  =  539.000(Ft.)
Highest elevation =  398.000(Ft.)
Lowest elevation =  394.000(Ft.)
Elevation difference =    4.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    11.54 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*( 539.000^.5)/( 0.742^(1/3)]=  11.54
Rainfall intensity (I) =      3.204(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      4.030(CFS)
Total initial stream area =        1.480(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       52.000 to Point/Station       54.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   394.000(Ft.)
End of street segment elevation =   373.800(Ft.)
Length of street segment  =  1345.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  34.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      8.686(CFS)
Depth of flow =   0.425(Ft.), Average velocity =   3.101(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.524(Ft.)
Flow velocity =   3.10(Ft/s)
Travel time =    7.23 min.     TC =   18.77  min.
 Adding area flow to street
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                        ]
Rainfall intensity =      2.653(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =      7.712(CFS) for    3.420(Ac.)
Total runoff =     11.742(CFS)   Total area =        4.90(Ac.)
Street flow at end of street =     11.742(CFS)
Half street flow at end of street =     11.742(CFS)
Depth of flow =   0.466(Ft.), Average velocity =   3.336(Ft/s)
Flow width (from curb towards crown)=  18.571(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       54.000 to Point/Station       49.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   373.800(Ft.)
Downstream point/station elevation =   373.000(Ft.)
Pipe length  =   114.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.742(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    11.742(CFS)
```

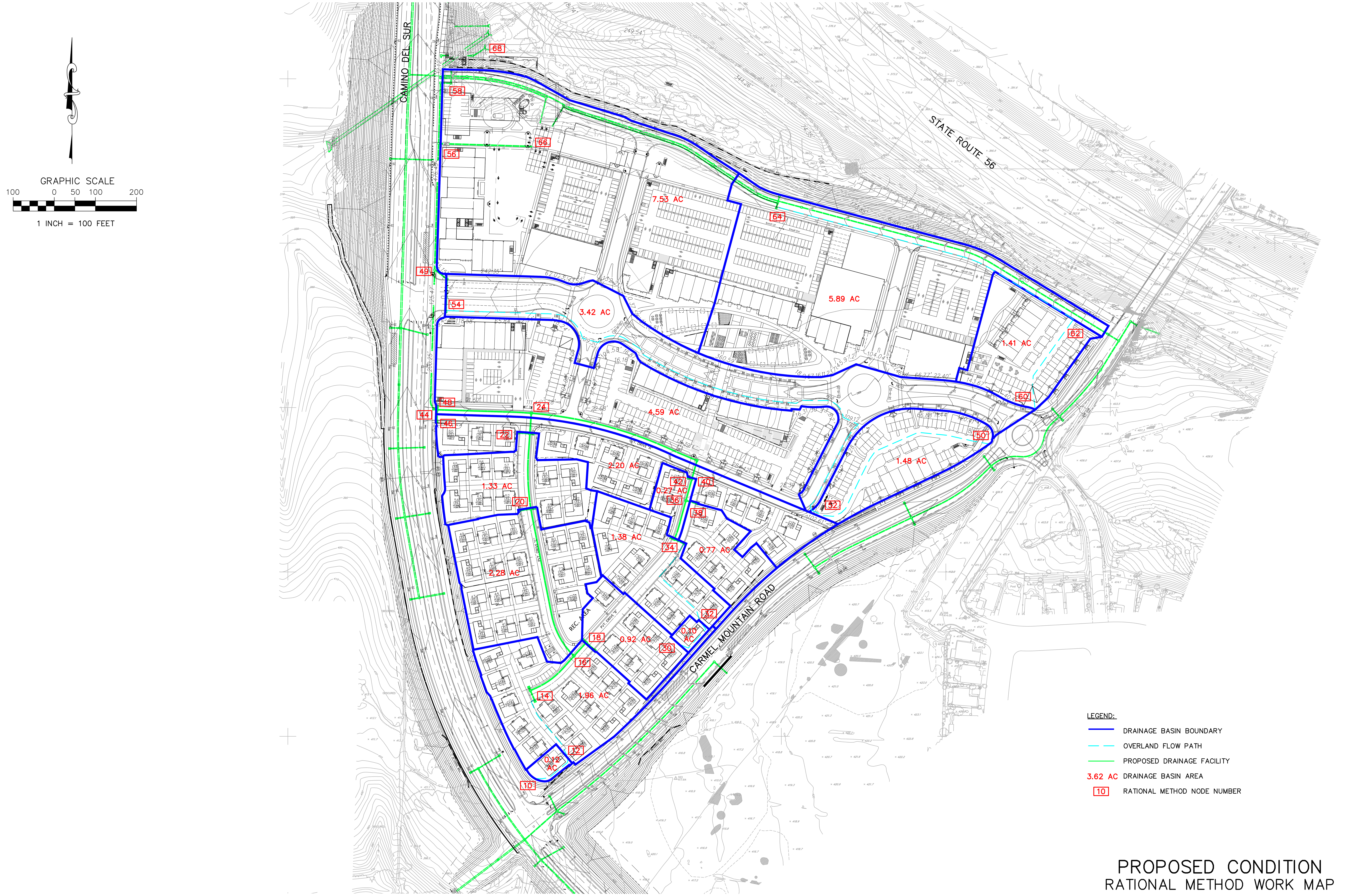
```
Normal flow depth in pipe =   15.35(In.)
Flow top width inside pipe =   18.62(In.)
Critical Depth =   15.32(In.)
Pipe flow velocity =      6.23(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =    19.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       54.000 to Point/Station       49.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.900(Ac.)
Runoff from this stream =     11.742(CFS)
Time of concentration =   19.07 min.
Rainfall intensity =     2.634(In/Hr)
Summary of stream data:

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


1       30.445     15.22            2.889
2       11.742     19.07            2.634
Qmax(1) =
         1.000 *    1.000 *    30.445) +
         1.000 *    0.798 *    11.742) + =      39.813
Qmax(2) =
         0.912 *    1.000 *    30.445) +
         1.000 *    1.000 *    11.742) + =      39.507

Total of 2 main streams to confluence:
Flow rates before confluence point:
      30.445      11.742
Maximum flow rates at confluence using above data:
       39.813       39.507
Area of streams before confluence:
       15.920        4.900


Results of confluence:
Total flow rate =     39.813(CFS)
Time of concentration =    15.218 min.
Effective stream area after confluence  =     20.820(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       49.000 to Point/Station       56.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
```

```
Upstream point/station elevation =   373.000(Ft.)
Downstream point/station elevation =   369.900(Ft.)
Pipe length  =   306.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    39.813(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    39.813(CFS)
Normal flow depth in pipe =   23.67(In.)
Flow top width inside pipe =   24.48(In.)
Critical Depth =   25.50(In.)
Pipe flow velocity =      9.58(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    15.75 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       58.000 to Point/Station       56.000
**** 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                        ]
Time of concentration =    15.75 min.
Rainfall intensity =      2.850(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =     18.243(CFS) for    7.530(Ac.)
Total runoff =     58.056(CFS)   Total area =       28.35(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       66.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   369.900(Ft.)
Downstream point/station elevation =   368.800(Ft.)
Pipe length  =   224.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    58.056(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    58.056(CFS)
Normal flow depth in pipe =   32.06(In.)
Flow top width inside pipe =   29.83(In.)
Critical Depth =   29.19(In.)
Pipe flow velocity =      7.95(Ft/s)
Travel time through pipe =    0.47 min.
Time of concentration (TC) =    16.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       66.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
```

```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     28.350(Ac.)
Runoff from this stream =     58.056(CFS)
Time of concentration =   16.22 min.
Rainfall intensity =     2.817(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       60.000 to Point/Station       62.000
**** 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                        ]
Initial subarea flow distance  =  251.000(Ft.)
Highest elevation =  399.000(Ft.)
Lowest elevation =  397.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.69 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*( 251.000^.5)/( 0.797^(1/3)]=   7.69
Rainfall intensity (I) =      3.714(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      4.451(CFS)
Total initial stream area =       1.410(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       62.000 to Point/Station       64.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   397.000(Ft.)
End of street segment elevation =   375.500(Ft.)
Length of street segment  =   773.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   6.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
```

```
Estimated mean flow rate at midpoint of street =     13.746(CFS)
Depth of flow =   0.434(Ft.), Average velocity =   5.093(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.000(Ft.)
Flow velocity =   5.09(Ft/s)
Travel time =    2.53 min.     TC =   10.22  min.
 Adding area flow to street
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                        ]
Rainfall intensity =      3.348(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =     16.760(CFS) for    5.890(Ac.)
Total runoff =     21.211(CFS)   Total area =        7.30(Ac.)
Street flow at end of street =     21.211(CFS)
Half street flow at end of street =     21.211(CFS)
Depth of flow =   0.502(Ft.), Average velocity =   6.032(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    0.10(Ft.)
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       64.000 to Point/Station       66.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   375.500(Ft.)
Downstream point/station elevation =   368.800(Ft.)
Pipe length  =   641.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.211(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    21.211(CFS)
Normal flow depth in pipe =   18.09(In.)
Flow top width inside pipe =   20.68(In.)
Critical Depth =   19.78(In.)
Pipe flow velocity =      8.35(Ft/s)
Travel time through pipe =    1.28 min.
Time of concentration (TC) =    11.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       66.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      7.300(Ac.)
Runoff from this stream =     21.211(CFS)
```

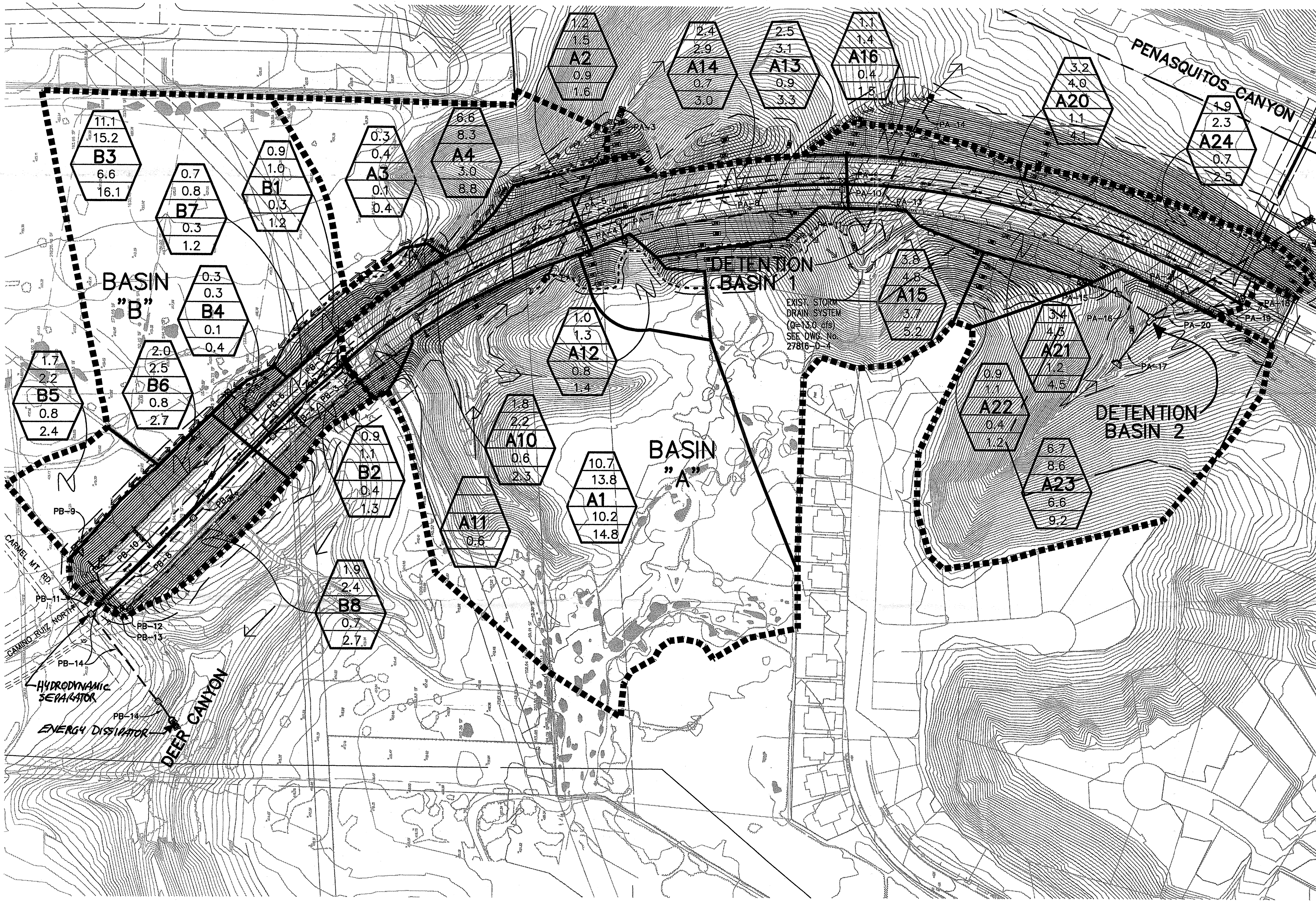
```
Time of concentration =   11.50 min.
Rainfall intensity =     3.208(In/Hr)
Summary of stream data:

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


1       58.056     16.22            2.817
2       21.211     11.50            3.208
Qmax(1) =
        1.000 *    1.000 *    58.056) +
        0.878 *    1.000 *    21.211) + =      76.686
Qmax(2) =
        1.000 *    0.709 *    58.056) +
        1.000 *    1.000 *    21.211) + =      62.368

Total of 2 main streams to confluence:
Flow rates before confluence point:
      58.056      21.211
Maximum flow rates at confluence using above data:
       76.686       62.368
Area of streams before confluence:
       28.350        7.300


Results of confluence:
Total flow rate =     76.686(CFS)
Time of concentration =    16.220 min.
Effective stream area after confluence  =     35.650(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.000 to Point/Station       68.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   368.800(Ft.)
Downstream point/station elevation =   316.000(Ft.)
Pipe length  =   495.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    76.686(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    76.686(CFS)
Normal flow depth in pipe =   20.63(In.)
Flow top width inside pipe =   16.69(In.)
Critical depth could not be calculated.
Pipe flow velocity =     26.71(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    16.53 min.
End of computations, total study area =         35.650 (Ac.)
```

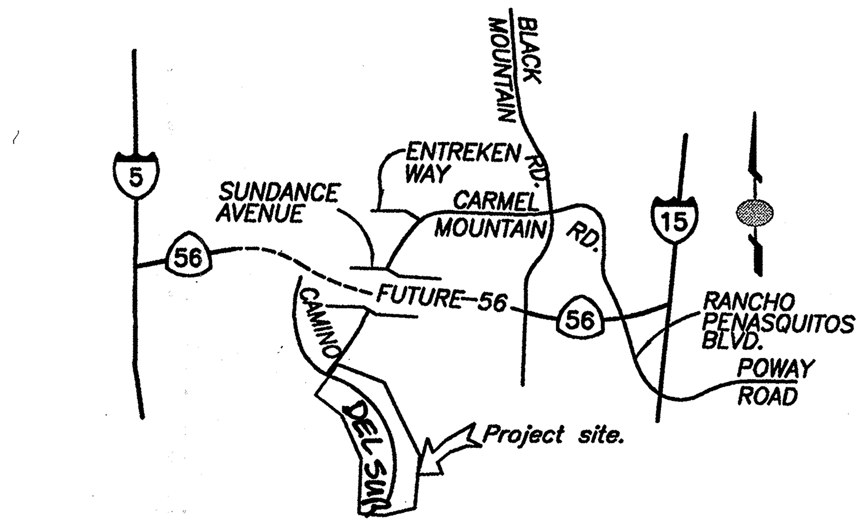


PROPOSED CONDITION
RATIONAL METHOD WORK MAP

SEE "PROPOSED CONDITION RATIONAL METHOD WORK MAP" FOR THIS AREA
TO DEER CANYON
TO DEER CANYON
TO PENASQUITOS CANYON
TO PENASQUITOS CANYON
CARMEL MOUNTAIN ROAD
CAMINO DEL SUR
VIA PANACEA
VIA LAS LENAS
VIA COLMENAR
SENDA PANACEA
ECLIPSE ROAD
EXIST. 48" RCP SD
EXIST. 24" RCP
A-4 exist.
A1 14.74
A1-3
A2 23.9
C-1 10.0
C-2
D 32.2
E1
E2 5.0
F 9.9
G
1
2a
2b
3a
3b
5
6
7
8
9
11
NOTE:
(1) REFER TO DRAINAGE STUDY TITLED "DRAINAGE STUDY FOR CAMINO RUIZ, SOUTH OF CARMEL MOUNTAIN ROAD" FOR THE CAMINO RUIZ PROJECT.
LEGEND
PROJECT BOUNDARY
EXISTING EASEMENT
RIGHT-OF-WAY
EXISTING CONTOUR
EXISTING TREE
EXISTING FENCE
LIMITS OF DRAINAGE BASINS
DIRECTION OF RUNOFF/ FLOW
EXISTING FLOWS PER SEPARATE EXISTING STUDY (Q=X.XX cfs)
PROPOSED FLOW Q=X.XX cfs
EXISTING S.D. FACILITIES
DRAINAGE BASIN
BASIN #
AREA (ACRES)
X
3.75
SITE DEVELOPMENT AREA
5
GRAPHIC SCALE
(IN FEET)
1 inch = 100 ft.
Project site
ENTREKEN WAY
CARMEL MOUNTAIN RD.
SUNDANCE AVENUE
FUTURE 56
BLACK MOUNTAIN RD.
RANCHO PENASQUITOS BLVD.
POWAY ROAD
VICINITY MAP
5
56
15
AREA OF EXISTING DEVELOPMENT DIVERTED INTO PROPOSED DETENTION/ DESILTATION BASIN
PREPARED IN THE OFFICE OF:
Latitude 33
Planning and Engineering
4933 Paramount Drive, 2nd Floor
San Diego, CA 92123
858-751-0633 Fax 858-751-0634
SEE "CAMINO DEL SUR SAN DIEGO, CALIFORNIA DEVELOPED DRAINAGE BASIN EXHIBIT" FOR SOUTHERLY ROAD AREA
RHODES CROSSING
EXHIBIT 'B'
PROPOSED DRAINAGE CONDITIONS

CAMINO DEL SUR
SAN DIEGO, CALIFORNIA
DEVELOPED DRAINAGE BASIN EXHIBIT





VICINITY MAP
NOT TO SCALE

LEGEND

- PROJECT BOUNDARY
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- CLEANOUT
- TYPE 'F' CATCH BASIN
- DITCH
- SWALE
- TYPE 'B-1' INLET
- STORM DRAIN PIPE
- WING TYPE HEADWALL
- FLOW

1.2 — Q_{10} (cfs)
4.6 — Q_{50} (csf)
B4 — SUB BASIN DESIGNATION
0.8 — BASIN AREA (ACRES)
5.2 — Q_{100} (cfs)

PA-26 — STORM DRAIN SYSTEM (PIPE SECTION)

(IN FEET)
1 inch = 100 ft.

GRAPHIC SCALE

1" = 100'

CAMINO DEL SUR
DEVELOPED DRAINAGE EXHIBIT

5-24-2001

Latitude 33
Planning and Engineering
4933 Paramount Drive, Ste. 200
San Diego, CA 92123
(858) 751-0633

The City of San Diego	**PRIORITY DEVELOPMENT PROJECT (PDP) STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) FOR**

MERGE 56 (FORMERLY RHODES CROSSING)
PTS 360009
IO No. 24004023

ENGINEER OF WORK:

JIM KILGORE, PE 46692

PREPARED FOR:

SEABREEZE PROPERTIES, LLC
3525 DEL MAR HEIGHTS ROAD, SUITE 246
SAN DIEGO, CA 92130
(858) 509-0484

PREPARED BY:

latitude 33 PLANNING & ENGINEERING

Latitude 33 Planning & Engineering
9968 Hibert Street Second Floor
San Diego, CA 92131
(858) 751-0633

DATE:
September 2016

Approved by: City of San Diego Date

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TABLE OF CONTENTS

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ACRONYMS

APN	Assessor's Parcel Number
ASBS	Area of Special Biological Significance
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CGP	Construction General Permit
DCV	Design Capture Volume
DMA	Drainage Management Areas
ESA	Environmentally Sensitive Area
GLU	Geomorphic Landscape Unit
GW	Ground Water
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
HU	Harvest and Use
INF	Infiltration
LID	Low Impact Development
LUP	Linear Underground/Overhead Projects
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
POC	Pollutant of Concern
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWPPP	Storm Water Pollutant Protection Plan
SWQMP	Storm Water Quality Management Plan
TMDL	Total Maximum Daily Load
WMAA	Watershed Management Area Analysis
WPCP	Water Pollution Control Program
WQIP	Water Quality Improvement Plan

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CERTIFICATION PAGE

Project Name: MERGE 56
Permit Application Number: 360009

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the Storm Water Standards, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Storm Water Standards. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

____

Engineer of Work's Signature, PE Number & Expiration Date

____

Print Name

____

Company

____

Date

Engineer's Stamp

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SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In last column indicate changes that have been made or indicate if response to plan check comments is included. When applicable, insert response to plan check comments.

Submittal Number	Date	Project Status	Changes
1	May 2016	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Revise Approved WQTR to SWQMP
2	July 2016	☒ Preliminary Design/Planning/CEQA ☐ Final Design	First Resubmittal
3	Sept. 2016	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Second Resubmittal
4		☐ Preliminary Design/Planning/CEQA ☐ Final Design	

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PROJECT BACKGROUND

The Merge 56 project is an amendment to the Rhodes Crossing project (PDP 53203, SDP 53204, VTM 7938 & CUP 53205) which was approved by City Council on March 30, 2004. Merge 56 will be a mixed-use development with 83 single-family units, 111 multi-family units, 47 affordable housing units, and a retail commercial shopping center. The project is located within the Torrey Highlands Subarea Plan and the Rancho Penasquitos Community Plan and is bounded by State Route 56 to the north and Camino Del Sur to the east. Refer to Figure 1, page 4 for the Project Location Map.

<u>Existing Land Use</u>

The site consists of mostly undeveloped lands with the exception of portions of SR-56, Camino Del Sur and Carmel Mountain Road. There are no known existing contaminants onsite.

<u>Camino Del Sur and Carmel Mountain Road BMP/HMP Analysis</u>

The water quality system will be separated into two systems – one for Camino Del Sur/Carmel Mountain Road and one for the private Merge 56 project. The reason for this is the following:

1. Camino Del Sur/Carmel Mountain Road are Facilities Benefit Assessment projects under the Torrey Highlands FBA infrastructure projects T-3.1A, 3.1B, 2.A, 2.B and T-5.2 and received approval by the City under SDP No. 40-0386 and SDP No. 41-0128, This approval established the road corridor and environmental limits.
2. Right of Way was granted for both streets by Parcel Map 15578.
3. Because Camino Del Sur and Carmel Mountain Road are public streets with nearly complete FBA funding, the City could construct these streets without the Merge 56 project at any time. As such, the water quality and hydro-modification systems will be separate from the remaining Merge 56. Operation and Maintenance of the basins and vaults for Carmel Mountain Road and Camino del Sur North are to be performed privately, while the bio-filtration basins located near Camino del Sur South will be performed by the City of San Diego Stormwater Department.

<u>Drainage Characteristics</u>

The majority of the project site, including most of Camino Del Sur and Carmel Mountain Road, drains northwest towards Deer Canyon, with the remaining portions of the site draining southwest towards Penasquitos Canyon. The runoff from both of these canyons outfall into the Los Penasquitos Lagoon and then into the Pacific Ocean at Torrey Pines State Beach. Refer to the Preliminary Drainage Report for the Rhodes Crossing project for the drainage analysis for the project.

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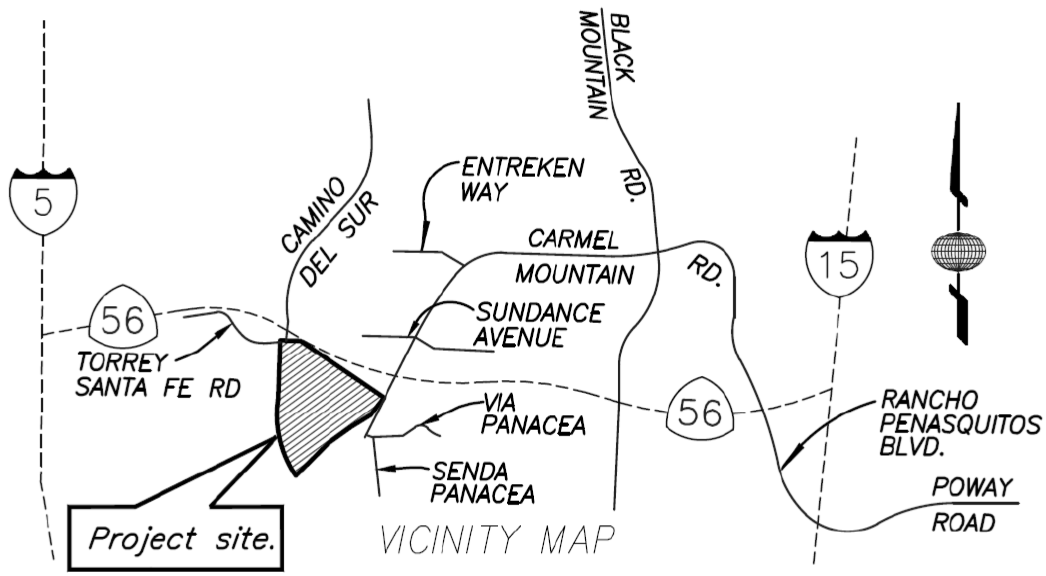
PROJECT VICINITY MAP

Project Name: *Merge 56*
Permit Application Number: *360009*



STORM WATER REQUIREMENTS APPLICABILITY CHECKLIST

Complete and attach DS-560 Form included in Appendix A.1

City of San Diego
Development Services
1222 First Ave., MS-302
San Diego, CA 92101
(619) 446-5000

THE CITY OF SAN DIEGO

Storm Water Requirements Applicability Checklist

FORM
DS-560
FEBRUARY 2016

Project Address: 13100 CAMINO DEL SUR - SAN DIEGO, CA 92129	Project Number *(for City Use Only)*:

SECTION 1. Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the Storm Water Standards Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP)[1] , which is administered by the State Water Resources Control Board.

For all project complete PART A: If project is required to submit a SWPPP or WPCP, continue to PART B.

PART A: Determine Construction Phase Storm Water Requirements.

1. Is the project subject to California's statewide General NPDES permit for Storm Water Discharges Associated with Construction Activities, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

☒ Yes; SWPPP required, skip questions 2-4 ☐ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity that results in ground disturbance and contact with storm water runoff?

☐ Yes; WPCP required, skip 3-4 ☐ No; next question

3. Does the project propose routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (Projects such as pipeline/utility replacement)

☐ Yes; WPCP required, skip 4 ☐ No; next question

4. Does the project only include the following Permit types listed below?
   - Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
   - Individual Right of Way Permits that exclusively include only ONE of the following activities: water service, sewer lateral, or utility service.
   - Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, pot holing, curb and gutter replacement, and retaining wall encroachments.

   ☐ Yes; no document required

   Check one of the boxes to the right, and continue to PART B:

   ☐ If you checked "Yes" for question 1, **a SWPPP is REQUIRED. Continue to PART B**

   ☐ If you checked "No" for question 1, and checked "Yes" for question 2 or 3, **a WPCP is REQUIRED.** If the project proposes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to PART B.**

   ☐ If you checked "No" for all questions 1-3, and checked "Yes" for question 4 PART B **does not apply and no document is required. Continue to Section 2.**

1. More information on the City's construction BMP requirements as well as CGP requirements can be found at: www.sandiego.gov/stormwater/regulations/index.shtml

PART B: Determine Construction Site Priorit

This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a “high threat to water quality.” The City has aligned the local definition of “high threat to water quality” to the risk determination approach of the State Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **NOTE:** The construction priority does **NOT** change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by city staff.

Complete PART B and continued to Section 2

1. ☐ **ASBS**

a. Projects located in the ASBS watershed.

2. ☒ **High Priority**

a. Projects 1 acre or more determined to be Risk Level 2 or Risk Level 3 per the Construction General Permit and not located in the ASBS watershed.

b. Projects 1 acre or more determined to be LUP Type 2 or LUP Type 3 per the Construction General Permit and not located in the ASBS watershed.

3. ☐ **Medium Priority**

a. Projects 1 acre or more but not subject to an ASBS or high priority designation.

b. Projects determined to be Risk Level 1 or LUP Type 1 per the Construction General Permit and not located in the ASBS watershed.

4. ☐ **Low Priority**

a. Projects requiring a Water Pollution Control Plan but not subject to ASBS, high, or medium priority designation.

SECTION 2. Permanent Storm Water BMP Requirements.

Additional information for determining the requirements is found in the Storm Water Standards Manual.

PART C: Determine if Not Subject to Permanent Storm Water Requirements.

Projects that are considered maintenance, or otherwise not categorized as “new development projects” or “redevelopment projects” according to the Storm Water Standards Manual are not subject to Permanent Storm Water BMPs.

If “yes” is checked for any number in Part C, proceed to Part F and check “Not Subject to Permanent Storm Water BMP Requirements”.

If “no” is checked for all of the numbers in Part C continue to Part D.

1.	Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact storm water?	☐ Yes ☒ No
2.	Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?	☐ Yes ☒ No
3.	Does the project fall under routine maintenance? Examples include, but are not limited to: roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay, and pothole repair).	☐ Yes ☒ No

PART D: PDP Exempt Requirements.

PDP Exempt projects are required to implement site design and source control BMPs.

If "yes" was checked for any questions in Part D, continue to Part F and check the box labeled "PDP Exempt."

If "no" was checked for all questions in Part D, continue to Part E.

1. Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:
   - Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   - Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;
   - Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Storm Water Standards manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Storm Water Standards Manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; project not exempt. PDP requirements apply

PART E: Determine if Project is a Priority Development Project (PDP).

Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

If "yes" is checked for any number in PART E, continue to PART F.

If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Development Project".

1.	**New Development that creates 10,000 square feet or more of impervious surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☒ Yes ☐ No
2.	**Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces**. This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☒ Yes ☐ No
3.	**New development or redevelopment of a restaurant.** Facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC 5812), and where the land development creates and/or replace 5,000 square feet or more of impervious surface.	☒ Yes ☐ No
4.	**New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater.	☐ Yes ☒ No
5.	**New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).**	☒ Yes ☐ No
6.	**New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).	☒ Yes ☐ No

7. **New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). ❑ Yes ☒ No

8. **New development or redevelopment projects of a retail gasoline outlet (RGO) that create and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. ❑ Yes ☒ No

9. **New development or redevelopment projects of an automotive repair shops that creates and/or replaces 5,000 square feet or more of impervious surfaces.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539. ❑ Yes ☒ No

10. **Other Pollutant Generating Project.** The project is not covered in the categories above, results in the disturbance of one or more acres of land and is expected to generate pollutants post construction, such as fertilizers and pesticides. This does not include projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces of if they sheet flow to surrounding pervious surfaces. ❑ Yes ☒ No

PART F: Select the appropriate category based on the outcomes of PART C through PART E.

1. The project is **NOT SUBJECT TO STORM WATER REQUIREMENTS**. ❑

2. The project is a **STANDARD DEVELOPMENT PROJECT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance. ❑

3. The project is **PDP EXEMPT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance. ❑

4. The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control, and structural pollutant control BMP requirements apply. See the Storm Water Standards Manual for guidance on determining if project requires a hydromodification plan management ☒

Name of Owner or Agent *(Please Print):* Title:

Signature: Date:

Applicability of Permanent, Post-Construction Storm Water BMP Requirements		**Form I-1**
Project Identification		
Project Name: *MERGE 56*		
Permit Application Number: *PTS 360009*		Date: *D*
Determination of Requirements		
The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short summary of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements. Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop". Refer to Part 1 of Storm Water Standards sections and/or separate forms referenced in each step below.		
Step	Answer	Progression
Step 1: Is the project a "development project"? See Section 1.3 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☒ Yes	Go to Step 2.
	☐ No	Stop. Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.
Discussion / justification if the project is not a "development project" (e.g., the project includes only interior remodels within an existing building):		
Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? To answer this item, see Section 1.4 of the BMP Design Manual (Part 1 of Storm Water Standards) in its entirety for guidance, AND complete Storm Water Requirements Applicability Checklist.	☐ Standard Project	Stop. Standard Project requirements apply.
	☒ PDP	PDP requirements apply, including PDP SWQMP. Go to Step 3.
	☐ PDP Exempt	Stop. Standard Project requirements apply. Provide discussion and list any additional requirements below.
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

Form I-1 Page 2		
Step	Answer	Progression
Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval? See Section 1.10 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Consult the City Engineer to determine requirements. Provide discussion and identify requirements below. Go to Step 4.
	☒ No	BMP Design Manual PDP requirements apply. Go to Step 4.
Discussion / justification of prior lawful approval, and identify requirements (not required if prior lawful approval does not apply):		
Step 4. Do hydromodification control requirements apply? See Section 1.6 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☒ Yes	PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6). Go to Step 5.
	☐ No	Stop. PDP structural BMPs required for pollutant control (Chapter 5) only. Provide brief discussion of exemption to hydromodification control below.
Discussion / justification if hydromodification control requirements do not apply:		
Step 5. Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☒ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☐ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.
Discussion / justification if protection of critical coarse sediment yield areas does not apply:		

Site Information Checklist For PDPs	Form I-3B
Project Summary Information	
Project Name	MERGE 56
Project Address	13100 CAMINO DEL SUR SAN DIEGO, CA 92129
Assessor's Parcel Number(s) (APN(s))	306-42-04, 05 & 10
Permit Application Number	PTS 360009
Project Watershed	Select One: ☐ San Dieguito River ☒ Penasquitos ☐ Mission Bay ☐ San Diego River ☐ San Diego Bay ☐ Tijuana River
Hydrologic subarea name with Numeric Identifier up to two decimal places (9XX.XX)	906.10
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	70 Acres (3,043,000 Square Feet)
Area to be disturbed by the project (Project Footprint)	57.2 Acres (2,492,190 Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	37.6 Acres (855,876 Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	19.6 Acres (855,100 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Project Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition.	65.66 %

Form I-3B Page 2 of 11
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☐ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☒ Vacant, undeveloped/natural Description / Additional Information:
Existing Land Cover Includes (select all that apply): ☒ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Description / Additional Information:
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☒ NRCS Type D
Approximate Depth to Groundwater (GW): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☐ 10 feet < GW Depth < 20 feet ☒ GW Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☒ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information: *A stream currently runs through the north end of the project boundary, nearest the dead end of Torrey Santa Fe Road and Camino Del Sur.*

Form I-3B Page 3 of 11
Description of Existing Site Topography and Drainage:

How is storm water runoff conveyed from the site? At a minimum, this description should answer:

1. Whether existing drainage conveyance is natural or urban;
2. If runoff from offsite is conveyed through the site? If yes, quantification of all offsite drainage areas, design flows, and locations where offsite flows enter the project site and summarize how such flows are conveyed through the site;
3. Provide details regarding existing project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, and natural and constructed channels;
4. Identify all discharge locations from the existing project along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.

Description / Additional Information:

1. *The existing drainage conveyance has a natural runoff and is conveyed via streams.*

2. *Approximately 235 acres of upstream drainage area is conveyed through the stream that runs under the SR-56 at the northern corner of the project site nearest the dead end of Camino Del Sur and Torrey Santa Fe Road, Lot Z. This runoff will be mitigated by adding a by-pass storm drain system to maintain current drainage patterns.*

3. *All onsite runoff generated by this project is gathered within private inlets and stormdrains and outlets at the by-pass as described above. Water treatment is performed within private partial biofiltration basins (IMP A thru T) and detained in underground storage vaults to meet HMP requirements.*

   All offsite improvements, which consist of the extension of Camino Del Sur and Carmel Valley road, gather runoff via public inlets and storm drains. This water is treated by partial biofiltration basins and detained in underground storage vaults before it outlets into Deer Canyon Creek.

4. *There are three (3) discharge locations for this project, one nearest Lot Z, at the intersection of Torrey Santa Fe Road and Camino Del Sur where it will discharge into a storm drain by-pass under the proposed street connection. The second being nearest the intersection of Carmel Valley Road and Camino Del Sur where it will discharge into an existing stream. All runoff will ultimately gather an existing retention facility downstream of the project site within Deer Canyon Creek. The third discharge point is nearest the most southerly biofiltration basin which collects runoff from Camino Del Sur South and discharges offsite into an existing drainage pathway.*

   All drainage patterns have been designed to ensure that existing drainage patterns are maintained and no eroding occurs downstream of the project site.

Form I-3B Page 4 of 11
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities: *This project proposes the following land uses: commercial, single-family residential and multi-family residential as well as preserved open space areas.*
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): *Proposed impervious areas will consist of commercial, office and retail buildings, parking structures, single-family and multi-family residential buildings as well as public and private roads.*
List/describe proposed pervious features of the project (e.g., landscape areas): *Proposed pervious areas will consist of conservation of open space, landscaping and recreational park areas.*
Does the project include grading and changes to site topography? ☒ Yes ☐ No Description / Additional Information: *Grading will be required to allow for a roadway to connect Camino Del Sur as well as provide access to Carmel Mountain Road. Grading will also be done to create pads for future buildings and private streets.*

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☒ Yes

☐ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural and constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Description / Additional Information:

Proposed drainage conveyance will consist of storm drains, partial biofiltration facilities and storage vaults for all public and private areas.

One of the proposed discharge locations will be at the northern corner of the site, Lot 'Z', where this project will convey drainage from the northern half of the site, along with the offsite drainage, through biofiltration basins and HMP vaults prior to discharging to a proposed 84" storm drain following the existing stream running through the project site.

Another discharge location is at the proposed intersection of Camino Del Sur and Carmel Mountain Road, where runoff will be treated in a biofiltration basin, detained in an HMP vault and then discharged into the open space.

Drainage from the southern extension of Camino del Sur will be conveyed through a storm drain system within Camino del Sur and collect in biofiltraion basins for treatment and HMP detention and then discharge into open space areas on the east side of the road.

During Final Engineering, BMP strategies beyond biofiltration basins will be investigated, including drywells. The ultimate design will comply with the applicable stormwater regulations in effect at the time of permitting.

For all HMP requirements, please reference attachment 2d for sizing calculations. All HMP vaults will mitigate any increases in discharge rates and durations to pre-development conditions for the required range of flows via an internal weir wall to detain the Q_{100} storm event and release runoff via a small orifice as size in Attachment 2d.

Please reference the drainage report titled, "DRAINAGE REPORT FOR MERGE 56 VESTING TENTATIVE MAP, dated May 12, 2015 by Change Consultants" for detailed calculations.

Form I-3B Page 6 of 11

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

☒ On-site storm drain inlets
☐ Interior floor drains and elevator shaft sump pumps
☒ Interior parking garages
☐ Need for future indoor & structural pest control
☒ Landscape/Outdoor Pesticide Use
☒ Pools, spas, ponds, decorative fountains, and other water features
☒ Food service
☒ Refuse areas
☐ Industrial processes
☒ Outdoor storage of equipment or materials
☒ Vehicle and Equipment Cleaning
☐ Vehicle/Equipment Repair and Maintenance
☐ Fuel Dispensing Areas
☒ Loading Docks
☒ Fire Sprinkler Test Water
☒ Miscellaneous Drain or Wash Water
☒ Plazas, sidewalks, and parking lots
☐ Large Trash Generating Facilities
☐ Animal Facilities
☐ Plant Nurseries and Garden Centers
☐ Automotive-related Uses

Description / Additional Information:

This proposed project will include all pollutant source control areas associated with the grading and construction of commercial/office/retail buildings as well as single-family/multi-family facilities.

Identification and Narrative of Receiving Water
Narrative describing flow path from discharge location(s), through urban storm conveyance system, to receiving creeks, rivers, and lagoons and ultimate discharge location to Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable) *The storm drain systems that capture the majority of the project runoff will discharge into Deer Canyon or McGonigle Canyon just west of the site. All other runoff generated by Camino Del Sur South will discharge into Penasquitos Canyon.* *Deer Canyon confluences with McGonigle Canyon Creek approximately 3,000 feet west of the site. From there, McGonigle Canyon Creek confluences with Carmel Valley Creek and ultimately discharges into the Los Penasquitos Lagoon then the Pacific Ocean.* *Penasquitos Canyon confluences with Poway Creek approximately 6,000 feet south of the site. From there, Poway Creek discharges into the Los Penasquitos Lagoon then the Pacific Ocean.*
Provide a summary of all beneficial uses of receiving waters downstream of the project discharge locations. *The beneficial uses for Downstream Inland Surfaces (RWQCB, 1998) are ARG, IND, REC1, REC2, WARM and WILD* *The beneficial uses for Groundwater (RWQCB, 1998) are MUN, ARG and IND.*
Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations. *The only ASBS that exists within San Diego County includes the San Diego-Scripps State Marine Conservation Area in La Jolla. This project discharges approximately 4.75 miles up the coast line.*
Provide distance from project outfall location to impaired or sensitive receiving waters. *The ultimate project outfall is approximately 1.0 mile from the Pacific Ocean, which is listed as a 303 (d) impaired receiving water.*
Summarize information regarding the proximity of the permanent, post-construction storm water BMPs to the City's Multi-Habitat Planning Area and environmentally sensitive lands *There is an existing MHPA boundary on the west-side of our project limits. All of the Post-Construction BMPs discharge outside of this boundary, but due to natural drainage patterns water will naturally convey through the MHPA.*

Form I-3B Page 8 of 11

Identification of Receiving Water Pollutants of Concern		
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:		
303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs/ WQIP Highest Priority Pollutant
Los Penasquitos Lagoon	Sediments, Nutrients, Heavy Metals, Orgain Substances, Oxygen-Demanding Substances, Oils and Grease, Bacteria and Viruses and Pesticides.	N/A

Identification of Project Site Pollutants*			
*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated) Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see BMP Design Manual (Part 1 of Storm Water Standards) Appendix B.6):			
Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment			
Nutrients			
Heavy Metals			
Organic Compounds			
Trash & Debris			
Oxygen Demanding Substances			
Oil & Grease			
Bacteria & Viruses			
Pesticides			

The subject project proposed biofiltration BMPs. No flow-thru treatment BMPs are proposed for this project.

Form I-3B Page 9 of 11
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)? ☒ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above):
Critical Coarse Sediment Yield Areas* *This Section only required if hydromodification management requirements apply
Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint? ☒ Yes ☐ No Discussion / Additional Information: *See the report titled, "Technical Memorandum: Coarse Sediment Analysis for: Merge 56" dated May 16, 2016 from REC.* This report has been approved by Walter Gefrom, DSD Storm Water Section Senior Civil Engineer. The PCCSYAs identified are Non-CCSYAs as the channel receives no net impact.

Form I-3B Page 10 of 11

Flow Control for Post-Project Runoff*

*This Section only required if hydromodification management requirements apply

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.

There are three (3) Points of Compliance (POCs) onsite.

POC1: nearest Lot Z, at the intersection of Torrey Santa Fe Road and Camino Del Sur where it will discharge into a storm drain by-pass under the proposed street connection.
POC2: nearest the intersection of Carmel Mountain Road and Camino Del Sur where it will discharge into an existing stream
POC3: nearest the most southerly basin along Camino Del Sur South, will discharge to the east within Penasquitos Canyon.

The Ultimate Point of Confluence for the project is the Los Penasquitos Lagoon where Poway Creek and Carmel Valley Creek meet.

Has a geomorphic assessment been performed for the receiving channel(s)?

☐ No, the low flow threshold is 0.1Q2 (default low flow threshold)
☐ Yes, the result is the low flow threshold is 0.1Q2
☐ Yes, the result is the low flow threshold is 0.3Q2
☒ Yes, the result is the low flow threshold is 0.5Q2

If a geomorphic assessment has been performed, provide title, date, and preparer:

See report titled, HYDROMODIFICATION SCREENING FOR MERGE 56 (RHODES CROSSING), prepared by Chang Consultants, dated November 14, 2013.

Discussion / Additional Information: (optional)

Form I-3B Page 11 of 11
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements. *Not Applicable*
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

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Source Control BMP Checklist for All Development Projects	Form I-4	
Source Control BMPs		

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of the Storm Water Standards) for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-3 not implemented:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-4 not implemented:			
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			

Form I-4 Page 2 of 2	
Source Control Requirement	Applied?
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)	
On-site storm drain inlets	☒ Yes ☐ No ☐ N/A
Interior floor drains and elevator shaft sump pumps	☒ Yes ☐ No ☐ N/A
Interior parking garages	☒ Yes ☐ No ☐ N/A
Need for future indoor & structural pest control	☒ Yes ☐ No ☐ N/A
Landscape/Outdoor Pesticide Use	☒ Yes ☐ No ☐ N/A
Pools, spas, ponds, decorative fountains, and other water features	☒ Yes ☐ No ☐ N/A
Food service	☒ Yes ☐ No ☐ N/A
Refuse areas	☒ Yes ☐ No ☐ N/A
Industrial processes	☐ Yes ☐ No ☒ N/A
Outdoor storage of equipment or materials	☒ Yes ☐ No ☐ N/A
Vehicle/Equipment Repair and Maintenance	☐ Yes ☐ No ☒ N/A
Fuel Dispensing Areas	☐ Yes ☐ No ☐ N/A
Loading Docks	☒ Yes ☐ No ☐ N/A
Fire Sprinkler Test Water	☒ Yes ☐ No ☐ N/A
Miscellaneous Drain or Wash Water	☒ Yes ☐ No ☐ N/A
Plazas, sidewalks, and parking lots	☒ Yes ☐ No ☐ N/A
SC-6A: Large Trash Generating Facilities	☒ Yes ☐ No ☐ N/A
SC-6B: Animal Facilities	☐ Yes ☐ No ☒ N/A
SC-6C: Plant Nurseries and Garden Centers	☐ Yes ☐ No ☒ N/A
SC-6D: Automotive-related Uses	☐ Yes ☐ No ☒ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above. *Due to the scope of this project, we do not anticipate the need to implement any BMPs based on source runoff from the following: industrial processes, vehicle repair, fuel dispensing, SC-6B through 6D.*	

Source Control BMP Checklist for All Development Projects			Form I-5
Site Design BMPs			
All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of Storm Water Standards) for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided. A site map with implemented site design BMPs must be included at the end of this checklist.			
Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-1 not implemented:			
1-1 Are existing natural drainage pathways and hydrologic features mapped on the site map?	☒ Yes	☐ No	
1-2 Are trees implemented? If yes, are they shown on the site map?	☒ Yes	☒ No	
1-3 Implemented trees meet the design criteria in SD-1 Fact Sheet (e.g. soil volume, maximum credit, etc.)?	☐ Yes	☒ No	
1-4 Is tree credit volume calculated using Appendix B.2.2.1 and SD-1 Fact Sheet in Appendix E?	☐ Yes	☒ No	
SD-2 Have natural areas, soils and vegetation been conserved?	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-2 not implemented:			

Site Design Requirement	Applied?		
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented:			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-4 not implemented:			
SD-5 Impervious Area Dispersion	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-5 not implemented: *Site runoff will be routed from pervious areas to local storm drains then routed to biofiltration basins.*			
5-1 Is the pervious area receiving runon from impervious area identified on the site map?	☒ Yes	☐ No	
5-2 Does the pervious area satisfy the design criteria in SD-5 Fact Sheet in Appendix E (e.g. maximum slope, minimum length, etc.)	☒ Yes	☐ No	
5-3 Is impervious area dispersion credit volume calculated using Appendix B.2.1.1 and SD-5 Fact Sheet in Appendix E?	☒ Yes	☐ No	

Form I-5 Page 3 of 4			
Site Design Requirement	Applied?		
SD-6 Runoff Collection	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-6 not implemented: *No green roofs, permeable pavers etc. are being proposed on site.*			
6a-1 Are green roofs implemented in accordance with design criteria in SD-6A Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☒ No	
6a-2 Is green roof credit volume calculated using Appendix B.2.1.2 and SD-6A Fact Sheet in Appendix E?	☐ Yes	☒ No	
6b-1 Are permeable pavements implemented in accordance with design criteria in SD-6B Fact Sheet? If yes, are they shown on the site	☐ Yes	☒ No	
6b-2 Is permeable pavement credit volume calculated using Appendix B.2.1.3 and SD-6B Fact Sheet in Appendix E?	☐ Yes	☒ No	
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-8 not implemented: *This is not applicable to the Merge 56 project as Harvest and Using Precipitation does not apply to projects using recycled water.*			
8-1 Are rain barrels implemented in accordance with design criteria in SD-8 Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☒ No	
8-2 Is rain barrel credit volume calculated using Appendix B.2.2.2 and SD-8 Fact Sheet in Appendix E?	☐ Yes	☒ No	

Form I-5 Page 4 of 4

Insert Site Map with all site design BMPs identified:

**See Attachment 1a for location and identifications of all BMPs.*

Summary of PDP Structural BMPs	Form I-6
PDP Structural BMPs	

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual, Part 1 of Storm Water Standards). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the City at the completion of construction. This includes requiring the project owner or project owner's representative to certify construction of the structural BMPs (complete Form DS-563). PDP structural BMPs must be maintained into perpetuity (see Chapter 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

Step 1 – This project does not include any self-retaining or self-mitigating areas due to the Type D soils on site, which are not recommended for infiltration. An updated Soils Analysis will be provided as form I-8 which describes the partial infiltration proposed on site.

Step 2 – Per the included Harvest and Use feasibility screening, the proposed project is considered to be infeasible.

Step 3 – Per the proceeding Water Quality & HMP Feasibility analysis and the included Form I-8, full infiltration is not feasible. Partial infiltration is to be used at all biofiltration basins. See the Feasibility Analysis and Form I-8 for further analysis.

Step 4 – Biofiltration basins have been sized and placed accordingly to treat the required runoff generated per the proposed project.

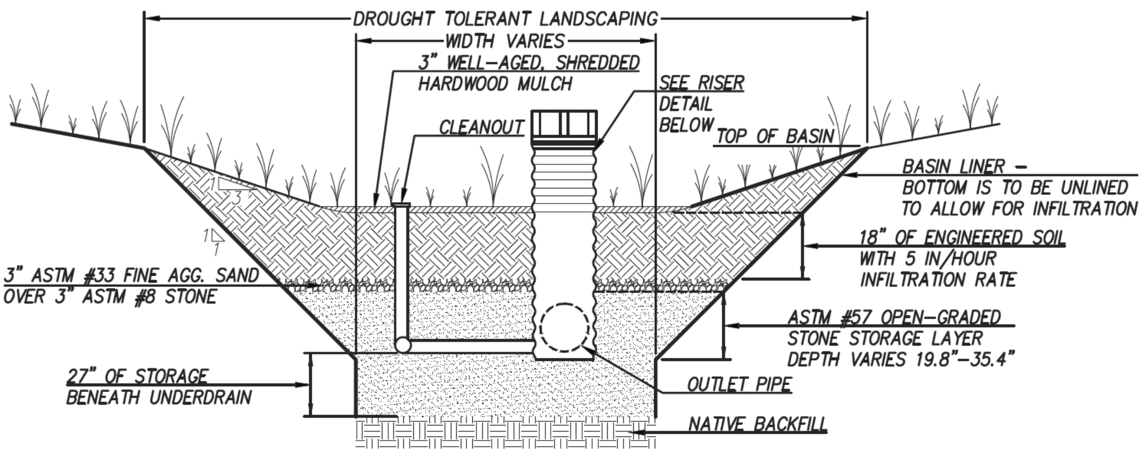
Form I-6 Page 2 of 4
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

Form I-6 Page 3 of 4 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No.	
Construction Plan Sheet No.	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☒ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☐ Hydromodification control only ☒ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	*Jim Kilgore, PE | RCE 46692 | 858.751.0633* *Latitude 33 Planning & Engineering –* *9968 Hibert Street, 2nd Floor* *San Diego, CA 92131*
Who will be the final owner of this BMP?	*SeaBreeze Communities, or designated Property/Homeowner's Association*
Who will maintain this BMP into perpetuity?	*SeaBreeze Communities, or designated Property/Homeowner's Association*
What is the funding mechanism for maintenance?	*SeaBreeze Communities, or designated Property/Homeowner's Association Dues*

Form I-6 Page 4 of 4 (Copy as many as needed)
Structural BMP ID No. *Imp. A through T*
Construction Plan Sheet No. *VTM 1266880-9 thru 11*

Discussion (as needed):

BMP Imp. A through T will consist of BF-1 Biofiltration Basins for treatment and partial hydromodification mitigations. See below for a typical section of each basin.



1. "ENGINEERED SOIL" LAYER SHALL BE "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOOD MULCH, AND 20-30% TOPSOIL, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS, AND ALSO FREE OF NOXIOUS WEEDS.

PVT. BIOFILTRATION BASIN

NTS

THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Permanent BMP Construction** **Self Certification Form**	FORM DS-563 January 2016

Date Prepared:	Project No.:
Project Applicant:	Phone:
Project Address:	
Project Engineer:	Phone:

The purpose of this form is to verify that the site improvements for the project, identified above, have been constructed in conformance with the approved Storm Water Quality Management Plan (SWQMP) documents and drawings.

This form must be completed by the engineer and submitted prior to final inspection of the construction permit. Completion and submittal of this form is required for all new development and redevelopment projects in order to comply with the City's Storm Water ordinances and NDPES Permit Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100. Final inspection for occupancy and/or release of grading or public improvement bonds may be delayed if this form is not submitted and approved by the City of San Diego.

CERTIFICATION:
As the professional in responsible charge for the design of the above project, I certify that I have inspected all constructed Low Impact Development (LID) site design, source control and structural BMP's required per the approved SWQMP and Construction Permit No.________________________; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 of the San Diego Regional Water Quality Control Board.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

Signature: ______________________________

Date of Signature: ______________________________

Printed Name: ______________________________

Title: ______________________________

Phone No. ______________________________

Engineer's Stamp

DS-563 (01-16)

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ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

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Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist.	☒ Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☒ Included on DMA Exhibit in Attachment 1a ☐ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☒ Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	☒ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines and site design credit calculations	☒ Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

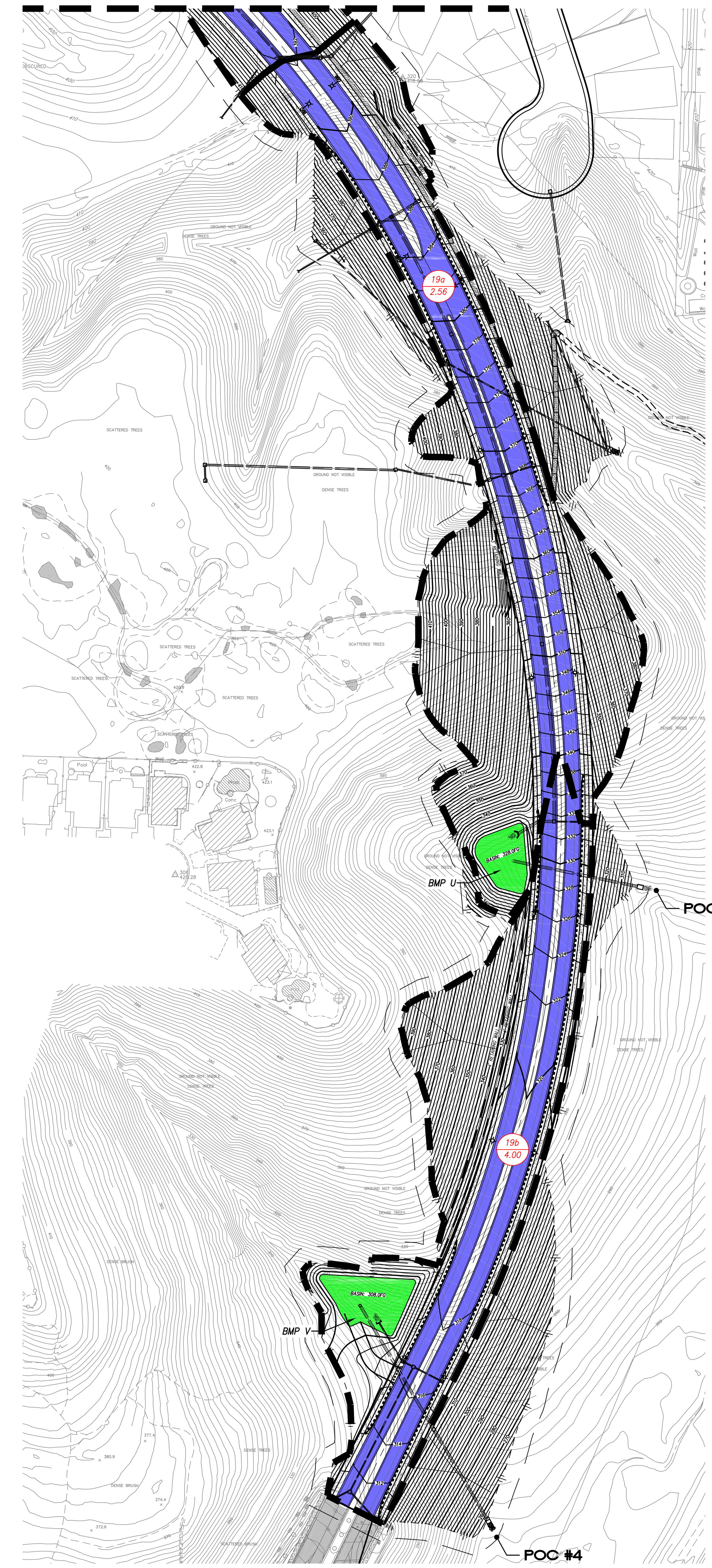
The DMA Exhibit must identify:

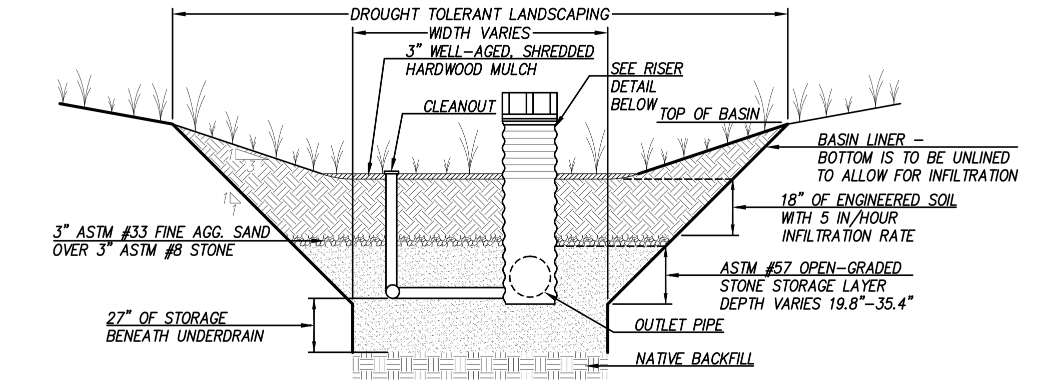
☒ Underlying hydrologic soil group
☒ Approximate depth to groundwater
☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☒ Critical coarse sediment yield areas to be protected
☒ Existing topography and impervious areas
☒ Existing and proposed site drainage network and connections to drainage offsite
☒ Proposed grading
☒ Proposed impervious features
☒ Proposed design features and surface treatments used to minimize imperviousness
☒ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
☒ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
☒ Structural BMPs (identify location, type of BMP, and size/detail)

DMA AREA TABLE

DMA NO.	PROPOSED IMPERVIOUS AREA	PROPOSED PERVIOUS AREA	IMPERVIOUS AREA (%)	TREATMENT BMP
1a	141,258 SF	31,527 SF	81.7%	BMP B
1b	27,334 SF	5,984 SF	81.8%	BMP C
2a	38,934 SF	8,663 SF	81.8%	BMP A
2b	5,607 SF	783 SF	86.7%	BMP H
3	136,677	19,458	87.5%	BMP D
5	46,312	2,128	95.6%	
6	60,607	4,218	93.5%	
4a	26,139 SF	3,053 SF	89.6%	BMP E
4b	70,161 SF	8,747 SF	89.0%	BMP F
7	54,420 SF	14,780 SF	78.6%	BMP I
8	64,198 SF	17,468 SF	78.6%	BMP K
10	14,734 SF	– SF	100%	
9	34,455 SF	7,445 SF	82.3%	BMP J
12	58,718 SF	20,382 SF	74.2%	BMP O
13	12,357 SF	3,643 SF	77.8%	BMP N
11	94,781 SF	24,531 SF	79.5%	BMP G
14	15,121 SF	– SF	100%	
15	273,496 SF	205,071 SF	57.1%	
16	190,465 SF	102,035 SF	65.1%	BMP R
17	66,182 SF	47,018 SF	58.5%	BMP S
18	102,840 SF	144,660 SF	41.5%	BMP T
19a	39,676 SF	71,911 SF	35.5%	BMP U
19b	61,842 SF	112,371 SF	35.5%	BMP V

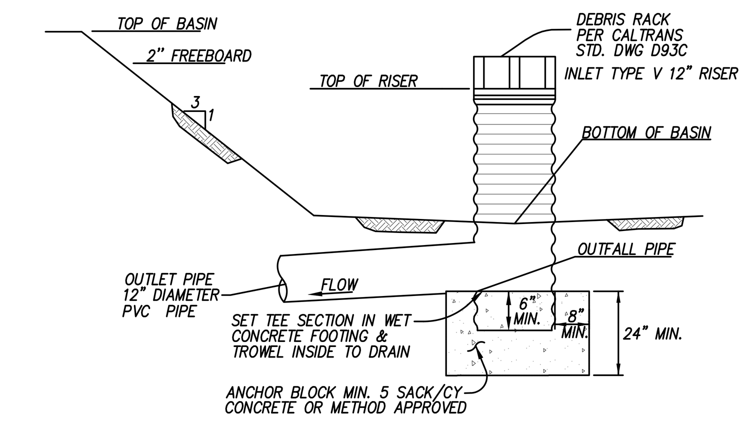
SEE MATCHLINE BELOW





1. "ENGINEERED SOIL" LAYER SHALL BE "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50–60% SAND, 20–30% COMPOST OR HARDWOOD MULCH, AND 20–30% TOPSOIL, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS, AND ALSO FREE OF NOXIOUS WEEDS.

PVT. BIOFILTRATION BASIN
NTS



PVT. RISER DETAIL
NTS

EXISTING SITE INFORMATION

HYDROLOGIC SOIL GROUP: SOIL CLASS TYPE "D"

GROUNDWATER: GROUNDWATER NOT ENCOUNTERED WITHIN 20 FEET IN BORINGS PER REPORT BY SOUTHERN CALIFORNIA SOIL & TESTING, INC. ENTITLED "GEOTECHNICAL INVESTIGATION, RHODES PROPERTY SAN DIEGO, CA" DATED JULY 1998 GROUNDWATER DEPTH IS ASSUMED TO BE GREATER THAN 20 FEET.

EXISTING NATURAL HYDROLOGIC FEATURES: THE EXISTING HYDRALOGICAL FEATURES ON SITE IS AN EXISTING CREEK WITHIN DEER CANYON.

CRITICAL COARSE SEDIMENT YIELD AREAS: CRITICAL COARSE SEDIMENT YIELD AREAS (CCSYAS) EXISTS ONSITE NEAREST THE CORNER OF TORREY SANTA FE ROAD AND CAMINO DEL SUR. PER THE CCSYAS ANALYSIS, ENTITLED "TECHNICAL MEMORANDUM: COARSE SEDIMENT ANALYSIS FOR: MERGE 56", THERE IS NO NET IMPACT AND MITIGATION IS NOT REQUIRED.

EXISTING TOPOGRAPHY AND IMPERVIOUS AREA: EXISTING TOPOGRAPHY SHOWN HEREON. SEE AREA SUMMARY TABLE FOR EXISTING IMPERVIOUS AREA.

EXISTING DRAINAGE: THE MAJORITY OF THE PROJECT NATURALLY FLOWS FROM WEST TO EAST AND DISCHARGES THROUGH DEER CANYON. THE SOUTHERLY PORTION OF THE PROJECT, NEAR THE CONNECTION OF CAMINO DEL SUR AND TORREY SANTA FE ROAD, NATURALLY FLOWS OUT THROUGH PENASQUITOS CANYON.

PROPOSED SITE INFORMATION

PROPOSED DRAINAGE: DRAINAGE PATTERNS HAVE BEEN DESIGNED TO MATCH EXISTING. THE PROPOSED DEVELOPMENT WILL HAVE URBAN FLOW THROUGH INLETS AND STORM DRAINS AND DISCHARGE IN LOT 'Z' NEAREST CAMINO DEL SUR AND TORREY SANTA FE ROAD, WHERE DRAINAGE FLOWS INTO A BY-PASS AND DISCHARGES INTO DEER CANYON. CAMINO DEL SUR SOUTH DRAINS THROUGH INLETS AND STORM DRAINS WITHIN THE STREET AND INTO BIOFILTRATION BASINS AND DISCHARGES INTO OPEN SPACE AREAS INTO PENASQUITOS CANYON.

PROPOSED GRADING: SHOWN HEREON.

PROPOSED IMPERVIOUS FEATURES: SHOWN HEREON.

PROPOSED DRAINAGE: SHOWN HEREON.

PROPOSED DESIGN FEATURES: SITE DESIGN REQUIREMENTS SHOWN HEREON. SEE FORM I-4 FOR EXPLANATION.

DRAINAGE MANAGEMENT AREAS: SHOWN HEREON. SEE DMA SUMMARY TABLE.

POTENTIAL POLLUTANT SOURCE AREAS AND SOURCE CONTROL: SHOWN HEREON. SEE FORMS 1-3B AND 1-4 FOR EXPLANATION.

STRUCTURAL BMPS: BF-1 BIOFILTRATION SHOWN HEREON. SEE DETAILS ABOVE.

BMP AREA TABLE

BMP NO.	TREATMENT AREA REQ'D	TREATMENT AREA PROVIDED
A	1,077 SF	1,100 SF
B	3,910 SF	3,910 SF
C	754 SF	770 SF
*D	6,665 SF	6,800 SF
E	711 SF	745 SF
F	1,922 SF	1,925 SF
*G	11,043 SF	15,100 SF
H	156 SF	180 SF
I	1,513 SF	1,600 SF
J	954 SF	980 SF
*K	2,183 SF	2,220 SF
N	343 SF	740 SF
*O	1,644 SF	1,900 SF
R	5,447 SF	12,775 SF
S	1,931 SF	4,620 SF
T	3,215 SF	9,650 SF
U	1,286 SF	4,100 SF
V	2,008 SF	5,940 SF

*THE DMAS THAT FLOW INTO THESE BASINS ARE TO ACT AS ONE BMP VIA EQUALIZING PIPES.

AREA TABLE

	EXISTING CONDITION	PROPOSED CONDITION	DIFFERENCE
IMPERVIOUS AREA	0 SF (0 AC) – 0%	1,636,314 SF (37.6 AC)–65.7%	1,636,314 SF
PERVIOUS AREA	2,492,190 SF (57.2 AC)–100%	855,876 SF (19.6 AC)–34.3%	–1,636,314 SF
TOTAL AREA	2,492,190 SF (57.2 AC)	2,485,800 SF (57.0 AC)	---

LEGEND

- BUILDING
- ASPHALT
- CONCRETE
- DG
- LANDSCAPE
- BMP AREA
- DMA
- AREA (ACRES)
- DMA BOUNDARY

N

0 40 80 160 240
(IN FEET)
1 inch = 80 ft.

latitude 33
PLANNING & ENGINEERING
9968 Hibert Street 2nd Floor, San Diego, CA 92131
Tel 858.751.0633

DMA MAP
MERGE 56
ATTACHMENT 1A

<table>
<tr><th colspan="2">Harvest and Use Feasibility Screening</th><th>Form I-7</th></tr>
<tr><td colspan="3">1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?
☒ Toilet and urinal flushing
☒ Landscape Irrigation
☐ Other: ______________</td></tr>
<tr><td colspan="3">2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

MF = 111 DU x 2.5 per x 9.3gal/day x 36hrs/24hrs = 3,870 gallons per 36hrs (assumed 2.5 per/DU)
SF = 84 DU x 3.5per x 9.3 gal/day x 36hrs/24hrs = 4,095 gallons per 36hrs (assumed 3.5 per/DU)
Commercial = 479,578 sf x 1per/50sf x 7 gal/day x 36hrs/24hrs = 100,710 gallons per 36hrs (assumed 1 person per 50 sf)
Irrigation = 19.6 acres x 390 gal/ac/day x 36hrs/24hrs = 11,466 gallons per 36hrs

TOTAL: 120,141 gallons per 36hrs = 16,075 cubic feet per 36hrs</td></tr>
<tr><td colspan="3">3. Calculate the DCV using worksheet B-2.1.

DCV = 67,357 cubic feet</td></tr>
<tr><td>3a. Is the 36-hour demand greater than or equal to the DCV?
Yes / No ⇨
⇩</td><td>3b. Is the 36-hour demand greater than 0.25 DCV but less than the full DCV?
Yes / No ⇨
⇩</td><td>3c. Is the 36-hour demand less than 0.25DCV?
Yes
⇩</td></tr>
<tr><td>Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.</td><td>Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.</td><td>Harvest and use is considered to be infeasible.</td></tr>
<tr><td colspan="3">Is harvest and use feasible based on further evaluation?
☐ Yes, refer to appendix E to select and size harvest and use BMPs
☒ No, select alternate BMPs</td></tr>
</table>

MERGE 56
SAN DIEGO, CALIFORNIA

GEOCON LEGEND

P-4 ....APPROX. LOCATION OF INFILTRATION TEST

THE GEOGRAPHICAL INFORMATION MADE AVAILABLE FOR DISPLAY WAS PROVIDED BY GOOGLE EARTH, SUBJECT TO A LICENSING AGREEMENT. THE INFORMATION IS FOR ILLUSTRATIVE PURPOSES ONLY; IT IS NOT INTENDED FOR CLIENT'S USE OR RELIANCE AND SHALL NOT BE REPRODUCED BY CLIENT. CLIENT SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS GEOCON FROM ANY LIABILITY INCURRED AS A RESULT OF SUCH USE OR RELIANCE BY CLIENT.

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SITE PLAN

PROJECT NO. 06021 - 32 - 05
FIGURE 1
DATE 07 - 13 - 2016

Ladrillono

Plotted:07/13/2016 8:42AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\06021-32-05 (Merge 56)\06021-32-05 Site Plan.dwg

Area 1

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying soils using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 0.17 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.09 iph at this location. The proposed BMP's are expected to expose compacted fill and/or formational materials with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.09 iph.			
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.		X
Provide basis: This general location is adjacent to a proposed fill slope. Infiltration of storm water, if allowed to saturate the compacted fill and slope zone soils, would reduce the factor of safety of the proposed slope below current standards.			

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 comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.	X	
Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all 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 Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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:

The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Saturation of the compacted fill and slope zone soils must be avoided to prevent settlement and slope instability. Any partial infiltration should occur within the underlying formational materials. Side liners and subdrains are recommended to help prevent lateral water migration into the compacted fill and utility trenches. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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:

Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, provided the compacted fill and slope zone materials do not become saturated, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration. It is imperative that the slope zone soils do not become saturated to avoid slope instability.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP’s adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.</td></tr>
<tr><td>8</td><td>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 presentedin Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 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.</td><td>Partial Infiltration</td></tr>
</table>

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

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-1	Ref. EL:	378.00
		Bottom EL:	375.67

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	2.33	ft	=	71.02	cm
Dist. Btwn Reservoir & Top of Borehole:	2.25	ft	=	68.58	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	121.1834	cm
Head Height (h):	11.90	cm
Distance Btwn Constant Head and Water Table (L):	550.49	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10566			
2	20.00	20.00	10174	392	392	19.60
3	35.00	15.00	10054	120	512	8.00
4	55.00	20.00	9928	126	638	6.30
5	65.00	10.00	9868	60	698	6.00
6	80.00	15.00	9780	88	786	5.87
7	96.00	16.00	9654	126	912	7.88
8	121.00	25.00	9444	210	1122	8.40
9	131.00	10.00	9368	76	1198	7.60
10	146.00	15.00	9258	110	1308	7.33
11	171.00	25.00	9068	190	1498	7.60
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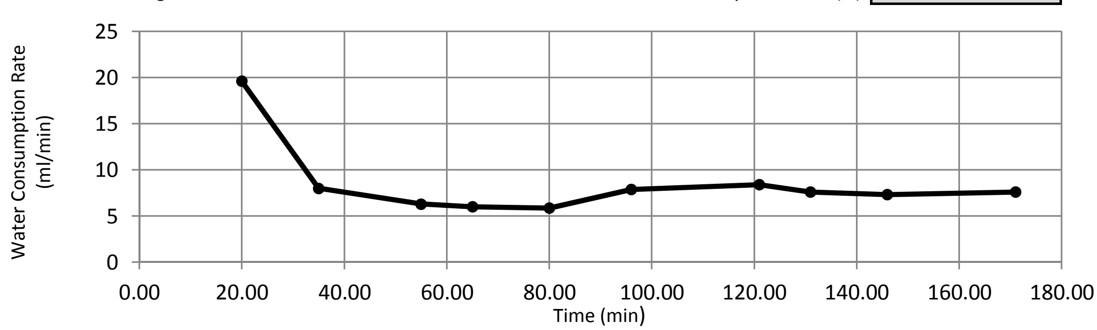
*1 ml = 1 g

Steady Flow Rate (Q): 7.00 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0073 cm/min 0.1722 in/hr

Area 2

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying soils using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 0.05 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.025 iph at this location. The proposed BMP's are expected to expose compacted fill and/or formational materials with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.025 iph.			
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.	X	
Provide basis: Provided any infiltration BMP's are founded in the formational materials below any compacted fill, the adverse impacts of storm water infiltration could be reasonably mitigated using side liners to prevent lateral water migration from adversely impacting utilities or nearby fill slopes.			

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 comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.	X	
Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all 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 Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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:

The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Saturation of the compacted fill and slope zone soils must be avoided to prevent settlement and slope instability. Any partial infiltration should occur within the underlying formational materials. Side liners and subdrains are recommended to help prevent lateral water migration into the compacted fill and utility trenches. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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:

Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, provided the compacted fill and slope zone materials do not become saturated, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration. It is imperative that any adjacent slope zone soils do not become saturated to avoid slope instability.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP’s adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.</td></tr>
<tr><td>8</td><td>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 presentedin Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 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.</td><td>Partial Infiltration</td></tr>
</table>

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

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56		Date:	6/29/2016
Project Number:	06021-32-05		By:	TM
Borehole Location:	P-2		Ref. EL:	375.00
			Bottom EL:	372.00

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	3.00	ft	=	91.44	cm
Dist. Btwn Reservoir & Top of Borehole:	2.42	ft	=	73.76	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	146.7866	cm
Head Height (h):	11.98	cm
Distance Btwn Constant Head and Water Table (L):	530.14	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10820			
2	16.00	16.00	10670	150	150	9.38
3	30.00	14.00	10570	100	250	7.14
4	65.00	35.00	10408	162	412	4.63
5	80.00	15.00	10354	54	466	3.60
6	90.00	10.00	10318	36	502	3.60
7	100.00	10.00	10296	22	524	2.20
8	110.00	10.00	10268	28	552	2.80
9	120.00	10.00	10240	28	580	2.80
10	130.00	10.00	10210	30	610	3.00
11	145.00	15.00	10172	38	648	2.53
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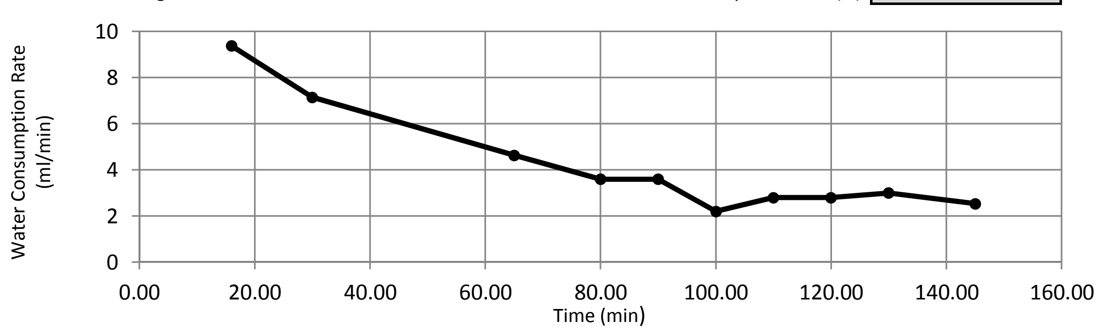
*1 ml = 1 g

Steady Flow Rate (Q): 2.20 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0023 cm/min 0.0537 in/hr

Area 3

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying soils using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 0.55 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.28 iph at this location. The proposed BMP's are expected to expose compacted fill with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.28 iph.			
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.		X
Provide basis: This area will be underlain by compacted fill. Full infiltration of storm water should be avoided to prevent fill saturation and the resulting settlement and/or heave, depending on soil types exposed after grading.			

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 comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.	X	
Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all 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 Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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:

The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Saturation of the compacted fill soils should be avoided to prevent settlement and/or heave. Side liners and subdrains are recommended to help prevent lateral water migration into the compacted fill and utility trenches. Some distress to surrounding improvements may be experienced as a result of storm water infiltration, but could be limited using subdrains and side liners. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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: Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, provided the compacted fill materials do not become saturated, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration. It is imperative that any adjacent slope zone soils do not become saturated to avoid slope instability.

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: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.			
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 presentedin Appendix C.3.	X	
Provide basis: Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.			
Part 2 Result*	If all answers from row 1-4 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.**		Partial Infiltration

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

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-3	Ref. EL:	381.00
		Bottom EL:	380.21

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	0.79	ft	=	24.08	cm
Dist. Btwn Reservoir & Top of Borehole:	2.25	ft	=	68.58	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	74.2442	cm
Head Height (h):	11.76	cm
Distance Btwn Constant Head and Water Table (L):	597.28	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10420			
2	10.00	10.00	9930	490	490	49.00
3	25.00	15.00	9448	482	972	32.13
4	35.00	10.00	9176	272	1244	27.20
5	45.00	10.00	8934	242	1486	24.20
6	57.00	12.00	8660	274	1760	22.83
7	70.00	13.00	8360	300	2060	23.08
8	80.00	10.00	8120	240	2300	24.00
9	90.00	10.00	7898	222	2522	22.20
10	105.00	15.00	7560	338	2860	22.53
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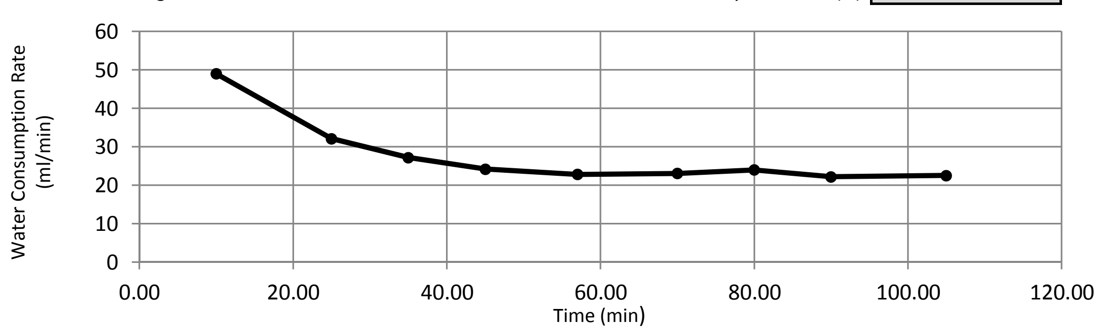
*1 ml = 1 g

Steady Flow Rate (Q): 22.00 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0233 cm/min 0.5497 in/hr

Area 4

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying Terrace Deposits using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 1.03 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.52 iph at this location. However, the terrace deposits tested will likely be removed during grading, therefore the test results obtained at Locations P-1, P-2, and P-3 are considered more representative of the anticipated geologic conditions after site grading. The proposed BMP's are expected to expose formational materials with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.52 iph, however, the rates obtained in P-1, P-2, and P-3, of 0.09, 0.03, and 0.28 iph, respectively, are considered more applicable.			
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.	X	
Provide basis: Provided any infiltration BMP's are founded in the formational materials, the adverse impacts of storm water infiltration could be reasonably mitigated using side liners to prevent lateral water migration from adversely impacting utilities, foundations, and other improvements.			

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 2 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>3</td><td>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 comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP’s adversely impacting groundwater is considered negligible.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all 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</td><td>No Full Infiltration</td></tr>
</table>

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

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Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any 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: The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Any partial infiltration should occur within the underlying formational materials. Side liners and subdrains are recommended to help prevent lateral water migration into the utility trenches and beneath foundations and improvements. These statements are based on a comprehensive evaluation of Appendix C.2.			
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: Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration.			

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: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.			
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 presentedin Appendix C.3.	X	
Provide basis: Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.			
Part 2 Result*	If all answers from row 1-4 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.**		Partial Infiltration

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

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-4	Ref. EL:	412.00
		Bottom EL:	409.67

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	2.33	ft	=	71.02	cm
Dist. Btwn Reservoir & Top of Borehole:	2.17	ft	=	66.14	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	118.745	cm
Head Height (h):	11.90	cm
Distance Btwn Constant Head and Water Table (L):	550.48	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10156			
2	55.00	55.00	6212	3944	3944	71.71
3	75.00	20.00	5116	1096	5040	54.80
4			11060			
5	90.00	15.00	10168	892	892	59.47
6	105.00	15.00	9356	812	1704	54.13
7	120.00	15.00	8594	762	2466	50.80
8	130.00	10.00	8106	488	2954	48.80
9	145.00	15.00	7404	702	3656	46.80
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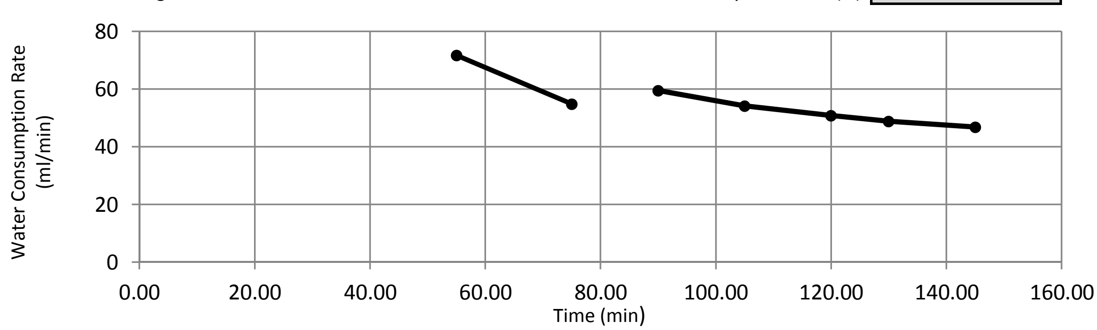
*1 ml = 1 g

Steady Flow Rate (Q): 42.00 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0438 cm/min 1.0342 in/hr

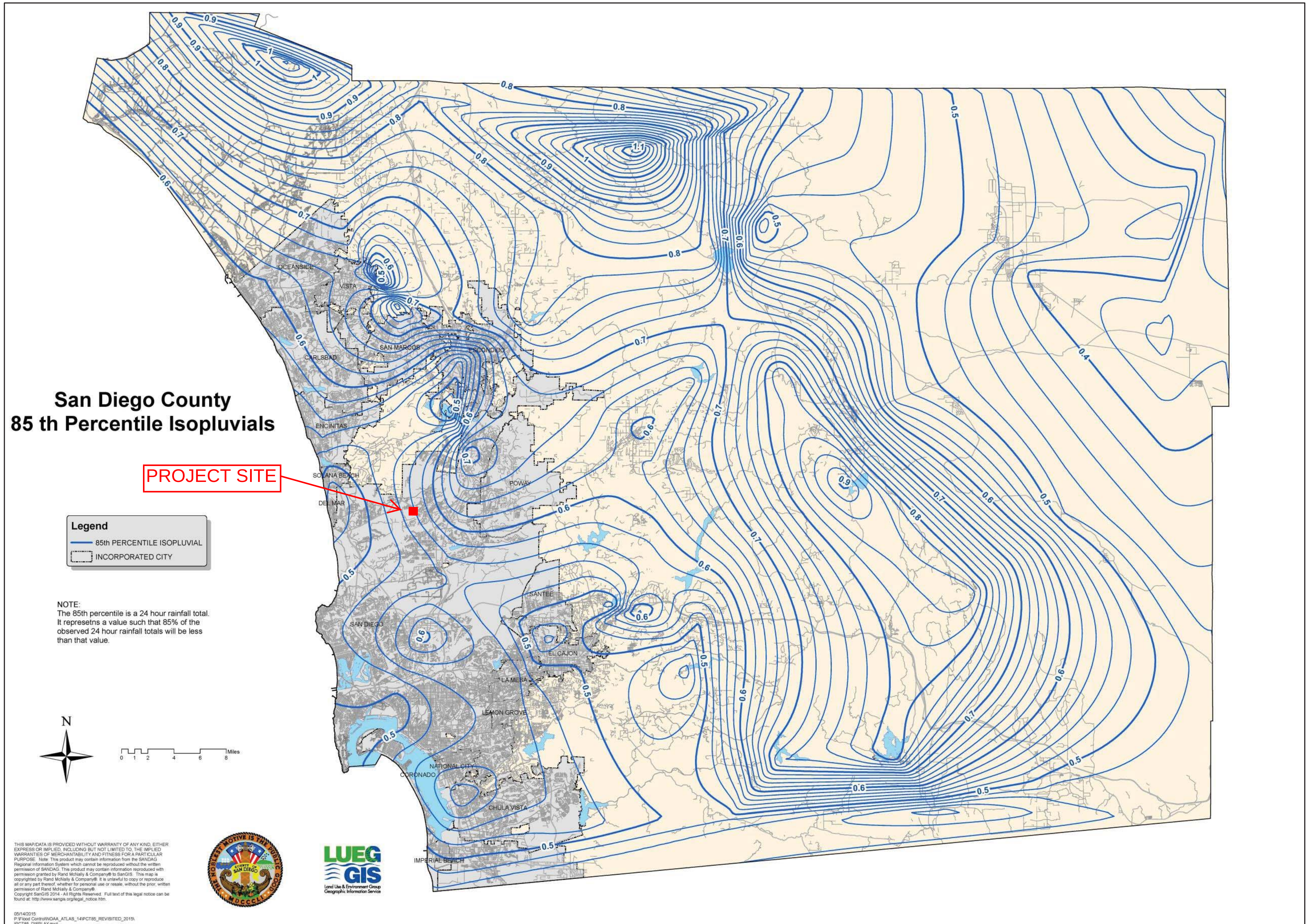


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

Runoff Factor Calculation BMP A

Use	A (acres)	C	C·A	% DCV
Impervious	0.894	0.900	0.804	97.6%
Pervious	0.199	0.100	0.020	2.4%
DG	-	0.300	0.000	0.0%
TOTAL	**1.093**	**0.754**	**0.824**	**100%**

BMP Name: A

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	47597	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.754	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	1675	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	2512	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	605	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	1256	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	761	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	1077	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	1077	sq.ft.
Proposed Size of BMP		**1100**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP B

Use	A (acres)	C	C·A	% DCV
Impervious	3.244	0.900	2.920	97.6%
Pervious	0.725	0.100	0.072	2.4%
DG	-	0.300	0.000	0.0%
TOTAL	**3.969**	**0.754**	**2.99**	**100%**

BMP Name: B

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	172785	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.754	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	6082	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	9123	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	2198	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	4562	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	2765	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0300	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	3910	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	3910	sq.ft.
Proposed Size of BMP		**3910**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP C

Use	A (acres)	C	C·A	% DCV
Impervious	0.63	0.900	0.563	97.6%
Pervious	0.14	0.100	0.014	2.4%
DG	-	0.300	0.000	0.0%
TOTAL	**0.765**	**0.754**	**0.58**	**100%**

BMP Name: C

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	33318	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.754	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	1172	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	1759	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	424	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	879	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	533	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	754	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	754	sq.ft.
Proposed Size of BMP		**770**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP D

Use	A (acres)	C	C·A	% DCV
Impervious	5.59	0.900	5.033	98.8%
Pervious	0.59	0.100	0.059	1.2%
DG	-	0.300	0.000	0.0%
TOTAL	**6.185**	**0.823**	**5.09**	**100%**

BMP Name: D

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	269400	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.823	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	10352	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	36	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)[(1)]	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	35.4	inches
15	Total Depth Treated [Line 13 + Line 14]	65.4	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	15527	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	2849	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	7764	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	2632	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0300	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	6655	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	6655	sq.ft.
Proposed Size of BMP		**6800**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP E

Use	A (acres)	C	C·A	% DCV
Impervious	0.60	0.900	0.537	98.6%
Pervious	0.07	0.100	0.007	1.4%
DG	-	0.300	0.000	0.0%
TOTAL	**0.670**	**0.812**	**0.54**	**100%**

BMP Name: E

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	29192	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.812	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	1106	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)[1]	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	1659	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	400	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	830	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	503	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0300	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	711	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	711	sq.ft.
Proposed Size of BMP		**745**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP F

Use	A (acres)	C	C·A	% DCV
Impervious	1.61	0.900	1.451	98.6%
Pervious	0.20	0.100	0.020	1.4%
DG	-	0.300	0.000	0.0%
TOTAL	**1.811**	**0.812**	**1.47**	**100%**

BMP Name: F

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	78908	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.812	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	2990	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	4485	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	1081	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2242	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	1359	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0300	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	1922	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	1922	sq.ft.
Proposed Size of BMP		**1925**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP G'

Use	A (acres)	C	C·A	% DCV
Impervious	8.80	0.900	7.924	93.8%
Pervious	5.27	0.100	0.527	6.2%
DG	-	0.300	0.000	0.0%
TOTAL	**14.073**	**0.600**	**8.45**	**100%**

BMP Name: G'

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	613000	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.600	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	17178	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	25767	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	5313	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	12884	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	5482	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	11043	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	11043	sq.ft.
Proposed Size of BMP		**15100**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP H

Use	A (acres)	C	C·A	% DCV
Impervious	0.13	0.900	0.118	98.7%
Pervious	0.02	0.100	0.002	1.3%
DG	-	0.300	0.000	0.0%
TOTAL	**0.147**	**0.815**	**0.12**	**100%**

BMP Name: H

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	6390	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.815	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	243	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	365	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	75	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	182	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	78	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	156	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	156	sq.ft.
Proposed Size of BMP		**180**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP I

Use	A (acres)	C	C·A	% DCV
Impervious	1.25	0.900	1.124	97.1%
Pervious	0.34	0.100	0.034	2.9%
DG	-	0.300	0.000	0.0%
TOTAL	**1.589**	**0.729**	**1.16**	**100%**

BMP Name: I

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	69200	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.73	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	2354	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	3531	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	851	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	1765	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	1070	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	1513	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	1513	sq.ft.
Proposed Size of BMP		**1600**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP J

Use	A (acres)	C	C·A	% DCV
Impervious	0.79	0.900	0.713	97.7%
Pervious	0.17	0.100	0.017	2.3%
DG	-	0.300	0.000	0.0%
TOTAL	**0.962**	**0.759**	**0.73**	**100%**

BMP Name: J

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	41900	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.76	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	1484	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	6	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	19.8	inches
15	Total Depth Treated [Line 13 + Line 14]	49.8	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	2225	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	536	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	1113	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	674	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	954	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	954	sq.ft.
Proposed Size of BMP		**980**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP K

Use	A (acres)	C	C·A	% DCV
Impervious	1.81	0.900	1.630	97.6%
Pervious	0.40	0.100	0.040	2.4%
DG	-	0.300	0.000	0.0%
TOTAL	**2.213**	**0.755**	**1.67**	**100%**

BMP Name: K

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	96400	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.755	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	3395	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	5093	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	1050	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2547	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	1084	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	2183	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	2183	sq.ft.
Proposed Size of BMP		**2220**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP N

Use	A (acres)	C	C·A	% DCV
Impervious	0.28	0.900	0.254	96.8%
Pervious	0.08	0.100	0.008	3.2%
DG	-	0.300	0.000	0.0%
TOTAL	**0.367**	**0.715**	**0.26**	**100%**

BMP Name: N

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	16000	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.715	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	534	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	801	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	165	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	400	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	170	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	343	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	343	sq.ft.
Proposed Size of BMP		**740**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP O'

Use	A (acres)	C	C·A	% DCV
Impervious	1.35	0.900	1.211	96.3%
Pervious	0.47	0.100	0.047	3.7%
DG	-	0.300	0.000	0.0%
TOTAL	**1.816**	**0.693**	**1.26**	**100%**

BMP Name: O'

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	79100	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.693	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	2557	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	3835	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	791	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	1918	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	816	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	1644	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	1644	sq.ft.
Proposed Size of BMP		**1900**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP R

Use	A (acres)	C	C·A	% DCV
Impervious	4.37	0.900	3.934	94.4%
Pervious	2.34	0.100	0.234	5.6%
DG	-	0.300	0.000	0.0%
TOTAL	**6.715**	**0.621**	**4.17**	**100%**

BMP Name: R

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	292500	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.621	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	8473	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	12710	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	2621	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	6355	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	2704	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	5447	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	5447	sq.ft.
Proposed Size of BMP		**12775**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP S

Use	A (acres)	C	C·A	% DCV
Impervious	1.52	0.900	1.370	92.7%
Pervious	1.08	0.100	0.108	7.3%
DG	-	0.300	0.000	0.0%
TOTAL	**2.599**	**0.569**	**1.48**	**100%**

BMP Name: S

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	113200	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.569	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	3003	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	4505	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	929	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2253	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	959	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	1931	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	1931	sq.ft.
Proposed Size of BMP		**4620**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP T

Use	A (acres)	C	C·A	% DCV
Impervious	2.41	0.900	2.171	86.8%
Pervious	3.32	0.100	0.332	13.2%
DG	-	0.300	0.000	0.0%
TOTAL	**5.730**	**0.433**	**2.50**	**100%**

BMP Name: T

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	249600	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.433	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	5000	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	5	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	58.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	7501	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	1546	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	3750	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	1596	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	3215	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	3215	sq.ft.
Proposed Size of BMP		**9650**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP U

Use	A (acres)	C	C·A	% DCV
Impervious	0.91	0.900	0.819	83.2%
Pervious	1.65	0.100	0.165	16.8%
DG	-	0.300	0.000	0.0%
TOTAL	**2.562**	**0.384**	**0.98**	**100%**

BMP Name: U

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	111587	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.384	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	2000	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	1	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	6	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	34.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	3000	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	1053	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	1500	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	638	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	1286	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	1286	sq.ft.
Proposed Size of BMP		**4100**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

Runoff Factor Calculation BMP V

Use	A (acres)	C	C·A	% DCV
Impervious	1.42	0.900	1.278	83.2%
Pervious	2.58	0.100	0.258	16.8%
DG	-	0.300	0.000	0.0%
TOTAL	**3.999**	**0.384**	**1.54**	**100%**

BMP Name: V

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area Draining to the BMP	174213	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.384	
3	85th percentile 24-hour rainfall depth	0.56	inches
4	Design Capture volume [Line 1 x Line 2 x (Line 3/12)]	3123	cu.ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	12	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)(1)	1	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]	6	inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	28.2	inches
15	Total Depth Treated [Line 13 + Line 14]	34.2	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]	4684	cu.ft.
17	Required Footprint [Line 16/ Line 15] x 12	1644	sq.ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2342	cu.ft.
19	Required Footprint [Line 18/ Line 14] x 12	997	sq.ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.03	
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]	2008	sq.ft.
22	Footprint of the BMP = Maximum(Minimum(Line 17, Line 19), Line 21)	2008	sq.ft.
Proposed Size of BMP		**5940**	**sq.ft.**

(1): Once HMP is designed for, the controlling factor will be the discharge of the LID orifice.

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

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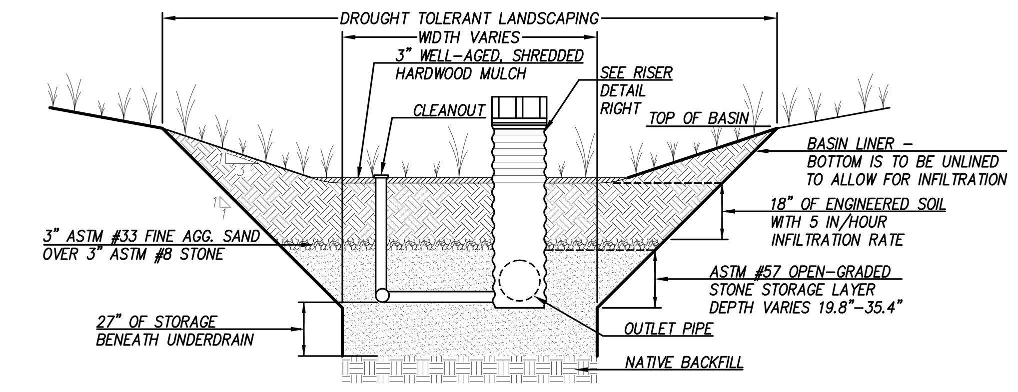
Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 2a	Hydromodification Management Exhibit (Required)	☒ Included See Hydromodification Management Exhibit Checklist
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☒ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☐ Not Performed ☒ Included ☐ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each structural BMP See Chapter 6 and Appendix G of the BMP Design Manual	☒ Included ☐ Submitted as separate stand-alone document
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included ☒ Not required because BMPs will drain in less than 96 hours

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

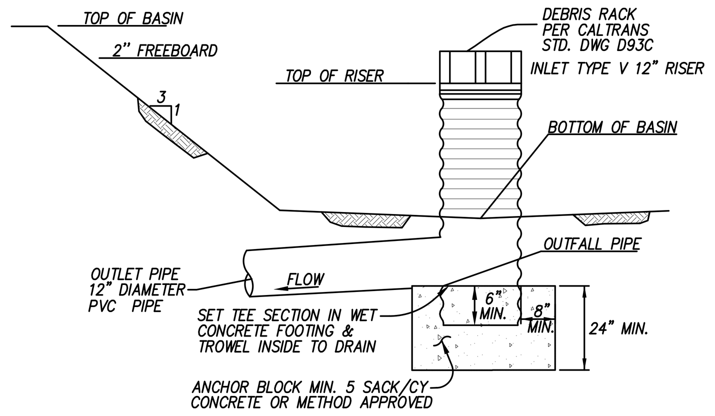
The Hydromodification Management Exhibit must identify:

☒ Underlying hydrologic soil group
☒ Approximate depth to groundwater
☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☒ Critical coarse sediment yield areas to be protected
☒ Existing topography
☒ Existing and proposed site drainage network and connections to drainage offsite
☒ Proposed grading
☒ Proposed impervious features
☒ Proposed design features and surface treatments used to minimize imperviousness
☒ Point(s) of Compliance (POC) for Hydromodification Management
☒ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☒ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)



1. "ENGINEERED SOIL" LAYER SHALL BE "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50–60% SAND, 20–30% COMPOST OR HARDWOOD MULCH, AND 20–30% TOPSOIL, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS, AND ALSO FREE OF NOXIOUS WEEDS.

PVT. BIOFILTRATION BASIN
NTS



PVT. RISER DETAIL
NTS

EXISTING SITE INFORMATION

HYDROLOGIC SOIL GROUP: SOIL CLASS TYPE "D"

GROUNDWATER: GROUNDWATER NOT ENCOUNTERED WITHIN 20 FEET IN BORINGS PER REPORT BY SOUTHERN CALIFORNIA SOIL & TESTING, INC. ENTITLED "GEOTECHNICAL INVESTIGATION, RHODES PROPERTY SAN DIEGO, CA" DATED JULY 1998 GROUNDWATER DEPTH IS ASSUMED TO BE GREATER THAN 20 FEET.

EXISTING NATURAL HYDROLOGIC FEATURES: THE EXISTING HYDRALOGICAL FEATURES ON SITE IS AN EXISTING CREEK WITHIN DEER CANYON.

CRITICAL COARSE SEDIMENT YIELD AREAS: CRITICAL COARSE SEDIMENT YIELD AREAS (CCSYAS) EXISTS ONSITE NEAREST THE CORNER OF TORREY SANTA FE ROAD AND CAMINO DEL SUR. PER THE CCSYAS ANALYSIS, ENTITLED "TECHNICAL MEMORANDUM: COARSE SEDIMENT ANALYSIS FOR: MERGE 56", THERE IS NO NET IMPACT AND MITIGATION IS NOT REQUIRED.

EXISTING TOPOGRAPHY AND IMPERVIOUS AREA: EXISTING TOPOGRAPHY SHOWN HEREON. SEE AREA SUMMARY TABLE FOR EXISTING IMPERVIOUS AREA.

EXISTING DRAINAGE: THE MAJORITY OF THE PROJECT NATURALLY FLOWS FROM WEST TO EAST AND DISCHARGES THROUGH DEER CANYON. THE SOUTHERLY PORTION OF THE PROJECT, NEAR THE CONNECTION OF CAMINO DEL SUR AND TORREY SANTA FE ROAD, NATURALLY FLOWS OUT THROUGH PENASQUITOS CANYON.

PROPOSED SITE INFORMATION

PROPOSED DRAINAGE: DRAINAGE PATTERNS HAVE BEEN DESIGNED TO MATCH EXISTING. THE PROPOSED DEVELOPMENT WILL HAVE URBAN FLOW THROUGH INLETS AND STORM DRAINS AND DISCHARGE IN LOT 'Z' NEAREST CAMINO DEL SUR AND TORREY SANTA FE ROAD, WHERE DRAINAGE FLOWS INTO A BY-PASS AND DISCHARGES INTO DEER CANYON. CAMINO DEL SUR SOUTH DRAINS THROUGH INLETS AND STORM DRAINS WITHIN THE STREET AND INTO BIOFILTRATION BASINS AND DISCHARGES INTO OPEN SPACE AREAS INTO PENASQUITOS CANYON.

PROPOSED GRADING: SHOWN HEREON.

PROPOSED IMPERVIOUS FEATURES: SHOWN HEREON.

PROPOSED DRAINAGE: SHOWN HEREON.

PROPOSED DESIGN FEATURES: SITE DESIGN REQUIREMENTS SHOWN HEREON. SEE FORM I-4 FOR EXPLANATION.

DRAINAGE MANAGEMENT AREAS: SHOWN HEREON. SEE DMA SUMMARY TABLE.

POTENTIAL POLLUTANT SOURCE AREAS AND SOURCE CONTROL: SHOWN HEREON. SEE FORMS 1-3B AND 1-4 FOR EXPLANATION.

STRUCTURAL BMPS: BF-1 BIOFILTRATION SHOWN HEREON. SEE DETAILS ABOVE.

BMP NO.	TREATMENT AREA REQ'D	TREATMENT AREA PROVIDED
A	1,077 SF	1,100 SF
B	3,910 SF	3,910 SF
C	754 SF	770 SF
*D	6,665 SF	6,800 SF
E	711 SF	745 SF
F	1,922 SF	1,925 SF
*G	11,043 SF	15,100 SF
H	156 SF	180 SF
I	1,513 SF	1,600 SF
J	954 SF	980 SF
*K	2,183 SF	2,220 SF
N	343 SF	740 SF
*O	1,644 SF	1,900 SF
R	5,447 SF	12,775 SF
S	1,931 SF	4,620 SF
T	3,215 SF	9,650 SF
U	1,286 SF	4,100 SF
V	2,008 SF	5,940 SF

BMP AREA TABLE

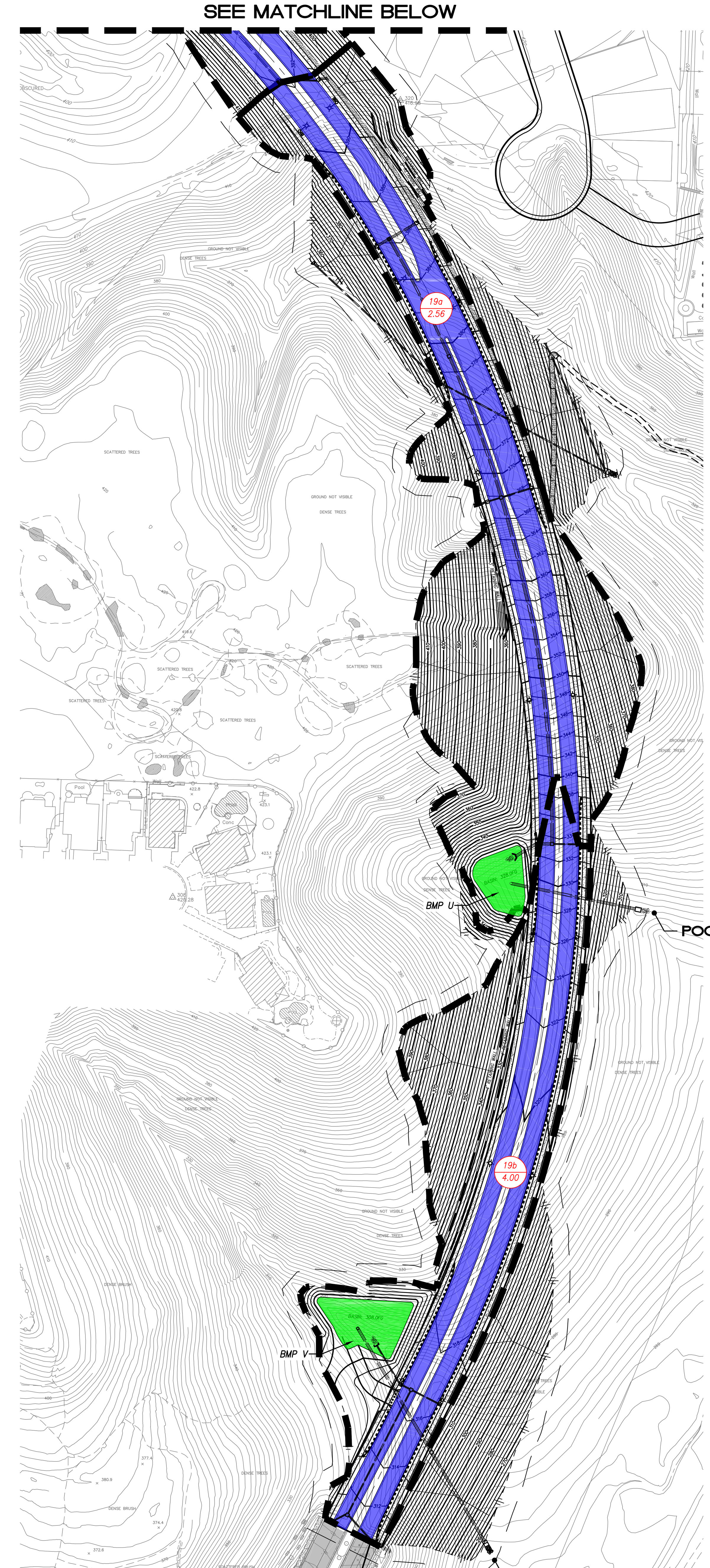
*THE DMAS THAT FLOW INTO THESE BASINS ARE TO ACT AS ONE BMP VIA EQUALIZING PIPES.

POST-CONSTRUCTION PERMANENT BMP OPERATION & MAINTENANCE PROCEDURE DETAILS

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT APPROVAL NO.: 1644549

O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNER / HOA / CITY / OTHER

BMP DESCRIPTION	INSPECTION FREQUENCY	MAINTENANCE FREQUENCY	MAINTENANCE METHOD	QUANTITY	SHEET NUMBER(S)
BIOFILTRATION BASIN	YEARLY	AS-NEEDED	REMOVE ACCUMULATING MATERIALS	23	9–11
HMP FACILITY					
UNDERGROUND STORAGE VAULT	YEARLY	AS-NEEDED	REMOVE ACCUMULATING MATERIALS (IE TRASH AND DEBRIS)	4	9–10



LEGEND

- BUILDING
- ASPHALT
- CONCRETE
- DG
- LANDSCAPE
- BMP AREA
- DMA
- AREA (ACRES)
- DMA BOUNDARY

N

0 40 80 160 240
(IN FEET)
1 inch = 80 ft.

latitude 33
PLANNING & ENGINEERING
9968 Hibert Street 2nd Floor, San Diego, CA 92131
Tel 858.751.0633

HMP EXHIBIT
MERGE 56
ATTACHMENT 2A

R·E·C

ATTACHMENT 2B

TECHNICAL MEMORANDUM:

Coarse Sediment Analysis for:

Merge 56

Prepared For:

Latitude 33

May 16, 2016.

Prepared by:

Luis Parra, PhD, CPSWQ, ToR, D.WRE.
R.C.E. 66377

REC Consultants
2442 Second Avenue
San Diego, CA 92101
Telephone: (619) 232-9200

1. SUMMARY

The purpose of this Technical Memo is to demonstrate that the Merge 56 project generates a No Net Impact in the Critical Coarse Sediment Yield for Deer Canyon and an unnamed tributary to it in its left margin. The methodology explained in Appendix H of the City of San Diego BMP Design Manual (updated by the Critical Coarse Sediment Technical Advisory Committee on March 2016, from which the City of San Diego, The County of San Diego, Technical Experts and representatives of the Water Quality Control Board were represented, see Appendix 1) will be used to conclude that the Potential Critical Coarse Sediment Yield Areas (PCCSYAs) within the Merge 56 project are not significant and can be removed from Critical Designation, and their removal will not impact negatively the receiving stream (Deer Canyon Creek).

2. METHODOLOGY TO IDENTIFY CCSYAs

2.1 Identification of CCSYAs

The Watershed Management Area Analysis (WMAA) PCCSYA Map prepared by the County of San Diego (commonly known as the Rash Map where PCCSYA are depicted in red) is used in the memo to identify PCCSYA in the project. Figure 1a and 1b, prepared by Latitude 33, displays the red areas identified for the project, all of them adjacent to the north-west slope of the project towards Deer Canyon Creek, where no impervious development will occur but modifications of the topography will take place. Figure 1b only displays the detailed area around the PCCSYAs. Further refinement options will be applied to determine if the small PCCSYA identified areas become CCSYAs or Non-CCSYAs.

At this point, it is important to mention that only Reach 1 has PCCSYAs, so the analysis will focus on this Reach.

2.2 Refinement Options

2.2.1 Depositional Analysis

If it can be demonstrated that the potential source of coarse sediment is deposited in existing system prior to reaching the first downstream unlined water of the state, then PCCSYA can be removed from further considerations. Depositional systems may include natural sinks, existing structural BMPs, existing hardened MS4 systems or other existing similar features that produce a peak velocity from the discrete 2-year, 24 hour runoff event of less than 3 ft/s in the system being analyzed.

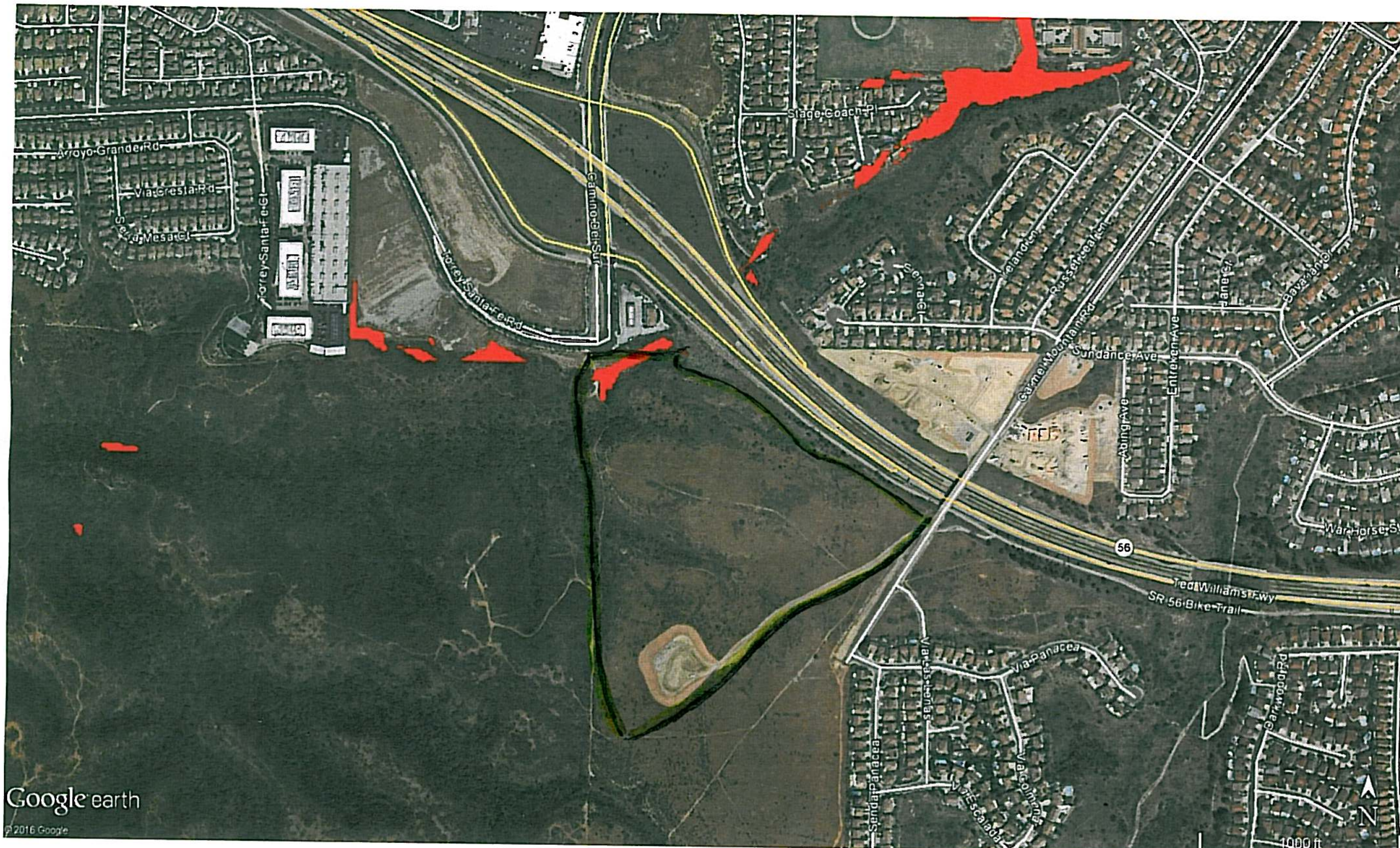


FIGURE 1a: PCCSYA & Overall Development.

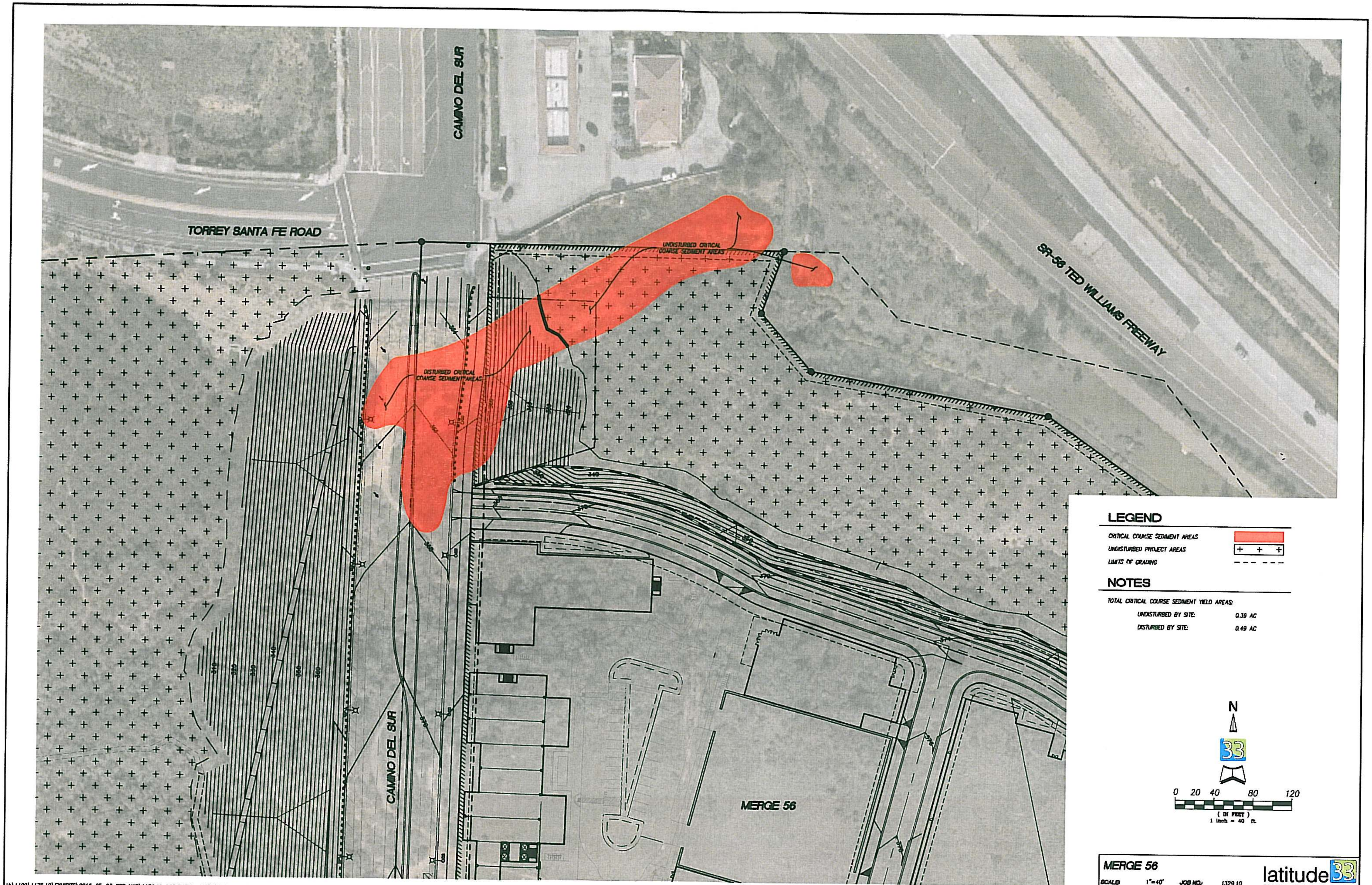


FIGURE 1b: PCCSYA & Development (Detail).

It is clear for the location of the PCCSYA next to the banks of the creek that a deposition of coarse sediments before reaching Deer Canyon Creek will not occur, as the PCCSYA drain directly into the creek. Therefore, this refinement option is considered unnecessary for this project.

2.2.2 Threshold Channel Analysis

A threshold channel is a stream channel in which channel boundary material has no significant movement during the design flow. If there is no movement of bed load in the stream channel, then it is not anticipated that reductions in sediment supply will be detrimental to stream stability because the channel bed consists of the parent material and not coarse sediment supplied from upstream. In such a situation, changes in sediment supply are not considered a geomorphic condition of concern.

An approximate threshold channel analysis was performed. The following are the assumptions and results:

- Upstream and Downstream analysis extend identically as the downstream and upstream analysis prepared by Chang (Hydromodification Screening for Merge 56, November 14, 2013, Appendix 2). Therefore, measurements, results, and/or assumptions made in the Chang's study will be useful for this analysis.
- For calculations of Specific Stream Power Q_{10}, slope S and channel width w are needed. S and w will be obtained from Chang's study, while Q_{10} will be obtained following the methodology of the updated Appendix H (see Appendix 1 of this study).
- For Q_{10} calculations, the percentage of impervious area draining to the channel is needed. A conservatively large value of 20% (that is also a realistic value) will be used to insure that the conclusions of the analysis are valid regardless of the impervious percentage (see Appendix 3).
- For the calculation of an overall d_{50} value, the value obtained in Chang's study will be applied here: d_{50} in Reach 1 will be 64 mm.
- The value of d_{50} = 64 mm = 2.52" will be used in Figure H.7-1 to determine if the channel is a threshold channel or an alluvial channel.
- A sensitivity analysis will be done: as the contributing areas are now slightly different than those obtained by Chang due to development in the recent years, and as the impervious percentage might increase, the following conservative assumptions were made: (a) impervious percentage will increase up to 50%; (b) contributing areas will increase up to 15%; (c) as d_{50} is also an statistical value, a conservative assumption of reducing this value by a factor of 2 is included in the sensitivity analysis; therefore, d_{50} = 32 mm.

Table 1 shows the results of the Threshold Channel Calculation based on information collected in Chang's study, and methodology detailed in final version of Appendix H (see Appendix 1). Table 1' shows the same results but with the Sensitivity Analysis. From the result of the calculations, it is clear that Deer

TABLE 1 : THRESHOLD CHANNEL CALCULATIONS

Reach	Slope, S	Width, W (m)	Area, A (mi^2)	P, inches	AF(1)	Q_{10} (cfs)(2)	Q_{10} (m^3/s)	SSP (W/m^2)(3)	d_{50} (mm)	ω-BE (W/m^2)(4)	ω-BE > SSP(5)?
1	0.0164	30.5	1.580	13.3	1.18	235	6.64	35.0	64.0	377.9	YES

(1): Adjustment Factor (AF) taken from Figure H.7-2 with an impervious percentage of 20 % for Reach 1 (conservative value). See **Appendix 3**.

(2): Q (cfs) obtained with equation H.7-4 : $\mathbf{Q_{10} = AF \cdot 18.2 \cdot A^{0.87} \cdot P^{0.77}}$

(3): SSP (Specific Stream Power, Watt/m^2): Obtained with equation H.7-1 : $\mathbf{SSP = \Upsilon \cdot Q_{10} \cdot S/W}$ (International Units)

(4): ω-BE (Braided equilibrium Specific Power, Watt/m^2): Obtained with equation in Figure H.7-1 : $\mathbf{\omega\text{-}BE = 16.7 \cdot d_{50}^{0.75}}$ (d_{50} = mm)

(5) : If ω-BE > SSP then the point (d_{50} , SSP) plots below the braided equilibrium line in Figure H.7-1, and therefore the channel is a threshold channel (see **Appendix 3**).

TABLE 1' : THRESHOLD CHANNEL CALCULATIONS - Sensitivity Analysis on the Approximate Parameters

Reach	Slope, S	Width, W (m)	Area*, A(mi^2)	P, inches	AF(1)	Q_{10} (cfs)(2)	Q_{10} (m^3/s)	SSP (W/m^2)(3)	d_{50} (mm)**	ω-BE (W/m^2)(4)	ω-BE > SSP(5)?
1	0.0164	30.5	1.817	13.3	1.286	289	8.17	43.1	32.0	224.7	YES

* : Area has been increased 15% from Chang's value just for sensitivity analysis purposes, and because of development in the contributing area

(1): Adjustment Factor (AF) taken from Figure H.7-2 with an impervious percentage of 50 % for Reach 1 (sensitivity analysis value). See **Appendix 3**.

(2): Q (cfs) obtained with equation H.7-4 : $\mathbf{Q_{10} = AF \cdot 18.2 \cdot A^{0.87} \cdot P^{0.77}}$

(3): SSP (Specific Stream Power, Watt/m^2): Obtained with equation H.7-1 : $\mathbf{SSP = \Upsilon \cdot Q_{10} \cdot S/W}$ (International Units)

**: d_{50} has been reduced to 50% of the Chang's recommended value

(4): ω-BE (Braided equilibrium Specific Power, Watt/m^2): Obtained with equation in Figure H.7-1 : $\mathbf{\omega\text{-}BE = 16.7 \cdot d_{50}^{0.75}}$ (d_{50} = mm)

(5) : If ω-BE > SSP then the point (d_{50} , SSP) plots below the braided equilibrium line in Figure H.7-1, and therefore the channel is a threshold channel (see **Appendix 3**).

Canyon Creek is a Threshold Channel in the range of analysis. Final results are also included in Appendix 3 by completing form H.7-1.

2.2.2.1 Conclusions of Threshold Channel Analysis

Deer Canyon Creek is preliminarily a threshold channel in the range of analysis (which is the same range of analysis than that used to determine a low susceptibility to erosion). This Threshold analysis has a large safety factor as the sensitivity analysis also shows Deer Canyon Creek as a Threshold Channel.

2.2.3 Coarse Sediment Source Area Verification

A sieve analysis has not been performed, and it is not required as the Threshold Analysis section proved that Deer Canyon Creek is a Threshold Channel. Therefore, this optional analysis is not included.

2.2.4 Verification of Geomorphic Landscape Units (GLUs)

GLU analysis was not performed in detail, but a quick verification of the slope, land use and geology of the project size confirms that GLU analysis will not remove PCCSYA areas. Therefore, no specific GLU analysis was performed in this project as it is consider unnecessary.

2.3. Conclusion of the Refinement Options

After a refinement analysis a PCCSYA has two options: it is either a Critical Coarse Sediment Yield Area (CCSYA) or it becomes a Non Critical Coarse Sediment Yield Area (Non-CCSYA). Only one of the refinement options need to produce a positive result for PCCSYA to become a Non-CCSYA. If no positive result occurs, then PCCSYA becomes CCSYA. As the threshold analysis produced a positive result, then the red areas of Figure 1b are considered Non-CCSYA and no protection of those areas (avoidance o no net impact demonstration) is needed.

3. AVOIDANCE AND BYPASS

The project cannot avoid the PCCSYAs included within its boundaries as those areas are located at the needed slope for the development and also at the location of a new proposed culvert. In regards to bypass CCSYAs, it does not apply to this project as there is no run-on in the project area with PCCSYAs. However, per section 2.3, the PCCSYAs are now Non-CCSTAs and no avoidance is needed.

4. DEMONSTRATE NO NET IMPACT

Calculations of No net impact based on a continuous simulation model and a sediment yield model will not be necessary for this project as Section 2.3 proves that the PCCSYAs can be classified as Not-CCSYAs.

5. CONCLUSIONS OF THE STUDY

The Deer Canyon Creek downstream of the project area is considered a threshold channel, (which is also consistent with the independent analysis prepared by Chang that demonstrates that the river has low susceptibility for erosion). Therefore, the PCCSYAs in the project area are not needed by the creek. **This conclusion in itself should be sufficient to remove the critical designation of the PCCSYAs. In other words, PCCSYAs identified here become Non-CCSYAs as the channel receives no net impact by the reduction/transformation of the PCCSYAs caused by the construction of the slopes along the left bank of the Deer Canyon Creek.**

6. LIST OF APPENDICES

- Appendix 1: Final Version of Appendix H – Methods
- Appendix 2: Hydromodification Screening – Chang Consultants
- Appendix 3: Results (Includes Form H.7-1)

APPENDIX 1: FINAL VERSION OF APPENDIX H – METHODS

H.7. PCCSYAs: Refinement Options

If an applicant has identified onsite and/or upstream PCCSYAs and elects to perform additional optional analyses to refine the PCCSYA designation, the guidance presented below should be followed. Protection of critical coarse sediment yield areas is a necessary element of hydromodification management because coarse sediment supply is as much an issue for causing erosive conditions to receiving streams as are accelerated flows. However, not all downstream systems warrant preservation of coarse sediment supply nor all source areas need to be protected. The following guidance shall be used to refine PCCSYA designations:

- Depositional Analysis (Appendix H.7.1)
- Threshold Channel Analysis (Appendix H.7.2)
- Coarse Sediment Source Area Verification (Appendix H.7.3)

H.7.1. Depositional Analysis

Areas identified as PCCSYAs may be removed from consideration if it is demonstrated that these sources are deposited into existing systems prior to reaching the first downstream unlined water of the state. Systems resulting in deposition may include existing natural sinks, existing structural BMPs, existing hardened MS4 systems, or other existing similar features. Applicants electing to perform depositional analysis to refine PCCSYA mapping must meet the following criteria to qualify for exemption from CCSYA designation:

- The existing hardened MS4 system that is being analyzed should be upstream of the first downstream unlined waters of the state; and
- The peak velocity from the discrete 2-year, 24-hour runoff event for the existing hardened MS4 system that is being analyzed is less than three feet per second.

The three feet per second criteria was established by calculated the minimum self-cleansing velocity using Equation H.7.1 and the following assumptions:

- Hydraulic radius calculated based on: Storm drain diameter = 1.5 feet, Slope = 0.5%, and De minimis 2-year 24-hour peak flow = 0.25 cfs;
- Manning's roughness coefficient = 0.013 (concrete);
- Specific gravity = 2.65;
- Sediment particle diameter = 0.5 mm (coarse sand).

The three feet per second criteria is also consistent with the recommended minimum velocity for storm and sanitary sewers in ASCE Manual of Engineering Practice No. 37 (ASCE, 1970).

In limited scenarios, applicant may have the option to establish site specific minimum self-cleansing velocity using Equation H.7.1 or other appropriate equations instead of using the default three feet per second criteria. This site specific analysis must be documented in the SWQMP and the County has the discretion to request additional analysis prior to approving a site specific minimum self-cleansing velocity. If an applicant chooses to establish a site specific minimum self-cleansing velocity for refinement, then the applicant must design any new bypass hardened conveyance systems proposed by the project to meet the site specific criteria.

$$V = \frac{1.486}{n} R^{1/6} \left[B \left(s_g - 1 \right) D_g \right]^{1/2} \qquad \text{Equation H.7.1}$$

Where:

V = minimum self-cleansing velocity (ft/sec)

R = Hydraulic Radius (ft)

n = Manning's roughness coefficient (unitless)

B = constant equal to 0.04 for clean granular particles (unitless)

s_g = specific gravity of sediment particle (unitless)

D_g = sediment particle diameter (inches)

H.7.2. Threshold Channel Analysis

A threshold channel is a stream channel in which channel boundary material has no significant movement during the design flow. If there is no movement of bed load in the stream channel, then it is not anticipated that reductions in sediment supply will be detrimental to stream stability because the channel bed consists of the parent material and not coarse sediment supplied from upstream. In such a situation, changes in sediment supply are not considered a geomorphic condition of concern. SCCWRP Technical Report 562 (2008) states the following in regards to sand vs. gravel bed behavior/threshold vs. live-bed contrasts:

> "Sand and gravel systems are quite varied in their transport of sediment and their sensitivity to sediment supply. On the former, sand-bed channels typically have live beds, which transport sediment continuously even at relatively low flows. Conversely, gravel/cobble-bed channels generally transport the bulk of their bed sediment load more episodically, requiring higher flow events for bed mobility (i.e., threshold behavior)."
>
> "Sand-bed streams without vertical control are much more sensitive to perturbations in flow and sediment regimes than coarse-grain (gravel/cobble) threshold channels. This has clear implications in their respective management regarding hydromodification (i.e., sand systems being relatively more susceptible than coarser systems). This also has direct implications for the issue of sediment trapping by storm water practices in watersheds draining to sand-bed streams, as well as general loss of sediment supply following the conversion from undeveloped sparsely-vegetated to developed well-vegetated via irrigation."

The following provides guidance for evaluating whether a stream channel is a threshold channel or not. This determination is important because while accounting for changes in bed sediment supply is appropriate for quantifying geomorphic impacts in non-threshold stream channels, it is not considered appropriate for threshold channels. The domain of analysis for this evaluation shall be the same as that used to evaluate susceptibility, per SCCWRP Technical Report 606, Field Manual for Assessing Channel Susceptibility (2010). This domain is defined by the following upstream and downstream boundaries:

- From the point of compliance proceed downstream until reaching one of the following:
    - At least one reach downstream of the first grade-control point (preferably second downstream grade control location);
    - Tidal backwater/lentic (still water) waterbody;
    - Equal order tributary (Strahler 1952);
    - A 2-fold increase in drainage area.

OR demonstrate sufficient flow attenuation through existing hydrologic modeling.

- From the point of compliance proceed upstream for 20 channel top widths OR to the first grade control in good condition, whichever comes first.

Applicant must complete Worksheet H.7-1 to document selection of the domain of analysis. If the entire domain of analysis is classified as a threshold channel, then the PDP can be exempt from the MS4 Permit requirement for sediment supply. The following definitions from the Natural Resources Conservation Service's (NRCS) National Engineering Handbook Part 654 - Stream Restoration Design (2007) are helpful in understanding what a threshold channel is.

- **Alluvial Channel**: Streams and channels that have bed and banks formed of material transported by the stream. There is an exchange of material between the inflowing sediment load and the bed and banks of an alluvial channel (NRCS, 2007).
- **Threshold Channel**: A channel in which channel boundary material has no significant movement during the design flow (NRCS, 2007).

The key factor for determining whether a channel is a threshold channel is the composition of its bed material. Larger bed sediment consisting primarily of cobbles and boulders are typically immobile, unless the channel is a large river with sufficient discharge to regularly transport such grain sizes as bed load. As a rule-of-thumb, channels with bed material that can withstand a 10-year peak discharge without incipient motion are considered threshold channels and not live-bed alluvial channels. Threshold channel beds typically consist of cobbles, boulders, bedrock, or very dense vegetation (e.g., a thicket). Threshold channels also includes channels that have existing grade control structures that protect the stream channels from hydromodification impacts.

For a project to be exempt from coarse sediment supply requirements, the applicant must submit the following for approval by the County:

- Photographic documentation and grain size analysis used to determine the d_{50} of the bed material; and

- Calculations that show that the receiving water of concern meets the specific stream power criteria defined below or a finding from a geomorphologist that the stream channel has existing grade control structures that protect the stream channel from hydromodification impacts.

Specific Stream Power

Specific (i.e., unit) stream power is the rate at which the energy of flowing water is expended on the bed and banks of a channel (refer to Equation H.7-1). SCCWRP studies have found that locating channels on a plot of Specific Stream Power at Q_{10} (as calculated by the Hawley et al. method optimized for Southern California watersheds – Figure H.7-1) versus median channel grain size is a good predictor of channel stability. The Q_{10} equation from SCCWRP TR 606 is presented as Equation H.7-2.

Equation H.7-1: Calculation of Specific Stream Power

$$Specific\ Stream\ Power = \frac{Total\ Stream\ Power}{Channel\ Width} = \frac{\gamma QS}{w}$$

Where:

γ: Specific Weight of Water (9810 N/m^3)
Q: Flow Rate (dominant discharge in many cases, m^3/sec)
S: Slope of Channel
w: Channel Width (meters)

Equation H.7-2: Calculation of Q_{10} using the Hawley et al. method

$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$

Where:

Q_{10cfs}: 10 year Flow Rate in cubic feet per second
A: Drainage Area in sq. miles
P: Mean Annual Precipitation in inches

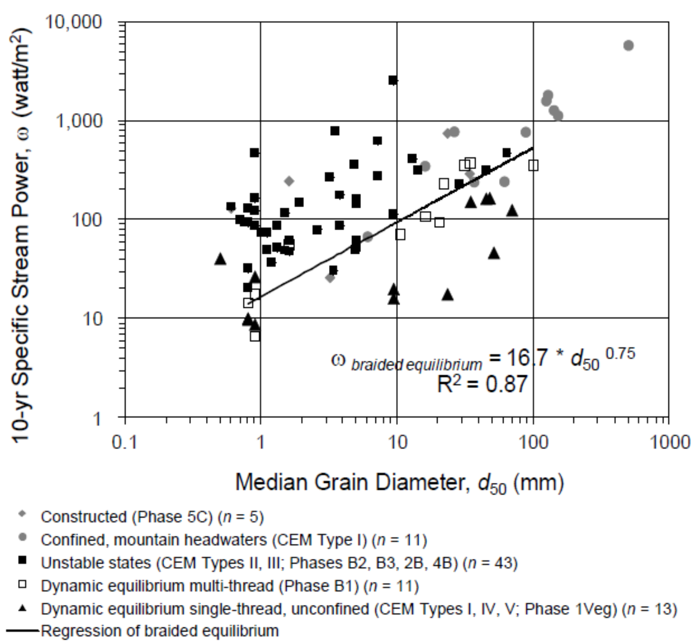


Figure H.7-1: Threshold of stream instability based on specific stream power and channel sediment diameter

Since the SCCWRP TR 606 Q_{10} (Equation H.7-2) does not explicitly consider watershed imperviousness, adjustment factors (AF) shown in Figure H.7-2 were developed using the following Equation H.7-3 for Q_{10} from SCCWRP TR 654 to account for imperviousness while estimating Q_{10}.

Equation H.7-3: Calculation of Q_{10} using equation from SCCWRP TR 654

$$Q_{10} = e^{3.61} * A^{0.865} * DD^{0.804} * P_{224}^{0.778} * IMP^{0.096}$$

Where:

Q_{10}: 10 year Flow Rate
A: Drainage Area in sq. miles
DD: Drainage Density
P_{224}: 2-Year 24-Hour Precipitation in inches
IMP: Watershed Imperviousness

Adjustment factors were developed as part of this methodology by changing the watershed imperviousness in Equation H.7-3 and keeping the remaining terms constant. Adjustment factor for imperviousness of 3.6% was set to 1; since it is the mean imperviousness of the dataset used to develop the stability curve in Figure H.7-1. Updated Q_{10} equation with adjustment factor is presented as Equation H.7-4 below:

Equation H.7-4: Calculation of Q_{10} with Adjustment Factor for Watershed Imperviousness

$$Q_{10cfs} = AF * 18.2 * A^{0.87} * P^{0.77}$$

Where:

Q_{10cfs}: 10 year Flow Rate in cubic feet per second
AF: Adjustment Factor
A: Drainage Area in sq. miles
P: Mean Annual Precipitation in inches

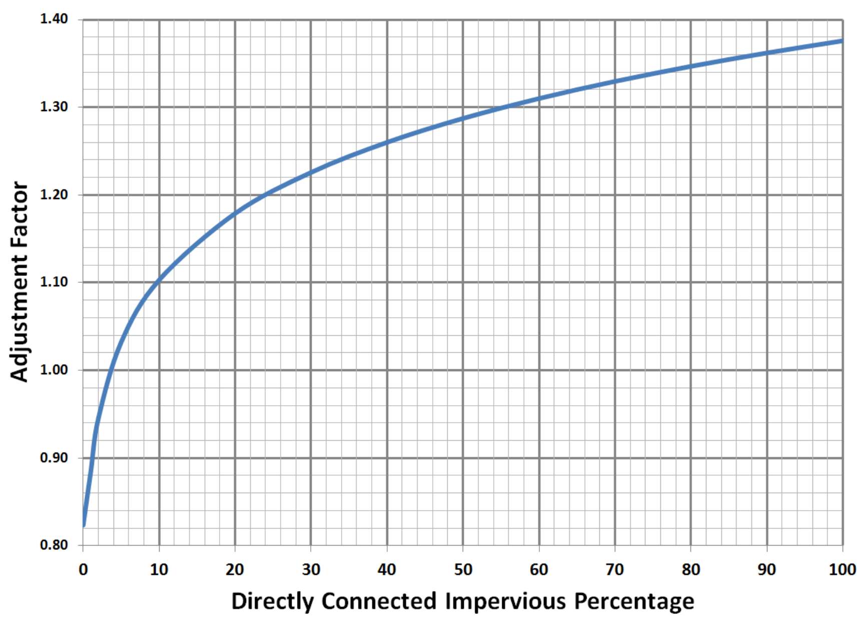


Figure H.7-2: Adjustment factor to account for imperviousness while estimating Q_{10}

Steps for evaluating the specific stream power criteria are presented below:

- **<u>Step 1</u>**: Calculate the specific stream power for the receiving water. Use Equation H.7-1, H.7-4 and Figure H.7-2. Directly connected imperviousness shall be estimated using guidance provided in the Water Quality Equivalency guidance document.

- **<u>Step 2</u>**: Determine the d_{50} of representative cross section within the domain of analysis.

- **<u>Step 3</u>**: Use results from Step 1 and Step 2; and Figure H.7-1 to determine if the receiving water meets the specific stream power criteria. Receiving water shall be considered meeting the specific stream power criteria when the point plotted based on results from Step 1 and Step 2 is below the solid line in Figure H.7-1.

H.7.3. Coarse Sediment Source Area Verification

When it has been determined that PCCSYAs are present, and it has been determined that downstream systems require protection, additional analysis may be performed that may refine the extents of actual CCSYAs to be protected onsite. The following analysis shall be performed to determine if the mapped PCCSYAs are a significant source of bed sediment supply to the receiving water, based on the coarse sediment proportion of the soil onsite

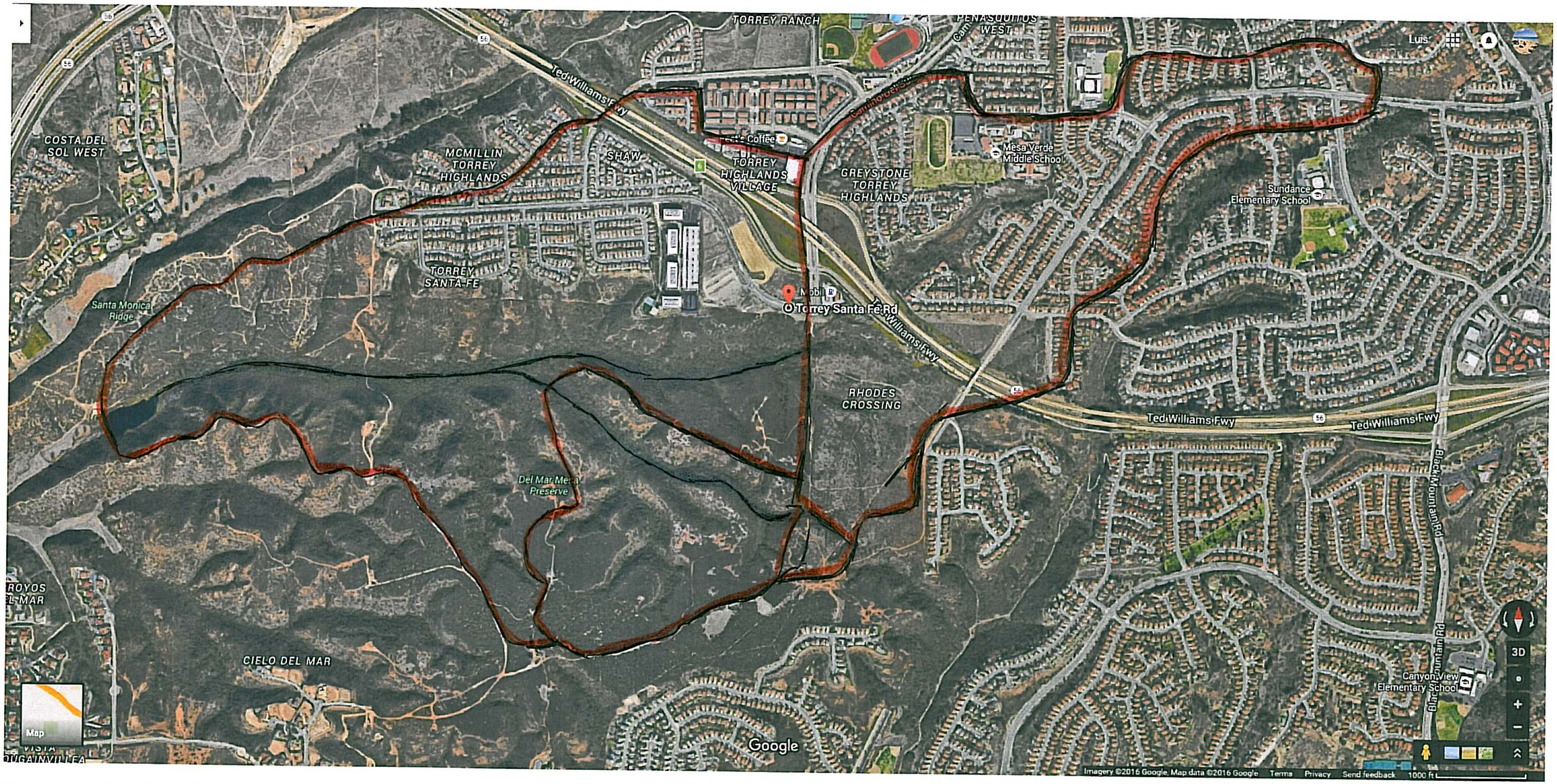
- Obtain a grain size distribution per ASTM D422 for the project's PCCSYA that is being evaluated.
- Identify whether the source material is a coarse grained or fine grained soil. Coarse grained is defined as over 50% by weight coarse than no. 200 sieve (i.e., $d_{50} > 0.074$ mm).
- By performing this analysis, the applicant can exclude PCCSYAs that are determined to be fine grained (i.e., $d_{50} < 0.074$ mm). Fine grained soils are not considered significant sources of bed sediment supply.
- Applicant shall include the following information in the SWQMP when this refinement option is performed:
    - Map with locations on where the grain size distribution analysis was performed;
    - Photographic documentation; and
    - Grain size distribution.
- Additional grain size distribution analysis may be requested at specific locations by the County prior to approval of this refinement.

Areas that are not expected to be a significant source of bed sediment supply (i.e. fine grained soils) to the receiving stream do not require protection and are not considered CCSYAs.
If it is determined that the PCCSYAs are producing sediment that is critical to receiving streams, or if the optional additional analysis presented above has not been performed, the project must provide management measures for protection of critical coarse sediment yield (refer to Appendix H.2, H.3 and H.4).

APPENDIX 2: HYDROMODIFICATION SCREENING – CHANG CONSULTANTS

APPENDIX 3: RESULTS

(INCLUDES FORM H.7-1)



Google Satellite View of Contributing Area. Percentage of Connected impervious Areas: Less than 20% for Reach 1, and 10% for Reach 2.

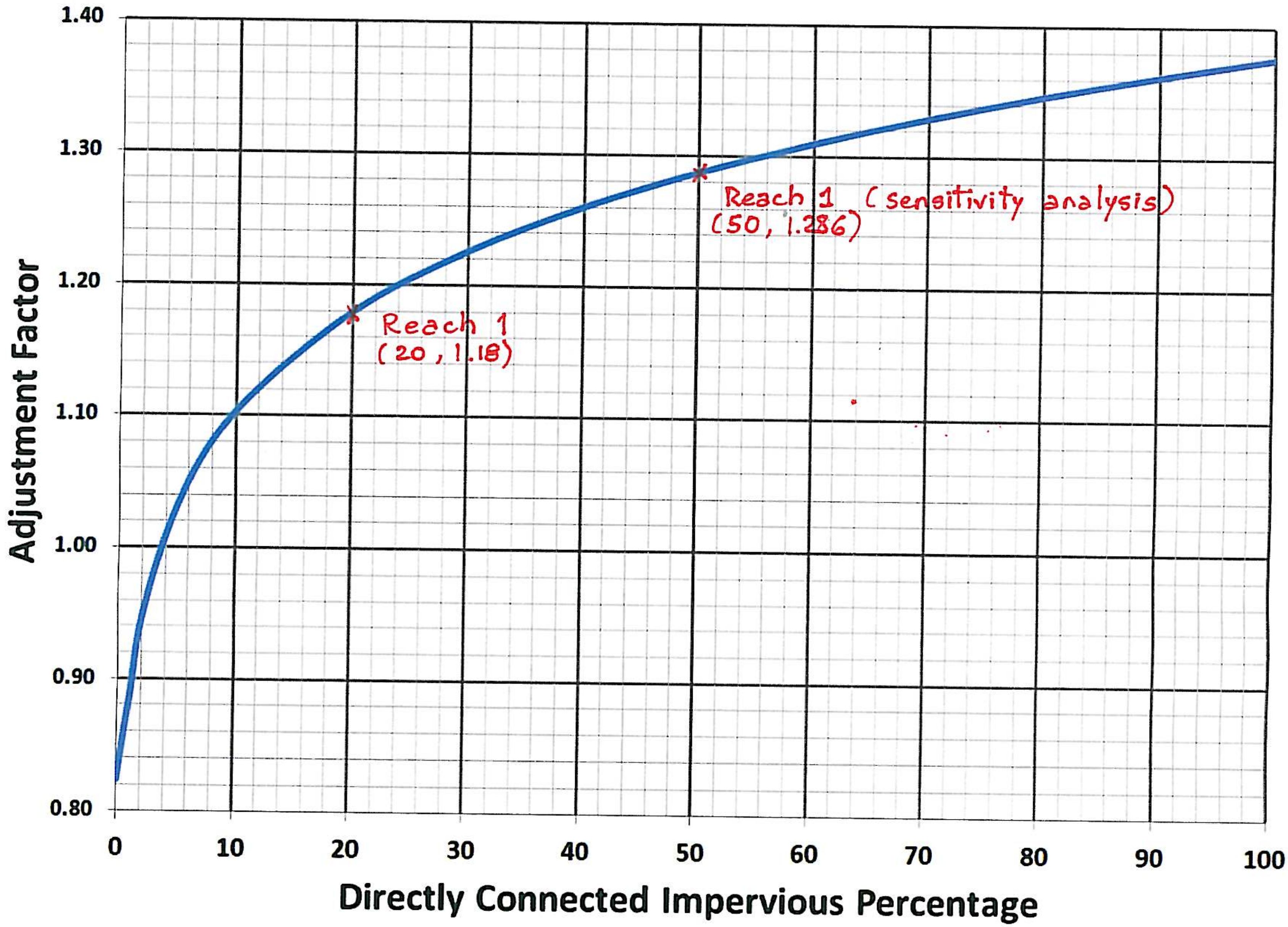


Figure H.7-2: Adjustment factor to account for imperviousness while estimating Q10

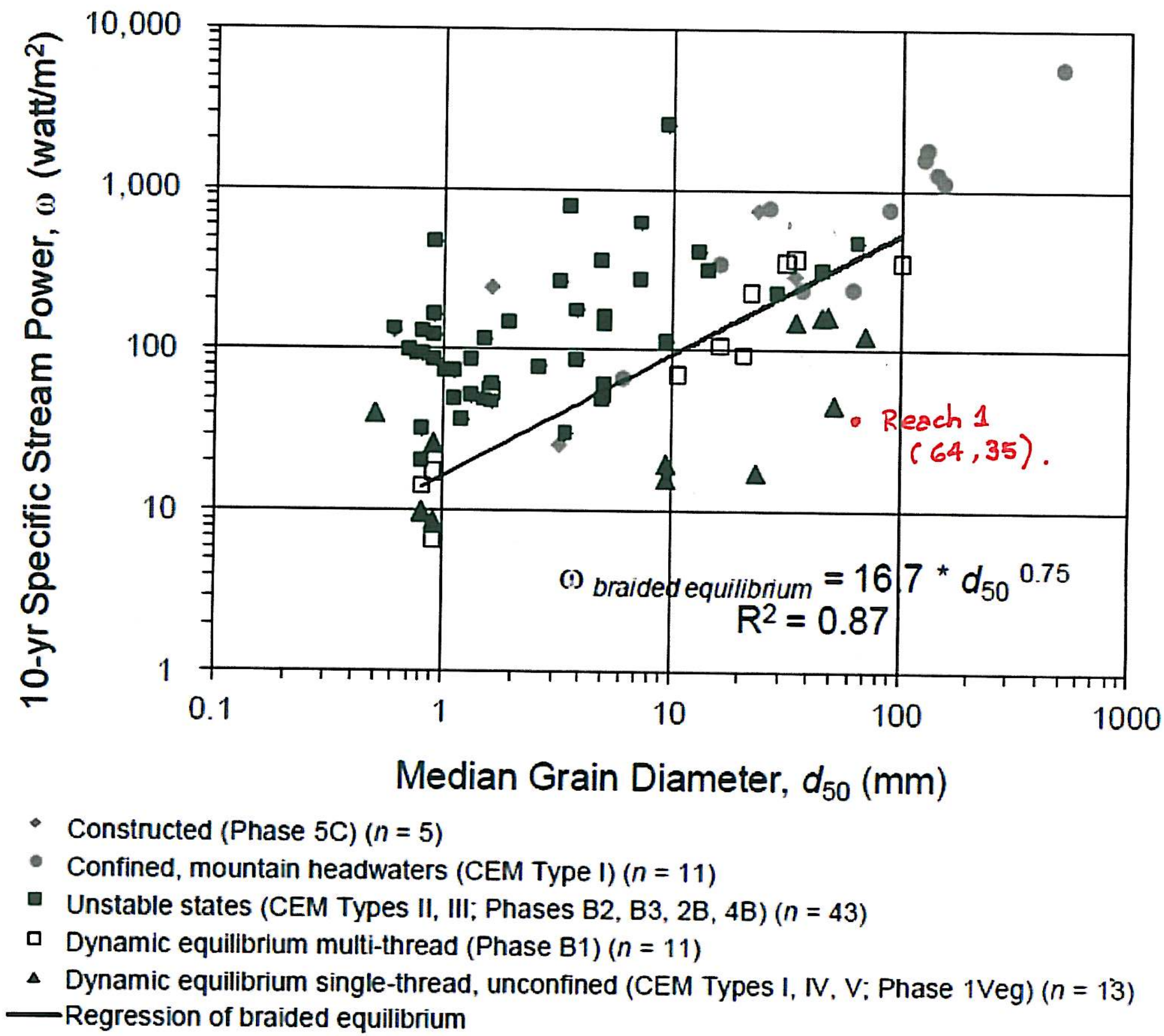


Figure H.7-1: Threshold of stream instability based on specific stream power and channel sediment diameter

Domain of Analysis			Worksheet H.7-1
Use this form to document the domain of analysis			
Project Name: Merge 56			
Project Tracking Number / Permit Application Number:			
Part 1: Identify Domain of Analysis			
Project Location (at proposed storm water discharge point)			
1	Address:	South of HWY 56 and East of future extension of Camino del Sur, San Diego, CA.	
2	Latitude (decimal degrees):	32.5707	
3	Longitude (decimal degrees):	-117.0905	
4	Watershed:	Los Peñasquitos Lagoon	
Basis for determining downstream limit: See "Downstream Domain of Analysis" Section, pages 2 & 3 of the Hydromodification Screening for Merge 56 prepared by Chang Consultants, included in Appendix 2.			
Channel length from discharge point to downstream limit:		8000 ft (POC-1);	
Basis for determining upstream limit: See "Upstream Domain of Analysis" Section, page 3 of the Hydromodification Screening for Merge 56, prepared by Chang Consultants, Included in Appendix 2.			
Channel length from discharge point to upstream limit:		N/A.	

Worksheet H.7-1; Page 2 of 2
Photo(s) Map or aerial photo of site. Include channel alignment and tributaries, project discharge point, upstream and downstream limits of analysis, ID number and boundaries of geomorphic channel units, and any other features used to determine limits (e.g. exempt water body, grade control). Please refer to Appendix 2, where the complete "Hydromodification Screening for Merge 56" study is included.

HYDROMODIFICATION SCREENING

FOR

MERGE 56
(RHODES CROSSING)

November 14, 2013

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APPENDICES

INTRODUCTION

The City of San Diego's January 14, 2011, *Storm Water Standards*, outline low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility*, developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's BMP Sizing Calculator to establish the appropriate erosion susceptibility threshold of low, medium, or high.

This report provides hydromodification channel screening analyses for the Merge 56 project (aka Rhodes Crossing) being designed by Latitude 33. The project is located south of State Route 56 and east of the future extension of Camino Del Sur in the city of San Diego. The project proposes to connect the northerly segment of Camino Del Sur from Torrey Santa Fe Road to the southerly segment near Dormouse Road (see the Study Area Exhibit following the figures). The project will also extend Carmel Mountain Road southwesterly to the proposed Camino Del Sur extension. Finally, the project will create a mixed-use development (commercial, single-family residential, and multi-family residential) north of the future intersection of Camino Del Sur and Carmel Mountain Road. The project is subject to hydromodification requirements because it is a priority development project.

Under pre-project conditions, the site is undeveloped and covered with some grasses and brush. The majority of the site is gently to steeply sloping in a westerly direction. Surface runoff primarily sheet flows westerly across the site into either Deer Canyon or smaller tributary canyons to Deer Canyon. Deer Canyon ultimately confluences with McGonigle Canyon, which flows into Carmel Valley Creek and Los Penasquitos Lagoon. A small portion of the southerly project area flows southeasterly to a tributary to Los Penasquitos Creek. Under post-project conditions, storm runoff at the site will be conveyed within a series of on-site drainage facilities constructed by the project. The drainage facilities will convey most of the post-project runoff to Deer Canyon or an unnamed tributary canyon approximately 1,800 feet south of Deer Canyon.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for the project's points of compliance, which are at the proposed storm drain outlets to Deer Canyon and the unnamed tributary canyon to the south.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the study limits. The County of San Diego's March 2011, *Final Hydromodification Management Plan* (HMP), specifies the downstream domain of analysis based on the SCCWRP criteria. The HMP indicates that the downstream domain is the **first point** where one of these is reached:

- at least one reach downstream of the first grade control point (preferably second downstream grade control location)
- tidal backwater/lentic waterbody
- equal order tributary
- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.)

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area should be subdivided into smaller reaches of less than 200 meters for analysis. Most of the units in the HMP's SCCWRP analysis are metric. Metric units are used in this report only where given so in the HMP. Otherwise English units are used.

Downstream Domain of Analysis
The downstream domain of analysis for the study area has been determined by assessing and comparing the four bullet items above. There are two proposed storm drains that essentially outlet to the same location in Deer Canyon (see Study Area Exhibit). This location is the first point of compliance (POC 1) for the project. Another proposed storm drain will outlet into the unnamed tributary canyon that is approximately 1,800 feet south of Deer Canyon. This outlet is POC 2. A downstream domain of analysis is selected below POC 1 and 2.

Per the first bullet item, the first permanent grade control below each POC was located. A site visit was performed in the vicinity below each POC and a permanent grade control was not observed. A review of Google Earth revealed that the first permanent grade control below both POCs is likely at a retention facility within Deer Canyon approximately 8,000 feet west of the site (see Figures 1 and 3). The containment berm at the lower edge of the retention facility is the permanent grade control structure.

The second bullet item is the tidal backwater or lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody location. A lentic waterbody occurs within the retention facility. Water stored in the facility causes it to act as a lentic waterbody. Ponded water is seen in Figures 1 and 3.

The final two bullet items are related to the tributary drainage area. The watersheds tributary to POC 1 and 2 are delineated on the Watershed Exhibit in Appendix A and cover 335.12 and 14.93 acres, respectively. The watershed tributary to the retention facility has also been delineated and covers 521.91 acres below POC 1. Therefore, for POC 1, the retention facility satisfies the 50 and 100 percent drainage area criteria. For POC 2, the drainage area between POC 2 and Deer Canyon covers 142.33 acres, which meets the equal order tributary criteria. Note that for POC 1 and 2, the criteria are actually met somewhere upstream of the two noted locations.

Based on the above information, the retention facility establishes the downstream domain of analysis location for POC 1 – it is being considered as the first point reached from the four bullet items. The detention basin meets both the first grade control and lentic waterbody criteria (and exceeds the tributary area criteria). Of these two criteria, the lentic waterbody is closer to the POC because it is established by the ponded water in the detention basin, while the first grade control is established by the containment berm at the lower end of the detention basin. Since the HMP uses the first point where one of the four bullet criteria is met, the lentic waterbody (or detention basin entrance) establishes the downstream domain of analysis location. The confluence with Deer Canyon establishes the downstream domain of analysis location for POC 2 because it meets the equal order tributary criteria.

Upstream Domain of Analysis

A natural channel does not exist upstream of either POC. The upstream area will contain the Merge 56 development area. Since the area upstream of each POC is not an erodible drainage course, each POC establishes the upstream domain of analysis location.

Study Reaches within Domain of Analysis

The entire domain of analysis extends over approximately 7,080 feet from the POC 1 to the retention facility (Reach 1) and over approximately 3,640 feet from POC 2 to Deer Canyon (Reach 2). A review of topographic mapping, aerial photographs, and field conditions reveals that the physical (channel geometry and longitudinal slope), vegetative, hydraulic, and soil conditions within Reach 1 and Reach 2 are relatively uniform throughout. Subdividing either reach into smaller subreaches of less than 656 feet will not yield significantly varying results within the reach. Therefore, the screening tool was applied across the entire length of Reach 1 and of Reach 2. The results will be similar for shorter subreaches within either reach.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an "initial desktop analysis" that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1, which is included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed area, valley slope, and valley width. The NED data is similar to USGS quadrangle mapping. Therefore, USGS quadrangle mapping was used. However, where more precision was warranted (such as in obtaining elevation and width information) SANGIS' 2-foot contour interval topographic mapping was used.

The watershed areas were delineated from the USGS mapping and are shown on the Watershed Exhibit in Appendix A. The mean annual precipitation was obtained from County BMP Sizing calculator. The project is within the Oceanside rainfall station according to the calculator and the mean annual precipitation is 13.3 inches (see Appendix A).

The valley slope and width of the study reach were determined from the USGS and SANGIS topographic mapping. The valley slope is the longitudinal slope of the channel bed along the flow line, so it is determined by dividing the elevation difference within the reach by the length of the flow line. The valley width is the average channel bottom width. The tributary drainage area, valley slope, and valley width are summarized in Table 1.

Reach	Tributary Drainage Area, sq. mi.	Valley Slope, m/m	Valley Width, m
1	1.58	0.0164	30.5
2	0.25	0.0325	6.1

Table 1. Summary of Tributary Drainage Area, Valley Slope, and Valley Width

These values were input to a spreadsheet to calculate the simulated peak flow, screening index, reference width, and valley width index outlined in Form 1. The input data and results are tabulated in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is complete, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., d_{50} < 16 mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 6. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.

2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.

3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Channel bed resistance is a function of the bed material and vegetation. Figure 5 contains a photograph of bed material within the study area, which ranges up to cobbles. Figures 1 through 4 contain photographs of the natural channel in each study reach. A site investigation and the figures indicate that the vegetative cover throughout each natural channel within the two reaches is mature, dense, and fairly uniform. The vegetation in many areas is so dense that the channel was either difficult to access or not possible to access at all unless the vegetation is trimmed. The vegetation consists of a variety of mature grasses, reeds, shrubs, and trees. Vegetation prevents bed incision because its root structure binds soil and because the aboveground vegetative growth reduces flow velocities. Table 5-13 from the County of San Diego's *Drainage Design Manual* outlines maximum permissible velocities for various channel linings (see Table 5-13 in Appendix B). Maximum permissible velocity is defined in the manual as the velocity below which a channel section will remain stable, i.e., not erode. Table 5-13 indicates that a fully-lined channel with unreinforced vegetation has a maximum permissible velocity of 5 feet per second (fps). Due to the dense cover and mature vegetation, the permissible velocity when erosion can initiate is likely greater than 5 fps in most of the natural channel areas. Table 5-13 indicates that 5 fps is equivalent to an unvegetated channel containing cobbles (grain size from 64 to 256 mm) and shingles (rounded cobbles). In comparison, coarse gravel (19 to 75 mm) has a maximum permissible velocity of 4 fps. Based on this information, the densely vegetated natural channels in Reach 1 and 2 have an equivalent grain size of at least 64 mm, which is comparable to a transitional/intermediate bed.

In addition to the grain size, there are several factors that establish the erodibility of a channel such as the flow rate (i.e., size of the tributary area), grade controls, channel slope, vegetative cover, channel planform, etc. The Introduction of the SCCWRP *Hydromodification Screening Tools: Field Manual* identifies several of these factors. When multiple factors influence erodibility, it is appropriate to perform the more detailed SCCWRP analysis, which is to analyze a channel according to SCCWRP's transitional/intermediate bed procedure. This requires the most rigorous steps and will generate the appropriate results given the range of factors that define erodibility. The transitional/intermediate bed procedure takes into account that bed material may fall within the labile category (the bed material size is used in SCCWRP's Form 3 Figure 4), but other factors may trend towards a less erodible condition. Dr. Eric Stein from SCCWRP, who co-authored the *Hydromodification Screening Tools: Field Manual* in the *Final Hydromodification Management Plan* (HMP), indicated that it would be appropriate to analyze channels with multiple factors that impact erodibility using the transitional/intermediate bed procedure. Consequently, this procedure was used to produce more accurate results for each study reach.

Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The natural channel bed along Reach 1 and 2 are within Category B, which represents intermediate bed material of unknown resistance or unknown armoring potential due to a surface veneer such as vegetation. The soil was probed and penetration was relatively difficult through the underlying layer. The channel bed in both reaches was covered with dense vegetation and cobbles were noted within the natural canyons.

Checklist 2 determines grade control characteristics of the channel bed. The first category of grade control spacing is based on $2/S_v$, where S_v is the valley slope from Table 1. The $2/S_v$ values for Reach 1 and 2 are 401 and 202 feet, respectively. SCCWRP states that grade controls can be natural. Examples are vegetation or confluences with a larger waterbody. As verified with photographs and during a site investigation, the study reach contains dense vegetation (see

Figures 1 through 4). The plant roots serve as a natural grade control. The spacing of the plants throughout the study area is less than a meter. Further evidence of the effectiveness of the natural grade controls is the absence of headcutting and mass wasting (large vertical erosion of a channel bank). The dense vegetation further confirms that each study reach is within Category A on Checklist 2.

The Screening Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the Screening Index determined in the initial desktop analysis (see Appendix A). d_{50} is derived from field conditions. As discussed above, the equivalent grain size for the densely-vegetated channels in Reach 1 and 2 is at least 64 mm. The Screening Index Threshold diagram shows that the 50 percent probability of incising or braiding for a d_{50} of 64 mm has an index of at least 0.101 (in red rectangle on diagram). The Screening Index for Reach 1 and 2 calculated in Appendix A are 0.0389 and 0.0343, respectively. Since each reach's Screening Index value is less than the 50 percent value, Reach 1 and 2 fall within Category A.

The overall vertical rating is determined from the Checklist 1, Checklist 2, and Screening Index Threshold results. The scoring is based on the following values:

Category A = 3, Category B = 6, Category C = 9

The vertical rating score is based on these values and the equation:

$$\text{Vertical Rating} = [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2}$$
$$= [(6 \times 3)^{1/2} \times 3]^{1/2}$$
$$= 3.6$$

Since the vertical rating is less than 4.5 for the study reach, it has a low threshold for vertical susceptibility.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP included in Figure 7 is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial processes such as chute cutoffs, avulsions, and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within any of the reaches during a field investigation. The drainage course has a generally trapezoidal cross-section with dense vegetation and banks that are not subject to stream erosion.

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks were moderate to well-consolidated. This determination was made because the ground surface was difficult to penetrate with a probe. In addition, the banks showed no evidence of crumbling and were composed of relatively well-packed particles.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. Based on the SANGIS topographic mapping, the banks along the drainage course are 2:1 (26 degrees) or flatter. Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 26 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. The vertical rating of the study reach is low, so the braiding risk is less than 50 percent. Furthermore, a VWI greater than 2 represents channels unconfined by bedrock or hillslope and, hence, subject to lateral migration. The VWI calculations in the spreadsheet in Appendix A show that the VWI for the study reach is less than 2.

From the above steps, the lateral susceptibility rating is low (red circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for Merge 56 development project. The majority of the project runoff will be collected by Deer Canyon or a tributary to Deer Canyon. The natural canyons support dense vegetation and relatively large cobbles. There is no evidence of significant vertical or lateral stream-induced erosion in the drainage courses. The downstream channel assessment for each drainage course was performed based on office analyses and field work. The results indicate a low threshold for vertical and lateral susceptibilities to erosion for Reach 1 and 2, which is consistent with the in-site conditions.

The HMP requires that these results be compared with the critical stress calculator results incorporated in the County of San Diego's BMP Sizing Calculator. The BMP Sizing Calculator critical stress results are included in Appendix B for the study reach. Based on these values, the critical stress results returned a low threshold. Therefore, the SCCWRP analyses and critical stress calculator demonstrate that the project can be designed assuming a low susceptibility to erosion, i.e., $0.5Q_2$.

A smaller portion of the project near the south will drain into one of three small natural canyons that flow in a southeasterly direction and ultimately enter Los Penasquitos Lagoon. The project runoff tributary to these canyons will be contributed from the Camino Del Sur extension. Detailed channel assessments have not been performed for the three canyons. However, they exhibit similar characteristics to the study reaches (such as dense vegetation) and have much smaller tributary drainage areas. Therefore, if it is determined that a channel assessment should be performed for these areas, it is anticipated that these areas will also have a low susceptibility to erosion.

Figure 1. Overall Study Area

Figure 2. Dense Vegetation below POC 1 and POC 2

Figure 3. Dense Vegetation near Detention Facility

Figure 4. Dense Vegetation in Deer Canyon at Confluence with Unnamed Natural Tributary

Figure 5. Cobbles within Study Area

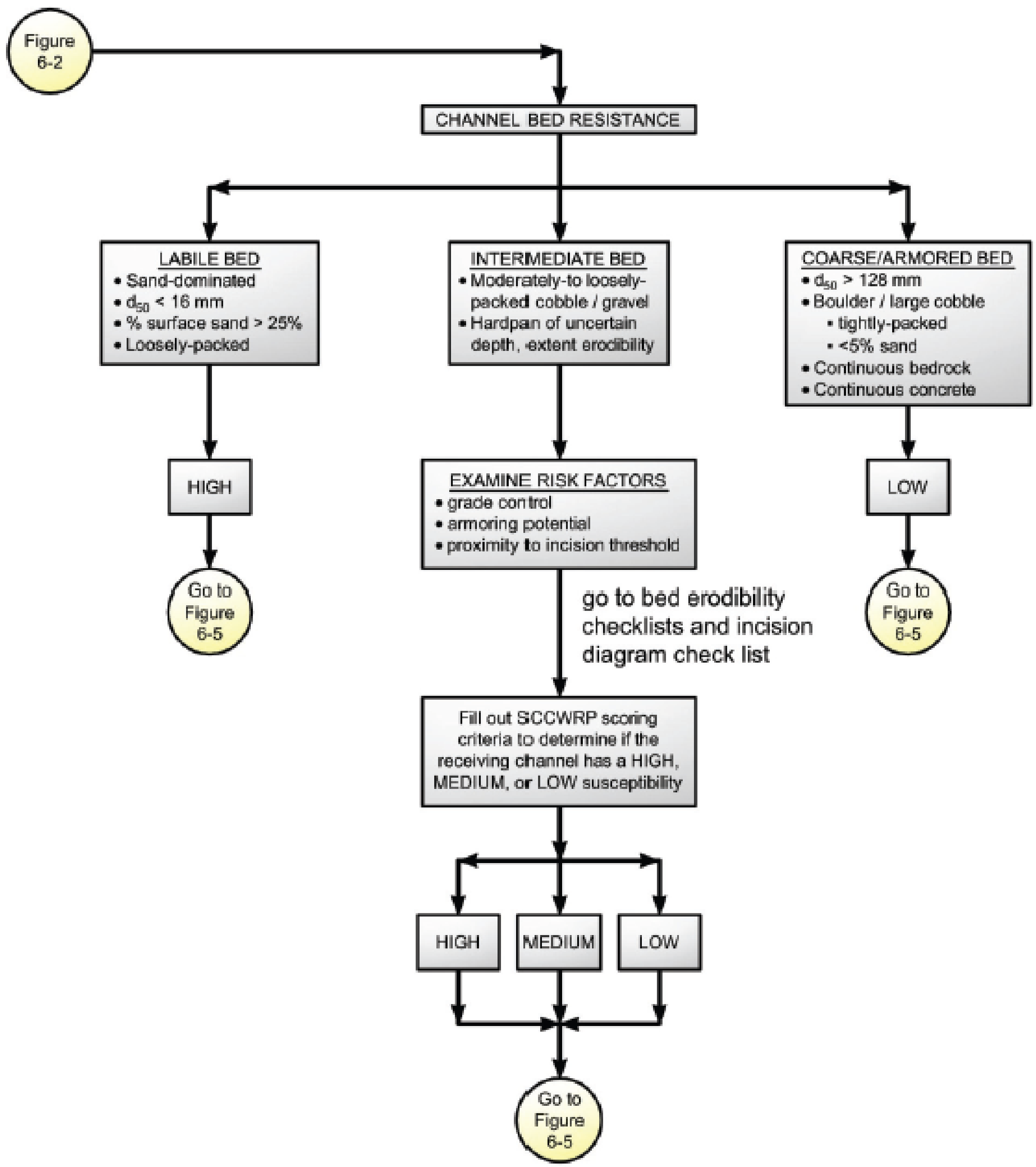


Figure 6-4. SCCWRP Vertical Susceptibility

Figure 6. SCCWRP Vertical Channel Susceptibility Matrix

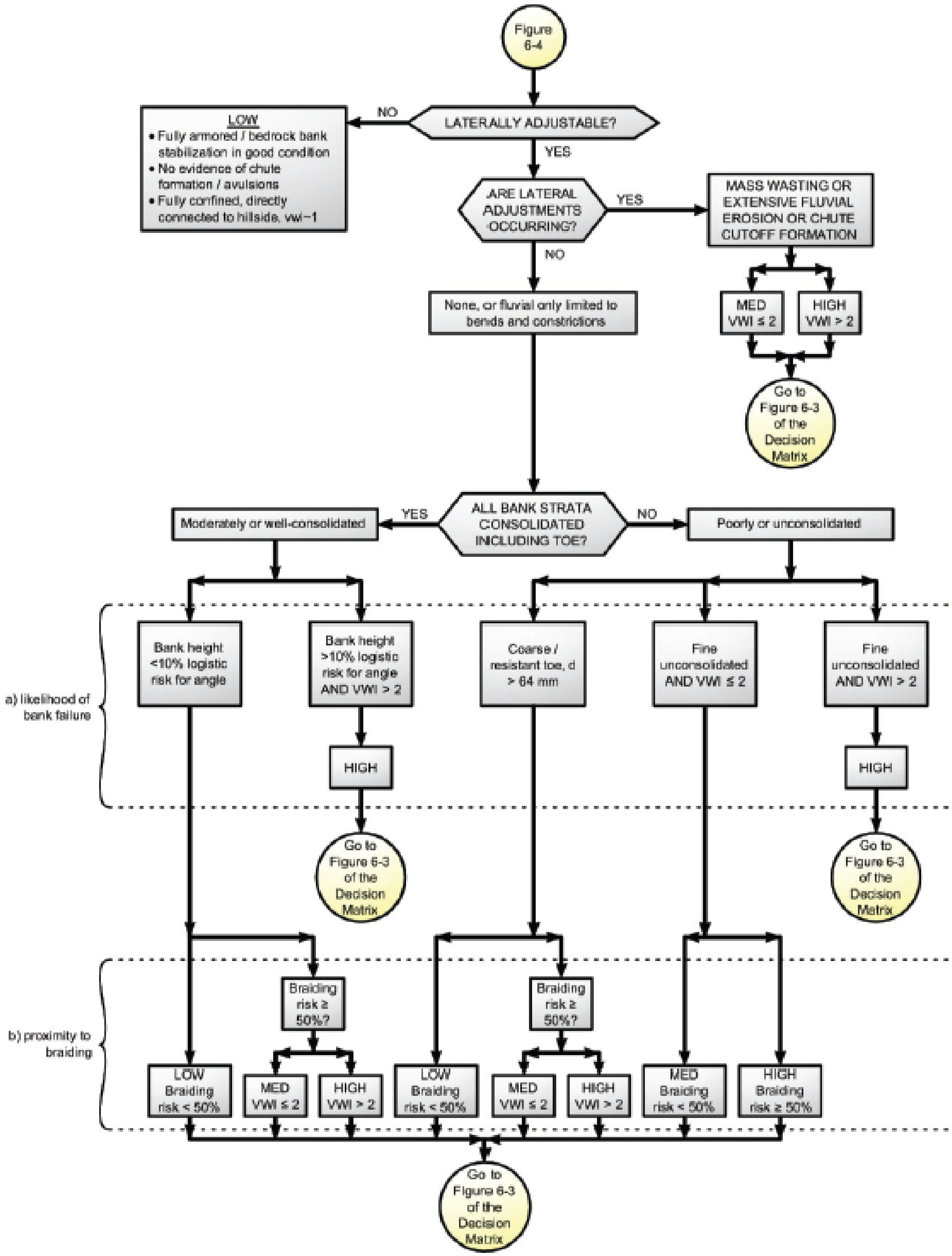
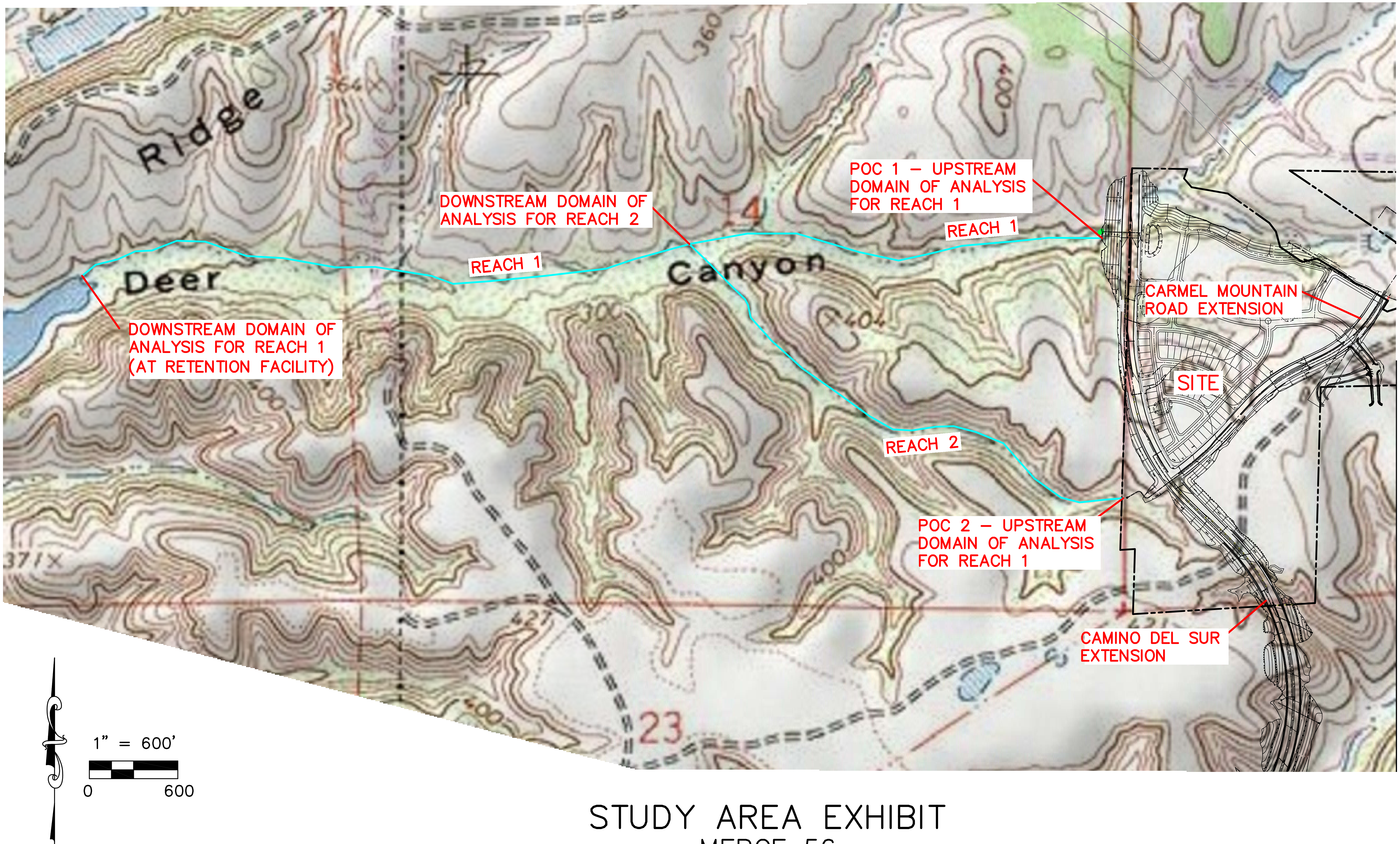


Figure 6-5. Lateral Channel Susceptibility

Figure 7. SCCWRP Lateral Channel Susceptibility Matrix



STUDY AREA EXHIBIT
MERGE 56

APPENDIX A

SCCWRP INITIAL DESKTOP ANALYSIS

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / Upstream Extent / Downstream Extent

Location: Latitude: 32.5707 Longitude: -117.0905

Description (river name, crossing streets, etc.): Merge 56 (Rhodes Crossing)

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	A	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	See attached Form 1 table on next page for calculated values for study reach.
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	

Form 1 Tabl e 2. Simplif ied peak flo w, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

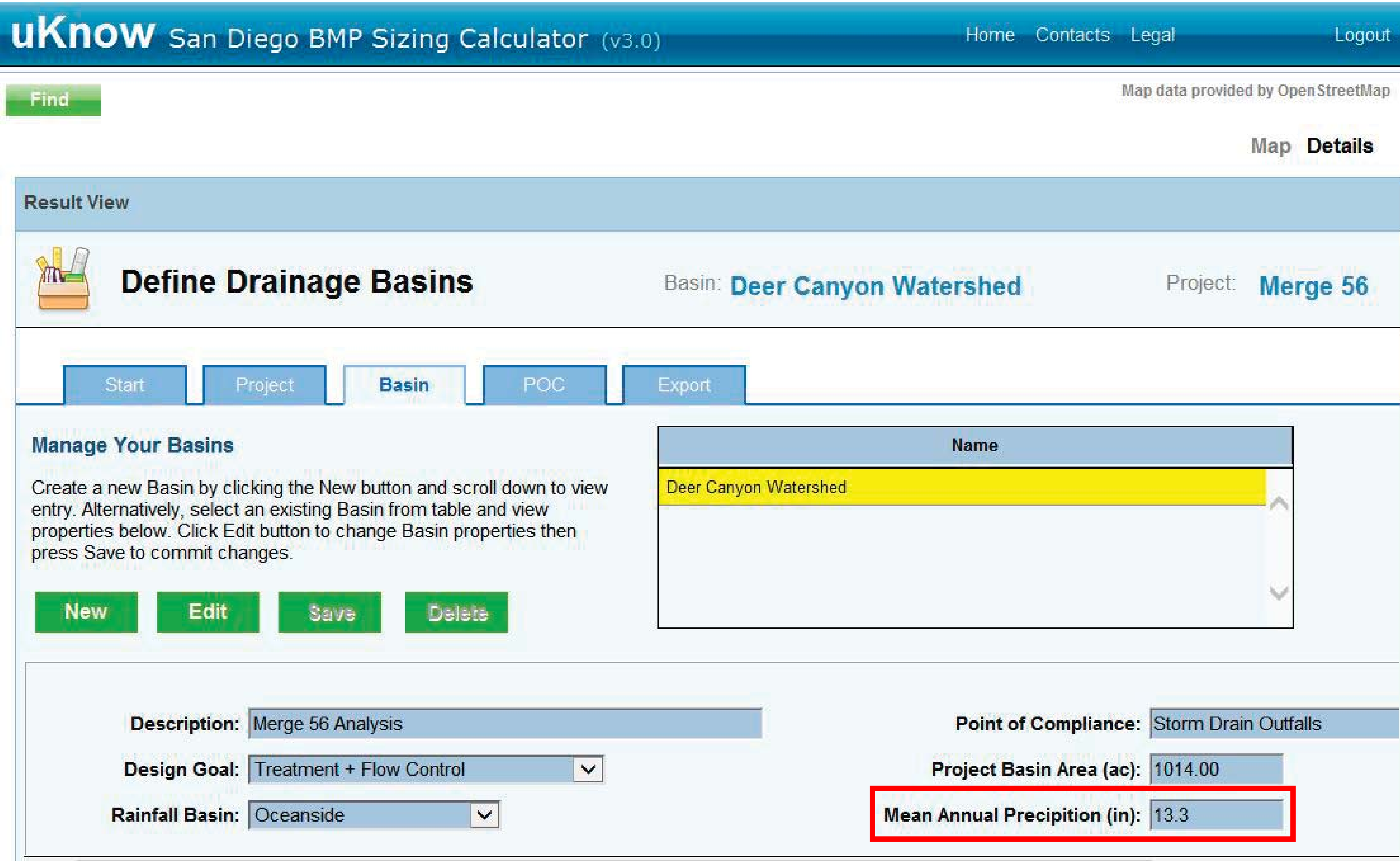
Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	See attached Form 1 table on next page for calculated values for study reach.
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	

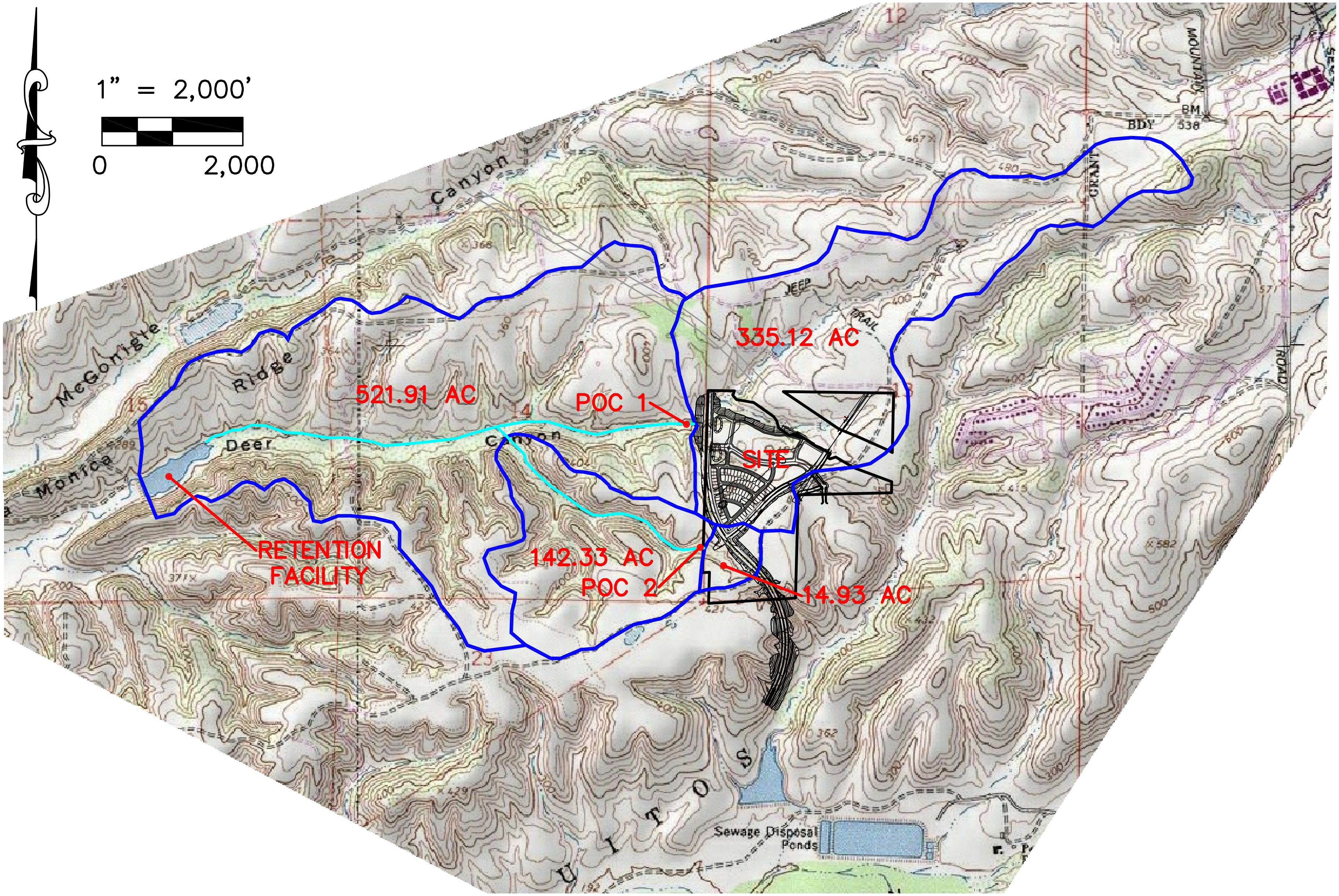
(Sheet 1 of 1)

SCCWRP FORM 1 ANALYSES

Reach	Area A, sq. mi.	Mean Annual Precip. P, inches	Valley Slope Sv, m/m	Valley Width Wv, m	10-Year Flow Q10cfs, cfs	10-Year Flow Q10, cms
1	1.58	13.3	0.0164	30.5	199	5.6
2	0.25	13.3	0.0325	6.1	39	1.1

Reach	10-Year Screening Index INDEX	Reference Width Wref, m	Valley Width Index VWI, m/m
1	0.0389	14.9	2.04
2	0.0343	7.3	0.83


uKnow San Diego BMP Sizing Calculator (v3.0)
Home Contacts Legal
Logout
Find
Map data provided by OpenStreetMap
Map Details
Result View
Define Drainage Basins
Basin: Deer Canyon Watershed
Project: Merge 56
Start
Project
Basin
POC
Export
Manage Your Basins
Create a new Basin by clicking the New button and scroll down to view entry. Alternatively, select an existing Basin from table and view properties below. Click Edit button to change Basin properties then press Save to commit changes.
New
Edit
Save
Delete
Name
Deer Canyon Watershed
Description: Merge 56 Analysis
Design Goal: Treatment + Flow Control
Rainfall Basin: Oceanside
Point of Compliance: Storm Drain Outfalls
Project Basin Area (ac): 1014.00
Mean Annual Precipition (in): 13.3



WATERSHED EXHIBIT
MERGE 56

APPENDIX B

SCCWRP FIELD SCREENING DATA

Table 5-13 Maximum Permissible Velocities for Lined and Unlined Channels

Material or Lining	Maximum Permissible Average Velocity* (ft/sec)
Natural and Improved Unlined Channels	
Fine Sand, Colloidal	1.50
Sandy Loam, Noncolloidal	1.75
Silt Loam, Noncolloidal	2.00
Alluvial Silts, Noncolloidal	2.00
Ordinary Firm Loam	2.50
Volcanic Ash	2.50
Stiff Clay, Very Colloidal	3.75
Alluvial Silts, Colloidal	3.75
Shales And Hardpans	6.00
Fine Gravel	2.50
Graded Loam To Cobbles When Noncolloidal	3.75
Graded Silts To Cobbles When Colloidal	4.00
Coarse Gravel, Noncolloidal	4.00
Cobbles And Shingles	5.00
Sandy Silt	2.00
Silty Clay	2.50
Clay	6.00
Poor Sedimentary Rock	10.0
Fully-Lined Channels	
Unreinforced Vegetation	5.0
Reinforced Turf	10.0
Loose Riprap	per Table 5-2
Grouted Riprap	25.0
Gabions	15.0
Soil Cement	15.0
Concrete	35.0

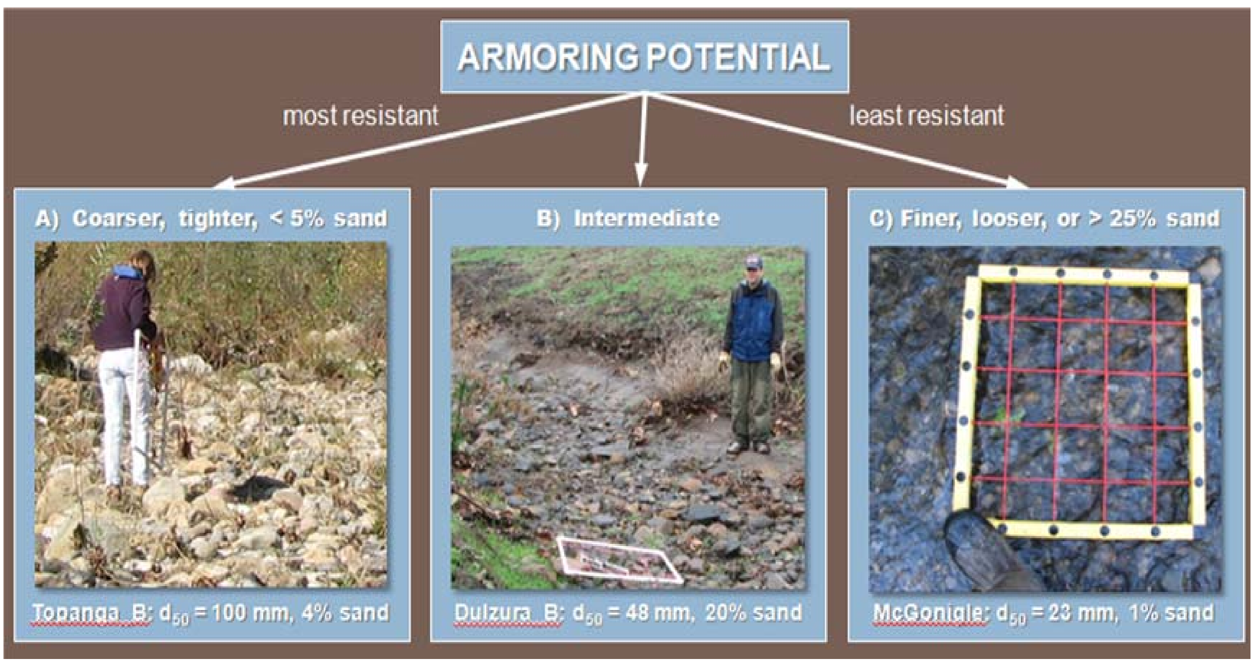
** Maximum permissible velocity listed here is basic guideline; higher design velocities may be used, provided appropriate technical documentation from manufacturer.*

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

□	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
X	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
□	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used i**n conjunction with Form 3 Checklist 1.**

(Sheet 2 of 4)

REACH 1 AND 2 RESULTS

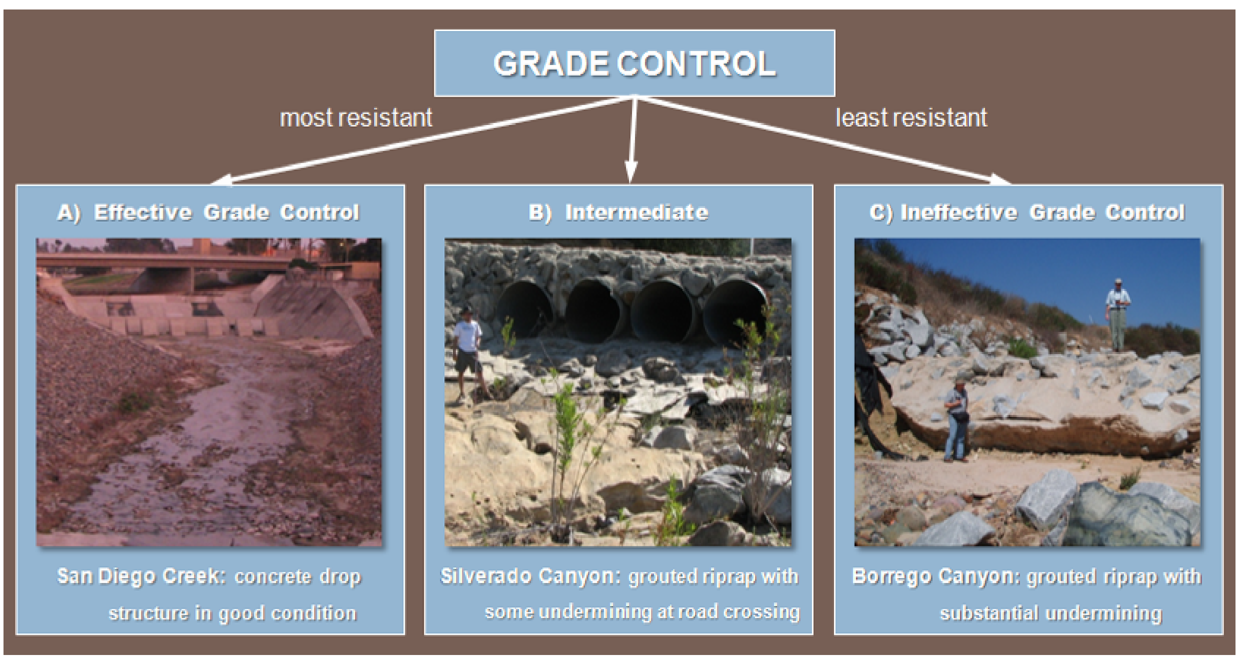
Form 3 Checklist 2: Grade Control

x A Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

□ B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

□ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness



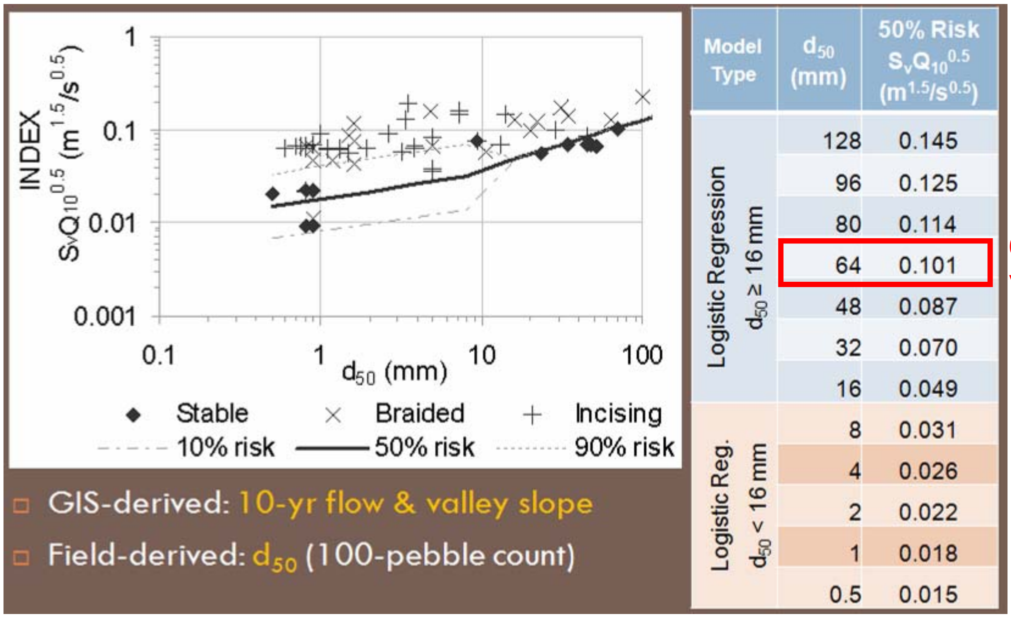
Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

(Sheet 3 of 4)

REACH 1 AND 2 RESULTS

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



64mm for dense vegetation

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	**$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)** *From Form 1*	**$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)** *50% risk of incising/braiding from table in Form 3 Figure 3 above*	**Screening Index Score (A, B, C)**

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\left\{\left(\sqrt{armoring * grade\ control}\right) * screening\ index\ score\right\}}$$

6 x 3 x 3 = 3.6

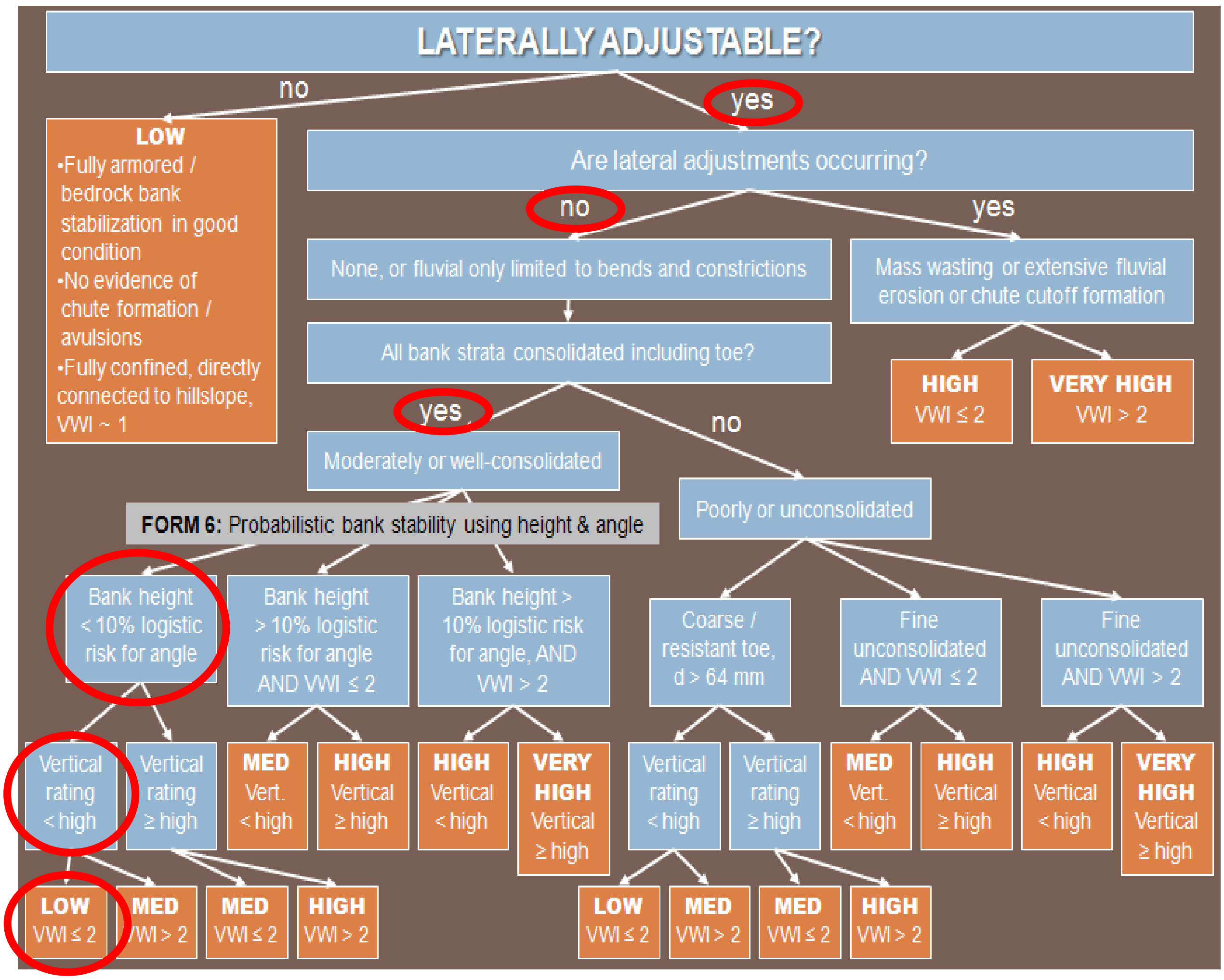
Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

REACH 1 AND 2 RESULTS

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



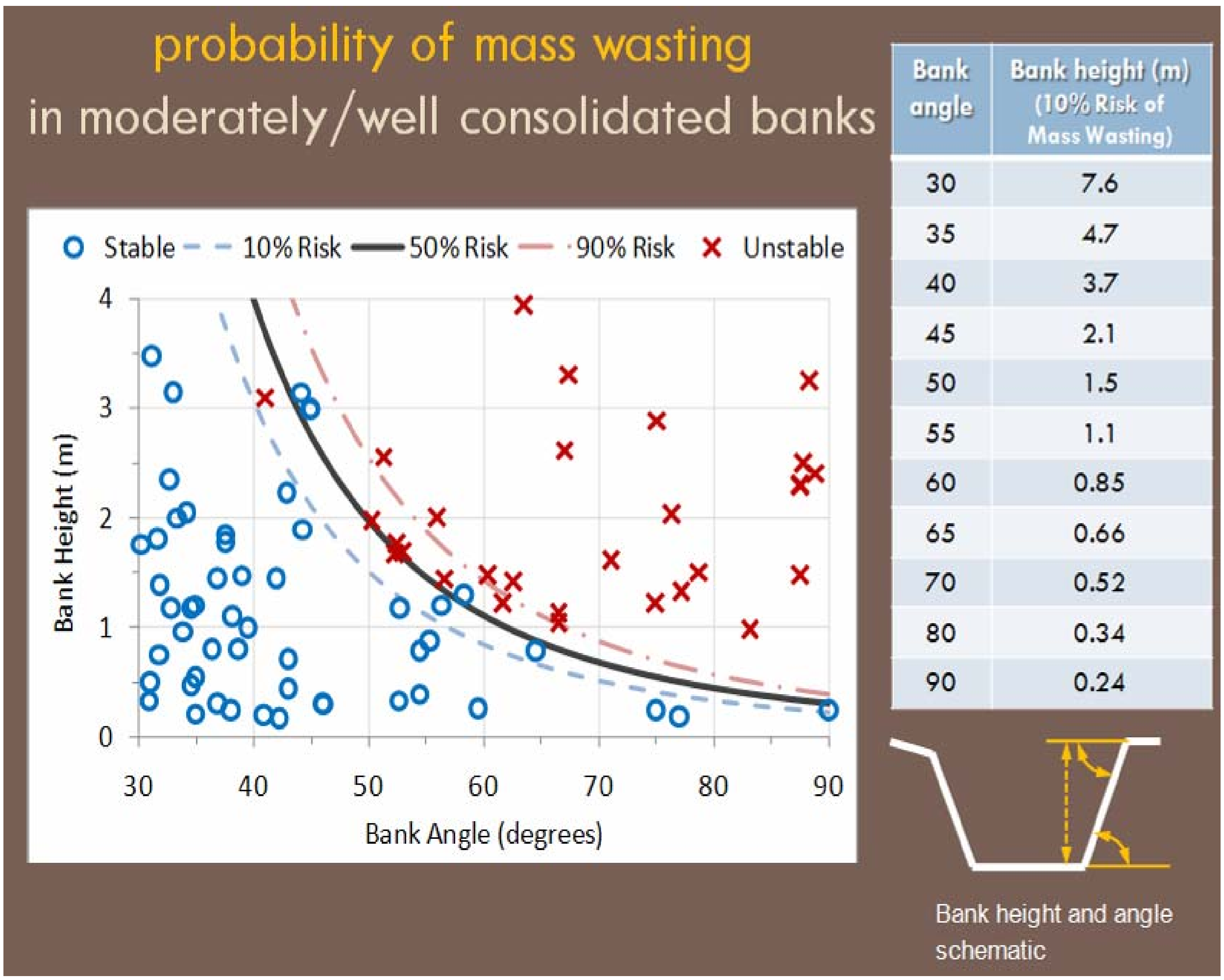
(Sheet 1 of 1)

REACH 1 AND 2 RESULTS

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	26.6 degrees (2:1)	---	---	<10%
Right Bank	26.6 degrees (2:1)	----	---	<10%



Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

(Sheet 1 of 1)

REACH 1 AND 2 RESULTS

uKnow San Diego BMP Sizing Calculator (v3.0)

Home Contacts Legal Logout

Find

Map data provided by OpenStreetMap

Map Details

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH 1

Define Drainage Basins

Basin: **Deer Canyon Watershed**

Project: **Merge 56**

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Cancel Save Update

Channel Assessed: Yes

Watershed Area (ac): 1014.29

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 160.0

Channel Bottom Width (ft): 100.0

Channel Height (ft): 10.0

Channel Slope: 0.0164

Large View

uKnow San Diego BMP Sizing Calculator (v3.0)   Home Contacts Legal   Logout

Find   Map data provided by OpenStreetMap

Map Details

Result View

CRITICAL STRESS CALCULATOR RESULTS FOR REACH 2

Define Drainage Basins

Basin: Deer Canyon Watershed   Project: Merge 56

Start | Project | Basin | POC | Export

Manage Your Point of Compliance (POC)

Analyze the receiving water at the 'Point of Compliance' by completing this form. Click Edit and enter the appropriate fields, then click the Update button to calculate the critical flow and low-flow threshold condition. Finally, click Save to commit the changes.

Cancel Save Update

Channel Susceptibility: LOW

Low Flow Threshold: 0.5Q2

Channel Assessed: Yes

Watershed Area (ac): 157.26

Vertical Susceptibility: Low (Vertical)

Lateral Susceptibility: Low (Lateral)

Material: Vegetation

Roughness: 0.100

Channel Top Width (ft): 80.0

Channel Bottom Width (ft): 20.0

Channel Height (ft): 10.0

Channel Slope: 0.0325

Large View

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name:	ONSITE STORAGE VAULTS	BMP Type:	Bioretention Plus Vault
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Vault Volume	N/A	Bioretention Surface Area (sf)	Vault Volume (cf)	N/A
1a, 1b, 2a, 2b, 3, 4a, 4b	1169615	D	FLAT	Impervious	1.0	0.04	0.14	N/A	46785	163746	N/A
5, 6, 7, 8, 9, 10, 11, 12	377080	D	FLAT	Pervious	0.1	0.04	0.14	N/A	1508	5279	N/A
13, 14 & 15											
Total BMP Area	1546695							Minimum BMP Size	48292.92	169025	
								Proposed BMP Size*		N/A	N/A
											in
									Minimum Vault Depth	N/A	in
									Maximum Vault Depth	N/A	in
									Selected Vault Depth	84.00	in
									Selected Vault Volume	169100	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name	)NSITE STORAGE VAULT!	BMP Type:	Bioretention Plus Vault

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
1a, 1b, 2a, 2b, 3, 4a, 4b	Oceanside	D	Scrub	FLAT	0.175	26.851	2.349	**29.69**
5, 6, 7, 8, 9, 10, 11, 12	Oceanside	D	Scrub	FLAT	0.175	8.657	0.757	**9.57**
13, 14 & 15								

3.107	**39.26**	**7.07**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

3.050	**34.47**	**6.63**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	30.8

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name:	CDS North	BMP Type:	Bioretention Plus Vault
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Vault Volume	N/A	Bioretention Surface Area (sf)	Vault Volume (cf)	N/A
16	190400	D	FLAT	Impervious	1.0	0.04	0.14	N/A	7616	26656	N/A
	102100	D	FLAT	Pervious	0.1	0.04	0.14	N/A	408	1429	N/A
Total BMP Area	292500							Minimum BMP Size	8024.4	28085	
								Proposed BMP Size*		N/A	N/A
											in
								Minimum Vault Depth		N/A	in
								Maximum Vault Depth		N/A	in
								Selected Vault Depth		84.00	in
								Selected Vault Volume		28100	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name	CDS North	BMP Type:	Bioretention Plus Vault

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
16	Oceanside	D	Scrub	FLAT	0.175	4.371	0.382	**4.83**
	Oceanside	D	Scrub	FLAT	0.175	2.344	0.205	**2.59**

0.588	**7.43**	**3.07**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.525	**5.94**	**2.75**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	29.7

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name:	CMR North	BMP Type:	Bioretention Plus Vault
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Vault Volume	N/A	Bioretention Surface Area (sf)	Vault Volume (cf)	N/A
17	66300	D	FLAT	Impervious	1.0	0.04	0.14	N/A	2652	9282	N/A
	46900	D	FLAT	Pervious	0.1	0.04	0.14	N/A	188	657	N/A
Total BMP Area	113200							Minimum BMP Size	2839.6	9939	
								Proposed BMP Size*		N/A	N/A
											in
								Minimum Vault Depth		N/A	in
								Maximum Vault Depth		N/A	in
								Selected Vault Depth		84.00	in
								Selected Vault Volume		10000	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name	CMR North	BMP Type:	Bioretention Plus Vault

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
17	Oceanside	D	Scrub	FLAT	0.175	1.522	0.133	**1.68**
	Oceanside	D	Scrub	FLAT	0.175	1.077	0.094	**1.19**

0.227	**2.87**	**1.91**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.213	**2.41**	**1.75**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	26.1

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name:	CDS & CMR	BMP Type:	Bioretention Plus Vault
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Vault Volume	N/A	Bioretention Surface Area (sf)	Vault Volume (cf)	N/A
18	105100	D	FLAT	Impervious	1.0	0.04	0.14	N/A	4204	14714	N/A
	144500	D	FLAT	Pervious	0.1	0.04	0.14	N/A	578	2023	N/A
Total BMP Area	249600							Minimum BMP Size	4782	16737	
								Proposed BMP Size*		N/A	N/A
											in
								Minimum Vault Depth		N/A	in
								Maximum Vault Depth		N/A	in
								Selected Vault Depth		84.00	in
								Selected Vault Volume		16750	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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Designated Staff have final review and approval authority over the project design.

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BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name	CDS & CMR	BMP Type:	Bioretention Plus Vault

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
18	Oceanside	D	Scrub	FLAT	0.175	2.413	0.211	**2.67**
	Oceanside	D	Scrub	FLAT	0.175	3.317	0.290	**3.67**

0.501	**6.34**	**2.84**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.499	**5.64**	**2.68**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	18.6

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name:	U	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
19a	57835	D	Flat	Impervious	1.0	0.065	0.0542	0.039	3759	3135	2256
	43550	D	Flat	Pervious	0.1	0.065	0.0542	0.039	283	236	170
Total BMP Area	101385							Minimum BMP Size	4042.35	3371	2425
								Proposed BMP Size*	4100	4100	2460
								Soil Matrix Depth		18.00	in
								Minimum Ponding Depth		9.87	in
								Maximum Ponding Depth		292.81	in
								Selected Ponding Depth		12.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name	U	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
19a	Oceanside	D	Scrub	FLAT	0.175	1.328	0.116	**2.84**
	Oceanside	D	Scrub	FLAT	0.175	1.000	0.087	**2.14**

0.204	**4.97**	**2.52**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.201	**4.91**	**2.50**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	5.7

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name:	V	BMP Type:	Bioretention
BMP Native Soil Type:	D	BMP Infiltration Rate (in/hr):	0.024

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
19b	43550	D	FLAT	Impervious	1.0	0.065	0.0542	0.039	2831	2360	1698
	79410	D	FLAT	Pervious	0.1	0.065	0.0542	0.039	516	430	310
					1.0						
Total BMP Area	122960										
								Minimum BMP Size	3346.915	2791	2008
								Proposed BMP Size*	5940	5940	3564
									Soil Matrix Depth	18.00	in
									Minimum Ponding Depth	5.64	in
									Maximum Ponding Depth	169.82	in
									Selected Ponding Depth	12.00	in

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	MERGE 56	Hydrologic Unit:	906.1
Project Applicant:	LATITUDE 33	Rain Gauge:	Oceanside
Jurisdiction:	CITY OF SAN DIEGO	Total Project Area:	3049200
Parcel (APN):	306-42-004, 005 & 010	Low Flow Threshold:	0.5Q2
BMP Name	V	BMP Type:	Bioretention

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
19b	Oceanside	D	Scrub	FLAT	0.175	1.000	0.087	**2.14**
	Oceanside	D	Scrub	FLAT	0.175	1.823	0.160	**3.90**

0.247	**6.03**	**2.77**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.243	**5.94**	**2.75**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	6.8

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE INFORMATION

This is the cover sheet for Attachment 3.

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Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	☒ Included See Structural BMP Maintenance Information Checklist.
Attachment 3b	Maintenance Agreement (Form DS-3247) (when applicable)	☐ Included ☒ Not Applicable

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Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Preliminary Design / Planning / CEQA level submittal:

- Attachment 3a must identify:
  - ☒ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual
- Attachment 3b is not required for preliminary design / planning / CEQA level submittal.

Final Design level submittal:

Attachment 3a must identify:

- ☒ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
- ☒ How to access the structural BMP(s) to inspect and perform maintenance
- ☒ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☒ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☒ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☒ When applicable, frequency of bioretention soil media replacement.
- ☒ Recommended equipment to perform maintenance
- ☒ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

Attachment 3b: For private entity operation and maintenance, Attachment 3b must include a Storm Water Management and Discharge Control Maintenance Agreement (Form DS-3247). The following information must be included in the exhibits attached to the maintenance agreement:

- ☐ Vicinity map
- ☐ Site design BMPs for which DCV reduction is claimed for meeting the pollutant control obligations.
- ☐ BMP and HMP location and dimensions
- ☐ BMP and HMP specifications/cross section/model
- ☐ Maintenance recommendations and frequency
- ☐ LID features such as (permeable paver and LS location, dim, SF).

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation per original plans when applicable (e.g. a vegetated swale may require a minimum vegetation height).
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in vegetated swales	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, loosening or replacing top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

Typical Maintenance Indicator(s) for Filtration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.
Clogged filter media	Remove and properly dispose filter media, and replace with fresh media.
Damage to components of the filtration system	Repair or replace as applicable.
Note: For proprietary media filters, refer to the manufacturer's maintenance guide.	

ATTACHMENT 4
COPY OF PLAN SHEETS SHOWING PERMANENT STORM WATER BMPS

This is the cover sheet for Attachment 4.

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Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

☒ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
☒ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
☒ Details and specifications for construction of structural BMP(s)
☒ Signage indicating the location and boundary of structural BMP(s) as required by the City Engineer
☒ How to access the structural BMP(s) to inspect and perform maintenance
☒ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
☒ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
☒ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
☒ Recommended equipment to perform maintenance
☒ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
☒ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
☒ All BMPs must be fully dimensioned on the plans
☒ When proprietary BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Boucher photocopies are not allowed.

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ATTACHMENT 5
DRAINAGE REPORT

Attach project's drainage report. Refer to Drainage Design Manual to determine the reporting requirements.

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DRAINAGE REPORT FOR
MERGE 56
VESTING TENTATIVE MAP

May 12, 2015

Wayne W. Chang, MS, PE 46548

Chang Consultants
Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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Rancho Santa Fe, CA 92067
(858) 692-0760

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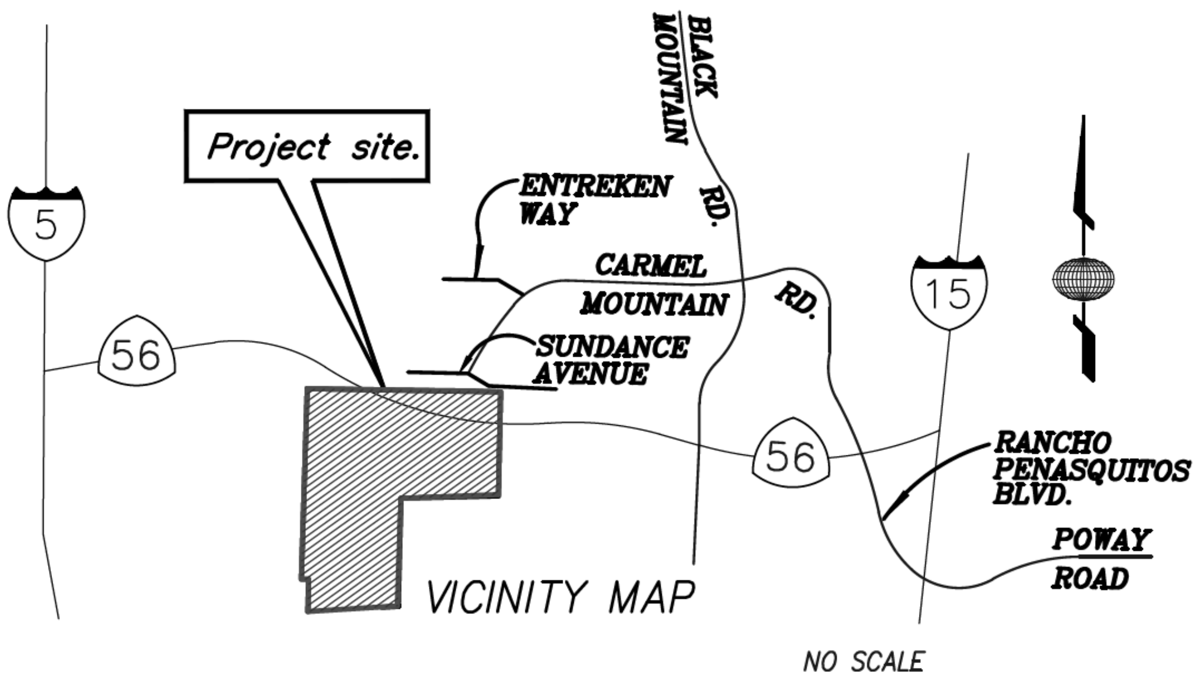
APPENDIX

MAP POCKET

INTRODUCTION

The Merge 56 (aka Rhodes Crossing) Vesting Tentative Map is being designed by Latitude 33. The overall project is located south of State Route 56 and east of the future extension of Camino Del Sur in the city of San Diego (see Vicinity Map). The project proposes to connect the northerly segment of Camino Del Sur from Torrey Santa Fe Road to the southerly segment near Dormouse Road. The project will also extend Carmel Mountain Road southwesterly to the proposed Camino Del Sur extension. Finally, the project will create a mixed-use development (commercial, single-family residential, and possibly some multi-family residential) north of the future intersection of Camino Del Sur and Carmel Mountain Road.



Vicinity Map

This preliminary drainage report provides preliminary drainage information for the VTM. The drainage information includes new rational method analyses for the mixed-use development. In addition, a summary of Latitude 33's prior drainage analyses for the project areas beyond the mixed-use development are provided. Latitude 33's prior drainage analyses are included in the following reports:

- January 2001, *Drainage Study for Camino Ruiz* (aka Camino Del Sur), *South of Carmel Mountain Road*
- January 22, 2004, *Preliminary Drainage Study*, *Rhodes Crossing*
- August 28, 2006, *Drainage Study*, *Rhodes Crossing*, *Camino del Sur & Camel Mountain Roadway Plans.*

The first two reports contain entitlement-level analyses, so the results from these reports are included herein. The January 2001 report analyzes the southerly segment of Camino Del Sur including two proposed detention basins. The “Camino Del Sur, San Diego, California, Developed Drainage Basin Exhibit” from the January 2001 report is included in the map pocket. The January 2004 report analyzes the project area north of the January 2001 report coverage. The “Rhodes Crossing Exhibit ‘B’ Proposed Drainage Conditions” exhibit from the January 2004 report is included in the map pocket. Both exhibits contain the preliminary drainage basin boundaries and hydrologic results performed by Latitude 33. Therefore, additional analyses have not been performed for these areas. The current project proposes to reduce the number of lanes in Camino Del Sur and Carmel Mountain Road by up to one lane in each direction. Therefore, the prior analyses should yield somewhat conservative proposed condition results for entitlement purposes since the actual roadway paving will be less.

Since the mixed-use site plan has been revised from what is shown in the January 2004 report, this report contains updated analyses reflecting the revision. The analyses in this report are for entitlement purposes only and intended to demonstrate feasibility of the proposed drainage system. The following outlines the analyses.

HYDROLOGIC RESULTS

The overall drainage basin covers 35.65 acres so the City of San Diego’s 1984 *Drainage Design Manual’s* rational method procedure was the basis for the proposed condition 100-year hydrologic analysis. An existing condition analysis is contained in the prior 2004 (and 2006) reports. The CivilDesign Rational Method Hydrology Program is based on the City criteria and was used for the analyses. The rational method input parameters are summarized below and the supporting data is included in Appendix A:

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

- Drainage area: The proposed condition drainage basins were delineated using Latitude 33’s Vesting Tentative Map grading. The drainage basin boundaries and grading are shown on the Existing Condition Rational Method Work Map in the map pocket.

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

- Runoff coefficients: The proposed condition runoff coefficients were based on the single-family residential category for the single-family residential areas, the multi-units category for the townhomes, and the commercial category for the commercial development.

- Flow lengths and elevations: The flow lengths and elevations were obtained from the Vesting Tentative Map grading.

The rational method results are included in Appendix A and summarized in Table 1. Storm runoff discharges from the mixed-use area from a single storm drain outlet into a natural area near the northwest corner of the site (see the Proposed Condition Rational Method Work Map). Table 1 indicates that the flow rates are in a range that can be conveyed by typical storm drain facilities. The rational method results contain normal depth Pipeflow routines showing that the conceptual pipe sizes do not exceed 42 inches in diameter, which is not excessive.

Rational Method Node	Drainage Area, ac	Proposed Condition 100-Year Flow Rate, cfs
68	35.65	77

Table 1. Rational Method Results at Project Discharge Locations

CONCLUSION

Preliminary hydrologic analyses have been performed for the Merge 56 Vesting Tentative Map by Latitude 33. The mixed-use area rational method analyses prepared for this report show that proposed condition 100-year flow rates are within a range that can be handled by typical storm drain facilities. Therefore, the drainage design for the mixed-use area is feasible. In addition, Latitude 33's hydrologic exhibits created for their preliminary analyses of the remainder of the site are included in the map pocket. These exhibits provide flow rates and proposed detention basin locations that were assessed and deemed feasible by Latitude 33.

APPENDIX A

RATIONAL METHOD RESULTS

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

Land Use	Coefficient, C Soil Type (1)
Residential:	D
Single Family	.55
Multi-Units	.70
Mobile Homes	.65
Rural (lots greater than 1/2 acre)	.45
Commercial (2) 80% Impervious	.85
Industrial (2) 90% Impervious	.95

NOTES:

(1) Type D soil to be used for all areas.

(2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

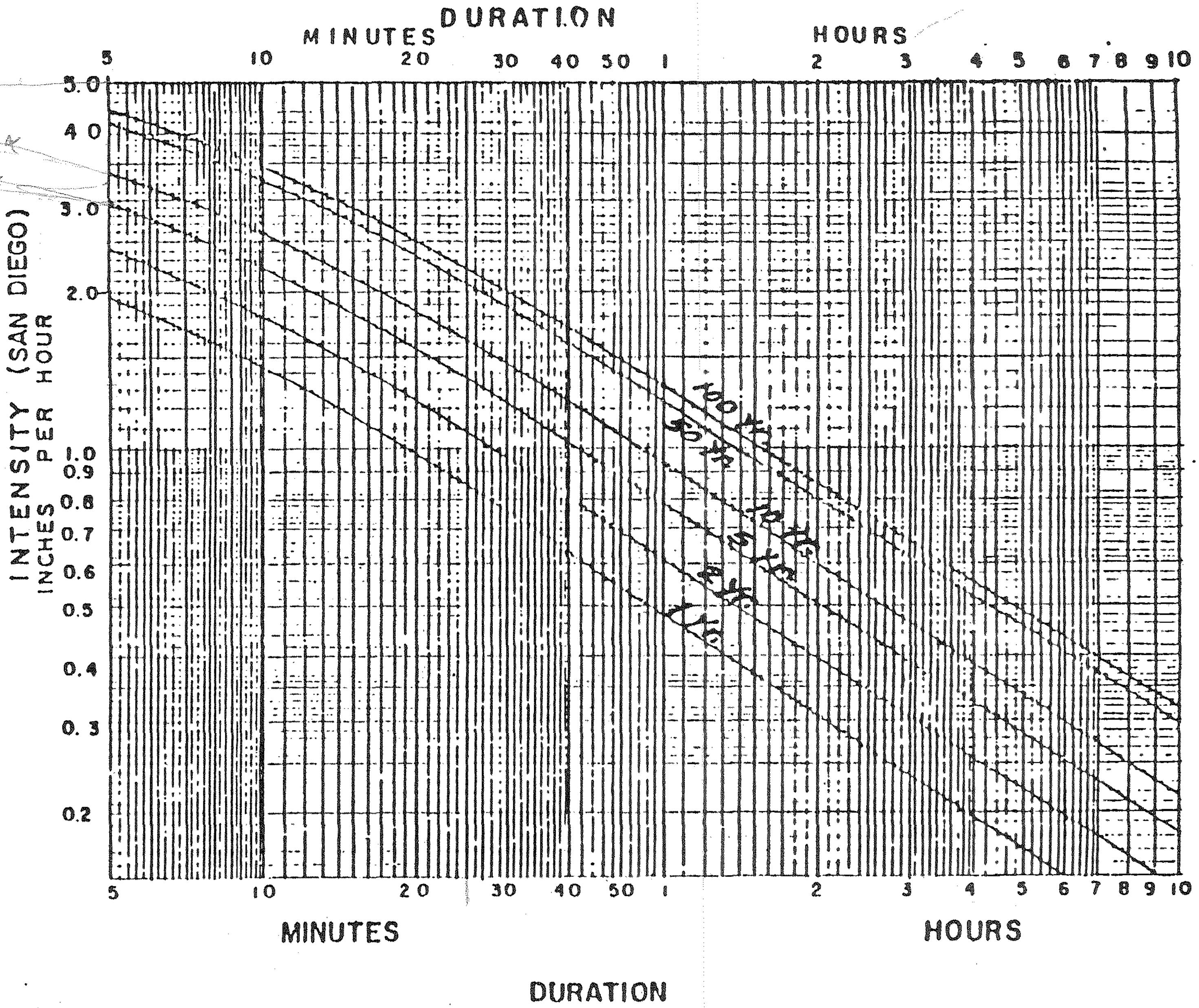
Actual imperviousness = 50%

Tabulated imperviousness = 80%

$$\text{Revised C} = \frac{50}{80} \times 0.85 = 0.53$$

ELEV.	FACTOR
0–1500	1.00
1500–3000	1.25
3000–4000	1.42
4000–5000	1.60
5000–6000	1.70
DESERT	1.25

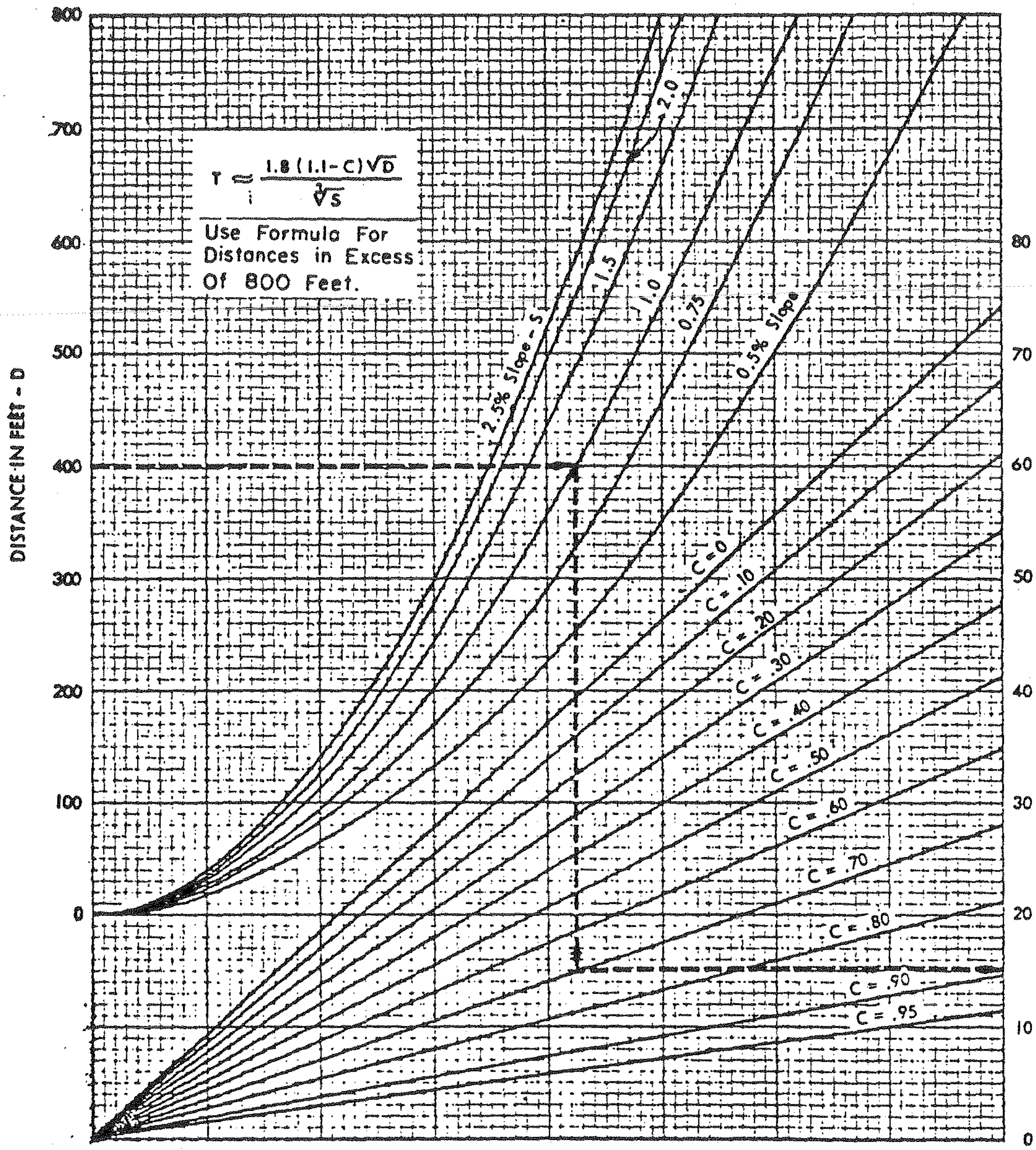
To obtain correct intensity, multiply intensity on chart by factor for design elevation.



RAINFALL
INTENSITY - DURATION - FREQUENC
CURVES
for
COUNTY OF SAN DIEGO

APPENDIX I-

URBAN AREAS OVERLAND TIME OF FLOW CURVES



Surface Flow Time Curves

EXAMPLE:

GIVEN: LENGTH OF FLOW = 400 FT.

SLOPE = 1.0 %

COEFFICIENT OF RUNOFF C = .70

READ: OVERLAND FLOWTIME = 15 MINUTES

```
          San Diego County Rational Hydrology Program

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

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
     Rational Hydrology Study        Date: 05/13/15
------------------------------------------------------------------------
```

Merge 56
Vesting Tentative Map
Proposed Conditions
100-Year Flow Rate

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

Program License Serial Number 4028

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

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


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      10.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                     ]
Initial subarea flow distance  =  103.000(Ft.)
Highest elevation =  395.200(Ft.)
Lowest elevation =  394.200(Ft.)
Elevation difference =    1.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    10.15 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 103.000^.5)/( 0.971^(1/3)]=  10.15
Rainfall intensity (I) =      3.356(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.222(CFS)
Total initial stream area =       0.120(Ac.)
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Process from Point/Station       12.000 to Point/Station       14.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   395.200(Ft.)
End of street segment elevation =   393.600(Ft.)
Length of street segment  =   173.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   6.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.031(CFS)
Depth of flow =   0.299(Ft.), Average velocity =   1.825(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.205(Ft.)
Flow velocity =   1.83(Ft/s)
Travel time =    1.58 min.     TC =   11.73  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.185(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.433(CFS) for    1.960(Ac.)
Total runoff =      3.655(CFS)   Total area =        2.08(Ac.)
Street flow at end of street =      3.655(CFS)
Half street flow at end of street =      3.655(CFS)
Depth of flow =   0.350(Ft.), Average velocity =   2.160(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


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Process from Point/Station       14.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   393.600(Ft.)
Downstream point/station elevation =   392.000(Ft.)
Pipe length  =   160.00(Ft.)   Manning's N = 0.013
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No. of pipes = 1  Required pipe flow  =     3.655(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.655(CFS)
Normal flow depth in pipe =    8.07(In.)
Flow top width inside pipe =   14.96(In.)
Critical Depth =    9.27(In.)
Pipe flow velocity =      5.43(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    12.22 min.


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Process from Point/Station       18.000 to Point/Station      16.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    12.22 min.
Rainfall intensity =      3.137(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.588(CFS) for    0.920(Ac.)
Total runoff =      5.242(CFS)   Total area =       3.00(Ac.)


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Process from Point/Station       16.000 to Point/Station      20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   392.000(Ft.)
Downstream point/station elevation =   388.000(Ft.)
Pipe length  =   373.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.242(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.242(CFS)
Normal flow depth in pipe =   10.00(In.)
Flow top width inside pipe =   14.14(In.)
Critical Depth =   11.14(In.)
Pipe flow velocity =      6.03(Ft/s)
Travel time through pipe =    1.03 min.
Time of concentration (TC) =    13.25 min.


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Process from Point/Station       20.000 to Point/Station      20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                     ]
Time of concentration =    13.25 min.
Rainfall intensity =      3.045(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.818(CFS) for    2.280(Ac.)
Total runoff =      9.061(CFS)   Total area =        5.28(Ac.)


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Process from Point/Station       20.000 to Point/Station       22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   388.000(Ft.)
Downstream point/station elevation =   384.000(Ft.)
Pipe length  =   179.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.061(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.061(CFS)
Normal flow depth in pipe =   11.53(In.)
Flow top width inside pipe =   12.65(In.)
Critical Depth =   13.89(In.)
Pipe flow velocity =      8.94(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =    13.58 min.


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Process from Point/Station       22.000 to Point/Station       22.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                     ]
Time of concentration =    13.58 min.
Rainfall intensity =      3.017(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.207(CFS) for    1.330(Ac.)
Total runoff =     11.267(CFS)   Total area =        6.61(Ac.)


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Process from Point/Station       22.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   384.000(Ft.)
Downstream point/station elevation =   382.800(Ft.)
Pipe length  =    47.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.267(CFS)
Nearest computed pipe diameter  =     18.00(In.)
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Calculated individual pipe flow  =    11.267(CFS)
Normal flow depth in pipe =   10.79(In.)
Flow top width inside pipe =   17.64(In.)
Critical Depth =   15.40(In.)
Pipe flow velocity =     10.18(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    13.66 min.


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Process from Point/Station       22.000 to Point/Station       24.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.610(Ac.)
Runoff from this stream =     11.267(CFS)
Time of concentration =   13.66 min.
Rainfall intensity =     3.010(In/Hr)


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Process from Point/Station       30.000 to Point/Station       32.000
**** 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
[SINGLE FAMILY area type                     ]
Initial subarea flow distance  =  112.000(Ft.)
Highest elevation =  398.400(Ft.)
Lowest elevation =  397.300(Ft.)
Elevation difference =    1.100(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    10.54 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 112.000^.5)/( 0.982^(1/3)]=  10.54
Rainfall intensity (I) =      3.311(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.182(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station       32.000 to Point/Station       34.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   398.400(Ft.)
End of street segment elevation =   395.000(Ft.)
Length of street segment  =   247.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
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Distance from crown to crossfall grade break  =   6.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.438(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   1.968(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.121(Ft.)
Flow velocity =   1.97(Ft/s)
Travel time =    2.09 min.     TC =   12.63  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                     ]
Rainfall intensity =      3.099(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.352(CFS) for    1.380(Ac.)
Total runoff =      2.534(CFS)   Total area =        1.48(Ac.)
Street flow at end of street =      2.534(CFS)
Half street flow at end of street =      2.534(CFS)
Depth of flow =   0.301(Ft.), Average velocity =   2.238(Ft/s)
Flow width (from curb towards crown)=  10.300(Ft.)


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Process from Point/Station       34.000 to Point/Station       36.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   395.000(Ft.)
Downstream point/station elevation =   392.100(Ft.)
Pipe length  =    94.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.534(CFS)
Nearest computed pipe diameter  =     9.00(In.)
Calculated individual pipe flow  =     2.534(CFS)
Normal flow depth in pipe =    6.50(In.)
Flow top width inside pipe =    8.06(In.)
Critical Depth =    8.34(In.)
Pipe flow velocity =      7.41(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =    12.84 min.


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Process from Point/Station       38.000 to Point/Station       36.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    12.84 min.
Rainfall intensity =      3.080(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.304(CFS) for    0.770(Ac.)
Total runoff =      3.839(CFS)   Total area =       2.25(Ac.)


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Process from Point/Station       36.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   392.100(Ft.)
Downstream point/station elevation =   391.100(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.839(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.839(CFS)
Normal flow depth in pipe =    7.84(In.)
Flow top width inside pipe =   11.42(In.)
Critical Depth =    9.99(In.)
Pipe flow velocity =      7.06(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    12.96 min.


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Process from Point/Station       42.000 to Point/Station       40.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    12.96 min.
Rainfall intensity =      3.070(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      0.456(CFS) for    0.270(Ac.)
Total runoff =      4.295(CFS)   Total area =       2.52(Ac.)


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Process from Point/Station       40.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
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Upstream point/station elevation =   391.100(Ft.)
Downstream point/station elevation =   382.800(Ft.)
Pipe length  =   464.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.295(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.295(CFS)
Normal flow depth in pipe =    8.91(In.)
Flow top width inside pipe =   10.50(In.)
Critical Depth =   10.45(In.)
Pipe flow velocity =      6.87(Ft/s)
Travel time through pipe =    1.13 min.
Time of concentration (TC) =    14.09 min.


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Process from Point/Station      40.000 to Point/Station      24.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.520(Ac.)
Runoff from this stream =      4.295(CFS)
Time of concentration =   14.09 min.
Rainfall intensity =     2.976(In/Hr)
Summary of stream data:

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


1       11.267     13.66            3.010
2        4.295     14.09            2.976
Qmax(1) =
        1.000 *    1.000 *    11.267) +
        1.000 *    0.970 *     4.295) + =      15.431
Qmax(2) =
        0.988 *    1.000 *    11.267) +
        1.000 *    1.000 *     4.295) + =      15.432

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.267       4.295
Maximum flow rates at confluence using above data:
       15.431       15.432
Area of streams before confluence:
        6.610        2.520
Results of confluence:
Total flow rate =     15.432(CFS)
Time of concentration =    14.087 min.
Effective stream area after confluence =      9.130(Ac.)
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Process from Point/Station      24.000 to Point/Station      44.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   382.800(Ft.)
Downstream point/station elevation =   380.500(Ft.)
Pipe length  =   223.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.432(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    15.432(CFS)
Normal flow depth in pipe =   16.50(In.)
Flow top width inside pipe =   17.23(In.)
Critical Depth =   17.44(In.)
Pipe flow velocity =      7.62(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    14.58 min.


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Process from Point/Station      46.000 to Point/Station      44.000
**** 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
[SINGLE FAMILY area type                     ]
Time of concentration =    14.58 min.
Rainfall intensity =      2.937(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.554(CFS) for    2.200(Ac.)
Total runoff =     18.986(CFS)   Total area =      11.33(Ac.)


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Process from Point/Station      48.000 to Point/Station      44.000
**** 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                        ]
Time of concentration =    14.58 min.
Rainfall intensity =      2.937(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =     11.460(CFS) for    4.590(Ac.)
Total runoff =     30.445(CFS)   Total area =      15.92(Ac.)


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Process from Point/Station      44.000 to Point/Station      49.000
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**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   376.500(Ft.)
Downstream point/station elevation =   373.000(Ft.)
Pipe length  =   345.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    30.445(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    30.445(CFS)
Normal flow depth in pipe =   21.56(In.)
Flow top width inside pipe =   21.66(In.)
Critical Depth =   22.89(In.)
Pipe flow velocity =      8.94(Ft/s)
Travel time through pipe =    0.64 min.
Time of concentration (TC) =    15.22 min.


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Process from Point/Station       44.000 to Point/Station       49.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     15.920(Ac.)
Runoff from this stream =     30.445(CFS)
Time of concentration =   15.22 min.
Rainfall intensity =     2.889(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       50.000 to Point/Station       52.000
**** 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                    ]
Initial subarea flow distance  =  539.000(Ft.)
Highest elevation =  398.000(Ft.)
Lowest elevation =  394.000(Ft.)
Elevation difference =    4.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    11.54 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*( 539.000^.5)/( 0.742^(1/3)]=  11.54
Rainfall intensity (I) =      3.204(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      4.030(CFS)
Total initial stream area =       1.480(Ac.)
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Process from Point/Station       52.000 to Point/Station       54.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   394.000(Ft.)
End of street segment elevation =   373.800(Ft.)
Length of street segment  =  1345.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  34.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      8.686(CFS)
Depth of flow =   0.425(Ft.), Average velocity =   3.101(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.524(Ft.)
Flow velocity =   3.10(Ft/s)
Travel time =    7.23 min.     TC =   18.77  min.
 Adding area flow to street
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                        ]
Rainfall intensity =      2.653(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =      7.712(CFS) for    3.420(Ac.)
Total runoff =     11.742(CFS)   Total area =        4.90(Ac.)
Street flow at end of street =     11.742(CFS)
Half street flow at end of street =     11.742(CFS)
Depth of flow =   0.466(Ft.), Average velocity =   3.336(Ft/s)
Flow width (from curb towards crown)=  18.571(Ft.)


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Process from Point/Station       54.000 to Point/Station       49.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   373.800(Ft.)
Downstream point/station elevation =   373.000(Ft.)
Pipe length  =   114.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.742(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    11.742(CFS)
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Normal flow depth in pipe =   15.35(In.)
Flow top width inside pipe =   18.62(In.)
Critical Depth =   15.32(In.)
Pipe flow velocity =      6.23(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =    19.07 min.


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Process from Point/Station       54.000 to Point/Station       49.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.900(Ac.)
Runoff from this stream =     11.742(CFS)
Time of concentration =   19.07 min.
Rainfall intensity =     2.634(In/Hr)
Summary of stream data:

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


1       30.445     15.22            2.889
2       11.742     19.07            2.634
Qmax(1) =
         1.000 *    1.000 *    30.445) +
         1.000 *    0.798 *    11.742) + =      39.813
Qmax(2) =
         0.912 *    1.000 *    30.445) +
         1.000 *    1.000 *    11.742) + =      39.507

Total of 2 main streams to confluence:
Flow rates before confluence point:
      30.445      11.742
Maximum flow rates at confluence using above data:
       39.813       39.507
Area of streams before confluence:
       15.920        4.900


Results of confluence:
Total flow rate =     39.813(CFS)
Time of concentration =    15.218 min.
Effective stream area after confluence  =     20.820(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       49.000 to Point/Station       56.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
```
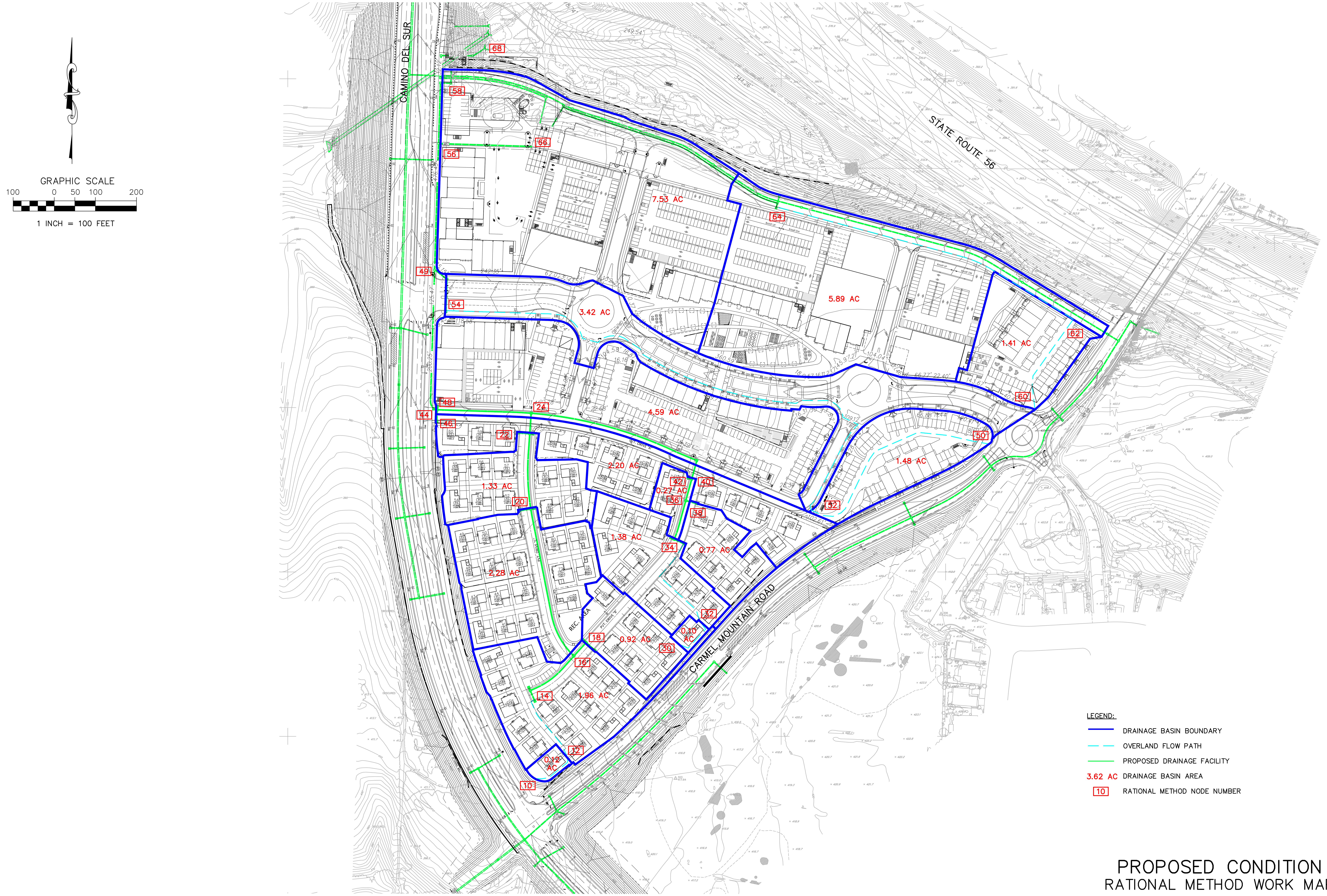

```
Upstream point/station elevation =   373.000(Ft.)
Downstream point/station elevation =   369.900(Ft.)
Pipe length  =   306.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    39.813(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    39.813(CFS)
Normal flow depth in pipe =   23.67(In.)
Flow top width inside pipe =   24.48(In.)
Critical Depth =   25.50(In.)
Pipe flow velocity =      9.58(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    15.75 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       58.000 to Point/Station       56.000
**** 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                        ]
Time of concentration =    15.75 min.
Rainfall intensity =      2.850(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =     18.243(CFS) for    7.530(Ac.)
Total runoff =     58.056(CFS)   Total area =       28.35(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       66.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   369.900(Ft.)
Downstream point/station elevation =   368.800(Ft.)
Pipe length  =   224.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    58.056(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    58.056(CFS)
Normal flow depth in pipe =   32.06(In.)
Flow top width inside pipe =   29.83(In.)
Critical Depth =   29.19(In.)
Pipe flow velocity =      7.95(Ft/s)
Travel time through pipe =    0.47 min.
Time of concentration (TC) =    16.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       66.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
```

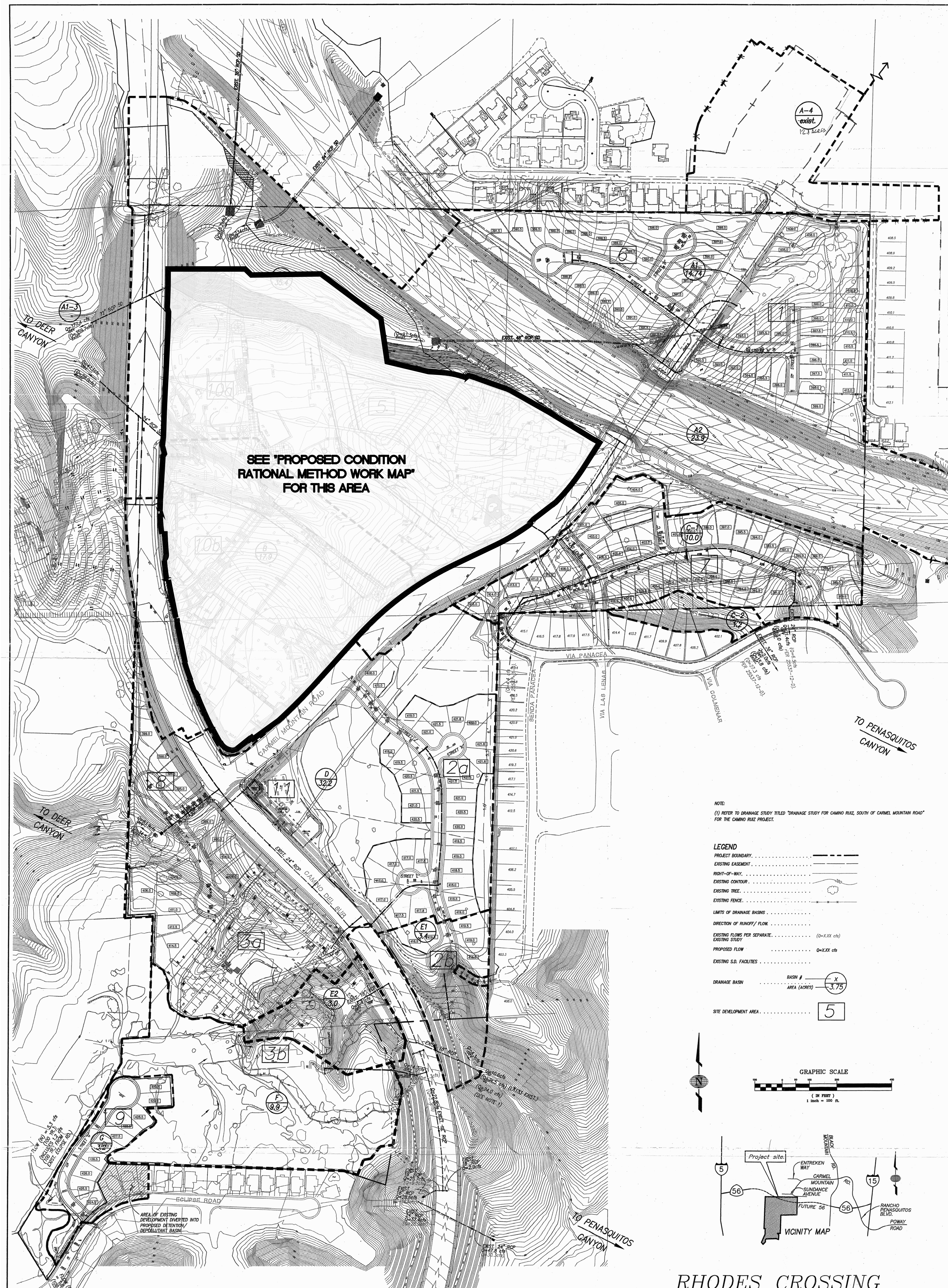
```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     28.350(Ac.)
Runoff from this stream =     58.056(CFS)
Time of concentration =   16.22 min.
Rainfall intensity =     2.817(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       60.000 to Point/Station       62.000
**** 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                        ]
Initial subarea flow distance  =  251.000(Ft.)
Highest elevation =  399.000(Ft.)
Lowest elevation =  397.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.69 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8500)*( 251.000^.5)/( 0.797^(1/3)]=   7.69
Rainfall intensity (I) =      3.714(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =      4.451(CFS)
Total initial stream area =       1.410(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       62.000 to Point/Station       64.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   397.000(Ft.)
End of street segment elevation =   375.500(Ft.)
Length of street segment  =   773.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   6.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
```

```
Estimated mean flow rate at midpoint of street =     13.746(CFS)
Depth of flow =   0.434(Ft.), Average velocity =   5.093(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.000(Ft.)
Flow velocity =   5.09(Ft/s)
Travel time =    2.53 min.     TC =   10.22  min.
 Adding area flow to street
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                        ]
Rainfall intensity =      3.348(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.850
Subarea runoff =     16.760(CFS) for    5.890(Ac.)
Total runoff =     21.211(CFS)   Total area =        7.30(Ac.)
Street flow at end of street =     21.211(CFS)
Half street flow at end of street =     21.211(CFS)
Depth of flow =   0.502(Ft.), Average velocity =   6.032(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    0.10(Ft.)
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       64.000 to Point/Station       66.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   375.500(Ft.)
Downstream point/station elevation =   368.800(Ft.)
Pipe length  =   641.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.211(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    21.211(CFS)
Normal flow depth in pipe =   18.09(In.)
Flow top width inside pipe =   20.68(In.)
Critical Depth =   19.78(In.)
Pipe flow velocity =      8.35(Ft/s)
Travel time through pipe =    1.28 min.
Time of concentration (TC) =    11.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       66.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      7.300(Ac.)
Runoff from this stream =     21.211(CFS)
```

```
Time of concentration =   11.50 min.
Rainfall intensity =     3.208(In/Hr)
Summary of stream data:

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


1       58.056     16.22            2.817
2       21.211     11.50            3.208
Qmax(1) =
        1.000 *    1.000 *    58.056) +
        0.878 *    1.000 *    21.211) + =      76.686
Qmax(2) =
        1.000 *    0.709 *    58.056) +
        1.000 *    1.000 *    21.211) + =      62.368

Total of 2 main streams to confluence:
Flow rates before confluence point:
      58.056      21.211
Maximum flow rates at confluence using above data:
       76.686       62.368
Area of streams before confluence:
       28.350        7.300


Results of confluence:
Total flow rate =     76.686(CFS)
Time of concentration =    16.220 min.
Effective stream area after confluence  =     35.650(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       66.000 to Point/Station       68.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   368.800(Ft.)
Downstream point/station elevation =   316.000(Ft.)
Pipe length  =   495.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    76.686(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    76.686(CFS)
Normal flow depth in pipe =   20.63(In.)
Flow top width inside pipe =   16.69(In.)
Critical depth could not be calculated.
Pipe flow velocity =     26.71(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    16.53 min.
End of computations, total study area =          35.650 (Ac.)
```



PROPOSED CONDITION
RATIONAL METHOD WORK MAP



NOTE:

(1) REFER TO DRAINAGE STUDY TITLED "DRAINAGE STUDY FOR CAMINO RUIZ, SOUTH OF CARMEL MOUNTAIN ROAD" FOR THE CAMINO RUIZ PROJECT.

LEGEND

- PROJECT BOUNDARY
- EXISTING EASEMENT
- RIGHT-OF-WAY
- EXISTING CONTOUR
- EXISTING TREE
- EXISTING FENCE
- LIMITS OF DRAINAGE BASINS
- DIRECTION OF RUNOFF/ FLOW
- EXISTING FLOWS PER SEPARATE EXISTING STUDY (Q=X.XX cfs)
- PROPOSED FLOW Q=X.XX cfs
- EXISTING S.D. FACILITIES
- DRAINAGE BASIN: BASIN # / AREA (ACRES) (X / 3.75)
- SITE DEVELOPMENT AREA (5)

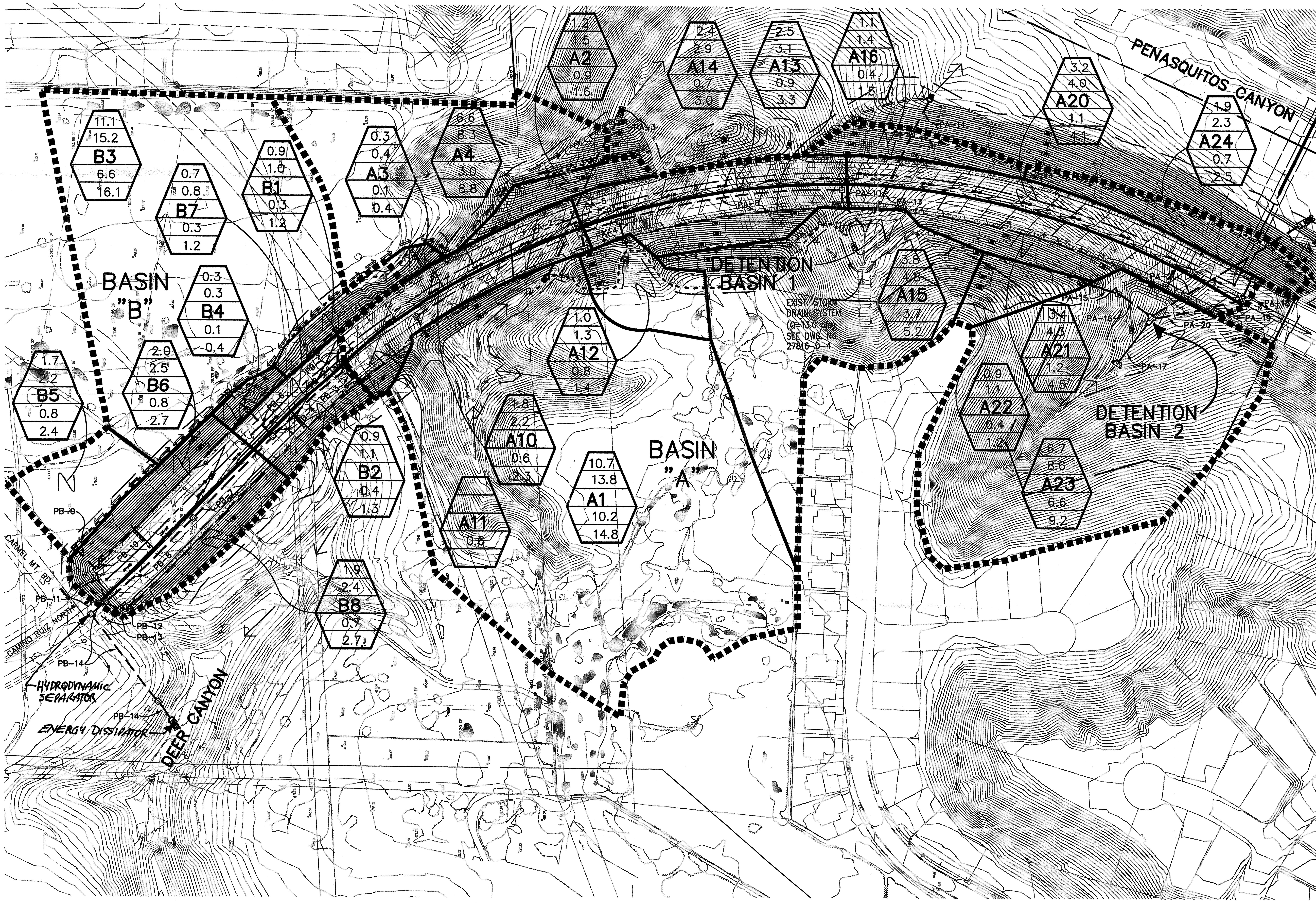
SEE "CAMINO DEL SUR SAN DIEGO, CALIFORNIA DEVELOPED DRAINAGE BASIN EXHIBIT" FOR SOUTHERLY ROAD AREA

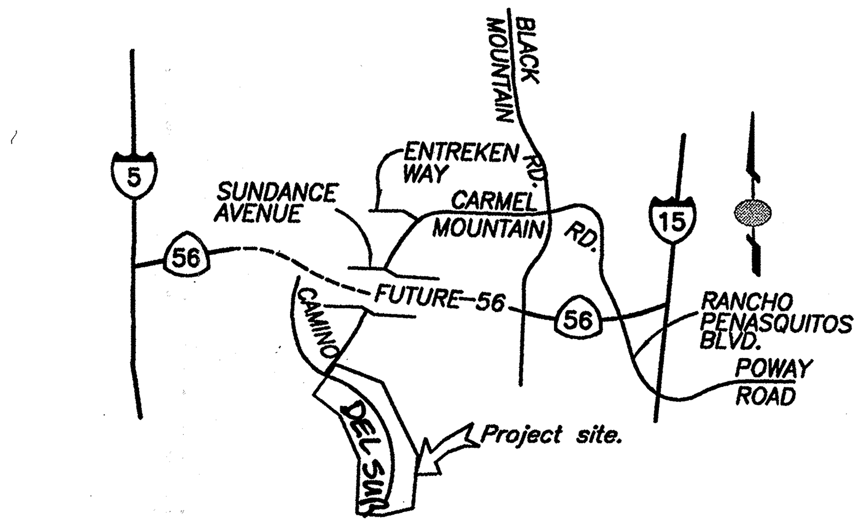
PREPARED IN THE OFFICE OF:
Latitude 33
Planning and Engineering
4933 Paramount Drive, 2nd Floor
San Diego, CA 92123
858-751-0633 Fax 858-751-0634

RHODES CROSSING
EXHIBIT 'B'
PROPOSED DRAINAGE CONDITIONS

H:\300\352-3\DRAINAGE\12-22-04 352-PROP-DRAINAGE.DWG 01/23/04 09:35:28 AM PST

CAMINO DEL SUR
SAN DIEGO, CALIFORNIA
DEVELOPED DRAINAGE BASIN EXHIBIT





VICINITY MAP

NOT TO SCALE

LEGEND

- PROJECT BOUNDARY
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- CLEANOUT
- TYPE 'F' CATCH BASIN
- DITCH
- SWALE
- TYPE 'B-1' INLET
- STORM DRAIN PIPE
- WING TYPE HEADWALL
- FLOW

1.2 — Q_{10} (cfs)
4.6 — Q_{50} (csf)
B4 — SUB BASIN DESIGNATION
0.8 — BASIN AREA (ACRES)
5.2 — Q_{100} (cfs)

PA-26 STORM DRAIN SYSTEM (PIPE SECTION)

(IN FEET)
1 inch = 100 ft.

GRAPHIC SCALE

200 100 50 0 100 300

1" = 100'

CAMINO DEL SUR
DEVELOPED DRAINAGE EXHIBIT

5-24-2001

Latitude 33
Planning and Engineering
4933 Paramount Drive, Ste. 200
San Diego, CA 92123
(858) 751-0633

ATTACHMENT 6
GEOTECHNICAL AND GROUNDWATER INVESTIGATION REPORT

Attach project's geotechnical and groundwater investigation report. Refer to Appendix C.4 to determine the reporting requirements.

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TRANSMITTAL OF GEOTECHNICAL INFORMATION

MERGE 56
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

LATITUDE 33
SAN DIEGO, CALIFORNIA

JULY 13, 2016
PROJECT NO. 06021-32-05

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. 06021-32-05
July 13, 2016

Latitude 33
9968 Hibert Street
San Diego, California 92131

Attention: Mr. John Arenz

Subject: TRANSMITTAL OF GEOTECHNICAL INFORMATION
MERGE 56
SAN DIEGO, CALIFORNIA

References:

1. *Geotechnical Investigation, Rhodes Property, San Diego, California*, prepared by Geocon Incorporated, dated July 2, 1998 (Project No. 06021-52-01).
2. *Update Letter and Response to Geotechnical Review Comments, Merge 56 (Formerly Rhodes Crossing), San Diego, California*, prepared by Geocon Incorporated, dated August 29, 2014 (Project No. 06021-32-04).
3. *Update Letter and Response to Geotechnical Review Comments, Merge 56 (Formerly Rhodes Crossing), San Diego, California*, prepared by Geocon Incorporated, dated October 13, 2014 (Project No. 06021-32-04).

Dear Mr. Arenz:

In accordance with your request, Geocon Incorporated has provided geotechnical engineering services on the subject project. Specifically, we have performed four in-situ permeability tests to aid in evaluating the on-site storm water BMP design. The following information is provided to support storm water BMP design in accordance with the *2016 Model BMP Design Manual San Diego Region*.

STORM WATER MANAGEMENT INVESTIGATION

We understand storm water management devices are being proposed in accordance with the *2016 Model BMP Design Manual San Diego Region*. If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table 1 presents the descriptions of the hydrologic soil groups. 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.

TABLE 1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
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.
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.
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.
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.

The subject site is underlain by surficial deposits consisting of topsoil, alluvium and colluvium. Formational units include Very Old Paralic Deposits and Stadium Conglomerate/Mission Valley Formation (undifferentiated). The drainages generally expose alluvium/colluvium. After completion of the proposed grading operations, the property would consist of formational units exposed at grade and compacted fill deposits overlying bedrock materials. The compacted fill and formational materials should be classified as Soil Group D. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil. Table 2 presents the information from the USDA website. The Hydrologic Soil Group Map presents output from the USDA website showing the limits of the soil units.

TABLE 2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (Inches/ Hour)
Olivenhain cobbly loam	OhE	15.9	D	0.00 – 0.06
Redding gravelly loam	RdC	42.3	D	0.00 – 0.06
Terrace escarpments	Tef	11.2	NA	NA

NA – Data not provided on the USDA website.

In-Situ Testing

We performed four Soil Moisture, Inc. Aardvark Permeameter tests at the locations shown on the attached *Site Plan*, Figure 1. The test borings were 4 inches in diameter. The results of the tests provide parameters regarding the saturated hydraulic conductivity and infiltration characteristics of on-site soil and geologic units. Table 3 presents the results of the field saturated hydraulic conductivity/infiltration rates obtained from the Aardvark Permeameter tests. The data sheets are also attached herein in Appendix A. We applied a feasibility factor of safety of 2 to the infiltration test results. Soil infiltration rates from in-situ tests can vary significantly from one location to another due to the non-homogeneous characteristics inherent to most soil.

TABLE 3
FIELD PERMEAMETER INFILTRATION TEST RESULTS

Test No.	Geologic Unit	Test Depth (feet, below grade)	Field-Saturated Hydraulic Conductivity, k_{sat} (inch/hour)	Field Infiltration Rate (inch/hour)
P-1	Tst/Tmv	2.3	0.17	0.09
P-2	Tst/Tmv	3.0	0.05	0.03
P-3	Tst/Tmv	0.8	0.55	0.28
P-4	Qvop8	2.3	1.03	0.52

STORM WATER MANAGEMENT CONCLUSIONS

The *Site Plan*, Figure 1, presents the existing property and the locations of the in-situ infiltration test locations.

Infiltration Rates

The results of the unfactored infiltration rates (i.e. field saturated hydraulic conductivity) show ranges of 0.05 to 1.03-inches per hour. After applying a feasibility factor of safety of 2.0, the infiltration rates range between 0.03 to 0.52-inches per hour. The infiltration test results show the on-site soil is variable across the site. A single design rate for an area could not be accurate based on the variability. Therefore, based on the results of the field infiltration tests, anticipated grading, and our experience, full infiltration should be considered infeasible. The results of the permeability testing are presented in Appendix A.

Based on the site conditions, partial infiltration may be considered feasible if designed properly.

Groundwater Elevations

Groundwater is expected to be encountered at elevations of approximately 80 feet above Mean Sea Level (MSL). The site elevations after grading will range between approximately 376 to 400 feet above MSL, therefore groundwater is not expected to be a factor. Groundwater mounding is caused when infiltration is allowed and the lateral hydraulic conductivity is relatively low causing an increase in the groundwater table. Groundwater mounding could occur if full infiltration was considered. For partial infiltration, groundwater mounding is not likely given the expected low volume of water to infiltrate vertically into the ground.

Soil or Groundwater Contamination

Based on review of the Geotracker website, no active cleanup sites exist on or adjacent to the subject site. In addition, we are not aware of any contaminated soils or shallow groundwater on the site that would preclude storm water infiltration. An environmental assessment was not part of our scope of work.

Slopes and Other Geologic Hazards

Existing slopes exist on the property that should preclude full or partial infiltration of storm water. Proposed fill slopes are planned. Infiltration of storm water adjacent to cut or fill slopes should be avoided. Fill slopes will exhibit instability if water is allowed to saturate the compacted fill. Cut slopes may exhibit daylight seepage.

Storm Water Management Devices

Based on the discussion above, considering three of the four infiltration tests did not meet the feasibility criteria. The single test that met the minimum threshold criteria was founded in materials that will be subsequently removed during site grading. Therefore, the proposed bioretention areas should be designed considering partial infiltration of storm water, provided the infiltration is limited to formational materials and not within compacted fill. To prevent lateral water migration from adversely impacting public utilities and roadway improvements, impermeable side liners (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride**,** PVC) and subdrain are recommended. The liner should only extend up the sidewalls of the trench. The subdrain should be perforated, installed near the base of the excavation, or elevated slightly to promote infiltration of water into the ground, be at least 4-inches in diameter and consist of Schedule 40 PVC pipe. The final segment of the subdrain outside the limits of the storm water BMP should consist of solid pipe and connected to a proper outlet. Any penetration of the liner should be properly waterproofed. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

The Storm Water Standard manual stipulates the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1) worksheet information to help evaluate the potential for infiltration on the property. Worksheets C.4-1 for Areas 1 through 4 of the site are presented in Appendix B.

The regional storm water standards also have a worksheet (Worksheet D.5-1) that helps the project civil engineer estimate the factor of safety based on several factors. Table 4 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE 4
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Based on our geotechnical investigation and the previous table, Table 5 presents the estimated factor values for the evaluation of the factor of safety. This table only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate. Worksheet D.5-1 is presented in Appendix C.

TABLE 5
FACTOR OF SAFETY WORKSHEET DESIGN VALUES – PART A[1]

Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	2	0.50
Predominant Soil Texture	0.25	3	0.75
Site Soil Variability	0.25	3	0.75
Depth to Groundwater/ Impervious Layer	0.25	1	0.25
Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.25

[1]The project civil engineer should complete Worksheet D.5-1 or Form I-9 using the data provided above. Additional information is required to evaluate the design factor of safety.

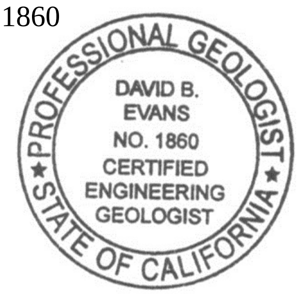
If you have questions, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Trevor E. Myers
RCE 63773

David B. Evans
CEG 1860



TEM:DBE:dmc

(4) Addressee

MERGE 56
SAN DIEGO, CALIFORNIA

0' 125' 250' 375' 500'

SCALE 1"= 250' (on 11x17)

GEOCON LEGEND

P-4 ....APPROX. LOCATION OF INFILTRATION TEST

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GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SITE PLAN

PROJECT NO. 06021 - 32 - 05
FIGURE 1
DATE 07 - 13 - 2016

Ladrillono

Plotted:07/13/2016 8:42AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\06021-32-05 (Merge 56)\06021-32-05 Site Plan.dwg

APPENDIX A

APPENDIX A

AARDVARK TEST RESULTS

FOR

MERGE 56
SAN DIEGO, CALIFORNIA

PROJECT NO. 06021-32-05

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-1	Ref. EL:	378.00
		Bottom EL:	375.67

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	2.33	ft	=	71.02	cm
Dist. Btwn Reservoir & Top of Borehole:	2.25	ft	=	68.58	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	121.1834	cm
Head Height (h):	11.90	cm
Distance Btwn Constant Head and Water Table (L):	550.49	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10566			
2	20.00	20.00	10174	392	392	19.60
3	35.00	15.00	10054	120	512	8.00
4	55.00	20.00	9928	126	638	6.30
5	65.00	10.00	9868	60	698	6.00
6	80.00	15.00	9780	88	786	5.87
7	96.00	16.00	9654	126	912	7.88
8	121.00	25.00	9444	210	1122	8.40
9	131.00	10.00	9368	76	1198	7.60
10	146.00	15.00	9258	110	1308	7.33
11	171.00	25.00	9068	190	1498	7.60
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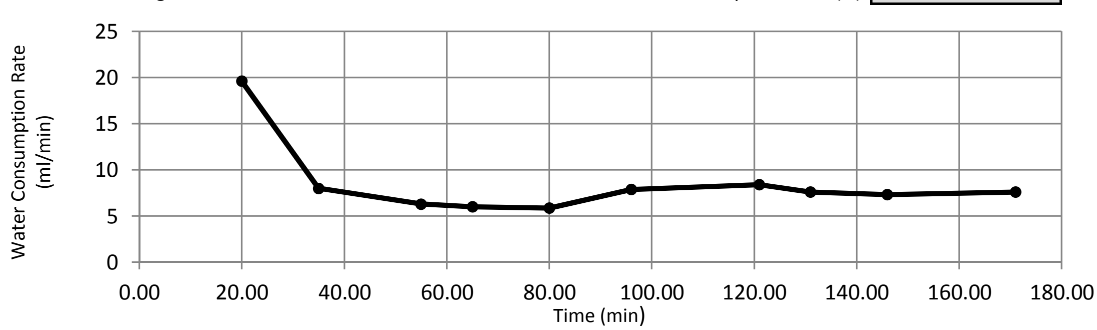
*1 ml = 1 g

Steady Flow Rate (Q): 7.00 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0073 cm/min 0.1722 in/hr

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-2	Ref. EL:	375.00
		Bottom EL:	372.00

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	3.00	ft	=	91.44	cm
Dist. Btwn Reservoir & Top of Borehole:	2.42	ft	=	73.76	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	146.7866	cm
Head Height (h):	11.98	cm
Distance Btwn Constant Head and Water Table (L):	530.14	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10820			
2	16.00	16.00	10670	150	150	9.38
3	30.00	14.00	10570	100	250	7.14
4	65.00	35.00	10408	162	412	4.63
5	80.00	15.00	10354	54	466	3.60
6	90.00	10.00	10318	36	502	3.60
7	100.00	10.00	10296	22	524	2.20
8	110.00	10.00	10268	28	552	2.80
9	120.00	10.00	10240	28	580	2.80
10	130.00	10.00	10210	30	610	3.00
11	145.00	15.00	10172	38	648	2.53
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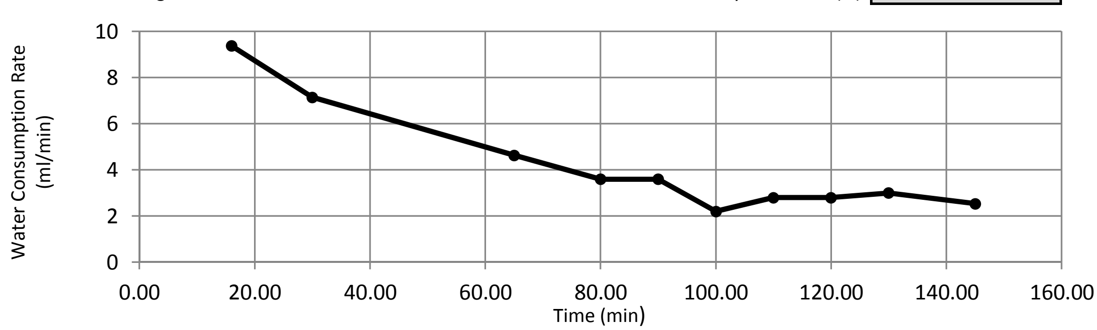
*1 ml = 1 g

Steady Flow Rate (Q): 2.20 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0023 cm/min 0.0537 in/hr

GEOCON

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-3	Ref. EL:	381.00
		Bottom EL:	380.21

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	0.79	ft	=	24.08	cm
Dist. Btwn Reservoir & Top of Borehole:	2.25	ft	=	68.58	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	74.2442	cm
Head Height (h):	11.76	cm
Distance Btwn Constant Head and Water Table (L):	597.28	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10420			
2	10.00	10.00	9930	490	490	49.00
3	25.00	15.00	9448	482	972	32.13
4	35.00	10.00	9176	272	1244	27.20
5	45.00	10.00	8934	242	1486	24.20
6	57.00	12.00	8660	274	1760	22.83
7	70.00	13.00	8360	300	2060	23.08
8	80.00	10.00	8120	240	2300	24.00
9	90.00	10.00	7898	222	2522	22.20
10	105.00	15.00	7560	338	2860	22.53
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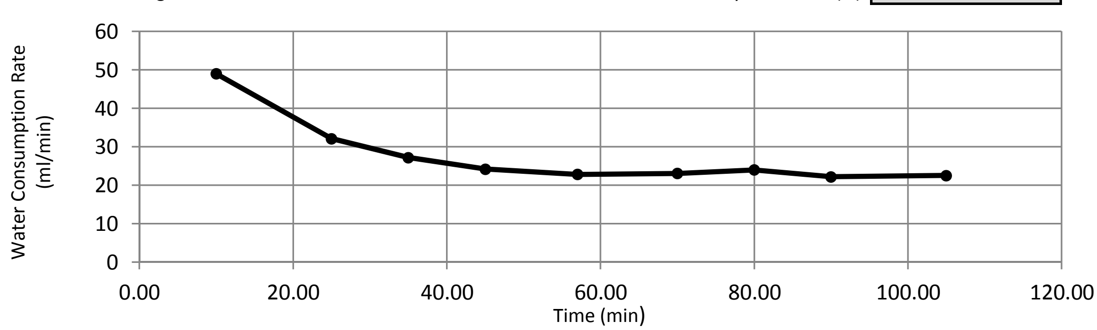
*1 ml = 1 g

Steady Flow Rate (Q): 22.00 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0233 cm/min 0.5497 in/hr

Aardvark Permeameter Data Analysis

Project Name:	MERGE 56	Date:	6/29/2016
Project Number:	06021-32-05	By:	TM
Borehole Location:	P-4	Ref. EL:	412.00
		Bottom EL:	409.67

Borehole Diameter (2r):	4.00	in	=	10.16	cm
Borehole Depth (H):	2.33	ft	=	71.02	cm
Dist. Btwn Reservoir & Top of Borehole:	2.17	ft	=	66.14	cm
Depth to Water Table (s):	20.00	ft	=	609.60	cm
Height APM Raised from Bottom:	1.00	in	=	2.54	cm

Distance Btwn Resevoir and APM (D):	118.745	cm
Head Height (h):	11.90	cm
Distance Btwn Constant Head and Water Table (L):	550.48	cm

Reading	Time (min)	Time Elapsed (min)	Resevoir Water Weight (g)	Interval Water Consumption (g)	Total Water Consumption (g)	*Water Consumption Rate (ml/min)
1	0.00		10156			
2	55.00	55.00	6212	3944	3944	71.71
3	75.00	20.00	5116	1096	5040	54.80
4			11060			
5	90.00	15.00	10168	892	892	59.47
6	105.00	15.00	9356	812	1704	54.13
7	120.00	15.00	8594	762	2466	50.80
8	130.00	10.00	8106	488	2954	48.80
9	145.00	15.00	7404	702	3656	46.80
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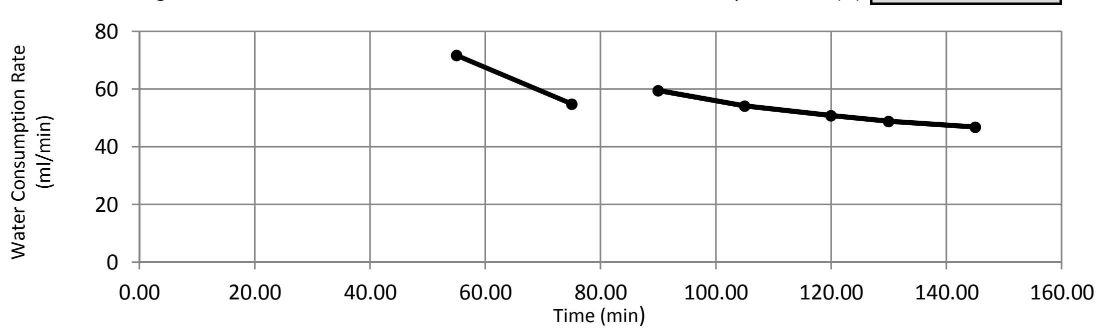
*1 ml = 1 g

Steady Flow Rate (Q): 42.00 ml/min



Field-Saturated Hydraulic Conductivity:

Case 1: L/h > 3 K_{sat} = 0.0438 cm/min 1.0342 in/hr

APPENDIX B

APPENDIX B

WORKSHEETS C.4-1

FOR

MERGE 56
SAN DIEGO, CALIFORNIA

PROJECT NO. 06021-32-05

Area 1

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying soils using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 0.17 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.09 iph at this location. The proposed BMP's are expected to expose compacted fill and/or formational materials with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.09 iph.			
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.		X
Provide basis: This general location is adjacent to a proposed fill slope. Infiltration of storm water, if allowed to saturate the compacted fill and slope zone soils, would reduce the factor of safety of the proposed slope below current standards.			

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 comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.	X	
Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all 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 Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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: The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Saturation of the compacted fill and slope zone soils must be avoided to prevent settlement and slope instability. Any partial infiltration should occur within the underlying formational materials. Side liners and subdrains are recommended to help prevent lateral water migration into the compacted fill and utility trenches. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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: Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, provided the compacted fill and slope zone materials do not become saturated, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration. It is imperative that the slope zone soils do not become saturated to avoid slope instability.

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: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.			
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 presentedin Appendix C.3.	X	
Provide basis: Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.			
Part 2 Result*	If all answers from row 1-4 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.**		Partial Infiltration

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

Area 2

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying soils using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 0.05 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.025 iph at this location. The proposed BMP's are expected to expose compacted fill and/or formational materials with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.025 iph.			
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.	X	
Provide basis: Provided any infiltration BMP's are founded in the formational materials below any compacted fill, the adverse impacts of storm water infiltration could be reasonably mitigated using side liners to prevent lateral water migration from adversely impacting utilities or nearby fill slopes.			

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 comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.	X	
Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all 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 Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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: The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Saturation of the compacted fill and slope zone soils must be avoided to prevent settlement and slope instability. Any partial infiltration should occur within the underlying formational materials. Side liners and subdrains are recommended to help prevent lateral water migration into the compacted fill and utility trenches. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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: Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, provided the compacted fill and slope zone materials do not become saturated, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration. It is imperative that any adjacent slope zone soils do not become saturated to avoid slope instability.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP’s adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.</td></tr>
<tr><td>8</td><td>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 presentedin Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 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.</td><td>Partial Infiltration</td></tr>
</table>

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

Area 3

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying soils using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 0.55 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.28 iph at this location. The proposed BMP's are expected to expose compacted fill with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.28 iph.			
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.		X
Provide basis: This area will be underlain by compacted fill. Full infiltration of storm water should be avoided to prevent fill saturation and the resulting settlement and/or heave, depending on soil types exposed after grading.			

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 comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.	X	
Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.			
Part 1 Result*	If all 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 Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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: The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Saturation of the compacted fill soils should be avoided to prevent settlement and/or heave. Side liners and subdrains are recommended to help prevent lateral water migration into the compacted fill and utility trenches. Some distress to surrounding improvements may be experienced as a result of storm water infiltration, but could be limited using subdrains and side liners. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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: Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, provided the compacted fill materials do not become saturated, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration. It is imperative that any adjacent slope zone soils do not become saturated to avoid slope instability.

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: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.			
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 presentedin Appendix C.3.	X	
Provide basis: Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.			
Part 2 Result*	If all answers from row 1-4 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.**	Partial Infiltration	

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

Area 4

Categorization of Infiltration Feasibility 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?**			
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: We measured the field saturated hydraulic conductivity (Ksat) of the underlying Terrace Deposits using an Aardvark constant head permeameter, which was placed inside a 4-inch diameter boring. The unfactored infiltration rate was 1.03 inches per hour (iph). After applying a feasibility factor of safety of 2, the infiltration rate is 0.52 iph at this location. However, the terrace deposits tested will likely be removed during grading, therefore the test results obtained at Locations P-1, P-2, and P-3 are considered more representative of the anticipated geologic conditions after site grading. The proposed BMP's are expected to expose formational materials with very low permeability. The Aardvark Permeameter test results are attached. In accordance with the Riverside County storm water procedures, which reference the United States Bureau of Reclamation Well Permeameter Method (USBR 7300), the saturated hydraulic conductivity (Ksat) is equal to the unfactored infiltration rate, therefore, for feasibility considerations, the infiltration rate at this location is 0.52 iph, however, the rates obtained in P-1, P-2, and P-3, of 0.09, 0.03, and 0.28 iph, respectively, are considered more applicable.			
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.	X	
Provide basis: Provided any infiltration BMP's are founded in the formational materials, the adverse impacts of storm water infiltration could be reasonably mitigated using side liners to prevent lateral water migration from adversely impacting utilities, foundations, and other improvements.			

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 2 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>3</td><td>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 comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater is considered negligible.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as 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.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis: A shallow groundwater table does not exist within 10 feet of any proposed BMP, we are not aware of any wells within 100 feet of the site, and given the limited amount of water that would infiltrate into the ground after a rain event, it is our opinion there are no adverse impacts to groundwater, water balance impacts to stream flow, or impacts on any downstream water rights. It should be noted that researching downstream water rights or evaluating water balance issues to stream flows is beyond the scope of the geotechnical consultant.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all 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</td><td>No Full Infiltration</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City 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 any 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: The adverse impacts of storm water infiltration can be reasonably mitigated to acceptable levels using side liners and subdrains. Any partial infiltration should occur within the underlying formational materials. Side liners and subdrains are recommended to help prevent lateral water migration into the utility trenches and beneath foundations and improvements. These statements are based on a comprehensive evaluation of Appendix C.2.

Criteria	Screening Question	Yes	No
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: Based on our comprehensive evaluation of risks associated with implementing storm water infiltration BMP's, the adverse impacts of partial infiltration could be reasonably mitigated using side liners and subdrains to prevent lateral water migration.

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: Groundwater is not located within 10 feet from any proposed infiltration BMP, therefore the risk of storm water infiltration BMP's adversely impacting groundwater or contributing to the flow of contaminated surface waters into the groundwater table is considered negligible.			
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 presentedin Appendix C.3.	X	
Provide basis: Geocon is not aware of any downstream water rights that would be affected by incidental infiltration of storm water. However, researching downstream water rights is beyond the scope of the geotechnical consultant.			
Part 2 Result*	If all answers from row 1-4 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.**		Partial Infiltration

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

Soil Map—San Diego County Area, California
(Merge 56)

Map Scale: 1:4,260 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: http://websoilsurvey.nrcs.usda.gov
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 9, Sep 17, 2015

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

Date(s) aerial images were photographed: Nov 3, 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.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes	10.1	15.9%
RdC	Redding gravelly loam, 2 to 9 percent slopes	42.3	66.5%
TeF	Terrace escarpments	11.2	17.6%
Totals for Area of Interest		**63.6**	**100.0%**

San Diego County Area, California

OhE—Olivenhain cobbly loam, 9 to 30 percent slopes

Map Unit Setting

National map unit symbol: hbfc
Elevation: 100 to 600 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 290 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition

Olivenhain and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olivenhain

Setting

Landform: Marine terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Gravelly alluvium derived from mixed sources

Typical profile

H1 - 0 to 10 inches: cobbly loam
H2 - 10 to 27 inches: very cobbly clay, very cobbly clay loam
H2 - 10 to 27 inches: cobbly loam, cobbly clay loam
H3 - 27 to 45 inches:
H3 - 27 to 45 inches:

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: CLAYPAN (1975) (R019XD061CA)

Minor Components

Diablo

Percent of map unit: 4 percent

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Depressions

Huerhuero

Percent of map unit: 2 percent

Linne

Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

San Diego County Area, California

RdC—Redding gravelly loam, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbfy
Elevation: 100 to 1,500 feet
Mean annual precipitation: 14 to 25 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 230 to 320 days
Farmland classification: Not prime farmland

Map Unit Composition

Redding and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Redding

Setting

Landform: Terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Typical profile

H1 - 0 to 15 inches: gravelly loam
H2 - 15 to 30 inches: gravelly clay loam, gravelly clay
H2 - 15 to 30 inches: indurated
H3 - 30 to 45 inches:

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: 20 to 40 inches to duripan
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: ACID CLAYPAN (Claypan Mesas - 1975) (R019XD062CA)

Minor Components

Unnamed, ponded
Percent of map unit: 2 percent
Landform: Depressions

Oliventain
Percent of map unit: 2 percent

Huerhuero
Percent of map unit: 2 percent

Chesterton
Percent of map unit: 2 percent

Unnamed
Percent of map unit: 2 percent

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

San Diego County Area, California

TeF—Terrace escarpments

Map Unit Composition

Terrace escarpments: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Terrace Escarpments

Setting

Landform: Escarpments
Landform position (three-dimensional): Riser

Typical profile

H1 - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

APPENDIX C

APPENDIX C

WORKSHEET D.5-1

FOR

MERGE 56
SAN DIEGO, CALIFORNIA

PROJECT NO. 06021-32-05

Worksheet D.5-1: Factor of Safety and Design Infiltration Rate Worksheet

Factor of Safety and Design Infiltration Rate Worksheet			Worksheet D.5-1		
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		Predominant soil texture	0.25	3	0.75
		Site soil variability	0.25	3	0.75
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.25
B	Design	Level of pretreatment/ expected sediment loads	0.5		
		Redundancy/resiliency	0.25		
		Compaction during construction	0.25		
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{total} = S_A \times S_B$					
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					