APPENDIX F

Betty Ford Center Expansion

Preliminary Hydrology Study

October 24, 2019

Prepared by

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Betty Ford Center Expansion

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Prepared By:

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Preparation Date:

10/24/2019

Purpose of Report

The purpose of this Preliminary Hydrology Report is to analyze in detail the proposed storm water conveyance and storage facilities as detailed on the Preliminary Grading Plan for the project prepared by Michael Baker International, and to determine at a conceptual level if the proposed facilities are adequate to warrant conceptual approval and final engineering for the proposed project.

Site Location and Characteristics

The site is located on the eastern side of the existing Betty Ford Center Campus in Rancho Mirage. The main hospital facilities lie to the west, vacant undeveloped desert to the north, Vista Del Sol Road to the east, and vacant undeveloped desert to the immediate south. The project consists of Day Treatment Building and future expansion site and parking lot to be constructed later. The site is located on approximately 5.91 acres of undeveloped desert, covered at present with drifting sand dunes and desert brush.

There are also two proposed residential treatments centers that will replace four existing buildings on the existing Betty Ford Center campus. The overall impervious area here will be reduced compared to the existing condition and as such will not need any peak flow mitigation. The existing pond (approximately 3 ac-ft volume) will not receive flows higher than the existing condition. The new drainage infrastructure proposed will be discharge the roof and nuisance flows to the existing pond. For this reason, the impact to this part of the site is not analyzed.

Methods and Procedures

The Riverside County Flood Control and Water Conservation District has been used as the primary guide for developing both the Rational Method Calculations for sizing the storm water conveyance systems, and the Shortcut Synthetic Unit Hydrographs for sizing the Retention Basins. Departures from the Manual include using the NOAA 14 Rainfall Data in lieu of the NOAA II data presented in the manual, and more specific information about the soils on the site.

Rainfall Data

For the Rational Calculations, the prescribed values for this region have been utilized from Plate D-4.1 of the RCFC&WCD Hydrology Manual are available in the CivilDesign software program which was used to calculate the peak flow rates for the 100-yr design storm.

For the Synthetic Unit Hydrograph Calculations, the rainfall values to be used for Retention Basin sizing are as follows, derived from the NOAA 14 Atlas:

3-hour, 100-year recurrence = 2.64 inches per hour

6-hour, 100-year recurrence = 3.33 inches per hour

24-hour, 100-year recurrence = 4.78 inches per hour

Soil Characteristics

For Rational Calculations, based on the direction from the RCFC&WCD Hydrology Manual, Soil Group A, Antecedent Moisture Condition II is deemed the most appropriate representation for modeling this site. Per Plates D-5.5 and D-5.6 of the Manual, the appropriate runoff index number is 32, and the appropriate impervious cover ratio is 90. Per Plate D-5.2 of the Manual, a runoff coefficient of C=0.86 is appropriate for all subareas in the study.

Proposed Site Plan Details

The proposed site plan provides for 2 different retention basins on the site on either side of the new access road at the south side of the site. The proposed site grading contains a series of high points and low point collection locations carefully planned to proportionately collect and convey runoff to different portions of the site. Please see the attached hydrology maps for both the Rational and Synthetic Unit Hydrograph Calculations as they clearly detail the various subareas and collection systems to be employed. The basins are sized with enough capacity to store the 100-yr 24-hour design storm volume.

Manning's Equation N Values

Manning's N values for asphalt with a smooth texture are typically taken as 0.013. N values for trowled finished Concrete Gutter are typically taken as 0.012. It was considered appropriate to utilize a manning's value of 0.013 for all curb/gutter/pavement cross sections.

HDPE pipe has been proven to easily achieve manning's N values of 0.012 or better in numerous tests, and therefore all pipes were sized utilizing a manning's N value of 0.012 for HDPE pipes.

Summary of Rational Method Modeling

To ensure the conveyance systems can convey the proposed Q100 flows to the retention basins, the conveyance systems were analyzed using Rational Method Calculations based on the RCFC&WCD manual. The initial subareas were analyzed to determine watercourse length, area, slope and time of concentration, and progressively analyzed to developed peak Q's. The peak Q's were applied to the street sections and pipes utilizing Hydraflow Express Software, which expedites solving the manning's equation for complex sections.

The full calculations can be found the Rational Calculations Section of this Report. A brief Summary is provided below:

Area Name	**Area**	**I**	**C**	**Q100**	**Pipe Size**
Subarea A-1	1.57 Acres	4.03	0.868	5.46 CFS	N/A
Subarea A-2	0.66 Acres	5.23	0.868	2.99 CFS	18" HDPE
Subarea A-3	0.37 Acres	4.03	0.868	1.29 CFS	18" HDPE
Subarea A-4	0.45 Acres	4.63	0.868	1.81 CFS	24" HDPE
Subarea A-5	0.44 Acres	5.05	0.868	1.93 CFS	18" HDPE
Subarea A-6	0.98 Acres	3.80	0.868	3.21 CFS	N/A
Subarea A-7	0.12 Acres	4.70	0.868	0.49 CFS	18" HDPE
Subarea A-8	0.12 Acres	4.70	0.868	0.49 CFS	18" HDPE
Subarea A-9	1.20 Acres	3.75	0.868	3.88 CFS	N/A

In short, the proposed conveyance system is an appropriately designed and sized system for the proposed project.

<u>Synthetic Unit Hydrograph Modeling</u>

The project is required to retain 100% of Q100 storm event onsite. A spreadsheet based on the Shortcut Method Synthetic Unit Hydrograph approach as prescribed by the RCFC&WCD Hydrology Manual has been utilized to perform the calculations. Basin storage capacity is modeled based on manual integration of the basin area at 1 foot contour intervals. Rainfall input data for the 100 year, 3- , 6- and 24-hour storms is input per NOAA 14 Atlas. Basin Inflow is modeled in 5 minute intervals for the 3 and 6 hour storms, and 15 minute intervals for the 24 hour storm, based on the design storm unit hydrographs presented in the manual.

The full calculations can be found the Synthetic Unit Hydrograph Calculations Section of this Report. A brief Summary is provided below:

Basin Name	Top	Depth	Area	Volume	100 Year Water Surface		
			@ top		3 Hour	6 Hour	24 Hour
Basin "A"	229	4 Ft	24,034 sq ft	53,209 Cu Ft	228.04	228.13	228.60

Summary

Based on preliminary review, the proposed grading design, conveyance system, and retention basins are adequate to facilitate the needs of the project. Based on a conceptual review, the system warrants approval and should be advanced to final design. The findings of this report should be incorporated into a final hydrology study which will more specifically address the details incorporated into the final engineering design.

Rational Method Calculations

CITY OF RANCHO MIRAGE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

HYDROLOGY EXHIBIT

BETTY FORD CENTER BUILDING EXPANSION

39000 Bob Hope Drive, Rancho Mirage, CA 92270

REVISIONS			
NO.	BY	DATE	REMARKS

PREPARED BY:

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Palm Desert, CA 92211
Phone: (760) 346-7481
MBAKERINTL.COM

DESIGN BY	DP
DRAWN BY	DP
CHECKED BY	PK
SCALE	AS NOTED

HYDROLOGY EXHIBIT

PARCEL 2 OF LLA 18-01, PARCELS 2 AND 3 OF LLA 99-19

WITHIN THE CITY OF RANCHO MIRAGE, A PORTION OF SECTIONS T.5S, R.6E S.B.M, RIVERSIDE COUNTY, CALIFORNIA

FOR:

SHEET 1 OF 1 SHEETS

DATE 10/23/19

DRAWING

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               Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
       Rational Hydrology Study        Date: 10/23/19  File:PROP100YRA.out
------------------------------------------------------------------------
BETTY FORD CENTER PRELIMINARY HYDROLOGY
RATIONAL METHOD CALCULATIONS
PROPOSED CONDITION - 100 YR DESIGN STORM
ANALYZED BY PK ON 10-23-19
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 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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Program License Serial Number 6388

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Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [ Cherry Valley ] area used.
10 year storm 10 minute intensity =  2.490(In/Hr)
10 year storm 60 minute intensity =  0.930(In/Hr)
100 year storm 10 minute intensity =  3.750(In/Hr)
100 year storm 60 minute intensity =  1.400(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.400(In/Hr)
Slope of intensity duration curve = 0.5500




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Process from Point/Station       10.000 to Point/Station       20.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   588.000(Ft.)
Top (of initial area) elevation =   240.000(Ft.)
Bottom (of initial area) elevation =   230.500(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.01616  s(percent)=       1.62
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.774 min.
Rainfall intensity =      4.030(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.863
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      5.460(CFS)
Total initial stream area =        1.570(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.570(Ac.)
Runoff from this stream =      5.460(CFS)
Time of concentration =    8.77 min.
Rainfall intensity =     4.030(In/Hr)
Program is now starting with Main Stream No. 2
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Process from Point/Station       10.000 to Point/Station       30.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   236.000(Ft.)
Top (of initial area) elevation =   240.000(Ft.)
Bottom (of initial area) elevation =   233.500(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.02754  s(percent)=       2.75
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.474 min.
Rainfall intensity =      5.225(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.868
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.994(CFS)
Total initial stream area =        0.660(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       30.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   230.500(Ft.)
Downstream point/station elevation =   228.500(Ft.)
Pipe length  =   200.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.994(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.994(CFS)
Normal flow depth in pipe =    6.30(In.)
Flow top width inside pipe =   17.17(In.)
Critical Depth =    7.89(In.)
Pipe flow velocity =      5.43(Ft/s)
Travel time through pipe =    0.61 min.
Time of concentration (TC) =     6.09 min.


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Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.660(Ac.)
Runoff from this stream =      2.994(CFS)
Time of concentration =    6.09 min.
Rainfall intensity =     4.928(In/Hr)
Summary of stream data:

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


1        5.460      8.77               4.030
2        2.994      6.09               4.928
Largest stream flow has longer time of concentration
Qp =      5.460 + sum of
         Qb          Ia/Ib
          2.994 *    0.818 =      2.449
Qp =      7.909

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.460       2.994
Area of streams before confluence:
        1.570        0.660


Results of confluence:
Total flow rate =      7.909(CFS)
Time of concentration =     8.774 min.
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Effective stream area after confluence  =      2.230(Ac.)


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Process from Point/Station       20.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.863
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     8.77 min.
Rainfall intensity =      4.030(In/Hr) for a   100.0 year storm
Subarea runoff =      1.287(CFS) for      0.370(Ac.)
Total runoff =      9.196(CFS)        Total area =       2.600(Ac.)


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Process from Point/Station       20.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   228.500(Ft.)
Downstream point/station elevation =   228.000(Ft.)
Pipe length  =   236.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     9.196(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     9.196(CFS)
Normal flow depth in pipe =   16.45(In.)
Flow top width inside pipe =   22.29(In.)
Critical Depth =   12.99(In.)
Pipe flow velocity =      4.00(Ft/s)
Travel time through pipe =    0.98 min.
Time of concentration (TC) =     9.76 min.


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Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.600(Ac.)
Runoff from this stream =      9.196(CFS)
Time of concentration =    9.76 min.
Rainfall intensity =     3.802(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       10.000 to Point/Station       50.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   311.000(Ft.)
Top (of initial area) elevation =   240.000(Ft.)
Bottom (of initial area) elevation =   235.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01608  s(percent)=       1.61
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.807 min.
Rainfall intensity =      4.634(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.866
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.806(CFS)
Total initial stream area =        0.450(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       50.000 to Point/Station       70.000
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**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   232.500(Ft.)
Downstream point/station elevation =   231.500(Ft.)
Pipe length  =   178.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.806(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.806(CFS)
Normal flow depth in pipe =    5.63(In.)
Flow top width inside pipe =   16.69(In.)
Critical Depth =    6.06(In.)
Pipe flow velocity =      3.83(Ft/s)
Travel time through pipe =    0.77 min.
Time of concentration (TC) =     7.58 min.


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Process from Point/Station       70.000 to Point/Station       70.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.450(Ac.)
Runoff from this stream =      1.806(CFS)
Time of concentration =    7.58 min.
Rainfall intensity =     4.367(In/Hr)


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Process from Point/Station       60.000 to Point/Station       70.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   231.000(Ft.)
Top (of initial area) elevation =   238.000(Ft.)
Bottom (of initial area) elevation =   233.500(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.01948  s(percent)=       1.95
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.816 min.
Rainfall intensity =      5.053(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.868
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.929(CFS)
Total initial stream area =        0.440(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       70.000 to Point/Station       70.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.440(Ac.)
Runoff from this stream =      1.929(CFS)
Time of concentration =    5.82 min.
Rainfall intensity =     5.053(In/Hr)
Summary of stream data:

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


1        1.806      7.58                  4.367
2        1.929      5.82                  5.053
Largest stream flow has longer or shorter time of concentration
Qp =      1.929 + sum of
         Qa           Tb/Ta
          1.806 *    0.767 =      1.385
Qp =      3.314

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.806       1.929
Area of streams before confluence:
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        0.450        0.440
Results of confluence:
Total flow rate =      3.314(CFS)
Time of concentration =     5.816 min.
Effective stream area after confluence =      0.890(Ac.)


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Process from Point/Station       70.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   231.000(Ft.)
Downstream point/station elevation =   228.000(Ft.)
Pipe length  =   161.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.314(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.314(CFS)
Normal flow depth in pipe =    5.64(In.)
Flow top width inside pipe =   16.70(In.)
Critical Depth =    8.32(In.)
Pipe flow velocity =      6.99(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =     6.20 min.


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Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.890(Ac.)
Runoff from this stream =      3.314(CFS)
Time of concentration =    6.20 min.
Rainfall intensity =     4.878(In/Hr)
Summary of stream data:

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


1        9.196      9.76               3.802
2        3.314      6.20               4.878
Largest stream flow has longer time of concentration
Qp =      9.196 + sum of
         Qb         Ia/Ib
          3.314 *    0.779 =      2.583
Qp =     11.778

Total of 2 main streams to confluence:
Flow rates before confluence point:
       9.196       3.314
Area of streams before confluence:
        2.600        0.890


Results of confluence:
Total flow rate =     11.778(CFS)
Time of concentration =     9.757 min.
Effective stream area after confluence  =      3.490(Ac.)


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Process from Point/Station       40.000 to Point/Station       40.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.76 min.
Rainfall intensity =      3.802(In/Hr) for a   100.0 year storm
Subarea runoff =      3.210(CFS) for      0.980(Ac.)
Total runoff =     14.988(CFS)       Total area =       4.470(Ac.)
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Process from Point/Station       40.000 to Point/Station       80.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   228.000(Ft.)
Downstream point/station elevation =   226.250(Ft.)
Pipe length  =    51.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    14.988(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    14.988(CFS)
Normal flow depth in pipe =    8.13(In.)
Flow top width inside pipe =   30.11(In.)
Critical Depth =   14.79(In.)
Pipe flow velocity =     12.51(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     9.82 min.


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Process from Point/Station       80.000 to Point/Station       80.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.470(Ac.)
Runoff from this stream =     14.988(CFS)
Time of concentration =    9.82 min.
Rainfall intensity =     3.787(In/Hr)


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Process from Point/Station       90.000 to Point/Station       80.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   290.000(Ft.)
Top (of initial area) elevation =   234.340(Ft.)
Bottom (of initial area) elevation =   229.750(Ft.)
Difference in elevation =     4.590(Ft.)
Slope =    0.01583  s(percent)=      1.58
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.640 min.
Rainfall intensity =      4.698(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.866
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.488(CFS)
Total initial stream area =        0.120(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       80.000 to Point/Station       80.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.120(Ac.)
Runoff from this stream =      0.488(CFS)
Time of concentration =    6.64 min.
Rainfall intensity =     4.698(In/Hr)
Summary of stream data:

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


1       14.988      9.82                 3.787
2        0.488      6.64                 4.698
Largest stream flow has longer time of concentration
Qp =     14.988 + sum of
         Qb         Ia/Ib
          0.488 *    0.806 =      0.394
Qp =     15.382

Total of 2 streams to confluence:
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Flow rates before confluence point:
      14.988       0.488
Area of streams before confluence:
        4.470       0.120
Results of confluence:
Total flow rate =     15.382(CFS)
Time of concentration =     9.825 min.
Effective stream area after confluence =      4.590(Ac.)


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Process from Point/Station       80.000 to Point/Station       94.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   226.250(Ft.)
Downstream point/station elevation =   226.000(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    15.382(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    15.382(CFS)
Normal flow depth in pipe =   11.82(In.)
Flow top width inside pipe =   33.81(In.)
Critical Depth =   14.99(In.)
Pipe flow velocity =      7.61(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     9.89 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       94.000 to Point/Station       94.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.590(Ac.)
Runoff from this stream =     15.382(CFS)
Time of concentration =    9.89 min.
Rainfall intensity =     3.773(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       92.000 to Point/Station       94.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   290.000(Ft.)
Top (of initial area) elevation =   234.340(Ft.)
Bottom (of initial area) elevation =   229.750(Ft.)
Difference in elevation =     4.590(Ft.)
Slope =    0.01583  s(percent)=      1.58
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.640 min.
Rainfall intensity =      4.698(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.866
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.488(CFS)
Total initial stream area =        0.120(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       94.000 to Point/Station       94.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.120(Ac.)
Runoff from this stream =      0.488(CFS)
Time of concentration =    6.64 min.
Rainfall intensity =     4.698(In/Hr)
Summary of stream data:

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

```
1       15.382      9.89                3.773
2        0.488      6.64                4.698
Largest stream flow has longer time of concentration
Qp =     15.382 + sum of
          Qb         Ia/Ib
           0.488 *    0.803 =      0.392
Qp =     15.774

Total of 2 streams to confluence:
Flow rates before confluence point:
      15.382       0.488
Area of streams before confluence:
        4.590        0.120
Results of confluence:
Total flow rate =     15.774(CFS)
Time of concentration =     9.891 min.
Effective stream area after confluence =      4.710(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       94.000 to Point/Station      100.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =   226.000(Ft.)
Downstream point/station elevation =   225.000(Ft.)
Pipe length  =    56.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    15.774(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    15.774(CFS)
Normal flow depth in pipe =    9.84(In.)
Flow top width inside pipe =   32.09(In.)
Critical Depth =   15.22(In.)
Pipe flow velocity =     10.07(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     9.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      100.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.98 min.
Rainfall intensity =      3.754(In/Hr) for a   100.0 year storm
Subarea runoff =      3.880(CFS) for      1.200(Ac.)
Total runoff =     19.654(CFS)       Total area =       5.910(Ac.)
End of computations, total study area =           5.91 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

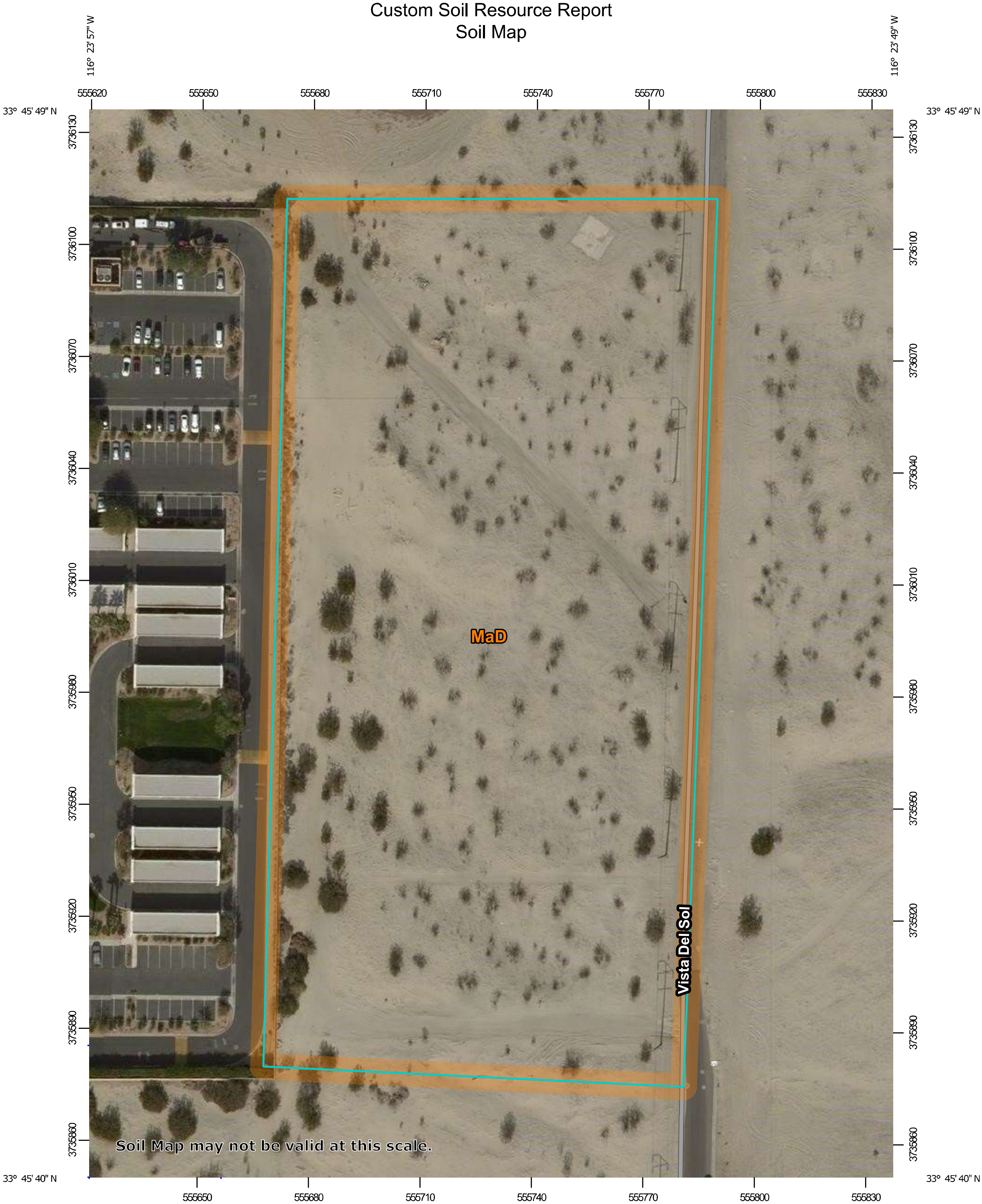
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Riverside County, Coachella Valley Area, California

Betty Ford Center

October 23, 2019

Soil Map



Map Scale: 1:1,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MaD	Myoma fine sand, 5 to 15 percent slopes	6.7	100.0%
Totals for Area of Interest		**6.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Riverside County, Coachella Valley Area, California

MaD—Myoma fine sand, 5 to 15 percent slopes

Map Unit Setting

National map unit symbol: hkw4
Elevation: -200 to 1,800 feet
Mean annual precipitation: 2 to 4 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 270 to 320 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Myoma and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Myoma

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind blown sandy alluvium

Typical profile

H1 - 0 to 18 inches: fine sand
H2 - 18 to 60 inches: sand

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Coachella

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed, calcareous soils

Percent of map unit: 5 percent
Hydric soil rating: No

Riverwash

Percent of map unit: 3 percent
Landform: Channels
Hydric soil rating: Yes

Carsitas

Percent of map unit: 2 percent
Hydric soil rating: No

NOAA Atlas 14, Volume 6, Version 2
Location name: Rancho Mirage, California, USA*
Latitude: 33.7647°, Longitude: -116.4056°
Elevation: 237.55 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.067** (0.056-0.081)	**0.106** (0.088-0.128)	**0.166** (0.138-0.202)	**0.224** (0.184-0.275)	**0.318** (0.253-0.403)	**0.404** (0.314-0.523)	**0.505** (0.384-0.672)	**0.627** (0.463-0.858)	**0.890** (0.630-1.27)	**1.22** (0.834-1.81)
10-min	**0.096** (0.080-0.116)	**0.152** (0.126-0.184)	**0.238** (0.198-0.290)	**0.321** (0.264-0.394)	**0.455** (0.362-0.578)	**0.578** (0.451-0.750)	**0.724** (0.550-0.963)	**0.899** (0.664-1.23)	**1.27** (0.903-1.82)	**1.75** (1.20-2.59)
15-min	**0.116** (0.097-0.141)	**0.183** (0.153-0.222)	**0.288** (0.239-0.350)	**0.388** (0.320-0.476)	**0.551** (0.438-0.699)	**0.700** (0.545-0.907)	**0.876** (0.665-1.16)	**1.09** (0.803-1.49)	**1.54** (1.09-2.20)	**2.12** (1.45-3.13)
30-min	**0.183** (0.153-0.222)	**0.289** (0.241-0.350)	**0.454** (0.377-0.552)	**0.612** (0.504-0.751)	**0.868** (0.691-1.10)	**1.10** (0.859-1.43)	**1.38** (1.05-1.84)	**1.71** (1.26-2.35)	**2.43** (1.72-3.47)	**3.34** (2.28-4.93)
60-min	**0.259** (0.216-0.314)	**0.408** (0.340-0.495)	**0.642** (0.533-0.781)	**0.865** (0.712-1.06)	**1.23** (0.977-1.56)	**1.56** (1.22-2.02)	**1.95** (1.48-2.60)	**2.42** (1.79-3.32)	**3.44** (2.43-4.91)	**4.72** (3.22-6.97)
2-hr	**0.357** (0.298-0.432)	**0.554** (0.462-0.672)	**0.852** (0.707-1.04)	**1.13** (0.926-1.38)	**1.55** (1.23-1.97)	**1.92** (1.50-2.49)	**2.35** (1.78-3.12)	**2.84** (2.09-3.88)	**3.59** (2.54-5.13)	**4.76** (3.25-7.04)
3-hr	**0.425** (0.354-0.515)	**0.657** (0.547-0.796)	**0.999** (0.829-1.21)	**1.31** (1.08-1.60)	**1.78** (1.42-2.26)	**2.19** (1.70-2.84)	**2.64** (2.01-3.51)	**3.16** (2.33-4.32)	**3.94** (2.79-5.63)	**4.81** (3.29-7.11)
6-hr	**0.569** (0.474-0.689)	**0.873** (0.727-1.06)	**1.31** (1.09-1.60)	**1.70** (1.40-2.09)	**2.29** (1.82-2.90)	**2.78** (2.17-3.61)	**3.33** (2.53-4.42)	**3.93** (2.90-5.38)	**4.84** (3.42-6.91)	**5.61** (3.83-8.29)
12-hr	**0.690** (0.576-0.836)	**1.06** (0.887-1.29)	**1.60** (1.33-1.95)	**2.07** (1.71-2.54)	**2.77** (2.21-3.52)	**3.36** (2.62-4.35)	**4.00** (3.04-5.32)	**4.71** (3.48-6.45)	**5.76** (4.08-8.23)	**6.65** (4.54-9.83)
24-hr	**0.815** (0.721-0.940)	**1.27** (1.12-1.46)	**1.91** (1.69-2.21)	**2.48** (2.17-2.89)	**3.31** (2.81-3.99)	**4.01** (3.33-4.93)	**4.78** (3.87-6.01)	**5.62** (4.44-7.27)	**6.87** (5.21-9.25)	**7.93** (5.81-11.0)
2-day	**0.921** (0.816-1.06)	**1.44** (1.27-1.66)	**2.17** (1.91-2.51)	**2.81** (2.46-3.28)	**3.76** (3.18-4.53)	**4.55** (3.78-5.59)	**5.41** (4.39-6.81)	**6.37** (5.03-8.23)	**7.77** (5.89-10.5)	**8.96** (6.57-12.5)
3-day	**0.975** (0.863-1.12)	**1.52** (1.34-1.75)	**2.30** (2.02-2.66)	**2.98** (2.61-3.48)	**3.99** (3.38-4.81)	**4.84** (4.01-5.94)	**5.76** (4.67-7.25)	**6.78** (5.36-8.77)	**8.30** (6.29-11.2)	**9.57** (7.02-13.3)
4-day	**1.01** (0.894-1.16)	**1.57** (1.39-1.81)	**2.38** (2.10-2.76)	**3.09** (2.71-3.61)	**4.14** (3.51-4.99)	**5.03** (4.17-6.18)	**5.99** (4.86-7.54)	**7.06** (5.57-9.13)	**8.64** (6.55-11.6)	**9.98** (7.32-13.9)
7-day	**1.08** (0.957-1.25)	**1.69** (1.50-1.95)	**2.57** (2.27-2.97)	**3.34** (2.92-3.90)	**4.49** (3.80-5.41)	**5.45** (4.52-6.69)	**6.49** (5.26-8.16)	**7.64** (6.03-9.88)	**9.35** (7.09-12.6)	**10.8** (7.90-15.0)
10-day	**1.13** (1.00-1.30)	**1.78** (1.57-2.05)	**2.71** (2.39-3.14)	**3.53** (3.09-4.12)	**4.75** (4.02-5.72)	**5.76** (4.79-7.08)	**6.87** (5.57-8.65)	**8.10** (6.39-10.5)	**9.90** (7.51-13.3)	**11.4** (8.37-15.9)
20-day	**1.23** (1.08-1.41)	**1.95** (1.72-2.25)	**3.00** (2.65-3.47)	**3.93** (3.44-4.59)	**5.32** (4.51-6.41)	**6.49** (5.39-7.98)	**7.77** (6.30-9.77)	**9.17** (7.24-11.9)	**11.2** (8.52-15.1)	**13.0** (9.51-18.0)
30-day	**1.36** (1.20-1.56)	**2.17** (1.92-2.51)	**3.37** (2.97-3.90)	**4.44** (3.88-5.18)	**6.05** (5.12-7.28)	**7.40** (6.14-9.09)	**8.87** (7.19-11.2)	**10.5** (8.29-13.6)	**12.9** (9.77-17.3)	**14.9** (10.9-20.7)
45-day	**1.47** (1.30-1.69)	**2.38** (2.10-2.75)	**3.73** (3.29-4.31)	**4.94** (4.32-5.76)	**6.78** (5.74-8.16)	**8.33** (6.92-10.2)	**10.0** (8.13-12.6)	**11.9** (9.39-15.4)	**14.7** (11.1-19.7)	**17.0** (12.4-23.6)
60-day	**1.58** (1.40-1.82)	**2.57** (2.27-2.97)	**4.06** (3.58-4.70)	**5.41** (4.73-6.31)	**7.45** (6.31-8.97)	**9.19** (7.63-11.3)	**11.1** (9.00-14.0)	**13.2** (10.4-17.1)	**16.3** (12.4-21.9)	**18.9** (13.9-26.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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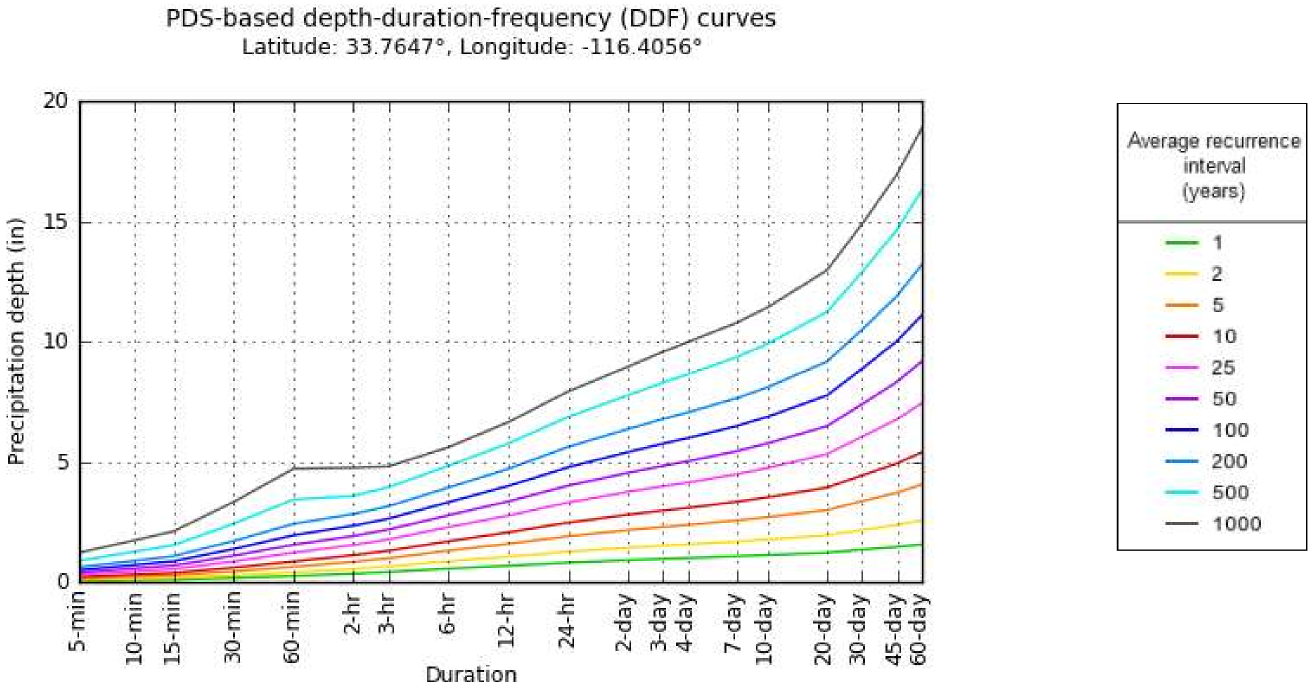
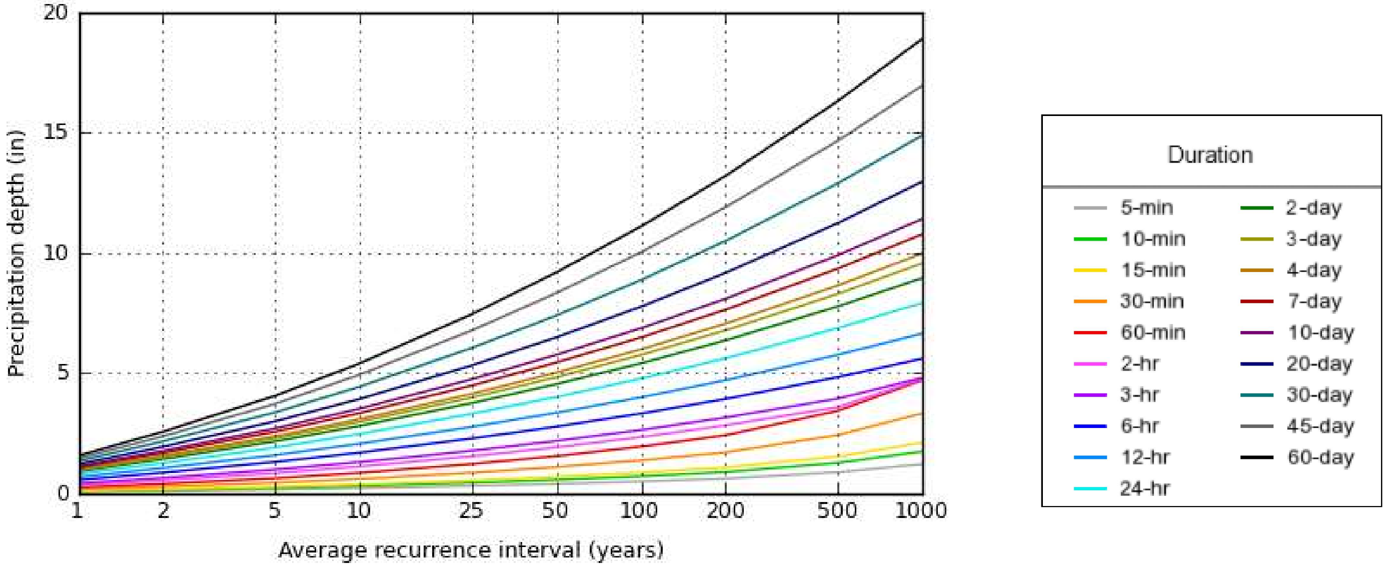
PF graphical





NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Wed Oct 23 22:01:28 2019

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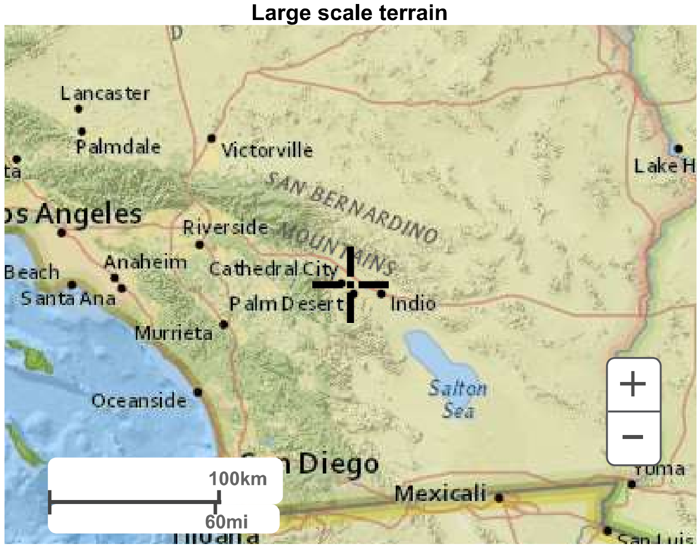
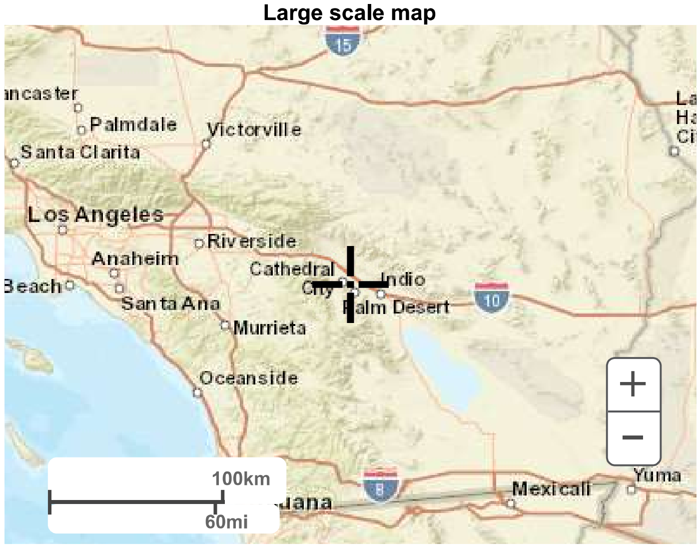
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Synthetic Unit Hydrograph

Shortcut Method

Calculations

	A	B	C	D
1	**RCFCD SYNTHETIC UNIT HYDROGRAPH**			
2	DATA INPUT SHEET			
3				
4	WORKSHEET PREPARED BY:	PK		
5				
6	PROJECT NAME	BETTY FORD CENTER UH ANALYSIS		
7	MICHAEL BAKER INTL. JOB#	174831		
8				
9	CONCENTRATION POINT DESIGNATION	RETENTION BASIN A		
10	AREA DESIGNATION	SUBAREAS A-1 thru A-9		
11				
12	TRIBUTARY AREAS	ACRES		
13				
14	COMMERCIAL	4.71		
15	PAVING/HARDSCAPE			
16	SF - 1 ACRE			
17	SF - 1/2 ACRE			
18	SF - 1/4 ACRE			
19	MF - CONDOMINIUMS			
20	MF - APARTMENTS			
21	MOBILE HOME PARK			
22	LANDSCAPING			
23	RETENTION BASIN	1.2		
24	GOLF COURSE			
25	MOUNTAINOUS			
26	LOW LOSS RATE (PERCENT)	33%		
27				
28	LENGTH OF WATERCOURSE (L)	1000		
29	LENGTH TO POINT OPPOSITE CENTROID (Lca)	530		
30				
31	ELEVATION OF HEADWATER	240		
32	ELEVATION OF CONCENTRATION POINT	225		
33				
34	AVERAGE MANNINGS 'N' VALUE	0.015		
35				
36	STORM FREQUENCY (YEAR)	100		
37				
38	POINT RAIN			
39	3-HOUR	2.64		
40	6-HOUR	3.33		
41	24-HOUR	4.78		
42				
43	BASIN CHARACTERISTICS:	ELEVATION	AREA	
44		225	8954	
45		226	11591	
46		227	14471	
47		228	19320	
48		229	24034	
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				
61	PERCOLATION RATE (in/hr)	0		
62				
63	DRYWELL DATA			
64	NUMBER USED	0		
65	PERCOLATION RATE (cfs)	0.000000		

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD	PROJECT:	BETTY FORD CENTER UH ANALYSIS		
BASIC DATA CALCULATION FORM	MBI JOB#	174831		
SHORTCUT METHOD	BY	PK	DATE	10/23/2019

PHYSICAL DATA

[1] CONCENTRATION POINT	RETENTION BASIN A
[2] AREA DESIGNATION	SUBAREAS A-1 thru A-9
[3] AREA - ACRES	5.910
[4] L-FEET	1000
[5] L-MILES	0.189
[6] La-FEET	530
[7] La-MILES	0.100
[8] ELEVATION OF HEADWATER	240
[9] ELEVATION OF CONCENTRATION POINT	225
[10] H-FEET	15
[11] S-FEET/MILE	79.2
[12] S^0.5	8.90
[13] L*LCA/S^0.5	0.00214
[14] AVERAGE MANNINGS 'N'	0.015
[15] LAG TIME-HOURS	0.035
[16] LAG TIME-MINUTES	2.09
[17] 25% OF LAG-MINUTES	0.52
[18] 40% OF LAG-MINUTES	0.84
[19] UNIT TIME-MINUTES (25%-40% OF LAG)	5
[24] TOTAL PERCOLATION RATE (cfs)	0.00

RAINFALL DATA

[1] SOURCE
[2] FREQUENCY-YEARS 100
[3] DURATION:

3-HOURS				6-HOURS				24-HOURS			
[4] POINT RAIN INCHES (Plate E-5.2)	[5] AREA	[6]	[7] AVERAGE POINT RAIN INCHES	[8] POINT RAIN INCHES (Plate E-5.4)	[9] AREA	[10]	[11] AVERAGE POINT RAIN INCHES	[12] POINT RAIN INCHES (Plate E-5.6)	[13] AREA	[14]	[15] AVERAGE POINT RAIN INCHES
2.64	5.910	1.00	2.64	3.33	5.910	1.00	3.33	4.78	5.910	1.00	4.78
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
SUM [5]	5.91	SUM [7]	2.64	SUM [9]	5.91	SUM [11]	3.33	SUM [13]	5.91	SUM [15]	4.78
[16] AREA ADJ FACTOR			1.000				1.000				1.000
[17] ADJ AVG POINT RAIN			2.64				3.33				4.78

STORM EVENT SUMMARY

DURATION		3-HOUR	6-HOUR	24-HOUR
EFFECTIVE RAIN	(in)	1.93	2.02	2.50
FLOOD VOLUME	(cu-ft)	41,511	43,363	53,652
	(acre-ft)	0.95	1.00	1.23
REQUIRED STORAGE	(cu-ft)	41,167	43,005	53,209
	(acre-ft)	0.95	0.99	1.22
PEAK FLOW	(cfs)	13.93	11.81	2.62
MAXIMUM WSEL	(ft)	228.04	228.13	228.60

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD	PROJECT BETTY FORD CENTER UH ANALYSIS CONCENTRATION POINT: RETENTION BASIN A BY PK DATE 10/23/2019

ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER (AMC II) [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (Fp) (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS (Ai) [Plate E-6.3]	ADJUSTED INFILTRATION RATE (F) (in/hr)	AREA		AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
A	COMMERCIAL	32	0.74	90%	0.14	4.71	0.797	0.1121
	PAVING/HARDSCAPE			100%	0.00	0.00	0.000	0.0000
	SF - 1 ACRE			20%	0.00	0.00	0.000	0.0000
	SF - 1/2 ACRE			40%	0.00	0.00	0.000	0.0000
	SF - 1/4 ACRE			50%	0.00	0.00	0.000	0.0000
	MF - COND0MINIUMS			65%	0.00	0.00	0.000	0.0000
	MF - APARTMENTS			80%	0.00	0.00	0.000	0.0000
	MOBILE HOME PARKS			75%	0.00	0.00	0.000	0.0000
	LANDSCAPING			0%	0.00	0.00	0.000	0.0000
A	RETENTION BASINS	44	0.63	0%	0.63	1.20	0.203	0.1279
	GOLF COURSE			0%	0.00	0.00	0.000	0.0000
	MOUNTAINOUS			90%	0.00	0.00	0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					SUM	5.91	SUM	0.2400

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.119985279

C= 0.00222

Ft=C(24-(T/60))^1.55 = 0.00222 (24-(T/60))^1.55 + 0.12 in/hr

LOW LOSS RATE (80-90 PERCENT) = 33%

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period,
T=1 1/2 unit time for the second period, etc.

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD	PROJECT: BETTY FORD CENTER UH ANALYSIS
100 YEAR - 3 HOUR STORM EVENT	CONCENTRATION POINT: RETENTION BASIN A
	BY: PK DATE 10/23/2019

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	5.91	
UNIT TIME-MINUTES	5	
LAG TIME - MINUTES	2.09	
UNIT TIME-PERCENT OF LAG	239.5	
TOTAL ADJUSTED STORM RAIN-INCHES	2.64	
CONSTANT LOSS RATE-in/hr	0.24	
LOW LOSS RATE - PERCENT	33%	TOTAL PERCOLATION RATE (cfs) 0.00 cfs

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
1	5	0.08	1.3	0.412	0.24	0.13	0.172	1.02	304.72
2	10	0.17	1.3	0.412	0.24	0.13	0.172	1.02	304.72
3	15	0.25	1.1	0.348	0.24	0.11	0.109	0.64	192.39
4	20	0.33	1.5	0.475	0.24	0.16	0.235	1.39	417.06
5	25	0.42	1.5	0.475	0.24	0.16	0.235	1.39	417.06
6	30	0.50	1.8	0.570	0.24	0.19	0.330	1.95	585.57
7	35	0.58	1.5	0.475	0.24	0.16	0.235	1.39	417.06
8	40	0.67	1.8	0.570	0.24	0.19	0.330	1.95	585.57
9	45	0.75	1.8	0.570	0.24	0.19	0.330	1.95	585.57
10	50	0.83	1.5	0.475	0.24	0.16	0.235	1.39	417.06
11	55	0.92	1.6	0.507	0.24	0.17	0.267	1.58	473.23
12	60	1.00	1.8	0.570	0.24	0.19	0.330	1.95	585.57
13	65	1.08	2.2	0.697	0.24	0.23	0.457	2.70	810.24
14	70	1.17	2.2	0.697	0.24	0.23	0.457	2.70	810.24
15	75	1.25	2.2	0.697	0.24	0.23	0.457	2.70	810.24
16	80	1.33	2.0	0.634	0.24	0.21	0.394	2.33	697.91
17	85	1.42	2.6	0.824	0.24	0.27	0.584	3.45	1034.92
18	90	1.50	2.7	0.855	0.24	0.28	0.615	3.64	1091.09
19	95	1.58	2.4	0.760	0.24	0.25	0.520	3.08	922.58
20	100	1.67	2.7	0.855	0.24	0.28	0.615	3.64	1091.09
21	105	1.75	3.3	1.045	0.24	0.34	0.805	4.76	1428.10
22	110	1.83	3.1	0.982	0.24	0.32	0.742	4.39	1315.76
23	115	1.92	2.9	0.919	0.24	0.30	0.679	4.01	1203.42
24	120	2.00	3.0	0.950	0.24	0.31	0.710	4.20	1259.59
25	125	2.08	3.1	0.982	0.24	0.32	0.742	4.39	1315.76
26	130	2.17	4.2	1.331	0.24	0.43	1.091	6.45	1933.62
27	135	2.25	5.0	1.584	0.24	0.52	1.344	7.94	2382.96
28	140	2.33	3.5	1.109	0.24	0.36	0.869	5.13	1540.43
29	145	2.42	6.8	2.154	0.24	0.70	1.914	11.31	3394.00
30	150	2.50	7.3	2.313	0.24	0.75	2.073	12.25	3674.84
31	155	2.58	8.2	2.598	0.24	0.85	2.358	13.93	4180.36
32	160	2.67	5.9	1.869	0.24	0.61	1.629	9.63	2888.48
33	165	2.75	2.0	0.634	0.24	0.21	0.394	2.33	697.91
34	170	2.83	1.8	0.570	0.24	0.19	0.330	1.95	585.57
35	175	2.92	1.8	0.570	0.24	0.19	0.330	1.95	585.57
36	180	3.00	0.6	0.190	0.24	0.06	0.128	0.76	227.08
							23.219		41167.34

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	1.93
FLOOD VOLUME (acft)	0.95
FLOOD VOLUME (cuft)	41510.56
REQUIRED STORAGE (acft)	0.95
REQUIRED STORAGE (cuft)	41167.34
PEAK FLOW RATE (cfs)	13.93

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 6 HOUR STORM EVENT

PROJECT: BETTY FORD CENTER UH ANALYSIS
CONCENTRATION POINT: RETENTION BASIN A
BY: PK DATE: 10/23/2019

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	5.91
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	2.09
UNIT TIME-PERCENT OF LAG	239.5
TOTAL ADJUSTED STORM RAIN-INCHES	3.33
CONSTANT LOSS RATE-in/hr	0.240
LOW LOSS RATE - PERCENT	33%

TOTAL PERCOLATION RATE (cfs) 0.00 cfs

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
1	5	0.08	0.5	0.200	0.24	0.07	0.13	0.80	238.69
2	10	0.17	0.6	0.240	0.24	0.08	0.16	0.95	286.43
3	15	0.25	0.6	0.240	0.24	0.08	0.16	0.95	286.43
4	20	0.33	0.6	0.240	0.24	0.08	0.16	0.95	286.43
5	25	0.42	0.6	0.240	0.24	0.08	0.16	0.95	286.43
6	30	0.50	0.7	0.280	0.24	0.09	0.04	0.23	70.48
7	35	0.58	0.7	0.280	0.24	0.09	0.04	0.23	70.48
8	40	0.67	0.7	0.280	0.24	0.09	0.04	0.23	70.48
9	45	0.75	0.7	0.280	0.24	0.09	0.04	0.23	70.48
10	50	0.83	0.7	0.280	0.24	0.09	0.04	0.23	70.48
11	55	0.92	0.7	0.280	0.24	0.09	0.04	0.23	70.48
12	60	1.00	0.8	0.320	0.24	0.10	0.08	0.47	141.32
13	65	1.08	0.8	0.320	0.24	0.10	0.08	0.47	141.32
14	70	1.17	0.8	0.320	0.24	0.10	0.08	0.47	141.32
15	75	1.25	0.8	0.320	0.24	0.10	0.08	0.47	141.32
16	80	1.33	0.8	0.320	0.24	0.10	0.08	0.47	141.32
17	85	1.42	0.8	0.320	0.24	0.10	0.08	0.47	141.32
18	90	1.50	0.8	0.320	0.24	0.10	0.08	0.47	141.32
19	95	1.58	0.8	0.320	0.24	0.10	0.08	0.47	141.32
20	100	1.67	0.8	0.320	0.24	0.10	0.08	0.47	141.32
21	105	1.75	0.8	0.320	0.24	0.10	0.08	0.47	141.32
22	110	1.83	0.8	0.320	0.24	0.10	0.08	0.47	141.32
23	115	1.92	0.8	0.320	0.24	0.10	0.08	0.47	141.32
24	120	2.00	0.9	0.360	0.24	0.12	0.12	0.71	212.17
25	125	2.08	0.8	0.320	0.24	0.10	0.08	0.47	141.32
26	130	2.17	0.9	0.360	0.24	0.12	0.12	0.71	212.17
27	135	2.25	0.9	0.360	0.24	0.12	0.12	0.71	212.17
28	140	2.33	0.9	0.360	0.24	0.12	0.12	0.71	212.17
29	145	2.42	0.9	0.360	0.24	0.12	0.12	0.71	212.17
30	150	2.50	0.9	0.360	0.24	0.12	0.12	0.71	212.17
31	155	2.58	0.9	0.360	0.24	0.12	0.12	0.71	212.17
32	160	2.67	0.9	0.360	0.24	0.12	0.12	0.71	212.17
33	165	2.75	1.0	0.400	0.24	0.13	0.16	0.94	283.02
34	170	2.83	1.0	0.400	0.24	0.13	0.16	0.94	283.02
35	175	2.92	1.0	0.400	0.24	0.13	0.16	0.94	283.02
36	180	3.00	1.0	0.400	0.24	0.13	0.16	0.94	283.02
37	185	3.08	1.0	0.400	0.24	0.13	0.16	0.94	283.02
38	190	3.17	1.1	0.440	0.24	0.14	0.20	1.18	353.87
39	195	3.25	1.1	0.440	0.24	0.14	0.20	1.18	353.87
40	200	3.33	1.1	0.440	0.24	0.14	0.20	1.18	353.87
41	205	3.42	1.2	0.480	0.24	0.16	0.24	1.42	424.72
42	210	3.50	1.3	0.519	0.24	0.17	0.28	1.65	495.57
43	215	3.58	1.4	0.559	0.24	0.18	0.32	1.89	566.42
44	220	3.67	1.4	0.559	0.24	0.18	0.32	1.89	566.42
45	225	3.75	1.5	0.599	0.24	0.20	0.36	2.12	637.27
46	230	3.83	1.5	0.599	0.24	0.20	0.36	2.12	637.27
47	235	3.92	1.6	0.639	0.24	0.21	0.40	2.36	708.12
48	240	4.00	1.6	0.639	0.24	0.21	0.40	2.36	708.12
49	245	4.08	1.7	0.679	0.24	0.22	0.44	2.60	778.97
50	250	4.17	1.8	0.719	0.24	0.23	0.48	2.83	849.82
51	255	4.25	1.9	0.759	0.24	0.25	0.52	3.07	920.66
52	260	4.33	2.0	0.799	0.24	0.26	0.56	3.31	991.51
53	265	4.42	2.1	0.839	0.24	0.27	0.60	3.54	1062.36
54	270	4.50	2.1	0.839	0.24	0.27	0.60	3.54	1062.36
55	275	4.58	2.2	0.879	0.24	0.29	0.64	3.78	1133.21
56	280	4.67	2.3	0.919	0.24	0.30	0.68	4.01	1204.06

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD	PROJECT:	BETTY FORD CENTER UH ANALYSIS
100 YEAR - 6 HOUR STORM EVENT	CONCENTRATION POINT:	RETENTION BASIN A
	BY: PK	DATE: 10/23/2019

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	5.91		
UNIT TIME-MINUTES	5		
LAG TIME - MINUTES	2.09		
UNIT TIME-PERCENT OF LAG	239.5		
TOTAL ADJUSTED STORM RAIN-INCHES	3.33		
CONSTANT LOSS RATE-in/hr	0.240		
LOW LOSS RATE - PERCENT	33%	TOTAL PERCOLATION RATE (cfs)	0.00 cfs

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
57	285	4.75	2.4	0.959	0.24	0.31	0.72	4.25	1274.91
58	290	4.83	2.4	0.959	0.24	0.31	0.72	4.25	1274.91
59	295	4.92	2.5	0.999	0.24	0.33	0.76	4.49	1345.76
60	300	5.00	2.6	1.039	0.24	0.34	0.80	4.72	1416.61
61	305	5.08	3.1	1.239	0.24	0.40	1.00	5.90	1770.85
62	310	5.17	3.6	1.439	0.24	0.47	1.20	7.08	2125.10
63	315	5.25	3.9	1.558	0.24	0.51	1.32	7.79	2337.65
64	320	5.33	4.2	1.678	0.24	0.55	1.44	8.50	2550.19
65	325	5.42	4.7	1.878	0.24	0.61	1.64	9.68	2904.44
66	330	5.50	5.6	2.238	0.24	0.73	2.00	11.81	3542.08
67	335	5.58	1.9	0.759	0.24	0.25	0.52	3.07	920.66
68	340	5.67	0.9	0.360	0.24	0.12	0.12	0.71	212.17
69	345	5.75	0.6	0.240	0.24	0.08	0.16	0.95	286.43
70	350	5.83	0.5	0.200	0.24	0.07	0.13	0.80	238.69
71	355	5.92	0.3	0.120	0.24	0.04	0.08	0.48	143.22
72	360	6.00	0.2	0.080	0.24	0.03	0.05	0.32	95.48

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	2.02
FLOOD VOLUME (acft)	1.00
FLOOD VOLUME (cuft)	43363.18
REQUIRED STORAGE (acft)	0.99
REQUIRED STORAGE (cuft)	43004.64
PEAK FLOW RATE (cfs)	11.81

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD		PROJECT:	BETTY FORD CENTER UH ANALYSIS
100 YEAR - 24 HOUR STORM EVENT		CONCENTRATION POINT:	RETENTION BASIN A
		BY: PK	DATE: 10/23/2019

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	5.910	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2400
LAG TIME - MINUTES	2.09	MINIMUM LOSS RATE (for var. loss) - in/hr	0.120
UNIT TIME-PERCENT OF LAG	718.4	LOW LOSS RATE - DECIMAL	0.33
TOTAL ADJUSTED STORM RAIN-INCHES	4.78	C	0.00222
		PERCOLATION RATE (cfs)	0.00

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
1	15	0.25	0.2	0.038	0.424	0.012	0.026	0.15	137.05
2	30	0.50	0.3	0.057	0.419	0.019	0.039	0.23	205.58
3	45	0.75	0.3	0.057	0.414	0.019	0.039	0.23	205.58
4	60	1.00	0.4	0.076	0.409	0.025	0.052	0.30	274.10
5	75	1.25	0.3	0.057	0.404	0.019	0.039	0.23	205.58
6	90	1.50	0.3	0.057	0.399	0.019	0.039	0.23	205.58
7	105	1.75	0.3	0.057	0.395	0.019	0.039	0.23	205.58
8	120	2.00	0.4	0.076	0.390	0.025	0.052	0.30	274.10
9	135	2.25	0.4	0.076	0.385	0.025	0.052	0.30	274.10
10	150	2.50	0.4	0.076	0.381	0.025	0.052	0.30	274.10
11	165	2.75	0.5	0.096	0.376	0.031	0.064	0.38	342.63
12	180	3.00	0.5	0.096	0.371	0.031	0.064	0.38	342.63
13	195	3.25	0.5	0.096	0.367	0.031	0.064	0.38	342.63
14	210	3.50	0.5	0.096	0.362	0.031	0.064	0.38	342.63
15	225	3.75	0.5	0.096	0.358	0.031	0.064	0.38	342.63
16	240	4.00	0.6	0.115	0.353	0.037	0.077	0.46	411.15
17	255	4.25	0.6	0.115	0.349	0.037	0.077	0.46	411.15
18	270	4.50	0.7	0.134	0.344	0.044	0.090	0.53	479.68
19	285	4.75	0.7	0.134	0.340	0.044	0.090	0.53	479.68
20	300	5.00	0.8	0.153	0.335	0.050	0.103	0.61	548.21
21	315	5.25	0.6	0.115	0.331	0.037	0.077	0.46	411.15
22	330	5.50	0.7	0.134	0.327	0.044	0.090	0.53	479.68
23	345	5.75	0.8	0.153	0.322	0.050	0.103	0.61	548.21
24	360	6.00	0.8	0.153	0.318	0.050	0.103	0.61	548.21
25	375	6.25	0.9	0.172	0.314	0.056	0.116	0.69	616.73
26	390	6.50	0.9	0.172	0.310	0.056	0.116	0.69	616.73
27	405	6.75	1.0	0.191	0.306	0.062	0.129	0.76	685.26
28	420	7.00	1.0	0.191	0.301	0.062	0.129	0.76	685.26
29	435	7.25	1.0	0.191	0.297	0.062	0.129	0.76	685.26
30	450	7.50	1.1	0.210	0.293	0.069	0.142	0.84	753.78
31	465	7.75	1.2	0.229	0.289	0.075	0.155	0.91	822.31
32	480	8.00	1.3	0.249	0.285	0.081	0.167	0.99	890.83
33	495	8.25	1.5	0.287	0.281	0.094	0.005	0.03	28.93
34	510	8.50	1.5	0.287	0.277	0.094	0.009	0.06	49.79
35	525	8.75	1.6	0.306	0.274	0.100	0.032	0.19	172.16
36	540	9.00	1.7	0.325	0.270	0.106	0.055	0.33	294.36
37	555	9.25	1.9	0.363	0.266	0.118	0.097	0.58	518.07
38	570	9.50	2.0	0.382	0.262	0.125	0.120	0.71	639.89
39	585	9.75	2.1	0.402	0.258	0.131	0.143	0.85	761.52
40	600	10.00	2.2	0.421	0.255	0.137	0.166	0.98	882.96
41	615	10.25	1.5	0.287	0.251	0.094	0.036	0.21	190.62
42	630	10.50	1.5	0.287	0.247	0.094	0.039	0.23	209.98
43	645	10.75	2.0	0.382	0.244	0.125	0.139	0.82	737.64
44	660	11.00	2.0	0.382	0.240	0.125	0.142	0.84	756.61
45	675	11.25	1.9	0.363	0.237	0.118	0.127	0.75	673.68
46	690	11.50	1.9	0.363	0.233	0.118	0.130	0.77	692.26
47	705	11.75	1.7	0.325	0.230	0.106	0.095	0.56	507.23
48	720	12.00	1.8	0.344	0.226	0.112	0.118	0.70	627.10
49	735	12.25	2.5	0.478	0.223	0.156	0.255	1.51	1356.95
50	750	12.50	2.6	0.497	0.220	0.162	0.278	1.64	1476.41
51	765	12.75	2.8	0.535	0.216	0.175	0.319	1.89	1697.36
52	780	13.00	2.9	0.554	0.213	0.181	0.341	2.02	1816.39
53	795	13.25	3.4	0.650	0.210	0.212	0.440	2.60	2342.01
54	810	13.50	3.4	0.650	0.207	0.212	0.443	2.62	2358.92
55	825	13.75	2.3	0.440	0.203	0.143	0.236	1.40	1256.92
56	840	14.00	2.3	0.440	0.200	0.143	0.239	1.41	1273.39
57	855	14.25	2.7	0.516	0.197	0.168	0.319	1.88	1696.44
58	870	14.50	2.6	0.497	0.194	0.162	0.303	1.79	1610.76
59	885	14.75	2.6	0.497	0.191	0.162	0.306	1.81	1626.56
60	900	15.00	2.5	0.478	0.188	0.156	0.290	1.71	1540.43

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD	PROJECT:	BETTY FORD CENTER UH ANALYSIS
100 YEAR - 24 HOUR STORM EVENT	CONCENTRATION POINT:	RETENTION BASIN A
	BY: PK	DATE: 10/23/2019

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	5.910	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2400
LAG TIME - MINUTES	2.09	MINIMUM LOSS RATE (for var. loss) - in/hr	0.120
UNIT TIME-PERCENT OF LAG	718.4	LOW LOSS RATE - DECIMAL	0.33
TOTAL ADJUSTED STORM RAIN-INCHES	4.78	C	0.00222
		PERCOLATION RATE (cfs)	0.00

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
61	915	15.25	2.4	0.459	0.186	0.150	0.273	1.62	1454.06
62	930	15.50	2.3	0.440	0.183	0.143	0.257	1.52	1367.46
63	945	15.75	1.9	0.363	0.180	0.118	0.183	1.08	975.53
64	960	16.00	1.9	0.363	0.177	0.118	0.186	1.10	990.14
65	975	16.25	0.4	0.076	0.174	0.025	0.052	0.30	274.10
66	990	16.50	0.4	0.076	0.172	0.025	0.052	0.30	274.10
67	1005	16.75	0.3	0.057	0.169	0.019	0.039	0.23	205.58
68	1020	17.00	0.3	0.057	0.167	0.019	0.039	0.23	205.58
69	1035	17.25	0.5	0.096	0.164	0.031	0.064	0.38	342.63
70	1050	17.50	0.5	0.096	0.162	0.031	0.064	0.38	342.63
71	1065	17.75	0.5	0.096	0.159	0.031	0.064	0.38	342.63
72	1080	18.00	0.4	0.076	0.157	0.025	0.052	0.30	274.10
73	1095	18.25	0.4	0.076	0.155	0.025	0.052	0.30	274.10
74	1110	18.50	0.4	0.076	0.152	0.025	0.052	0.30	274.10
75	1125	18.75	0.3	0.057	0.150	0.019	0.039	0.23	205.58
76	1140	19.00	0.2	0.038	0.148	0.012	0.026	0.15	137.05
77	1155	19.25	0.3	0.057	0.146	0.019	0.039	0.23	205.58
78	1170	19.50	0.4	0.076	0.144	0.025	0.052	0.30	274.10
79	1185	19.75	0.3	0.057	0.142	0.019	0.039	0.23	205.58
80	1200	20.00	0.2	0.038	0.140	0.012	0.026	0.15	137.05
81	1215	20.25	0.3	0.057	0.138	0.019	0.039	0.23	205.58
82	1230	20.50	0.3	0.057	0.136	0.019	0.039	0.23	205.58
83	1245	20.75	0.3	0.057	0.135	0.019	0.039	0.23	205.58
84	1260	21.00	0.2	0.038	0.133	0.012	0.026	0.15	137.05
85	1275	21.25	0.3	0.057	0.131	0.019	0.039	0.23	205.58
86	1290	21.50	0.2	0.038	0.130	0.012	0.026	0.15	137.05
87	1305	21.75	0.3	0.057	0.128	0.019	0.039	0.23	205.58
88	1320	22.00	0.2	0.038	0.127	0.012	0.026	0.15	137.05
89	1335	22.25	0.3	0.057	0.126	0.019	0.039	0.23	205.58
90	1350	22.50	0.2	0.038	0.125	0.012	0.026	0.15	137.05
91	1365	22.75	0.2	0.038	0.124	0.012	0.026	0.15	137.05
92	1380	23.00	0.2	0.038	0.123	0.012	0.026	0.15	137.05
93	1395	23.25	0.2	0.038	0.122	0.012	0.026	0.15	137.05
94	1410	23.50	0.2	0.038	0.121	0.012	0.026	0.15	137.05
95	1425	23.75	0.2	0.038	0.120	0.012	0.026	0.15	137.05
96	1440	24.00	0.2	0.038	0.120	0.012	0.026	0.15	137.05

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	2.50
FLOOD VOLUME (acft)	1.23
FLOOD VOLUME (cuft)	53652.37
REQUIRED STORAGE (acft)	1.22
REQUIRED STORAGE (cuft)	53208.76
PEAK FLOW (cfs)	2.62

PROJECT: BETTY FORD CENTER UH ANALYSIS
MBI JOB# 174831
RETENTION BASIN A

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
225	0	0		8954	0	0	0.00
226	1	1	2637	11591	10273	10273	0.24
227	1	2	2880	14471	13031	23304	0.53
228	1	3	4849	19320	16896	40199	0.92
229	1	4	4714	24034	21677	61876	1.42

PERCOLATION CALCULATIONS
PERCOLATION RATE 0 in/hr 0.00000 cfs

MAXWELL IV DRYWELLS
NUMBER USED 0
RATE/DRYWELL 0.00000 cfs
TOTAL DISSIPATED 0.00000 cfs

TOTAL PERCOLATION RATE 0.00000 cfs

RETENTION BASIN A
MBI JOB # 174831
100 YEAR - 3 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
1	5	1.02	305	305	0	305	225.03	305	0.01
2	10	1.02	305	609	0	609	225.06	609	0.01
3	15	0.64	192	802	0	802	225.08	802	0.02
4	20	1.39	417	1,219	0	1,219	225.12	1,219	0.03
5	25	1.39	417	1,636	0	1,636	225.16	1,636	0.04
6	30	1.95	586	2,222	0	2,222	225.22	2,222	0.05
7	35	1.39	417	2,639	0	2,639	225.26	2,639	0.06
8	40	1.95	586	3,224	0	3,224	225.31	3,224	0.07
9	45	1.95	586	3,810	0	3,810	225.37	3,810	0.09
10	50	1.39	417	4,227	0	4,227	225.41	4,227	0.10
11	55	1.58	473	4,700	0	4,700	225.46	4,700	0.11
12	60	1.95	586	5,286	0	5,286	225.51	5,286	0.12
13	65	2.70	810	6,096	0	6,096	225.59	6,096	0.14
14	70	2.70	810	6,906	0	6,906	225.67	6,906	0.16
15	75	2.70	810	7,716	0	7,716	225.75	7,716	0.18
16	80	2.33	698	8,414	0	8,414	225.82	8,414	0.19
17	85	3.45	1,035	9,449	0	9,449	225.92	9,449	0.22
18	90	3.64	1,091	10,540	0	10,540	226.02	10,540	0.24
19	95	3.08	923	11,463	0	11,463	226.09	11,463	0.26
20	100	3.64	1,091	12,554	0	12,554	226.18	12,554	0.29
21	105	4.76	1,428	13,982	0	13,982	226.28	13,982	0.32
22	110	4.39	1,316	15,298	0	15,298	226.39	15,298	0.35
23	115	4.01	1,203	16,501	0	16,501	226.48	16,501	0.38
24	120	4.20	1,260	17,761	0	17,761	226.57	17,761	0.41
25	125	4.39	1,316	19,077	0	19,077	226.68	19,077	0.44
26	130	6.45	1,934	21,010	0	21,010	226.82	21,010	0.48
27	135	7.94	2,383	23,393	0	23,393	227.01	23,393	0.54
28	140	5.13	1,540	24,934	0	24,934	227.10	24,934	0.57
29	145	11.31	3,394	28,328	0	28,328	227.30	28,328	0.65
30	150	12.25	3,675	32,002	0	32,002	227.51	32,002	0.73
31	155	13.93	4,180	36,183	0	36,183	227.76	36,183	0.83
32	160	9.63	2,888	39,071	0	39,071	227.93	39,071	0.90
33	165	2.33	698	39,769	0	39,769	227.97	39,769	0.91
34	170	1.95	586	40,355	0	40,355	228.01	40,355	0.93
35	175	1.95	586	40,940	0	40,940	228.03	40,940	0.94
36	180	0.76	227	41,167	0	41,167	228.04	41,167	0.95

RETENTION BASIN A
MBI JOB # 174831
100 YEAR - 6 HOUR STORM EVENT

TIME UNIT PERIOD	TIME (min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	BALANCE IN BASIN (acre-ft)
1	5	0.80	239	239	0	239	225.02	239	0.01
2	10	0.95	286	525	0	525	225.05	525	0.01
3	15	0.95	286	812	0	812	225.08	812	0.02
4	20	0.95	286	1,098	0	1,098	225.11	1,098	0.03
5	25	0.95	286	1,384	0	1,384	225.13	1,384	0.03
6	30	0.23	70	1,455	0	1,455	225.14	1,455	0.03
7	35	0.23	70	1,525	0	1,525	225.15	1,525	0.04
8	40	0.23	70	1,596	0	1,596	225.16	1,596	0.04
9	45	0.23	70	1,666	0	1,666	225.16	1,666	0.04
10	50	0.23	70	1,737	0	1,737	225.17	1,737	0.04
11	55	0.23	70	1,807	0	1,807	225.18	1,807	0.04
12	60	0.47	141	1,949	0	1,949	225.19	1,949	0.04
13	65	0.47	141	2,090	0	2,090	225.20	2,090	0.05
14	70	0.47	141	2,231	0	2,231	225.22	2,231	0.05
15	75	0.47	141	2,373	0	2,373	225.23	2,373	0.05
16	80	0.47	141	2,514	0	2,514	225.24	2,514	0.06
17	85	0.47	141	2,655	0	2,655	225.26	2,655	0.06
18	90	0.47	141	2,797	0	2,797	225.27	2,797	0.06
19	95	0.47	141	2,938	0	2,938	225.29	2,938	0.07
20	100	0.47	141	3,079	0	3,079	225.30	3,079	0.07
21	105	0.47	141	3,221	0	3,221	225.31	3,221	0.07
22	110	0.47	141	3,362	0	3,362	225.33	3,362	0.08
23	115	0.47	141	3,503	0	3,503	225.34	3,503	0.08
24	120	0.71	212	3,715	0	3,715	225.36	3,715	0.09
25	125	0.47	141	3,857	0	3,857	225.38	3,857	0.09
26	130	0.71	212	4,069	0	4,069	225.40	4,069	0.09
27	135	0.71	212	4,281	0	4,281	225.42	4,281	0.10
28	140	0.71	212	4,493	0	4,493	225.44	4,493	0.10
29	145	0.71	212	4,705	0	4,705	225.46	4,705	0.11
30	150	0.71	212	4,918	0	4,918	225.48	4,918	0.11
31	155	0.71	212	5,130	0	5,130	225.50	5,130	0.12
32	160	0.71	212	5,342	0	5,342	225.52	5,342	0.12
33	165	0.94	283	5,625	0	5,625	225.55	5,625	0.13
34	170	0.94	283	5,908	0	5,908	225.58	5,908	0.14
35	175	0.94	283	6,191	0	6,191	225.60	6,191	0.14
36	180	0.94	283	6,474	0	6,474	225.63	6,474	0.15
37	185	0.94	283	6,757	0	6,757	225.66	6,757	0.16
38	190	1.18	354	7,111	0	7,111	225.69	7,111	0.16
39	195	1.18	354	7,465	0	7,465	225.73	7,465	0.17
40	200	1.18	354	7,819	0	7,819	225.76	7,819	0.18
41	205	1.42	425	8,243	0	8,243	225.80	8,243	0.19
42	210	1.65	496	8,739	0	8,739	225.85	8,739	0.20
43	215	1.89	566	9,305	0	9,305	225.91	9,305	0.21
44	220	1.89	566	9,872	0	9,872	225.96	9,872	0.23
45	225	2.12	637	10,509	0	10,509	226.02	10,509	0.24
46	230	2.12	637	11,146	0	11,146	226.07	11,146	0.26
47	235	2.36	708	11,854	0	11,854	226.12	11,854	0.27
48	240	2.36	708	12,563	0	12,563	226.18	12,563	0.29
49	245	2.60	779	13,341	0	13,341	226.24	13,341	0.31
50	250	2.83	850	14,191	0	14,191	226.30	14,191	0.33
51	255	3.07	921	15,112	0	15,112	226.37	15,112	0.35
52	260	3.31	992	16,103	0	16,103	226.45	16,103	0.37
53	265	3.54	1,062	17,166	0	17,166	226.53	17,166	0.39
54	270	3.54	1,062	18,228	0	18,228	226.61	18,228	0.42
55	275	3.78	1,133	19,361	0	19,361	226.70	19,361	0.44

RETENTION BASIN A
MBI JOB # 174831
100 YEAR - 6 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
56	280	4.01	1,204	20,565	0	20,565	226.79	20,565	0.47
57	285	4.25	1,275	21,840	0	21,840	226.89	21,840	0.50
58	290	4.25	1,275	23,115	0	23,115	226.99	23,115	0.53
59	295	4.49	1,346	24,461	0	24,461	227.07	24,461	0.56
60	300	4.72	1,417	25,878	0	25,878	227.15	25,878	0.59
61	305	5.90	1,771	27,649	0	27,649	227.26	27,649	0.63
62	310	7.08	2,125	29,774	0	29,774	227.38	29,774	0.68
63	315	7.79	2,338	32,111	0	32,111	227.52	32,111	0.74
64	320	8.50	2,550	34,661	0	34,661	227.67	34,661	0.80
65	325	9.68	2,904	37,566	0	37,566	227.84	37,566	0.86
66	330	11.81	3,542	41,108	0	41,108	228.04	41,108	0.94
67	335	3.07	921	42,029	0	42,029	228.08	42,029	0.96
68	340	0.71	212	42,241	0	42,241	228.09	42,241	0.97
69	345	0.95	286	42,527	0	42,527	228.11	42,527	0.98
70	350	0.80	239	42,766	0	42,766	228.12	42,766	0.98
71	355	0.48	143	42,909	0	42,909	228.13	42,909	0.99
72	360	0.32	95	43,005	0	43,005	228.13	43,005	0.99

RETENTION BASIN A
MBI JOB # 174831
100 YEAR - 24 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT PERIOD	(min)	IN (cfs)	IN (cuft)	BASIN (cuft)	OUT (cuft)	BASIN (cuft)	DEPTH (ft)	BASIN (cuft)	(acre-ft)
1	15	0.15	137	137	0	137	225.01	137	0.00
2	30	0.23	206	343	0	343	225.03	343	0.01
3	45	0.23	206	548	0	548	225.05	548	0.01
4	60	0.30	274	822	0	822	225.08	822	0.02
5	75	0.23	206	1,028	0	1,028	225.10	1,028	0.02
6	90	0.23	206	1,233	0	1,233	225.12	1,233	0.03
7	105	0.23	206	1,439	0	1,439	225.14	1,439	0.03
8	120	0.30	274	1,713	0	1,713	225.17	1,713	0.04
9	135	0.30	274	1,987	0	1,987	225.19	1,987	0.05
10	150	0.30	274	2,261	0	2,261	225.22	2,261	0.05
11	165	0.38	343	2,604	0	2,604	225.25	2,604	0.06
12	180	0.38	343	2,947	0	2,947	225.29	2,947	0.07
13	195	0.38	343	3,289	0	3,289	225.32	3,289	0.08
14	210	0.38	343	3,632	0	3,632	225.35	3,632	0.08
15	225	0.38	343	3,974	0	3,974	225.39	3,974	0.09
16	240	0.46	411	4,386	0	4,386	225.43	4,386	0.10
17	255	0.46	411	4,797	0	4,797	225.47	4,797	0.11
18	270	0.53	480	5,276	0	5,276	225.51	5,276	0.12
19	285	0.53	480	5,756	0	5,756	225.56	5,756	0.13
20	300	0.61	548	6,304	0	6,304	225.61	6,304	0.14
21	315	0.46	411	6,716	0	6,716	225.65	6,716	0.15
22	330	0.53	480	7,195	0	7,195	225.70	7,195	0.17
23	345	0.61	548	7,743	0	7,743	225.75	7,743	0.18
24	360	0.61	548	8,292	0	8,292	225.81	8,292	0.19
25	375	0.69	617	8,908	0	8,908	225.87	8,908	0.20
26	390	0.69	617	9,525	0	9,525	225.93	9,525	0.22
27	405	0.76	685	10,210	0	10,210	225.99	10,210	0.23
28	420	0.76	685	10,896	0	10,896	226.05	10,896	0.25
29	435	0.76	685	11,581	0	11,581	226.10	11,581	0.27
30	450	0.84	754	12,335	0	12,335	226.16	12,335	0.28
31	465	0.91	822	13,157	0	13,157	226.22	13,157	0.30
32	480	0.99	891	14,048	0	14,048	226.29	14,048	0.32
33	495	0.03	29	14,077	0	14,077	226.29	14,077	0.32
34	510	0.06	50	14,126	0	14,126	226.30	14,126	0.32
35	525	0.19	172	14,299	0	14,299	226.31	14,299	0.33
36	540	0.33	294	14,593	0	14,593	226.33	14,593	0.34
37	555	0.58	518	15,111	0	15,111	226.37	15,111	0.35
38	570	0.71	640	15,751	0	15,751	226.42	15,751	0.36
39	585	0.85	762	16,512	0	16,512	226.48	16,512	0.38
40	600	0.98	883	17,395	0	17,395	226.55	17,395	0.40
41	615	0.21	191	17,586	0	17,586	226.56	17,586	0.40
42	630	0.23	210	17,796	0	17,796	226.58	17,796	0.41
43	645	0.82	738	18,534	0	18,534	226.63	18,534	0.43
44	660	0.84	757	19,290	0	19,290	226.69	19,290	0.44
45	675	0.75	674	19,964	0	19,964	226.74	19,964	0.46
46	690	0.77	692	20,656	0	20,656	226.80	20,656	0.47
47	705	0.56	507	21,163	0	21,163	226.84	21,163	0.49
48	720	0.70	627	21,791	0	21,791	226.88	21,791	0.50
49	735	1.51	1,357	23,148	0	23,148	226.99	23,148	0.53
50	750	1.64	1,476	24,624	0	24,624	227.08	24,624	0.57
51	765	1.89	1,697	26,321	0	26,321	227.18	26,321	0.60
52	780	2.02	1,816	28,138	0	28,138	227.29	28,138	0.65
53	795	2.60	2,342	30,480	0	30,480	227.42	30,480	0.70
54	810	2.62	2,359	32,839	0	32,839	227.56	32,839	0.75
55	825	1.40	1,257	34,096	0	34,096	227.64	34,096	0.78
56	840	1.41	1,273	35,369	0	35,369	227.71	35,369	0.81
57	855	1.88	1,696	37,065	0	37,065	227.81	37,065	0.85
58	870	1.79	1,611	38,676	0	38,676	227.91	38,676	0.89

RETENTION BASIN A
MBI JOB # 174831
100 YEAR - 24 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT PERIOD	(min)	IN (cfs)	IN (cuft)	BASIN (cuft)	OUT (cuft)	BASIN (cuft)	DEPTH (ft)	BASIN (cuft)	(acre-ft)
59	885	1.81	1,627	40,303	0	40,303	228.00	40,303	0.93
60	900	1.71	1,540	41,843	0	41,843	228.08	41,843	0.96
61	915	1.62	1,454	43,297	0	43,297	228.14	43,297	0.99
62	930	1.52	1,367	44,665	0	44,665	228.21	44,665	1.03
63	945	1.08	976	45,640	0	45,640	228.25	45,640	1.05
64	960	1.10	990	46,630	0	46,630	228.30	46,630	1.07
65	975	0.30	274	46,904	0	46,904	228.31	46,904	1.08
66	990	0.30	274	47,178	0	47,178	228.32	47,178	1.08
67	1005	0.23	206	47,384	0	47,384	228.33	47,384	1.09
68	1020	0.23	206	47,590	0	47,590	228.34	47,590	1.09
69	1035	0.38	343	47,932	0	47,932	228.36	47,932	1.10
70	1050	0.38	343	48,275	0	48,275	228.37	48,275	1.11
71	1065	0.38	343	48,618	0	48,618	228.39	48,618	1.12
72	1080	0.30	274	48,892	0	48,892	228.40	48,892	1.12
73	1095	0.30	274	49,166	0	49,166	228.41	49,166	1.13
74	1110	0.30	274	49,440	0	49,440	228.43	49,440	1.13
75	1125	0.23	206	49,645	0	49,645	228.44	49,645	1.14
76	1140	0.15	137	49,782	0	49,782	228.44	49,782	1.14
77	1155	0.23	206	49,988	0	49,988	228.45	49,988	1.15
78	1170	0.30	274	50,262	0	50,262	228.46	50,262	1.15
79	1185	0.23	206	50,468	0	50,468	228.47	50,468	1.16
80	1200	0.15	137	50,605	0	50,605	228.48	50,605	1.16
81	1215	0.23	206	50,810	0	50,810	228.49	50,810	1.17
82	1230	0.23	206	51,016	0	51,016	228.50	51,016	1.17
83	1245	0.23	206	51,222	0	51,222	228.51	51,222	1.18
84	1260	0.15	137	51,359	0	51,359	228.51	51,359	1.18
85	1275	0.23	206	51,564	0	51,564	228.52	51,564	1.18
86	1290	0.15	137	51,701	0	51,701	228.53	51,701	1.19
87	1305	0.23	206	51,907	0	51,907	228.54	51,907	1.19
88	1320	0.15	137	52,044	0	52,044	228.55	52,044	1.19
89	1335	0.23	206	52,249	0	52,249	228.56	52,249	1.20
90	1350	0.15	137	52,386	0	52,386	228.56	52,386	1.20
91	1365	0.15	137	52,524	0	52,524	228.57	52,524	1.21
92	1380	0.15	137	52,661	0	52,661	228.57	52,661	1.21
93	1395	0.15	137	52,798	0	52,798	228.58	52,798	1.21
94	1410	0.15	137	52,935	0	52,935	228.59	52,935	1.22
95	1425	0.15	137	53,072	0	53,072	228.59	53,072	1.22
96	1440	0.15	137	53,209	0	53,209	228.60	53,209	1.22