HYDROLOGY STUDY

New Light Industrial Building/Retail Facility

Located in the City of Jurupa Valley
County of Riverside, Ca

Prepared For:

INDUSTRIAL OUTDOOR VENTURES
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EXP. 03-31-25

Table of Contents

Hydrology Appendices

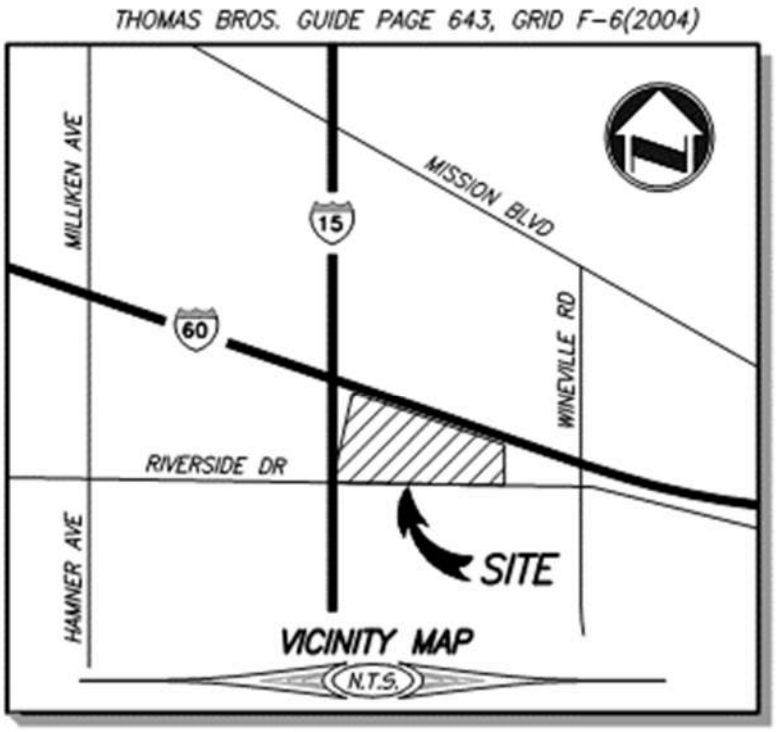
1. Purpose

The purpose of this study is to substantiate the hydrology design for a New Light Industrial Building/Retail Center in Jurupa Valley for Commercial Development as not to negatively impact the surrounding areas.

2. Project Description

The site is located in the City of Jurupa Valley, County of Riverside, North of Riverside Drive between Interstate 15 and Wineville Road South of Highway 60. The site will be used for construction equipment rentals, sales of new and used equipment, and maintenance services. The 6.88 acre property will have a 35,000 sq.ft. main facility with surrounding parking lot and a large paved area for equipment to be parked. Runoff from the site will be pretreated prior to leaving the site.

A. Vicinity Map



SEC.6 T.2.S. R.6.W

3. Existing Hydrology

The site is vacant land with annual grass and some vegetation and trees. The entire site slopes towards the southeast corner of the site towards an existing 48" concrete pipe under Riverside Drive (R.C.F.C &W.C.D Drawing No. 1-0598). This pipe is part of the Day Creek Master Drainage Plan Line D-3. Offsite runoff from the north comes from a 6 x 4 concrete box culvert under Highway 60 (Caltrans Right of Way Map 204/768). Flows from the box culvert flow towards the southeast corner of the site towards the existing 48" concrete pipe under Riverside Drive. The total existing runoff entering the pipe is 115.00 cfs.. The project is located within the WRCMSHCP, but is

located outside any criteria cell, PQP land, or conservation areas. The project site is located within the WRCMSHCP Species Survey Area for Burrowing Owl and Narrow Endemic Plant Species. See Western Riverside County Multiple species habitat conservation plan consistency analysis and biology resources assessment report in Section 5 of the report.

4. Proposed Hydrology

Per the HCOC Applicability Map the western portion of the site is not applicable and will only treat VBMP runoff with an infiltration trench before leaving the site. The east side of the site is applicable per the HCOC Applicability Map and will require to treat the 2 year 24 hour storm event. The runoff flows will be pretreated with an infiltration trench, then the flows will enter an infiltration basin to mitigate the 2 year 24 hour storm event. A portion of the east of the site will be left untouched to allow the northern offsite flows to naturally flow towards the existing 48" concrete pipe under Riverside Drive.

5. Method of Analysis

The site hydrology was based upon Riverside County Flood Control and Water Conversation District Hydrology Manual, from which pertinent soil and rainfall information was obtained.

Storm flows were determined by the "RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM", Riverside County Flood Control & Water Conservation District 1978 Hydrology Manual, produced by Bondamin Engineering.

The site was also analyzed by the "SYNTHETIC UNIT HYDROLOGY METHOD COMPUTER PROGRAM", Riverside County Flood Control & Water Conservation District 1978 Hydrology Manual, produced by Bondamin Engineering.

6. Conclusion

The hydrologic calculations provided herein substantiate the design of the proposed project and indicate the following:

- The proposed facilities demonstrate the ability to convey the 10 and 100 year storm events as required by the City of Jurupa Valley Conditions of Approval
- The post development impacts created by the additional impervious surface will be mitigated by the project Site Design and Structural BMP's for the 2 year 24hr storm event all other storm event will bypass the infiltration basin.

Storm Event	Existing		Proposed		Routed		
	Volume (cu.ft)	cfs	Volume (cu.ft)	cfs	Volume (cu.ft)	cfs	Depth
2yr24hr	0.0806	0.133	0.6611	1.088	0.5240	0.121	2.30

Therefore, it is our conclusion this project **does not** negatively impact the local community or watershed goals. All flows from the site ultimately drain towards a Riverside County Flood Control Facility.

Section 1 – Existing Hydrology (Rational Method) 10 & 100 Year

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                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2004 Version 7.0
        Rational Hydrology Study        Date: 07/03/19  File:ex10.out
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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 5006

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

Storm event (year) =   10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.500(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year =  10.0
Calculated rainfall intensity data:
1 hour intensity =  0.829(In/Hr)
Slope of intensity duration curve = 0.5500




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Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Initial area flow distance =   535.000(Ft.)
Top (of initial area) elevation =   820.000(Ft.)
Bottom (of initial area) elevation =   798.900(Ft.)
Difference in elevation =    21.100(Ft.)
Slope =    0.03944  s(percent)=       3.94
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.486 min.
Rainfall intensity =      1.966(In/Hr) for a    10.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.675
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)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      1.751(CFS)
Total initial stream area =       1.320(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station        2.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of natural channel elevation =    798.900(Ft.)
End of natural channel elevation =    797.000(Ft.)
Length of natural channel  =   412.000(Ft.)
Estimated mean flow rate at midpoint of channel =      4.688(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.41(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0046
Corrected/adjusted channel slope =  0.0046
Travel time =    4.87 min.     TC =   17.35  min.


 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.643
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      1.640(In/Hr) for a    10.0 year storm
Subarea runoff =      4.671(CFS) for      4.430(Ac.)
Total runoff =      6.421(CFS)       Total area =       5.750(Ac.)


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Process from Point/Station        3.000 to Point/Station        4.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of natural channel elevation =    797.000(Ft.)
End of natural channel elevation =    789.000(Ft.)
Length of natural channel  =   662.000(Ft.)
Estimated mean flow rate at midpoint of channel =      8.337(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   2.62(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0121
Corrected/adjusted channel slope =  0.0121
Travel time =    4.20 min.     TC =   21.56  min.


 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.620
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)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      1.456(In/Hr) for a    10.0 year storm
Subarea runoff =      3.097(CFS) for      3.430(Ac.)
Total runoff =      9.519(CFS)       Total area =       9.180(Ac.)
End of computations, total study area =            9.18 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  67.0
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                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2004 Version 7.0
        Rational Hydrology Study        Date: 07/03/19  File:ex.out
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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

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


Program License Serial Number 5006

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

2 year, 1 hour precipitation =  0.500(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500




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Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Initial area flow distance =   535.000(Ft.)
Top (of initial area) elevation =   820.000(Ft.)
Bottom (of initial area) elevation =   798.900(Ft.)
Difference in elevation =    21.100(Ft.)
Slope =    0.03944  s(percent)=       3.94
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.486 min.
Rainfall intensity =      3.082(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.742
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)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      3.019(CFS)
Total initial stream area =        1.320(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station        2.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of natural channel elevation =    798.900(Ft.)
End of natural channel elevation =    797.000(Ft.)
Length of natural channel  =   412.000(Ft.)
Estimated mean flow rate at midpoint of channel =      8.084(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.61(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0046
Corrected/adjusted channel slope =  0.0046
Travel time =    4.27 min.     TC =   16.75  min.


 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.720
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.622(In/Hr) for a   100.0 year storm
Subarea runoff =      8.361(CFS) for      4.430(Ac.)
Total runoff =     11.380(CFS)       Total area =       5.750(Ac.)


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Process from Point/Station        3.000 to Point/Station        4.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of natural channel elevation =    797.000(Ft.)
End of natural channel elevation =    789.000(Ft.)
Length of natural channel  =   662.000(Ft.)
Estimated mean flow rate at midpoint of channel =     14.774(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   3.04(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0121
Corrected/adjusted channel slope =  0.0121
Travel time =    3.63 min.     TC =   20.38  min.


 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.704
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)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.354(In/Hr) for a   100.0 year storm
Subarea runoff =      5.682(CFS) for      3.430(Ac.)
Total runoff =     17.061(CFS)       Total area =       9.180(Ac.)
End of computations, total study area =            9.18 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  67.0
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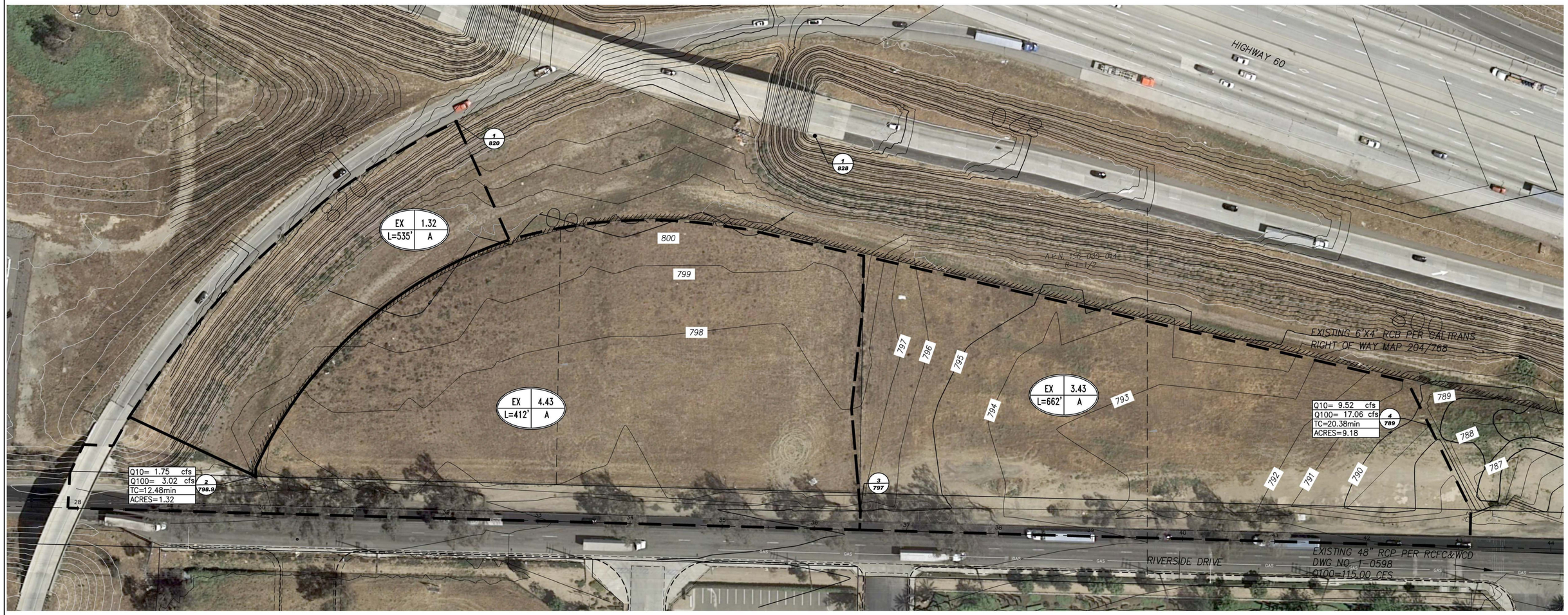
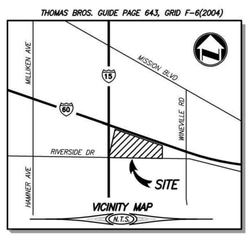
NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY EXISTING HYDROLOGY MAP



0 50 150
25 100 200
SCALE: 1" = 50'



SEC.6 T.2.S. R.6.W

LEGEND

AREA | ACRES
LENGTH | SOIL

NODE / ELEV
Q10=_____ cfs
Q100=_____ cfs
TC=____min
ACRES=

WATERSHED BOUNDARY

FLOW PATH

NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY EXISTING HYDROLOGY MAP

PREPARATION DATE : FEBRUARY 2023

PLAN PREPARED BY:
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6879 Airport Drive, Riverside, CA 92504
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PLOT DATE: 2/21/2023 10:58 AM

PLOT LOCATION: \\ADK-FS01\ADKANDATA\PROJECTS\JOV\10288\ENGINEERING\HYDROLOGY\EXISTING.DWG

Section 2 – Proposed Hydrology (Rational Method) 10 & 100 Year

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                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
        Rational Hydrology Study        Date: 02/20/23  File:PRO10.out
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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 5006

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

Storm event (year) =   10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.500(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year =  10.0
Calculated rainfall intensity data:
1 hour intensity =  0.829(In/Hr)
Slope of intensity duration curve = 0.5500




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Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Initial area flow distance =   535.000(Ft.)
Top (of initial area) elevation =   820.000(Ft.)
Bottom (of initial area) elevation =   798.900(Ft.)
Difference in elevation =    21.100(Ft.)
Slope =    0.03944  s(percent)=       3.94
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.486 min.
Rainfall intensity =      1.966(In/Hr) for a    10.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.675
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)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      1.844(CFS)
Total initial stream area =       1.390(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station        2.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of natural channel elevation =    798.900(Ft.)
End of natural channel elevation =    794.500(Ft.)
Length of natural channel  =   600.000(Ft.)
Estimated mean flow rate at midpoint of channel =      2.420(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.53(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0073
Corrected/adjusted channel slope =  0.0073
Travel time =    6.52 min.     TC =   19.00  min.


 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.842
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      1.560(In/Hr) for a    10.0 year storm
Subarea runoff =      1.143(CFS) for      0.870(Ac.)
Total runoff =      2.987(CFS)       Total area =       2.260(Ac.)


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Process from Point/Station        3.000 to Point/Station        3.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.260(Ac.)
Runoff from this stream =      2.987(CFS)
Time of concentration =   19.00 min.
Rainfall intensity =     1.560(In/Hr)


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Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
Initial area flow distance =   807.000(Ft.)
Top (of initial area) elevation =   799.000(Ft.)
Bottom (of initial area) elevation =   795.300(Ft.)
Difference in elevation =     3.700(Ft.)
Slope =    0.00458  s(percent)=       0.46
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.812 min.
Rainfall intensity =      1.938(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.847
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 =      2.478(CFS)
Total initial stream area =       1.510(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station        5.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
Top of natural channel elevation =    795.300(Ft.)
End of natural channel elevation =    794.500(Ft.)
Length of natural channel  =   275.000(Ft.)
Estimated mean flow rate at midpoint of channel =      3.405(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.04(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0029
Corrected/adjusted channel slope =  0.0029
Travel time =    4.40 min.     TC =   17.21  min.


 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.843
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
Rainfall intensity =      1.648(In/Hr) for a    10.0 year storm
Subarea runoff =      1.570(CFS) for      1.130(Ac.)
Total runoff =      4.048(CFS)       Total area =       2.640(Ac.)


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Process from Point/Station        3.000 to Point/Station        3.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.640(Ac.)
Runoff from this stream =      4.048(CFS)
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Time of concentration =   17.21 min.
Rainfall intensity =     1.648(In/Hr)
Summary of stream data:

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


1        2.987     19.00                 1.560
2        4.048     17.21                 1.648
Largest stream flow has longer or shorter time of concentration
Qp =      4.048 + sum of
          Qa          Tb/Ta
           2.987 *    0.906 =      2.705
Qp =      6.753

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.987       4.048
Area of streams before confluence:
        2.260        2.640
Results of confluence:
Total flow rate =      6.753(CFS)
Time of concentration =    17.211 min.
Effective stream area after confluence =      4.900(Ac.)


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Process from Point/Station        3.000 to Point/Station        6.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =   794.500(Ft.)
End of street segment elevation =   792.300(Ft.)
Length of street segment  =   771.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      7.168(CFS)
Depth of flow =   0.525(Ft.), Average velocity =   1.746(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    1.24(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  19.907(Ft.)
Flow velocity =   1.75(Ft/s)
Travel time =    7.36 min.     TC =   24.57  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.839
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
Rainfall intensity =      1.355(In/Hr) for a    10.0 year storm
Subarea runoff =      0.750(CFS) for      0.660(Ac.)
Total runoff =      7.503(CFS)       Total area =       5.560(Ac.)
Street flow at end of street =      7.503(CFS)
Half street flow at end of street =      7.503(CFS)
Depth of flow =   0.533(Ft.), Average velocity =   1.752(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    1.65(Ft.)
Flow width (from curb towards crown)=  20.319(Ft.)


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Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.560(Ac.)
Runoff from this stream =      7.503(CFS)
Time of concentration =   24.57 min.
Rainfall intensity =     1.355(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        6.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   618.000(Ft.)
Top (of initial area) elevation =   793.950(Ft.)
Bottom (of initial area) elevation =   792.300(Ft.)
Difference in elevation =     1.650(Ft.)
Slope =    0.00267  s(percent)=       0.27
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.830 min.
Rainfall intensity =      1.937(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.847
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 =      0.951(CFS)
Total initial stream area =        0.580(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.580(Ac.)
Runoff from this stream =      0.951(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     1.937(In/Hr)
Summary of stream data:

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


1        7.503     24.57                 1.355
2        0.951     12.83                 1.937
Largest stream flow has longer time of concentration
Qp =      7.503 + sum of
          Qb          Ia/Ib
           0.951 *    0.700 =      0.665
Qp =      8.168

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.503       0.951
Area of streams before confluence:
        5.560        0.580
Results of confluence:
Total flow rate =      8.168(CFS)
Time of concentration =    24.571 min.
Effective stream area after confluence =      6.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   792.300(Ft.)
Downstream point/station elevation =   790.000(Ft.)
Pipe length  =     6.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.168(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     8.168(CFS)
Normal flow depth in pipe =    6.08(In.)
Flow top width inside pipe =    8.43(In.)
Critical depth could not be calculated.
Pipe flow velocity =     25.74(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =    24.57 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.140(Ac.)
Runoff from this stream =      8.168(CFS)
Time of concentration =   24.57 min.
Rainfall intensity =     1.355(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   240.000(Ft.)
Top (of initial area) elevation =   792.000(Ft.)
Bottom (of initial area) elevation =   791.300(Ft.)
Difference in elevation =     0.700(Ft.)
Slope =    0.00292  s(percent)=       0.29
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.634 min.
Rainfall intensity =      2.408(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.851
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 =      0.574(CFS)
Total initial stream area =        0.280(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       10.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   791.300(Ft.)
Downstream point/station elevation =   790.000(Ft.)
Pipe length  =   148.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.574(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.574(CFS)
Normal flow depth in pipe =    3.79(In.)
Flow top width inside pipe =    8.89(In.)
Critical Depth =    4.11(In.)
Pipe flow velocity =      3.25(Ft/s)
Travel time through pipe =    0.76 min.
Time of concentration (TC) =     9.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.280(Ac.)
Runoff from this stream =      0.574(CFS)
Time of concentration =    9.39 min.
Rainfall intensity =     2.299(In/Hr)
Summary of stream data:

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


1        8.168     24.57                 1.355
2        0.574      9.39                 2.299
Largest stream flow has longer time of concentration
Qp =      8.168 + sum of
          Qb          Ia/Ib
           0.574 *    0.589 =      0.338
Qp =      8.506

Total of 2 streams to confluence:
Flow rates before confluence point:
       8.168       0.574
Area of streams before confluence:
        6.140        0.280
Results of confluence:
Total flow rate =      8.506(CFS)
Time of concentration =    24.575 min.
Effective stream area after confluence =      6.420(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   790.000(Ft.)
Downstream point/station elevation =   781.500(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
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No. of pipes = 1  Required pipe flow  =     8.506(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     8.506(CFS)
Normal flow depth in pipe =    5.70(In.)
Flow top width inside pipe =    8.68(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.88(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    24.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      6.420(Ac.)
Runoff from this stream =      8.506(CFS)
Time of concentration =   24.58 min.
Rainfall intensity =     1.354(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       12.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------------
Rainfall intensity =      2.221(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.850
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
User specified values are as follows:
TC =  10.00 min.  Rain intensity =       2.22(In/Hr)
Total area =         0.00(Ac.)  Total runoff =    115.00(CFS)


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Process from Point/Station       12.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   787.000(Ft.)
Downstream point/station elevation =   781.500(Ft.)
Pipe length  =    32.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   115.000(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =   115.000(CFS)
Normal flow depth in pipe =   19.95(In.)
Flow top width inside pipe =   23.72(In.)
Critical depth could not be calculated.
Pipe flow velocity =     36.52(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    10.01 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.000(Ac.)
Runoff from this stream =    115.000(CFS)
Time of concentration =   10.01 min.
Rainfall intensity =     2.220(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   890.000(Ft.)
Top (of initial area) elevation =   799.000(Ft.)
Bottom (of initial area) elevation =   789.500(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.01067  s(percent)=       1.07
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.252 min.
Rainfall intensity =      2.082(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
```

115.00 CFS WAS USED AS FILLER Q10 IS UKNOWN

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Runoff Coefficient = 0.848
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 =      1.854(CFS)
Total initial stream area =        1.050(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of natural channel elevation =    789.500(Ft.)
End of natural channel elevation =    789.000(Ft.)
Length of natural channel  =   151.000(Ft.)
Estimated mean flow rate at midpoint of channel =      2.507(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.04(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0033
Corrected/adjusted channel slope =  0.0033
Travel time =    2.42 min.     TC =   13.67  min.


 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.416
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)  =  38.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      1.870(In/Hr) for a    10.0 year storm
Subarea runoff =      0.576(CFS) for      0.740(Ac.)
Total runoff =      2.430(CFS)       Total area =       1.790(Ac.)


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Process from Point/Station       14.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 3 in normal stream number 1
Stream flow area =      1.790(Ac.)
Runoff from this stream =      2.430(CFS)
Time of concentration =   13.67 min.
Rainfall intensity =     1.870(In/Hr)


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Process from Point/Station       15.000 to Point/Station       16.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   631.000(Ft.)
Top (of initial area) elevation =   799.000(Ft.)
Bottom (of initial area) elevation =   790.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01426  s(percent)=       1.43
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.253 min.
Rainfall intensity =      2.318(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.850
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 =      4.101(CFS)
Total initial stream area =        2.080(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
```

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Upstream point/station elevation =   790.000(Ft.)
Downstream point/station elevation =   789.500(Ft.)
Pipe length  =    94.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.101(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.101(CFS)
Normal flow depth in pipe =   10.83(In.)
Flow top width inside pipe =   13.44(In.)
Critical Depth =    9.83(In.)
Pipe flow velocity =      4.33(Ft/s)
Travel time through pipe =    0.36 min.
Time of concentration (TC) =     9.62 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       14.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Top of natural channel elevation =    789.500(Ft.)
End of natural channel elevation =    789.000(Ft.)
Length of natural channel  =   132.000(Ft.)
Estimated mean flow rate at midpoint of channel =      4.101(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.24(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0038
Corrected/adjusted channel slope =  0.0038
Travel time =    1.77 min.     TC =   11.39  min.


 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.439
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)  =  38.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.068(In/Hr) for a    10.0 year storm
Subarea runoff =      0.000(CFS) for      0.000(Ac.)
Total runoff =      4.101(CFS)       Total area =       2.080(Ac.)


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Process from Point/Station       14.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 3 in normal stream number 2
Stream flow area =      2.080(Ac.)
Runoff from this stream =      4.101(CFS)
Time of concentration =   11.39 min.
Rainfall intensity =     2.068(In/Hr)
Summary of stream data:

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


1        2.430     13.67                 1.870
2        4.101     11.39                 2.068
Largest stream flow has longer or shorter time of concentration
Qp =      4.101 + sum of
          Qa          Tb/Ta
           2.430 *    0.833 =      2.024
Qp =      6.125

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.430       4.101
Area of streams before confluence:
       1.790       2.080
Results of confluence:
Total flow rate =      6.125(CFS)
Time of concentration =    11.390 min.
Effective stream area after confluence =      3.870(Ac.)


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Process from Point/Station       14.000 to Point/Station       11.000
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**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   789.000(Ft.)
Downstream point/station elevation =   781.500(Ft.)
Pipe length  =   104.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.125(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     6.125(CFS)
Normal flow depth in pipe =    6.98(In.)
Flow top width inside pipe =   11.84(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.92(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =    11.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      3.870(Ac.)
Runoff from this stream =      6.125(CFS)
Time of concentration =   11.52 min.
Rainfall intensity =     2.055(In/Hr)
Summary of stream data:

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


1        8.506     24.58               1.354
2      115.000     10.01               2.220
3        6.125     11.52               2.055
Largest stream flow has longer or shorter time of concentration
Qp =    115.000 + sum of
          Qa           Tb/Ta
           8.506 *    0.407 =      3.465
          Qa           Tb/Ta
           6.125 *    0.869 =      5.323
Qp =    123.788

Total of 3 main streams to confluence:
Flow rates before confluence point:
       8.506     115.000       6.125
Area of streams before confluence:
        6.420        0.000        3.870


Results of confluence:
Total flow rate =    123.788(CFS)
Time of concentration =    10.015 min.
Effective stream area after confluence  =     10.290(Ac.)
End of computations, total study area =           10.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.286
Area averaged RI index number =  37.2
```

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                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
        Rational Hydrology Study        Date: 02/20/23  File:pro.out
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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

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


Program License Serial Number 5006

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

2 year, 1 hour precipitation =  0.500(In.)
100 year, 1 hour precipitation =  1.300(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500




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Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
Initial area flow distance =   535.000(Ft.)
Top (of initial area) elevation =   820.000(Ft.)
Bottom (of initial area) elevation =   798.900(Ft.)
Difference in elevation =    21.100(Ft.)
Slope =    0.03944  s(percent)=       3.94
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.486 min.
Rainfall intensity =      3.082(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.742
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)  =  67.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      3.179(CFS)
Total initial stream area =       1.390(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
____________________________________________________________________________
Top of natural channel elevation =    798.900(Ft.)
End of natural channel elevation =    794.500(Ft.)
Length of natural channel  =   600.000(Ft.)
Estimated mean flow rate at midpoint of channel =      4.174(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.73(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0073
Corrected/adjusted channel slope =  0.0073
Travel time =    5.77 min.     TC =   18.26  min.


 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.852
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.501(In/Hr) for a   100.0 year storm
Subarea runoff =      1.854(CFS) for      0.870(Ac.)
Total runoff =      5.033(CFS)       Total area =       2.260(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        3.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.260(Ac.)
Runoff from this stream =      5.033(CFS)
Time of concentration =   18.26 min.
Rainfall intensity =     2.501(In/Hr)


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Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
Initial area flow distance =   807.000(Ft.)
Top (of initial area) elevation =   799.000(Ft.)
Bottom (of initial area) elevation =   795.300(Ft.)
Difference in elevation =     3.700(Ft.)
Slope =    0.00458  s(percent)=       0.46
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.812 min.
Rainfall intensity =      3.039(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.857
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 =      3.931(CFS)
Total initial stream area =        1.510(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station        5.000 to Point/Station        3.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
Top of natural channel elevation =    795.300(Ft.)
End of natural channel elevation =    794.500(Ft.)
Length of natural channel  =   275.000(Ft.)
Estimated mean flow rate at midpoint of channel =      5.402(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.16(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0029
Corrected/adjusted channel slope =  0.0029
Travel time =    3.96 min.     TC =   16.77  min.


 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.853
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
Rainfall intensity =      2.621(In/Hr) for a   100.0 year storm
Subarea runoff =      2.527(CFS) for      1.130(Ac.)
Total runoff =      6.458(CFS)       Total area =       2.640(Ac.)


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Process from Point/Station        3.000 to Point/Station        3.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.640(Ac.)
Runoff from this stream =      6.458(CFS)
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Time of concentration =   16.77 min.
Rainfall intensity =     2.621(In/Hr)
Summary of stream data:

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


1        5.033     18.26                 2.501
2        6.458     16.77                 2.621
Largest stream flow has longer or shorter time of concentration
Qp =      6.458 + sum of
          Qa          Tb/Ta
           5.033 *    0.918 =      4.622
Qp =     11.080

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.033       6.458
Area of streams before confluence:
       2.260       2.640
Results of confluence:
Total flow rate =     11.080(CFS)
Time of concentration =    16.767 min.
Effective stream area after confluence =      4.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        6.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =   794.500(Ft.)
End of street segment elevation =   792.300(Ft.)
Length of street segment  =   771.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     11.722(CFS)
Depth of flow =   0.611(Ft.), Average velocity =   1.858(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    5.56(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  24.230(Ft.)
Flow velocity =   1.86(Ft/s)
Travel time =    6.91 min.     TC =   23.68  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.849
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
Rainfall intensity =      2.168(In/Hr) for a   100.0 year storm
Subarea runoff =      1.215(CFS) for      0.660(Ac.)
Total runoff =     12.294(CFS)       Total area =       5.560(Ac.)
Street flow at end of street =     12.294(CFS)
Half street flow at end of street =     12.294(CFS)
Depth of flow =   0.620(Ft.), Average velocity =   1.874(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    5.99(Ft.)
Flow width (from curb towards crown)=  24.652(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.560(Ac.)
Runoff from this stream =     12.294(CFS)
Time of concentration =   23.68 min.
Rainfall intensity =     2.168(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        6.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   618.000(Ft.)
Top (of initial area) elevation =   793.950(Ft.)
Bottom (of initial area) elevation =   792.300(Ft.)
Difference in elevation =     1.650(Ft.)
Slope =    0.00267  s(percent)=       0.27
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.830 min.
Rainfall intensity =      3.037(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.857
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 =      1.509(CFS)
Total initial stream area =        0.580(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.580(Ac.)
Runoff from this stream =      1.509(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     3.037(In/Hr)
Summary of stream data:

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


1       12.294     23.68                 2.168
2        1.509     12.83                 3.037
Largest stream flow has longer time of concentration
Qp =     12.294 + sum of
          Qb          Ia/Ib
           1.509 *    0.714 =      1.077
Qp =     13.371

Total of 2 streams to confluence:
Flow rates before confluence point:
      12.294       1.509
Area of streams before confluence:
        5.560        0.580
Results of confluence:
Total flow rate =     13.371(CFS)
Time of concentration =    23.681 min.
Effective stream area after confluence =      6.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   792.300(Ft.)
Downstream point/station elevation =   790.000(Ft.)
Pipe length  =     6.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.371(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    13.371(CFS)
Normal flow depth in pipe =    6.74(In.)
Flow top width inside pipe =   11.91(In.)
Critical depth could not be calculated.
Pipe flow velocity =     29.42(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =    23.68 min.


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Process from Point/Station        8.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.140(Ac.)
Runoff from this stream =     13.371(CFS)
Time of concentration =   23.68 min.
Rainfall intensity =     2.168(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       10.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   240.000(Ft.)
Top (of initial area) elevation =   792.000(Ft.)
Bottom (of initial area) elevation =   791.300(Ft.)
Difference in elevation =     0.700(Ft.)
Slope =    0.00292  s(percent)=       0.29
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.634 min.
Rainfall intensity =      3.776(In/Hr) for a   100.0 year storm
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
Initial subarea runoff =      0.911(CFS)
Total initial stream area =        0.280(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       10.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   791.300(Ft.)
Downstream point/station elevation =   790.000(Ft.)
Pipe length  =   148.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.911(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.911(CFS)
Normal flow depth in pipe =    4.96(In.)
Flow top width inside pipe =    8.95(In.)
Critical Depth =    5.24(In.)
Pipe flow velocity =      3.65(Ft/s)
Travel time through pipe =    0.68 min.
Time of concentration (TC) =     9.31 min.


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Process from Point/Station        8.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.280(Ac.)
Runoff from this stream =      0.911(CFS)
Time of concentration =    9.31 min.
Rainfall intensity =     3.622(In/Hr)
Summary of stream data:

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


1       13.371     23.68                 2.168
2        0.911      9.31                 3.622
Largest stream flow has longer time of concentration
Qp =     13.371 + sum of
          Qb          Ia/Ib
           0.911 *    0.598 =      0.545
Qp =     13.916

Total of 2 streams to confluence:
Flow rates before confluence point:
      13.371       0.911
Area of streams before confluence:
        6.140        0.280
Results of confluence:
Total flow rate =     13.916(CFS)
Time of concentration =    23.684 min.
Effective stream area after confluence =      6.420(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   790.000(Ft.)
Downstream point/station elevation =   781.500(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
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No. of pipes = 1  Required pipe flow  =    13.916(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    13.916(CFS)
Normal flow depth in pipe =    6.37(In.)
Flow top width inside pipe =   11.98(In.)
Critical depth could not be calculated.
Pipe flow velocity =     32.88(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    23.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      6.420(Ac.)
Runoff from this stream =     13.916(CFS)
Time of concentration =   23.69 min.
Rainfall intensity =     2.167(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       12.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------------
Rainfall intensity =      3.483(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.860
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
User specified values are as follows:
TC =  10.00 min.  Rain intensity =       3.48(In/Hr)
Total area =         0.00(Ac.)  Total runoff =    115.00(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   787.000(Ft.)
Downstream point/station elevation =   781.500(Ft.)
Pipe length  =    32.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   115.000(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =   115.000(CFS)
Normal flow depth in pipe =   19.95(In.)
Flow top width inside pipe =   23.72(In.)
Critical depth could not be calculated.
Pipe flow velocity =     36.52(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    10.01 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.000(Ac.)
Runoff from this stream =    115.000(CFS)
Time of concentration =   10.01 min.
Rainfall intensity =     3.480(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   890.000(Ft.)
Top (of initial area) elevation =   799.000(Ft.)
Bottom (of initial area) elevation =   789.500(Ft.)
Difference in elevation =     9.500(Ft.)
Slope =    0.01067  s(percent)=       1.07
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.252 min.
Rainfall intensity =      3.264(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
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```
Runoff Coefficient = 0.858
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 =      2.941(CFS)
Total initial stream area =        1.050(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of natural channel elevation =    789.500(Ft.)
End of natural channel elevation =    789.000(Ft.)
Length of natural channel  =   151.000(Ft.)
Estimated mean flow rate at midpoint of channel =      3.978(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.15(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0033
Corrected/adjusted channel slope =  0.0033
Travel time =    2.19 min.     TC =   13.44  min.


 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.519
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)  =  38.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.960(In/Hr) for a   100.0 year storm
Subarea runoff =      1.136(CFS) for      0.740(Ac.)
Total runoff =      4.078(CFS)       Total area =       1.790(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 3 in normal stream number 1
Stream flow area =      1.790(Ac.)
Runoff from this stream =      4.078(CFS)
Time of concentration =   13.44 min.
Rainfall intensity =     2.960(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Initial area flow distance =   631.000(Ft.)
Top (of initial area) elevation =   799.000(Ft.)
Bottom (of initial area) elevation =   790.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01426  s(percent)=       1.43
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.253 min.
Rainfall intensity =      3.635(In/Hr) for a   100.0 year storm
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
Initial subarea runoff =      6.506(CFS)
Total initial stream area =        2.080(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
```

```
Upstream point/station elevation =   790.000(Ft.)
Downstream point/station elevation =   789.500(Ft.)
Pipe length  =    94.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.506(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.506(CFS)
Normal flow depth in pipe =   12.74(In.)
Flow top width inside pipe =   16.37(In.)
Critical Depth =   11.83(In.)
Pipe flow velocity =      4.87(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =     9.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       14.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Top of natural channel elevation =    789.500(Ft.)
End of natural channel elevation =    789.000(Ft.)
Length of natural channel  =   132.000(Ft.)
Estimated mean flow rate at midpoint of channel =      6.506(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =   1.38(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
        Normal channel slope =  0.0038
Corrected/adjusted channel slope =  0.0038
Travel time =    1.59 min.     TC =   11.17  min.


 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.541
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)  =  38.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      3.278(In/Hr) for a   100.0 year storm
Subarea runoff =      0.000(CFS) for      0.000(Ac.)
Total runoff =      6.506(CFS)       Total area =       2.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 3 in normal stream number 2
Stream flow area =      2.080(Ac.)
Runoff from this stream =      6.506(CFS)
Time of concentration =   11.17 min.
Rainfall intensity =     3.278(In/Hr)
Summary of stream data:

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


1        4.078     13.44                 2.960
2        6.506     11.17                 3.278
Largest stream flow has longer or shorter time of concentration
Qp =      6.506 + sum of
          Qa          Tb/Ta
           4.078 *    0.831 =      3.388
Qp =      9.895

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.078       6.506
Area of streams before confluence:
       1.790       2.080
Results of confluence:
Total flow rate =      9.895(CFS)
Time of concentration =    11.166 min.
Effective stream area after confluence =      3.870(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       11.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   789.000(Ft.)
Downstream point/station elevation =   781.500(Ft.)
Pipe length  =   104.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.895(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.895(CFS)
Normal flow depth in pipe =    8.12(In.)
Flow top width inside pipe =   14.95(In.)
Critical Depth =   14.17(In.)
Pipe flow velocity =     14.60(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    11.28 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      3.870(Ac.)
Runoff from this stream =      9.895(CFS)
Time of concentration =   11.28 min.
Rainfall intensity =     3.259(In/Hr)
Summary of stream data:

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

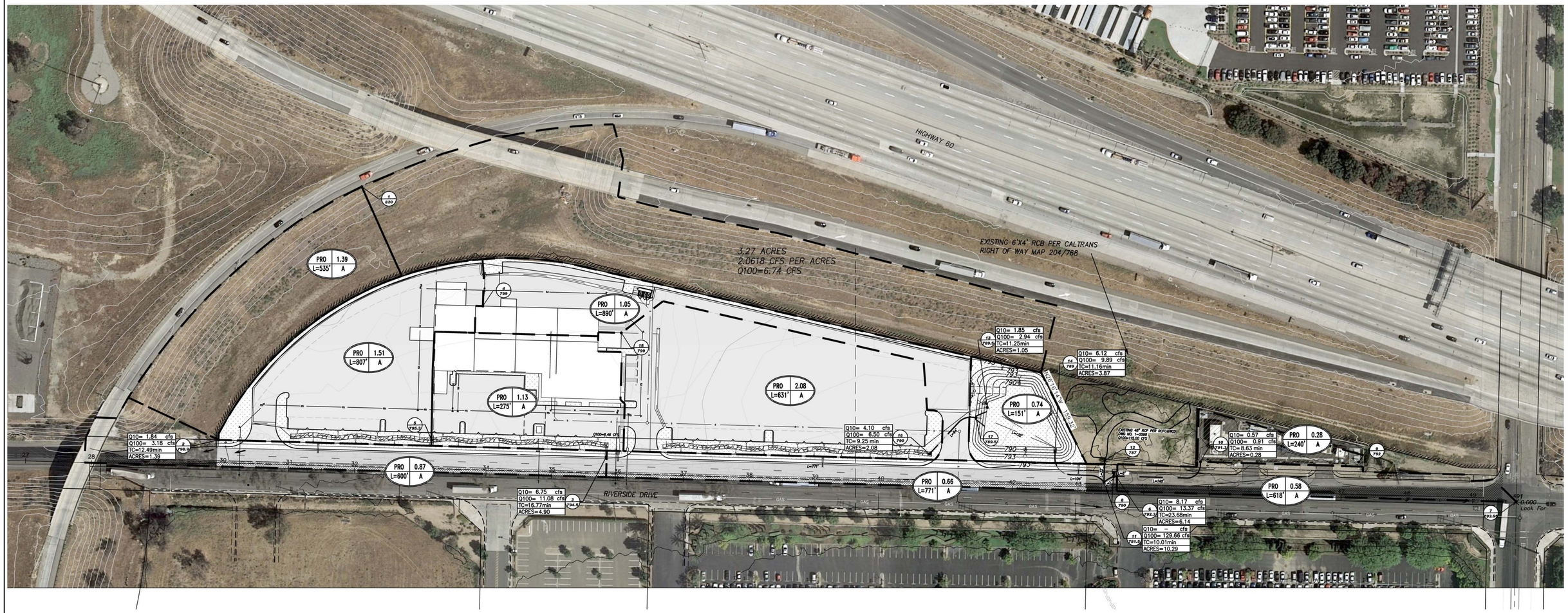

1       13.916     23.69               2.167
2      115.000     10.01               3.480
3        9.895     11.28               3.259
Largest stream flow has longer or shorter time of concentration
Qp =    115.000 + sum of
          Qa           Tb/Ta
          13.916 *    0.423 =      5.882
          Qa           Tb/Ta
           9.895 *    0.887 =      8.781
Qp =    129.663

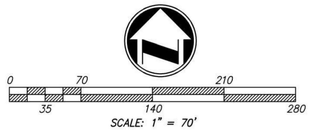
Total of 3 main streams to confluence:
Flow rates before confluence point:
      13.916     115.000       9.895
Area of streams before confluence:
        6.420        0.000        3.870

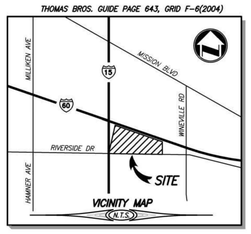

Results of confluence:
Total flow rate =    129.663(CFS)
Time of concentration =    10.015 min.
Effective stream area after confluence  =     10.290(Ac.)
End of computations, total study area =           10.29 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.286
Area averaged RI index number =  37.2
```

NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY PROPOSED HYDROLOGY MAP







SEC.6 T.2.S. R.6.W

LEGEND

AREA | ACRES
LENGTH | SOIL

NODE / ELEV
Q10=_____ cfs
Q100=_____ cfs
TC=_____min
ACRES=

WATERSHED BOUNDARY

FLOW PATH

NEW LIGHT INDUSTRIAL BUILDIN/RETAIL FACILITY
JURUPA VALLEY PROPOSED HYDROLOGY MAP

PREPARATION DATE : FEBRUARY 2023

PLAN PREPARED BY:
adkan ENGINEERS
Civil Engineering · Surveying · Planning
6879 Airport Drive, Riverside, CA 92504
Tel:(951) 688-0241 Fax:(951) 688-0599

PLOT DATE: 2/21/2023 1:54 PM

PLOT LOCATION: \\ADK-FS01\ADKANDATA\PROJECTS\OV\10288\ENGINEERING\HYDROLOGY\PROPOSED.DWG

Section 3 – Existing Unit Hydrograph (Unit Hydrograph Method)

2 year 24 hour

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
Study date 02/20/23 File: EX242.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 5006

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Drainage Area = 3.87(Ac.) = 0.006 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 3.87(Ac.) = 0.006 Sq. Mi.
Length along longest watercourse = 951.00(Ft.)
Length along longest watercourse measured to centroid = 476.00(Ft.)
Length along longest watercourse = 0.180 Mi.
Length along longest watercourse measured to centroid = 0.090 Mi.
Difference in elevation = 10.00(Ft.)
Slope along watercourse = 55.5205 Ft./Mi.
Average Manning's 'N' = 0.025
Lag time = 0.058 Hr.
Lag time = 3.51 Min.
25% of lag time = 0.88 Min.
40% of lag time = 1.40 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
3.87	2.50	9.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
3.87	6.00	23.22

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.000(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
3.870	50.00	0.000

Total Area Entered = 3.87(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
50.0	31.0	0.751	0.000	0.751	1.000	0.751
					Sum (F) =	0.751

Area averaged mean soil loss (F) (In/Hr) = 0.751
Minimum soil loss rate ((In/Hr)) = 0.376
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	142.599	31.342	1.222
2	0.167	285.198	47.533	1.854
3	0.250	427.797	11.634	0.454
4	0.333	570.396	5.116	0.200
5	0.417	712.995	2.691	0.105
6	0.500	855.593	1.684	0.066
			Sum = 100.000 Sum=	3.900

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(1.331)	0.018	0.002
2	0.17	0.07	0.020	(1.326)	0.018	0.002
3	0.25	0.07	0.020	(1.321)	0.018	0.002
4	0.33	0.10	0.030	(1.316)	0.027	0.003
5	0.42	0.10	0.030	(1.311)	0.027	0.003
6	0.50	0.10	0.030	(1.306)	0.027	0.003
7	0.58	0.10	0.030	(1.301)	0.027	0.003
8	0.67	0.10	0.030	(1.295)	0.027	0.003
9	0.75	0.10	0.030	(1.290)	0.027	0.003
10	0.83	0.13	0.040	(1.285)	0.036	0.004
11	0.92	0.13	0.040	(1.280)	0.036	0.004
12	1.00	0.13	0.040	(1.275)	0.036	0.004
13	1.08	0.10	0.030	(1.270)	0.027	0.003
14	1.17	0.10	0.030	(1.265)	0.027	0.003
15	1.25	0.10	0.030	(1.260)	0.027	0.003
16	1.33	0.10	0.030	(1.255)	0.027	0.003
17	1.42	0.10	0.030	(1.250)	0.027	0.003
18	1.50	0.10	0.030	(1.245)	0.027	0.003
19	1.58	0.10	0.030	(1.240)	0.027	0.003
20	1.67	0.10	0.030	(1.235)	0.027	0.003
21	1.75	0.10	0.030	(1.230)	0.027	0.003
22	1.83	0.13	0.040	(1.225)	0.036	0.004
23	1.92	0.13	0.040	(1.220)	0.036	0.004
24	2.00	0.13	0.040	(1.215)	0.036	0.004
25	2.08	0.13	0.040	(1.211)	0.036	0.004
26	2.17	0.13	0.040	(1.206)	0.036	0.004
27	2.25	0.13	0.040	(1.201)	0.036	0.004
28	2.33	0.13	0.040	(1.196)	0.036	0.004
29	2.42	0.13	0.040	(1.191)	0.036	0.004
30	2.50	0.13	0.040	(1.186)	0.036	0.004
31	2.58	0.17	0.050	(1.181)	0.045	0.005
32	2.67	0.17	0.050	(1.176)	0.045	0.005
33	2.75	0.17	0.050	(1.172)	0.045	0.005
34	2.83	0.17	0.050	(1.167)	0.045	0.005
35	2.92	0.17	0.050	(1.162)	0.045	0.005
36	3.00	0.17	0.050	(1.157)	0.045	0.005
37	3.08	0.17	0.050	(1.152)	0.045	0.005
38	3.17	0.17	0.050	(1.148)	0.045	0.005
39	3.25	0.17	0.050	(1.143)	0.045	0.005
40	3.33	0.17	0.050	(1.138)	0.045	0.005
41	3.42	0.17	0.050	(1.133)	0.045	0.005
42	3.50	0.17	0.050	(1.129)	0.045	0.005
43	3.58	0.17	0.050	(1.124)	0.045	0.005
44	3.67	0.17	0.050	(1.119)	0.045	0.005
45	3.75	0.17	0.050	(1.114)	0.045	0.005
46	3.83	0.20	0.060	(1.110)	0.054	0.006
47	3.92	0.20	0.060	(1.105)	0.054	0.006
48	4.00	0.20	0.060	(1.100)	0.054	0.006
49	4.08	0.20	0.060	(1.096)	0.054	0.006
50	4.17	0.20	0.060	(1.091)	0.054	0.006
51	4.25	0.20	0.060	(1.086)	0.054	0.006
52	4.33	0.23	0.070	(1.082)	0.063	0.007
53	4.42	0.23	0.070	(1.077)	0.063	0.007
54	4.50	0.23	0.070	(1.072)	0.063	0.007
55	4.58	0.23	0.070	(1.068)	0.063	0.007
56	4.67	0.23	0.070	(1.063)	0.063	0.007
57	4.75	0.23	0.070	(1.059)	0.063	0.007
58	4.83	0.27	0.080	(1.054)	0.072	0.008
59	4.92	0.27	0.080	(1.050)	0.072	0.008
60	5.00	0.27	0.080	(1.045)	0.072	0.008

61	5.08	0.20	0.060	(1.040)	0.054	0.006
62	5.17	0.20	0.060	(1.036)	0.054	0.006
63	5.25	0.20	0.060	(1.031)	0.054	0.006
64	5.33	0.23	0.070	(1.027)	0.063	0.007
65	5.42	0.23	0.070	(1.022)	0.063	0.007
66	5.50	0.23	0.070	(1.018)	0.063	0.007
67	5.58	0.27	0.080	(1.013)	0.072	0.008
68	5.67	0.27	0.080	(1.009)	0.072	0.008
69	5.75	0.27	0.080	(1.005)	0.072	0.008
70	5.83	0.27	0.080	(1.000)	0.072	0.008
71	5.92	0.27	0.080	(0.996)	0.072	0.008
72	6.00	0.27	0.080	(0.991)	0.072	0.008
73	6.08	0.30	0.090	(0.987)	0.081	0.009
74	6.17	0.30	0.090	(0.983)	0.081	0.009
75	6.25	0.30	0.090	(0.978)	0.081	0.009
76	6.33	0.30	0.090	(0.974)	0.081	0.009
77	6.42	0.30	0.090	(0.969)	0.081	0.009
78	6.50	0.30	0.090	(0.965)	0.081	0.009
79	6.58	0.33	0.100	(0.961)	0.090	0.010
80	6.67	0.33	0.100	(0.956)	0.090	0.010
81	6.75	0.33	0.100	(0.952)	0.090	0.010
82	6.83	0.33	0.100	(0.948)	0.090	0.010
83	6.92	0.33	0.100	(0.943)	0.090	0.010
84	7.00	0.33	0.100	(0.939)	0.090	0.010
85	7.08	0.33	0.100	(0.935)	0.090	0.010
86	7.17	0.33	0.100	(0.931)	0.090	0.010
87	7.25	0.33	0.100	(0.926)	0.090	0.010
88	7.33	0.37	0.110	(0.922)	0.099	0.011
89	7.42	0.37	0.110	(0.918)	0.099	0.011
90	7.50	0.37	0.110	(0.914)	0.099	0.011
91	7.58	0.40	0.120	(0.910)	0.108	0.012
92	7.67	0.40	0.120	(0.905)	0.108	0.012
93	7.75	0.40	0.120	(0.901)	0.108	0.012
94	7.83	0.43	0.130	(0.897)	0.117	0.013
95	7.92	0.43	0.130	(0.893)	0.117	0.013
96	8.00	0.43	0.130	(0.889)	0.117	0.013
97	8.08	0.50	0.150	(0.885)	0.135	0.015
98	8.17	0.50	0.150	(0.881)	0.135	0.015
99	8.25	0.50	0.150	(0.876)	0.135	0.015
100	8.33	0.50	0.150	(0.872)	0.135	0.015
101	8.42	0.50	0.150	(0.868)	0.135	0.015
102	8.50	0.50	0.150	(0.864)	0.135	0.015
103	8.58	0.53	0.160	(0.860)	0.144	0.016
104	8.67	0.53	0.160	(0.856)	0.144	0.016
105	8.75	0.53	0.160	(0.852)	0.144	0.016
106	8.83	0.57	0.170	(0.848)	0.153	0.017
107	8.92	0.57	0.170	(0.844)	0.153	0.017
108	9.00	0.57	0.170	(0.840)	0.153	0.017
109	9.08	0.63	0.190	(0.836)	0.171	0.019
110	9.17	0.63	0.190	(0.832)	0.171	0.019
111	9.25	0.63	0.190	(0.828)	0.171	0.019
112	9.33	0.67	0.200	(0.824)	0.180	0.020
113	9.42	0.67	0.200	(0.820)	0.180	0.020
114	9.50	0.67	0.200	(0.816)	0.180	0.020
115	9.58	0.70	0.210	(0.812)	0.189	0.021
116	9.67	0.70	0.210	(0.809)	0.189	0.021
117	9.75	0.70	0.210	(0.805)	0.189	0.021
118	9.83	0.73	0.220	(0.801)	0.198	0.022
119	9.92	0.73	0.220	(0.797)	0.198	0.022
120	10.00	0.73	0.220	(0.793)	0.198	0.022
121	10.08	0.50	0.150	(0.789)	0.135	0.015
122	10.17	0.50	0.150	(0.785)	0.135	0.015
123	10.25	0.50	0.150	(0.782)	0.135	0.015
124	10.33	0.50	0.150	(0.778)	0.135	0.015
125	10.42	0.50	0.150	(0.774)	0.135	0.015
126	10.50	0.50	0.150	(0.770)	0.135	0.015
127	10.58	0.67	0.200	(0.766)	0.180	0.020
128	10.67	0.67	0.200	(0.763)	0.180	0.020
129	10.75	0.67	0.200	(0.759)	0.180	0.020
130	10.83	0.67	0.200	(0.755)	0.180	0.020
131	10.92	0.67	0.200	(0.752)	0.180	0.020
132	11.00	0.67	0.200	(0.748)	0.180	0.020
133	11.08	0.63	0.190	(0.744)	0.171	0.019
134	11.17	0.63	0.190	(0.741)	0.171	0.019
135	11.25	0.63	0.190	(0.737)	0.171	0.019
136	11.33	0.63	0.190	(0.733)	0.171	0.019
137	11.42	0.63	0.190	(0.730)	0.171	0.019
138	11.50	0.63	0.190	(0.726)	0.171	0.019
139	11.58	0.57	0.170	(0.722)	0.153	0.017
140	11.67	0.57	0.170	(0.719)	0.153	0.017
141	11.75	0.57	0.170	(0.715)	0.153	0.017

142	11.83	0.60	0.180	(0.712)	0.162	0.018
143	11.92	0.60	0.180	(0.708)	0.162	0.018
144	12.00	0.60	0.180	(0.705)	0.162	0.018
145	12.08	0.83	0.250	(0.701)	0.225	0.025
146	12.17	0.83	0.250	(0.698)	0.225	0.025
147	12.25	0.83	0.250	(0.694)	0.225	0.025
148	12.33	0.87	0.260	(0.691)	0.234	0.026
149	12.42	0.87	0.260	(0.687)	0.234	0.026
150	12.50	0.87	0.260	(0.684)	0.234	0.026
151	12.58	0.93	0.280	(0.680)	0.252	0.028
152	12.67	0.93	0.280	(0.677)	0.252	0.028
153	12.75	0.93	0.280	(0.673)	0.252	0.028
154	12.83	0.97	0.290	(0.670)	0.261	0.029
155	12.92	0.97	0.290	(0.667)	0.261	0.029
156	13.00	0.97	0.290	(0.663)	0.261	0.029
157	13.08	1.13	0.340	(0.660)	0.306	0.034
158	13.17	1.13	0.340	(0.656)	0.306	0.034
159	13.25	1.13	0.340	(0.653)	0.306	0.034
160	13.33	1.13	0.340	(0.650)	0.306	0.034
161	13.42	1.13	0.340	(0.647)	0.306	0.034
162	13.50	1.13	0.340	(0.643)	0.306	0.034
163	13.58	0.77	0.230	(0.640)	0.207	0.023
164	13.67	0.77	0.230	(0.637)	0.207	0.023
165	13.75	0.77	0.230	(0.633)	0.207	0.023
166	13.83	0.77	0.230	(0.630)	0.207	0.023
167	13.92	0.77	0.230	(0.627)	0.207	0.023
168	14.00	0.77	0.230	(0.624)	0.207	0.023
169	14.08	0.90	0.270	(0.621)	0.243	0.027
170	14.17	0.90	0.270	(0.617)	0.243	0.027
171	14.25	0.90	0.270	(0.614)	0.243	0.027
172	14.33	0.87	0.260	(0.611)	0.234	0.026
173	14.42	0.87	0.260	(0.608)	0.234	0.026
174	14.50	0.87	0.260	(0.605)	0.234	0.026
175	14.58	0.87	0.260	(0.602)	0.234	0.026
176	14.67	0.87	0.260	(0.599)	0.234	0.026
177	14.75	0.87	0.260	(0.596)	0.234	0.026
178	14.83	0.83	0.250	(0.593)	0.225	0.025
179	14.92	0.83	0.250	(0.590)	0.225	0.025
180	15.00	0.83	0.250	(0.587)	0.225	0.025
181	15.08	0.80	0.240	(0.584)	0.216	0.024
182	15.17	0.80	0.240	(0.581)	0.216	0.024
183	15.25	0.80	0.240	(0.578)	0.216	0.024
184	15.33	0.77	0.230	(0.575)	0.207	0.023
185	15.42	0.77	0.230	(0.572)	0.207	0.023
186	15.50	0.77	0.230	(0.569)	0.207	0.023
187	15.58	0.63	0.190	(0.566)	0.171	0.019
188	15.67	0.63	0.190	(0.563)	0.171	0.019
189	15.75	0.63	0.190	(0.560)	0.171	0.019
190	15.83	0.63	0.190	(0.557)	0.171	0.019
191	15.92	0.63	0.190	(0.554)	0.171	0.019
192	16.00	0.63	0.190	(0.551)	0.171	0.019
193	16.08	0.13	0.040	(0.549)	0.036	0.004
194	16.17	0.13	0.040	(0.546)	0.036	0.004
195	16.25	0.13	0.040	(0.543)	0.036	0.004
196	16.33	0.13	0.040	(0.540)	0.036	0.004
197	16.42	0.13	0.040	(0.538)	0.036	0.004
198	16.50	0.13	0.040	(0.535)	0.036	0.004
199	16.58	0.10	0.030	(0.532)	0.027	0.003
200	16.67	0.10	0.030	(0.529)	0.027	0.003
201	16.75	0.10	0.030	(0.527)	0.027	0.003
202	16.83	0.10	0.030	(0.524)	0.027	0.003
203	16.92	0.10	0.030	(0.521)	0.027	0.003
204	17.00	0.10	0.030	(0.519)	0.027	0.003
205	17.08	0.17	0.050	(0.516)	0.045	0.005
206	17.17	0.17	0.050	(0.514)	0.045	0.005
207	17.25	0.17	0.050	(0.511)	0.045	0.005
208	17.33	0.17	0.050	(0.508)	0.045	0.005
209	17.42	0.17	0.050	(0.506)	0.045	0.005
210	17.50	0.17	0.050	(0.503)	0.045	0.005
211	17.58	0.17	0.050	(0.501)	0.045	0.005
212	17.67	0.17	0.050	(0.498)	0.045	0.005
213	17.75	0.17	0.050	(0.496)	0.045	0.005
214	17.83	0.13	0.040	(0.493)	0.036	0.004
215	17.92	0.13	0.040	(0.491)	0.036	0.004
216	18.00	0.13	0.040	(0.488)	0.036	0.004
217	18.08	0.13	0.040	(0.486)	0.036	0.004
218	18.17	0.13	0.040	(0.484)	0.036	0.004
219	18.25	0.13	0.040	(0.481)	0.036	0.004
220	18.33	0.13	0.040	(0.479)	0.036	0.004
221	18.42	0.13	0.040	(0.477)	0.036	0.004
222	18.50	0.13	0.040	(0.474)	0.036	0.004

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223  18.58     0.10      0.030       (  0.472)       0.027        0.003
224  18.67     0.10      0.030       (  0.470)       0.027        0.003
225  18.75     0.10      0.030       (  0.467)       0.027        0.003
226  18.83     0.07      0.020       (  0.465)       0.018        0.002
227  18.92     0.07      0.020       (  0.463)       0.018        0.002
228  19.00     0.07      0.020       (  0.461)       0.018        0.002
229  19.08     0.10      0.030       (  0.459)       0.027        0.003
230  19.17     0.10      0.030       (  0.457)       0.027        0.003
231  19.25     0.10      0.030       (  0.454)       0.027        0.003
232  19.33     0.13      0.040       (  0.452)       0.036        0.004
233  19.42     0.13      0.040       (  0.450)       0.036        0.004
234  19.50     0.13      0.040       (  0.448)       0.036        0.004
235  19.58     0.10      0.030       (  0.446)       0.027        0.003
236  19.67     0.10      0.030       (  0.444)       0.027        0.003
237  19.75     0.10      0.030       (  0.442)       0.027        0.003
238  19.83     0.07      0.020       (  0.440)       0.018        0.002
239  19.92     0.07      0.020       (  0.438)       0.018        0.002
240  20.00     0.07      0.020       (  0.436)       0.018        0.002
241  20.08     0.10      0.030       (  0.434)       0.027        0.003
242  20.17     0.10      0.030       (  0.432)       0.027        0.003
243  20.25     0.10      0.030       (  0.430)       0.027        0.003
244  20.33     0.10      0.030       (  0.429)       0.027        0.003
245  20.42     0.10      0.030       (  0.427)       0.027        0.003
246  20.50     0.10      0.030       (  0.425)       0.027        0.003
247  20.58     0.10      0.030       (  0.423)       0.027        0.003
248  20.67     0.10      0.030       (  0.421)       0.027        0.003
249  20.75     0.10      0.030       (  0.420)       0.027        0.003
250  20.83     0.07      0.020       (  0.418)       0.018        0.002
251  20.92     0.07      0.020       (  0.416)       0.018        0.002
252  21.00     0.07      0.020       (  0.414)       0.018        0.002
253  21.08     0.10      0.030       (  0.413)       0.027        0.003
254  21.17     0.10      0.030       (  0.411)       0.027        0.003
255  21.25     0.10      0.030       (  0.410)       0.027        0.003
256  21.33     0.07      0.020       (  0.408)       0.018        0.002
257  21.42     0.07      0.020       (  0.407)       0.018        0.002
258  21.50     0.07      0.020       (  0.405)       0.018        0.002
259  21.58     0.10      0.030       (  0.404)       0.027        0.003
260  21.67     0.10      0.030       (  0.402)       0.027        0.003
261  21.75     0.10      0.030       (  0.401)       0.027        0.003
262  21.83     0.07      0.020       (  0.399)       0.018        0.002
263  21.92     0.07      0.020       (  0.398)       0.018        0.002
264  22.00     0.07      0.020       (  0.397)       0.018        0.002
265  22.08     0.10      0.030       (  0.395)       0.027        0.003
266  22.17     0.10      0.030       (  0.394)       0.027        0.003
267  22.25     0.10      0.030       (  0.393)       0.027        0.003
268  22.33     0.07      0.020       (  0.391)       0.018        0.002
269  22.42     0.07      0.020       (  0.390)       0.018        0.002
270  22.50     0.07      0.020       (  0.389)       0.018        0.002
271  22.58     0.07      0.020       (  0.388)       0.018        0.002
272  22.67     0.07      0.020       (  0.387)       0.018        0.002
273  22.75     0.07      0.020       (  0.386)       0.018        0.002
274  22.83     0.07      0.020       (  0.385)       0.018        0.002
275  22.92     0.07      0.020       (  0.384)       0.018        0.002
276  23.00     0.07      0.020       (  0.383)       0.018        0.002
277  23.08     0.07      0.020       (  0.382)       0.018        0.002
278  23.17     0.07      0.020       (  0.381)       0.018        0.002
279  23.25     0.07      0.020       (  0.380)       0.018        0.002
280  23.33     0.07      0.020       (  0.380)       0.018        0.002
281  23.42     0.07      0.020       (  0.379)       0.018        0.002
282  23.50     0.07      0.020       (  0.378)       0.018        0.002
283  23.58     0.07      0.020       (  0.378)       0.018        0.002
284  23.67     0.07      0.020       (  0.377)       0.018        0.002
285  23.75     0.07      0.020       (  0.377)       0.018        0.002
286  23.83     0.07      0.020       (  0.376)       0.018        0.002
287  23.92     0.07      0.020       (  0.376)       0.018        0.002
288  24.00     0.07      0.020       (  0.376)       0.018        0.002
               (Loss Rate Not Used)
    Sum =     100.0                                  Sum =     3.0
      Flood volume = Effective rainfall      0.25(In)
       times area       3.9(Ac.)/[(In)/(Ft.)] =       0.1(Ac.Ft)
      Total soil loss =      2.25(In)
      Total soil loss =     0.726(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =        3512.0 Cubic Feet
      Total soil loss =       31608.0 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.133(CFS)
      ---------------------------------------------------------------------
      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R    S T O R M
                     R u n o f f     H y d r o g r a p h
```

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0001	0.01	Q				
0+20	0.0002	0.01	Q				
0+25	0.0002	0.01	Q				
0+30	0.0003	0.01	Q				
0+35	0.0004	0.01	Q				
0+40	0.0005	0.01	Q				
0+45	0.0006	0.01	Q				
0+50	0.0006	0.01	Q				
0+55	0.0008	0.01	Q				
1+ 0	0.0009	0.02	Q				
1+ 5	0.0010	0.01	Q				
1+10	0.0010	0.01	Q				
1+15	0.0011	0.01	Q				
1+20	0.0012	0.01	Q				
1+25	0.0013	0.01	Q				
1+30	0.0014	0.01	Q				
1+35	0.0014	0.01	Q				
1+40	0.0015	0.01	Q				
1+45	0.0016	0.01	Q				
1+50	0.0017	0.01	Q				
1+55	0.0018	0.01	Q				
2+ 0	0.0019	0.02	Q				
2+ 5	0.0020	0.02	Q				
2+10	0.0021	0.02	QV				
2+15	0.0022	0.02	QV				
2+20	0.0023	0.02	QV				
2+25	0.0024	0.02	QV				
2+30	0.0025	0.02	QV				
2+35	0.0027	0.02	QV				
2+40	0.0028	0.02	QV				
2+45	0.0029	0.02	QV				
2+50	0.0031	0.02	QV				
2+55	0.0032	0.02	QV				
3+ 0	0.0033	0.02	QV				
3+ 5	0.0035	0.02	QV				
3+10	0.0036	0.02	QV				
3+15	0.0037	0.02	QV				
3+20	0.0039	0.02	QV				
3+25	0.0040	0.02	QV				
3+30	0.0041	0.02	Q V				
3+35	0.0043	0.02	Q V				
3+40	0.0044	0.02	Q V				
3+45	0.0045	0.02	Q V				
3+50	0.0047	0.02	Q V				
3+55	0.0048	0.02	Q V				
4+ 0	0.0050	0.02	Q V				
4+ 5	0.0052	0.02	Q V				
4+10	0.0053	0.02	Q V				
4+15	0.0055	0.02	Q V				
4+20	0.0056	0.02	Q V				
4+25	0.0058	0.03	Q V				
4+30	0.0060	0.03	Q V				
4+35	0.0062	0.03	Q V				
4+40	0.0064	0.03	Q V				
4+45	0.0066	0.03	Q V				
4+50	0.0068	0.03	Q V				
4+55	0.0070	0.03	Q V				
5+ 0	0.0072	0.03	Q V				
5+ 5	0.0074	0.03	Q V				
5+10	0.0076	0.02	Q V				
5+15	0.0077	0.02	Q V				
5+20	0.0079	0.02	Q V				
5+25	0.0081	0.03	Q V				
5+30	0.0083	0.03	Q V				
5+35	0.0085	0.03	Q V				
5+40	0.0087	0.03	Q V				
5+45	0.0089	0.03	Q V				
5+50	0.0091	0.03	Q V				
5+55	0.0093	0.03	Q V				
6+ 0	0.0095	0.03	Q V				
6+ 5	0.0098	0.03	Q V				
6+10	0.0100	0.03	Q V				
6+15	0.0102	0.03	Q V				

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 6+20       0.0105      0.03  Q    V    |          |          |          |
 6+25       0.0107      0.04  Q    V    |          |          |          |
 6+30       0.0110      0.04  Q    V    |          |          |          |
 6+35       0.0112      0.04  Q    V    |          |          |          |
 6+40       0.0115      0.04  Q    V    |          |          |          |
 6+45       0.0117      0.04  Q    V    |          |          |          |
 6+50       0.0120      0.04  Q    V    |          |          |          |
 6+55       0.0123      0.04  Q     V   |          |          |          |
 7+ 0       0.0125      0.04  Q     V   |          |          |          |
 7+ 5       0.0128      0.04  Q     V   |          |          |          |
 7+10       0.0131      0.04  Q     V   |          |          |          |
 7+15       0.0133      0.04  Q     V   |          |          |          |
 7+20       0.0136      0.04  Q     V   |          |          |          |
 7+25       0.0139      0.04  Q     V   |          |          |          |
 7+30       0.0142      0.04  Q      V  |          |          |          |
 7+35       0.0145      0.04  Q      V  |          |          |          |
 7+40       0.0148      0.05  Q      V  |          |          |          |
 7+45       0.0151      0.05  Q      V  |          |          |          |
 7+50       0.0155      0.05  Q      V  |          |          |          |
 7+55       0.0158      0.05  Q      V  |          |          |          |
 8+ 0       0.0162      0.05  Q       V |          |          |          |
 8+ 5       0.0165      0.05  Q       V |          |          |          |
 8+10       0.0169      0.06  Q       V |          |          |          |
 8+15       0.0173      0.06  Q       V |          |          |          |
 8+20       0.0177      0.06  Q       V |          |          |          |
 8+25       0.0181      0.06  Q       V |          |          |          |
 8+30       0.0185      0.06  Q        V|          |          |          |
 8+35       0.0189      0.06  Q        V|          |          |          |
 8+40       0.0194      0.06  Q        V|          |          |          |
 8+45       0.0198      0.06  Q        V|          |          |          |
 8+50       0.0202      0.06  Q         V          |          |          |
 8+55       0.0207      0.07  Q         V          |          |          |
 9+ 0       0.0211      0.07  Q         V          |          |          |
 9+ 5       0.0216      0.07  Q         V          |          |          |
 9+10       0.0221      0.07  Q         V          |          |          |
 9+15       0.0226      0.07  Q         |V         |          |          |
 9+20       0.0231      0.08  Q         |V         |          |          |
 9+25       0.0237      0.08  Q         |V         |          |          |
 9+30       0.0242      0.08  Q         |V         |          |          |
 9+35       0.0247      0.08  Q          V         |          |          |
 9+40       0.0253      0.08  Q          V         |          |          |
 9+45       0.0259      0.08  Q          V         |          |          |
 9+50       0.0264      0.08  Q           V        |          |          |
 9+55       0.0270      0.08  Q           V        |          |          |
10+ 0       0.0276      0.09  Q           V        |          |          |
10+ 5       0.0281      0.08  Q           V        |          |          |
10+10       0.0286      0.06  Q            V       |          |          |
10+15       0.0290      0.06  Q            V       |          |          |
10+20       0.0294      0.06  Q            V       |          |          |
10+25       0.0298      0.06  Q            V       |          |          |
10+30       0.0302      0.06  Q            V       |          |          |
10+35       0.0307      0.06  Q             V      |          |          |
10+40       0.0312      0.07  Q             V      |          |          |
10+45       0.0317      0.08  Q             V      |          |          |
10+50       0.0322      0.08  Q             V      |          |          |
10+55       0.0328      0.08  Q              V     |          |          |
11+ 0       0.0333      0.08  Q              V     |          |          |
11+ 5       0.0338      0.08  Q              V     |          |          |
11+10       0.0343      0.07  Q               V    |          |          |
11+15       0.0349      0.07  Q               V    |          |          |
11+20       0.0354      0.07  Q               V    |          |          |
11+25       0.0359      0.07  Q               V    |          |          |
11+30       0.0364      0.07  Q                V   |          |          |
11+35       0.0369      0.07  Q                V   |          |          |
11+40       0.0374      0.07  Q                V   |          |          |
11+45       0.0378      0.07  Q                V   |          |          |
11+50       0.0383      0.07  Q                V   |          |          |
11+55       0.0388      0.07  Q                 V  |          |          |
12+ 0       0.0392      0.07  Q                 V  |          |          |
12+ 5       0.0398      0.08  Q                 V  |          |          |
12+10       0.0404      0.09  Q                  V |          |          |
12+15       0.0411      0.09  Q                  V |          |          |
12+20       0.0417      0.10  Q                  V |          |          |
12+25       0.0424      0.10  Q                  |V|          |          |
12+30       0.0431      0.10  Q                  |V|          |          |
12+35       0.0438      0.10  Q                  |V|          |          |
12+40       0.0446      0.11  Q                  | V          |          |
12+45       0.0453      0.11  Q                  | V          |          |
12+50       0.0461      0.11  Q                  | V          |          |
12+55       0.0469      0.11  Q                  |  V         |          |
13+ 0       0.0476      0.11  Q                  |  V         |          |
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13+ 5       0.0485      0.12  Q        |          |   V      |          |
13+10       0.0493      0.13  Q        |          |   V      |          |
13+15       0.0502      0.13  Q        |          |   V      |          |
13+20       0.0512      0.13  Q        |          |    V     |          |
13+25       0.0521      0.13  Q        |          |    V     |          |
13+30       0.0530      0.13  Q        |          |     V    |          |
13+35       0.0538      0.12  Q        |          |     V    |          |
13+40       0.0545      0.10  Q        |          |      V   |          |
13+45       0.0551      0.09  Q        |          |      V   |          |
13+50       0.0558      0.09  Q        |          |      V   |          |
13+55       0.0564      0.09  Q        |          |      V   |          |
14+ 0       0.0570      0.09  Q        |          |       V  |          |
14+ 5       0.0576      0.09  Q        |          |       V  |          |
14+10       0.0584      0.10  Q        |          |       V  |          |
14+15       0.0591      0.10  Q        |          |        V |          |
14+20       0.0598      0.10  Q        |          |        V |          |
14+25       0.0605      0.10  Q        |          |         V|          |
14+30       0.0612      0.10  Q        |          |         V|          |
14+35       0.0619      0.10  Q        |          |         V|          |
14+40       0.0626      0.10  Q        |          |          |V         |
14+45       0.0633      0.10  Q        |          |          |V         |
14+50       0.0640      0.10  Q        |          |          |V         |
14+55       0.0646      0.10  Q        |          |          | V        |
15+ 0       0.0653      0.10  Q        |          |          | V        |
15+ 5       0.0660      0.10  Q        |          |          | V        |
15+10       0.0666      0.09  Q        |          |          |  V       |
15+15       0.0673      0.09  Q        |          |          |  V       |
15+20       0.0679      0.09  Q        |          |          |  V       |
15+25       0.0685      0.09  Q        |          |          |   V      |
15+30       0.0692      0.09  Q        |          |          |   V      |
15+35       0.0698      0.09  Q        |          |          |   V      |
15+40       0.0703      0.08  Q        |          |          |   V      |
15+45       0.0708      0.08  Q        |          |          |    V     |
15+50       0.0713      0.07  Q        |          |          |    V     |
15+55       0.0718      0.07  Q        |          |          |    V     |
16+ 0       0.0723      0.07  Q        |          |          |    V     |
16+ 5       0.0727      0.06  Q        |          |          |     V    |
16+10       0.0729      0.03  Q        |          |          |     V    |
16+15       0.0731      0.02  Q        |          |          |     V    |
16+20       0.0732      0.02  Q        |          |          |     V    |
16+25       0.0733      0.02  Q        |          |          |     V    |
16+30       0.0734      0.02  Q        |          |          |     V    |
16+35       0.0735      0.01  Q        |          |          |     V    |
16+40       0.0736      0.01  Q        |          |          |     V    |
16+45       0.0737      0.01  Q        |          |          |     V    |
16+50       0.0738      0.01  Q        |          |          |     V    |
16+55       0.0738      0.01  Q        |          |          |     V    |
17+ 0       0.0739      0.01  Q        |          |          |     V    |
17+ 5       0.0740      0.01  Q        |          |          |     V    |
17+10       0.0741      0.02  Q        |          |          |     V    |
17+15       0.0743      0.02  Q        |          |          |     V    |
17+20       0.0744      0.02  Q        |          |          |     V    |
17+25       0.0745      0.02  Q        |          |          |     V    |
17+30       0.0747      0.02  Q        |          |          |      V   |
17+35       0.0748      0.02  Q        |          |          |      V   |
17+40       0.0749      0.02  Q        |          |          |      V   |
17+45       0.0751      0.02  Q        |          |          |      V   |
17+50       0.0752      0.02  Q        |          |          |      V   |
17+55       0.0753      0.02  Q        |          |          |      V   |
18+ 0       0.0754      0.02  Q        |          |          |      V   |
18+ 5       0.0755      0.02  Q        |          |          |      V   |
18+10       0.0756      0.02  Q        |          |          |      V   |
18+15       0.0758      0.02  Q        |          |          |      V   |
18+20       0.0759      0.02  Q        |          |          |      V   |
18+25       0.0760      0.02  Q        |          |          |      V   |
18+30       0.0761      0.02  Q        |          |          |      V   |
18+35       0.0762      0.01  Q        |          |          |      V   |
18+40       0.0763      0.01  Q        |          |          |      V   |
18+45       0.0763      0.01  Q        |          |          |      V   |
18+50       0.0764      0.01  Q        |          |          |      V   |
18+55       0.0765      0.01  Q        |          |          |      V   |
19+ 0       0.0765      0.01  Q        |          |          |      V   |
19+ 5       0.0766      0.01  Q        |          |          |       V  |
19+10       0.0767      0.01  Q        |          |          |       V  |
19+15       0.0768      0.01  Q        |          |          |       V  |
19+20       0.0768      0.01  Q        |          |          |       V  |
19+25       0.0769      0.01  Q        |          |          |       V  |
19+30       0.0770      0.02  Q        |          |          |       V  |
19+35       0.0771      0.01  Q        |          |          |       V  |
19+40       0.0772      0.01  Q        |          |          |       V  |
19+45       0.0773      0.01  Q        |          |          |       V  |
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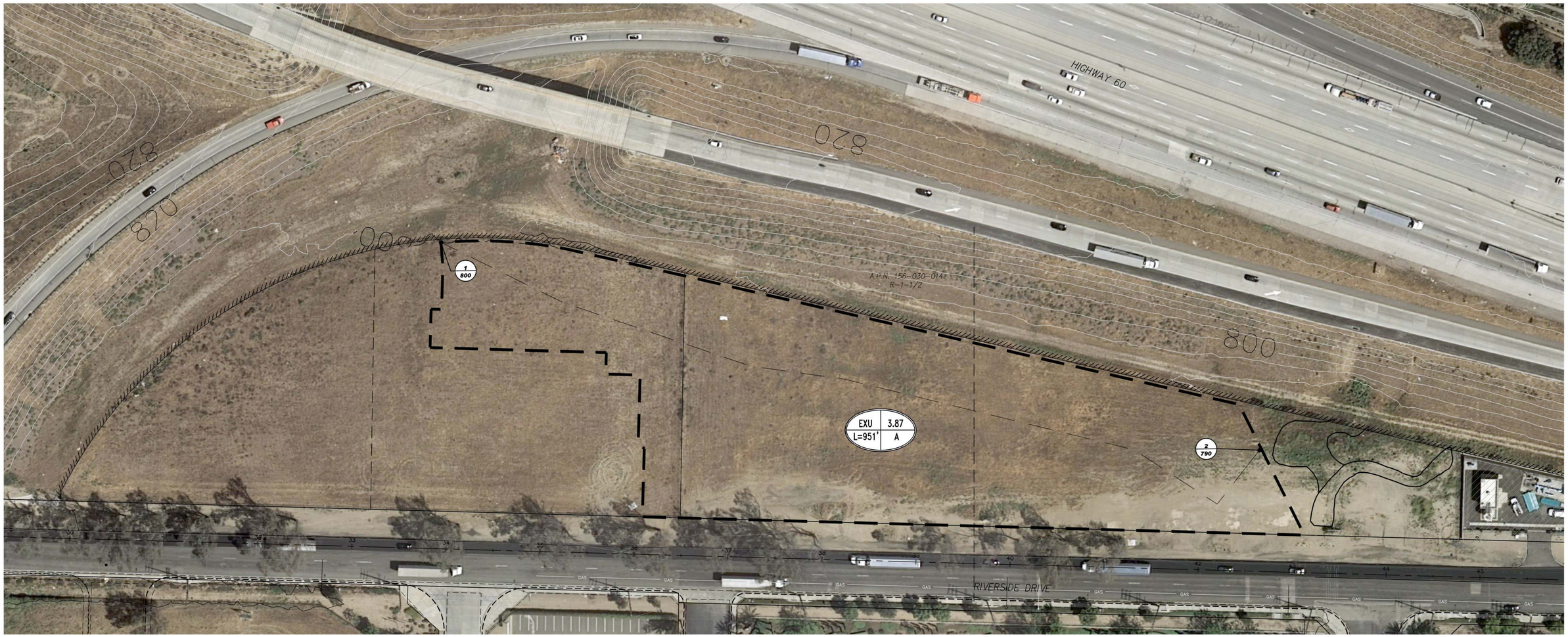
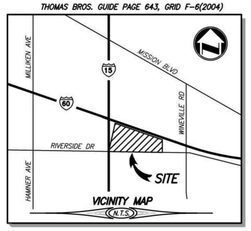
   19+50       0.0774      0.01  Q          |          |          |        V |
   19+55       0.0774      0.01  Q          |          |          |        V |
   20+ 0       0.0775      0.01  Q          |          |          |        V |
   20+ 5       0.0776      0.01  Q          |          |          |        V |
   20+10       0.0776      0.01  Q          |          |          |        V |
   20+15       0.0777      0.01  Q          |          |          |        V |
   20+20       0.0778      0.01  Q          |          |          |        V |
   20+25       0.0779      0.01  Q          |          |          |        V |
   20+30       0.0780      0.01  Q          |          |          |        V |
   20+35       0.0780      0.01  Q          |          |          |        V |
   20+40       0.0781      0.01  Q          |          |          |        V |
   20+45       0.0782      0.01  Q          |          |          |        V |
   20+50       0.0783      0.01  Q          |          |          |        V |
   20+55       0.0783      0.01  Q          |          |          |        V |
   21+ 0       0.0784      0.01  Q          |          |          |        V |
   21+ 5       0.0785      0.01  Q          |          |          |        V |
   21+10       0.0785      0.01  Q          |          |          |        V |
   21+15       0.0786      0.01  Q          |          |          |        V |
   21+20       0.0787      0.01  Q          |          |          |         V|
   21+25       0.0787      0.01  Q          |          |          |         V|
   21+30       0.0788      0.01  Q          |          |          |         V|
   21+35       0.0789      0.01  Q          |          |          |         V|
   21+40       0.0789      0.01  Q          |          |          |         V|
   21+45       0.0790      0.01  Q          |          |          |         V|
   21+50       0.0791      0.01  Q          |          |          |         V|
   21+55       0.0791      0.01  Q          |          |          |         V|
   22+ 0       0.0792      0.01  Q          |          |          |         V|
   22+ 5       0.0793      0.01  Q          |          |          |         V|
   22+10       0.0793      0.01  Q          |          |          |         V|
   22+15       0.0794      0.01  Q          |          |          |         V|
   22+20       0.0795      0.01  Q          |          |          |         V|
   22+25       0.0795      0.01  Q          |          |          |         V|
   22+30       0.0796      0.01  Q          |          |          |         V|
   22+35       0.0797      0.01  Q          |          |          |         V|
   22+40       0.0797      0.01  Q          |          |          |         V|
   22+45       0.0798      0.01  Q          |          |          |         V|
   22+50       0.0798      0.01  Q          |          |          |         V|
   22+55       0.0799      0.01  Q          |          |          |         V|
   23+ 0       0.0799      0.01  Q          |          |          |         V|
   23+ 5       0.0800      0.01  Q          |          |          |         V|
   23+10       0.0800      0.01  Q          |          |          |         V|
   23+15       0.0801      0.01  Q          |          |          |         V|
   23+20       0.0801      0.01  Q          |          |          |         V|
   23+25       0.0802      0.01  Q          |          |          |         V|
   23+30       0.0802      0.01  Q          |          |          |         V|
   23+35       0.0803      0.01  Q          |          |          |         V|
   23+40       0.0804      0.01  Q          |          |          |         V|
   23+45       0.0804      0.01  Q          |          |          |         V|
   23+50       0.0805      0.01  Q          |          |          |         V|
   23+55       0.0805      0.01  Q          |          |          |         V|
   24+ 0       0.0806      0.01  Q          |          |          |         V|
   24+ 5       0.0806      0.01  Q          |          |          |         V|
   24+10       0.0806      0.00  Q          |          |          |         V|
   24+15       0.0806      0.00  Q          |          |          |         V|
   24+20       0.0806      0.00  Q          |          |          |         V|
   24+25       0.0806      0.00  Q          |          |          |          V
-------------------------------------------------------------------------------
```

NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY EXISTING UNIT HYDROGRAPH MAP



0 50 150
25 100 200
SCALE: 1" = 50'

THOMAS BROS. GUIDE PAGE 643, GRID F-6(2004)



SEC.6 T.2.S. R.6.W

LEGEND

AREA	ACRES
LENGTH	SOIL

NODE / ELEV
Q10=_____ cfs
Q100=_____ cfs
TC=_____min
ACRES=

WATERSHED BOUNDARY
FLOW PATH

NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY EXISTING UNIT HYDROGRAPH MAP

PREPARATION DATE : FEBRUARY 2023

PLAN PREPARED BY:
adkan ENGINEERS
Civil Engineering • Surveying • Planning
6879 Airport Drive, Riverside, CA 92504
Tel:(951) 688-0241 Fax:(951) 688-0599

PLOT LOCATION: \\ADK-FS01\ADKANDATA\PROJECTS\OV\10288\ENGINEERING\HYDROLOGY\EX UNIT.DWG

PLOT DATE: 2/21/2023 11:12 AM

Section 4 – Proposed Unit Hydrograph (Unit Hydrograph Method)

2 year 24 hour / Map / Basin Routing Calculations

```
       U n i t   H y d r o g r a p h   A n a l y s i s

       Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
              Study date  02/20/23 File: pro242.out

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------------

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978


Program License Serial Number 5006

------------------------------------------------------------------------
 English (in-lb) Input Units Used
 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



------------------------------------------------------------------------
------------------------------------------------------------------------
Drainage Area =       3.87(Ac.)  =      0.006 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       3.87(Ac.)  =      0.006 Sq. Mi.
Length along longest watercourse =    1041.00(Ft.)
Length along longest watercourse measured to centroid =     520.00(Ft.)
Length along longest watercourse =      0.197 Mi.
Length along longest watercourse measured to centroid =      0.098 Mi.
Difference in elevation =      10.00(Ft.)
Slope along watercourse =     50.7205 Ft./Mi.
Average Manning's 'N' = 0.020
Lag time =    0.051 Hr.
Lag time =     3.05 Min.
25% of lag time =     0.76 Min.
40% of lag time =     1.22 Min.
Unit time =     5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        3.87            2.50                 9.68

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        3.87            6.00                23.22

STORM EVENT (YEAR) =    2.00
Area Averaged 2-Year Rainfall =    2.500(In)
Area Averaged 100-Year Rainfall =    6.000(In)

Point rain (area averaged) =    2.500(In)
Areal adjustment factor =  100.00 %
Adjusted average point rain =    2.500(In)

Sub-Area Data:
Area(Ac.)         Runoff Index   Impervious %
     3.870           32.00          0.900
 Total Area Entered =      3.87(Ac.)


RI    RI   Infil. Rate Impervious   Adj. Infil. Rate  Area%     F
AMC2 AMC-1     (In/Hr)    (Dec.%)     (In/Hr)      (Dec.)    (In/Hr)
32.0  16.2      0.870     0.900        0.165       1.000      0.165
                                                 Sum (F) =   0.165
Area averaged mean soil loss (F) (In/Hr) =  0.165
Minimum soil loss rate ((In/Hr)) =  0.083
(for 24 hour storm duration)
Soil low loss rate (decimal) =   0.180
------------------------------------------------------------------------

               U n i t  H y d r o g r a p h
                      VALLEY S-Curve
------------------------------------------------------------------
               Unit Hydrograph Data
------------------------------------------------------------------
Unit time period   Time % of lag   Distribution   Unit Hydrograph
    (hrs)                          Graph %           (CFS)
```

1	0.083	163.701	36.334	1.417
2	0.167	327.402	45.989	1.794
3	0.250	491.103	10.445	0.407
4	0.333	654.804	4.464	0.174
5	0.417	818.505	2.768	0.108
			Sum = 100.000 Sum=	3.900

The following loss rate calculations reflect use of the minimum calculated loss rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.293)	0.004	0.016
2	0.17	0.07	0.020	(0.292)	0.004	0.016
3	0.25	0.07	0.020	(0.291)	0.004	0.016
4	0.33	0.10	0.030	(0.290)	0.005	0.025
5	0.42	0.10	0.030	(0.289)	0.005	0.025
6	0.50	0.10	0.030	(0.288)	0.005	0.025
7	0.58	0.10	0.030	(0.286)	0.005	0.025
8	0.67	0.10	0.030	(0.285)	0.005	0.025
9	0.75	0.10	0.030	(0.284)	0.005	0.025
10	0.83	0.13	0.040	(0.283)	0.007	0.033
11	0.92	0.13	0.040	(0.282)	0.007	0.033
12	1.00	0.13	0.040	(0.281)	0.007	0.033
13	1.08	0.10	0.030	(0.280)	0.005	0.025
14	1.17	0.10	0.030	(0.279)	0.005	0.025
15	1.25	0.10	0.030	(0.277)	0.005	0.025
16	1.33	0.10	0.030	(0.276)	0.005	0.025
17	1.42	0.10	0.030	(0.275)	0.005	0.025
18	1.50	0.10	0.030	(0.274)	0.005	0.025
19	1.58	0.10	0.030	(0.273)	0.005	0.025
20	1.67	0.10	0.030	(0.272)	0.005	0.025
21	1.75	0.10	0.030	(0.271)	0.005	0.025
22	1.83	0.13	0.040	(0.270)	0.007	0.033
23	1.92	0.13	0.040	(0.269)	0.007	0.033
24	2.00	0.13	0.040	(0.268)	0.007	0.033
25	2.08	0.13	0.040	(0.267)	0.007	0.033
26	2.17	0.13	0.040	(0.265)	0.007	0.033
27	2.25	0.13	0.040	(0.264)	0.007	0.033
28	2.33	0.13	0.040	(0.263)	0.007	0.033
29	2.42	0.13	0.040	(0.262)	0.007	0.033
30	2.50	0.13	0.040	(0.261)	0.007	0.033
31	2.58	0.17	0.050	(0.260)	0.009	0.041
32	2.67	0.17	0.050	(0.259)	0.009	0.041
33	2.75	0.17	0.050	(0.258)	0.009	0.041
34	2.83	0.17	0.050	(0.257)	0.009	0.041
35	2.92	0.17	0.050	(0.256)	0.009	0.041
36	3.00	0.17	0.050	(0.255)	0.009	0.041
37	3.08	0.17	0.050	(0.254)	0.009	0.041
38	3.17	0.17	0.050	(0.253)	0.009	0.041
39	3.25	0.17	0.050	(0.252)	0.009	0.041
40	3.33	0.17	0.050	(0.251)	0.009	0.041
41	3.42	0.17	0.050	(0.250)	0.009	0.041
42	3.50	0.17	0.050	(0.249)	0.009	0.041
43	3.58	0.17	0.050	(0.247)	0.009	0.041
44	3.67	0.17	0.050	(0.246)	0.009	0.041
45	3.75	0.17	0.050	(0.245)	0.009	0.041
46	3.83	0.20	0.060	(0.244)	0.011	0.049
47	3.92	0.20	0.060	(0.243)	0.011	0.049
48	4.00	0.20	0.060	(0.242)	0.011	0.049
49	4.08	0.20	0.060	(0.241)	0.011	0.049
50	4.17	0.20	0.060	(0.240)	0.011	0.049
51	4.25	0.20	0.060	(0.239)	0.011	0.049
52	4.33	0.23	0.070	(0.238)	0.013	0.057
53	4.42	0.23	0.070	(0.237)	0.013	0.057
54	4.50	0.23	0.070	(0.236)	0.013	0.057
55	4.58	0.23	0.070	(0.235)	0.013	0.057
56	4.67	0.23	0.070	(0.234)	0.013	0.057
57	4.75	0.23	0.070	(0.233)	0.013	0.057
58	4.83	0.27	0.080	(0.232)	0.014	0.066
59	4.92	0.27	0.080	(0.231)	0.014	0.066
60	5.00	0.27	0.080	(0.230)	0.014	0.066
61	5.08	0.20	0.060	(0.229)	0.011	0.049
62	5.17	0.20	0.060	(0.228)	0.011	0.049
63	5.25	0.20	0.060	(0.227)	0.011	0.049
64	5.33	0.23	0.070	(0.226)	0.013	0.057
65	5.42	0.23	0.070	(0.225)	0.013	0.057
66	5.50	0.23	0.070	(0.224)	0.013	0.057
67	5.58	0.27	0.080	(0.223)	0.014	0.066
68	5.67	0.27	0.080	(0.222)	0.014	0.066
69	5.75	0.27	0.080	(0.221)	0.014	0.066
70	5.83	0.27	0.080	(0.220)	0.014	0.066
71	5.92	0.27	0.080	(0.219)	0.014	0.066

72	6.00	0.27	0.080	(0.218)	0.014	0.066
73	6.08	0.30	0.090	(0.217)	0.016	0.074
74	6.17	0.30	0.090	(0.216)	0.016	0.074
75	6.25	0.30	0.090	(0.215)	0.016	0.074
76	6.33	0.30	0.090	(0.214)	0.016	0.074
77	6.42	0.30	0.090	(0.213)	0.016	0.074
78	6.50	0.30	0.090	(0.213)	0.016	0.074
79	6.58	0.33	0.100	(0.212)	0.018	0.082
80	6.67	0.33	0.100	(0.211)	0.018	0.082
81	6.75	0.33	0.100	(0.210)	0.018	0.082
82	6.83	0.33	0.100	(0.209)	0.018	0.082
83	6.92	0.33	0.100	(0.208)	0.018	0.082
84	7.00	0.33	0.100	(0.207)	0.018	0.082
85	7.08	0.33	0.100	(0.206)	0.018	0.082
86	7.17	0.33	0.100	(0.205)	0.018	0.082
87	7.25	0.33	0.100	(0.204)	0.018	0.082
88	7.33	0.37	0.110	(0.203)	0.020	0.090
89	7.42	0.37	0.110	(0.202)	0.020	0.090
90	7.50	0.37	0.110	(0.201)	0.020	0.090
91	7.58	0.40	0.120	(0.200)	0.022	0.098
92	7.67	0.40	0.120	(0.199)	0.022	0.098
93	7.75	0.40	0.120	(0.198)	0.022	0.098
94	7.83	0.43	0.130	(0.198)	0.023	0.107
95	7.92	0.43	0.130	(0.197)	0.023	0.107
96	8.00	0.43	0.130	(0.196)	0.023	0.107
97	8.08	0.50	0.150	(0.195)	0.027	0.123
98	8.17	0.50	0.150	(0.194)	0.027	0.123
99	8.25	0.50	0.150	(0.193)	0.027	0.123
100	8.33	0.50	0.150	(0.192)	0.027	0.123
101	8.42	0.50	0.150	(0.191)	0.027	0.123
102	8.50	0.50	0.150	(0.190)	0.027	0.123
103	8.58	0.53	0.160	(0.189)	0.029	0.131
104	8.67	0.53	0.160	(0.189)	0.029	0.131
105	8.75	0.53	0.160	(0.188)	0.029	0.131
106	8.83	0.57	0.170	(0.187)	0.031	0.139
107	8.92	0.57	0.170	(0.186)	0.031	0.139
108	9.00	0.57	0.170	(0.185)	0.031	0.139
109	9.08	0.63	0.190	(0.184)	0.034	0.156
110	9.17	0.63	0.190	(0.183)	0.034	0.156
111	9.25	0.63	0.190	(0.182)	0.034	0.156
112	9.33	0.67	0.200	(0.181)	0.036	0.164
113	9.42	0.67	0.200	(0.181)	0.036	0.164
114	9.50	0.67	0.200	(0.180)	0.036	0.164
115	9.58	0.70	0.210	(0.179)	0.038	0.172
116	9.67	0.70	0.210	(0.178)	0.038	0.172
117	9.75	0.70	0.210	(0.177)	0.038	0.172
118	9.83	0.73	0.220	(0.176)	0.040	0.180
119	9.92	0.73	0.220	(0.175)	0.040	0.180
120	10.00	0.73	0.220	(0.175)	0.040	0.180
121	10.08	0.50	0.150	(0.174)	0.027	0.123
122	10.17	0.50	0.150	(0.173)	0.027	0.123
123	10.25	0.50	0.150	(0.172)	0.027	0.123
124	10.33	0.50	0.150	(0.171)	0.027	0.123
125	10.42	0.50	0.150	(0.170)	0.027	0.123
126	10.50	0.50	0.150	(0.170)	0.027	0.123
127	10.58	0.67	0.200	(0.169)	0.036	0.164
128	10.67	0.67	0.200	(0.168)	0.036	0.164
129	10.75	0.67	0.200	(0.167)	0.036	0.164
130	10.83	0.67	0.200	(0.166)	0.036	0.164
131	10.92	0.67	0.200	(0.166)	0.036	0.164
132	11.00	0.67	0.200	(0.165)	0.036	0.164
133	11.08	0.63	0.190	(0.164)	0.034	0.156
134	11.17	0.63	0.190	(0.163)	0.034	0.156
135	11.25	0.63	0.190	(0.162)	0.034	0.156
136	11.33	0.63	0.190	(0.161)	0.034	0.156
137	11.42	0.63	0.190	(0.161)	0.034	0.156
138	11.50	0.63	0.190	(0.160)	0.034	0.156
139	11.58	0.57	0.170	(0.159)	0.031	0.139
140	11.67	0.57	0.170	(0.158)	0.031	0.139
141	11.75	0.57	0.170	(0.157)	0.031	0.139
142	11.83	0.60	0.180	(0.157)	0.032	0.148
143	11.92	0.60	0.180	(0.156)	0.032	0.148
144	12.00	0.60	0.180	(0.155)	0.032	0.148
145	12.08	0.83	0.250	(0.154)	0.045	0.205
146	12.17	0.83	0.250	(0.154)	0.045	0.205
147	12.25	0.83	0.250	(0.153)	0.045	0.205
148	12.33	0.87	0.260	(0.152)	0.047	0.213
149	12.42	0.87	0.260	(0.151)	0.047	0.213
150	12.50	0.87	0.260	(0.151)	0.047	0.213
151	12.58	0.93	0.280	(0.150)	0.050	0.230
152	12.67	0.93	0.280	(0.149)	0.050	0.230
153	12.75	0.93	0.280	(0.148)	0.050	0.230
154	12.83	0.97	0.290	(0.148)	0.052	0.238
155	12.92	0.97	0.290	(0.147)	0.052	0.238
156	13.00	0.97	0.290	(0.146)	0.052	0.238
157	13.08	1.13	0.340	(0.145)	0.061	0.279

158	13.17	1.13	0.340	(0.145)	0.061	0.279
159	13.25	1.13	0.340	(0.144)	0.061	0.279
160	13.33	1.13	0.340	(0.143)	0.061	0.279
161	13.42	1.13	0.340	(0.142)	0.061	0.279
162	13.50	1.13	0.340	(0.142)	0.061	0.279
163	13.58	0.77	0.230	(0.141)	0.041	0.189
164	13.67	0.77	0.230	(0.140)	0.041	0.189
165	13.75	0.77	0.230	(0.139)	0.041	0.189
166	13.83	0.77	0.230	(0.139)	0.041	0.189
167	13.92	0.77	0.230	(0.138)	0.041	0.189
168	14.00	0.77	0.230	(0.137)	0.041	0.189
169	14.08	0.90	0.270	(0.137)	0.049	0.221
170	14.17	0.90	0.270	(0.136)	0.049	0.221
171	14.25	0.90	0.270	(0.135)	0.049	0.221
172	14.33	0.87	0.260	(0.135)	0.047	0.213
173	14.42	0.87	0.260	(0.134)	0.047	0.213
174	14.50	0.87	0.260	(0.133)	0.047	0.213
175	14.58	0.87	0.260	(0.133)	0.047	0.213
176	14.67	0.87	0.260	(0.132)	0.047	0.213
177	14.75	0.87	0.260	(0.131)	0.047	0.213
178	14.83	0.83	0.250	(0.130)	0.045	0.205
179	14.92	0.83	0.250	(0.130)	0.045	0.205
180	15.00	0.83	0.250	(0.129)	0.045	0.205
181	15.08	0.80	0.240	(0.129)	0.043	0.197
182	15.17	0.80	0.240	(0.128)	0.043	0.197
183	15.25	0.80	0.240	(0.127)	0.043	0.197
184	15.33	0.77	0.230	(0.127)	0.041	0.189
185	15.42	0.77	0.230	(0.126)	0.041	0.189
186	15.50	0.77	0.230	(0.125)	0.041	0.189
187	15.58	0.63	0.190	(0.125)	0.034	0.156
188	15.67	0.63	0.190	(0.124)	0.034	0.156
189	15.75	0.63	0.190	(0.123)	0.034	0.156
190	15.83	0.63	0.190	(0.123)	0.034	0.156
191	15.92	0.63	0.190	(0.122)	0.034	0.156
192	16.00	0.63	0.190	(0.121)	0.034	0.156
193	16.08	0.13	0.040	(0.121)	0.007	0.033
194	16.17	0.13	0.040	(0.120)	0.007	0.033
195	16.25	0.13	0.040	(0.120)	0.007	0.033
196	16.33	0.13	0.040	(0.119)	0.007	0.033
197	16.42	0.13	0.040	(0.118)	0.007	0.033
198	16.50	0.13	0.040	(0.118)	0.007	0.033
199	16.58	0.10	0.030	(0.117)	0.005	0.025
200	16.67	0.10	0.030	(0.117)	0.005	0.025
201	16.75	0.10	0.030	(0.116)	0.005	0.025
202	16.83	0.10	0.030	(0.115)	0.005	0.025
203	16.92	0.10	0.030	(0.115)	0.005	0.025
204	17.00	0.10	0.030	(0.114)	0.005	0.025
205	17.08	0.17	0.050	(0.114)	0.009	0.041
206	17.17	0.17	0.050	(0.113)	0.009	0.041
207	17.25	0.17	0.050	(0.113)	0.009	0.041
208	17.33	0.17	0.050	(0.112)	0.009	0.041
209	17.42	0.17	0.050	(0.111)	0.009	0.041
210	17.50	0.17	0.050	(0.111)	0.009	0.041
211	17.58	0.17	0.050	(0.110)	0.009	0.041
212	17.67	0.17	0.050	(0.110)	0.009	0.041
213	17.75	0.17	0.050	(0.109)	0.009	0.041
214	17.83	0.13	0.040	(0.109)	0.007	0.033
215	17.92	0.13	0.040	(0.108)	0.007	0.033
216	18.00	0.13	0.040	(0.108)	0.007	0.033
217	18.08	0.13	0.040	(0.107)	0.007	0.033
218	18.17	0.13	0.040	(0.107)	0.007	0.033
219	18.25	0.13	0.040	(0.106)	0.007	0.033
220	18.33	0.13	0.040	(0.105)	0.007	0.033
221	18.42	0.13	0.040	(0.105)	0.007	0.033
222	18.50	0.13	0.040	(0.104)	0.007	0.033
223	18.58	0.10	0.030	(0.104)	0.005	0.025
224	18.67	0.10	0.030	(0.103)	0.005	0.025
225	18.75	0.10	0.030	(0.103)	0.005	0.025
226	18.83	0.07	0.020	(0.102)	0.004	0.016
227	18.92	0.07	0.020	(0.102)	0.004	0.016
228	19.00	0.07	0.020	(0.101)	0.004	0.016
229	19.08	0.10	0.030	(0.101)	0.005	0.025
230	19.17	0.10	0.030	(0.101)	0.005	0.025
231	19.25	0.10	0.030	(0.100)	0.005	0.025
232	19.33	0.13	0.040	(0.100)	0.007	0.033
233	19.42	0.13	0.040	(0.099)	0.007	0.033
234	19.50	0.13	0.040	(0.099)	0.007	0.033
235	19.58	0.10	0.030	(0.098)	0.005	0.025
236	19.67	0.10	0.030	(0.098)	0.005	0.025
237	19.75	0.10	0.030	(0.097)	0.005	0.025
238	19.83	0.07	0.020	(0.097)	0.004	0.016
239	19.92	0.07	0.020	(0.096)	0.004	0.016
240	20.00	0.07	0.020	(0.096)	0.004	0.016
241	20.08	0.10	0.030	(0.096)	0.005	0.025
242	20.17	0.10	0.030	(0.095)	0.005	0.025
243	20.25	0.10	0.030	(0.095)	0.005	0.025

```
244  20.33     0.10      0.030       (  0.094)       0.005        0.025
245  20.42     0.10      0.030       (  0.094)       0.005        0.025
246  20.50     0.10      0.030       (  0.094)       0.005        0.025
247  20.58     0.10      0.030       (  0.093)       0.005        0.025
248  20.67     0.10      0.030       (  0.093)       0.005        0.025
249  20.75     0.10      0.030       (  0.092)       0.005        0.025
250  20.83     0.07      0.020       (  0.092)       0.004        0.016
251  20.92     0.07      0.020       (  0.092)       0.004        0.016
252  21.00     0.07      0.020       (  0.091)       0.004        0.016
253  21.08     0.10      0.030       (  0.091)       0.005        0.025
254  21.17     0.10      0.030       (  0.091)       0.005        0.025
255  21.25     0.10      0.030       (  0.090)       0.005        0.025
256  21.33     0.07      0.020       (  0.090)       0.004        0.016
257  21.42     0.07      0.020       (  0.090)       0.004        0.016
258  21.50     0.07      0.020       (  0.089)       0.004        0.016
259  21.58     0.10      0.030       (  0.089)       0.005        0.025
260  21.67     0.10      0.030       (  0.089)       0.005        0.025
261  21.75     0.10      0.030       (  0.088)       0.005        0.025
262  21.83     0.07      0.020       (  0.088)       0.004        0.016
263  21.92     0.07      0.020       (  0.088)       0.004        0.016
264  22.00     0.07      0.020       (  0.087)       0.004        0.016
265  22.08     0.10      0.030       (  0.087)       0.005        0.025
266  22.17     0.10      0.030       (  0.087)       0.005        0.025
267  22.25     0.10      0.030       (  0.086)       0.005        0.025
268  22.33     0.07      0.020       (  0.086)       0.004        0.016
269  22.42     0.07      0.020       (  0.086)       0.004        0.016
270  22.50     0.07      0.020       (  0.086)       0.004        0.016
271  22.58     0.07      0.020       (  0.085)       0.004        0.016
272  22.67     0.07      0.020       (  0.085)       0.004        0.016
273  22.75     0.07      0.020       (  0.085)       0.004        0.016
274  22.83     0.07      0.020       (  0.085)       0.004        0.016
275  22.92     0.07      0.020       (  0.085)       0.004        0.016
276  23.00     0.07      0.020       (  0.084)       0.004        0.016
277  23.08     0.07      0.020       (  0.084)       0.004        0.016
278  23.17     0.07      0.020       (  0.084)       0.004        0.016
279  23.25     0.07      0.020       (  0.084)       0.004        0.016
280  23.33     0.07      0.020       (  0.084)       0.004        0.016
281  23.42     0.07      0.020       (  0.083)       0.004        0.016
282  23.50     0.07      0.020       (  0.083)       0.004        0.016
283  23.58     0.07      0.020       (  0.083)       0.004        0.016
284  23.67     0.07      0.020       (  0.083)       0.004        0.016
285  23.75     0.07      0.020       (  0.083)       0.004        0.016
286  23.83     0.07      0.020       (  0.083)       0.004        0.016
287  23.92     0.07      0.020       (  0.083)       0.004        0.016
288  24.00     0.07      0.020       (  0.083)       0.004        0.016
              (Loss Rate Not Used)
    Sum =     100.0                                  Sum =    24.6
      Flood volume = Effective rainfall      2.05(In)
       times area       3.9(Ac.)/[(In)/(Ft.)] =       0.7(Ac.Ft)
      Total soil loss =      0.45(In)
      Total soil loss =     0.145(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =       28798.4 Cubic Feet
      Total soil loss =        6321.6 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      1.088(CFS)
      ---------------------------------------------------------------------
      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                        24 - H O U R    S T O R M
                   R u n o f f      H y d r o g r a p h
      ---------------------------------------------------------------------
                 Hydrograph in   5   Minute intervals ((CFS))

      ---------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-------------------------------------------------------------------------
  0+ 5       0.0002      0.02  Q          |         |         |         |
  0+10       0.0005      0.05  Q          |         |         |         |
  0+15       0.0009      0.06  Q          |         |         |         |
  0+20       0.0014      0.07  Q          |         |         |         |
  0+25       0.0021      0.09  Q          |         |         |         |
  0+30       0.0027      0.09  Q          |         |         |         |
  0+35       0.0034      0.10  Q          |         |         |         |
  0+40       0.0040      0.10  Q          |         |         |         |
  0+45       0.0047      0.10  Q          |         |         |         |
  0+50       0.0054      0.11  Q          |         |         |         |
  0+55       0.0063      0.12  Q          |         |         |         |
  1+ 0       0.0071      0.13  Q          |         |         |         |
  1+ 5       0.0079      0.12  Q          |         |         |         |
  1+10       0.0086      0.10  Q          |         |         |         |
  1+15       0.0093      0.10  Q          |         |         |         |
  1+20       0.0100      0.10  Q          |         |         |         |
  1+25       0.0106      0.10  Q          |         |         |         |
  1+30       0.0113      0.10  Q          |         |         |         |
  1+35       0.0120      0.10  Q          |         |         |         |
  1+40       0.0126      0.10  Q          |         |         |         |
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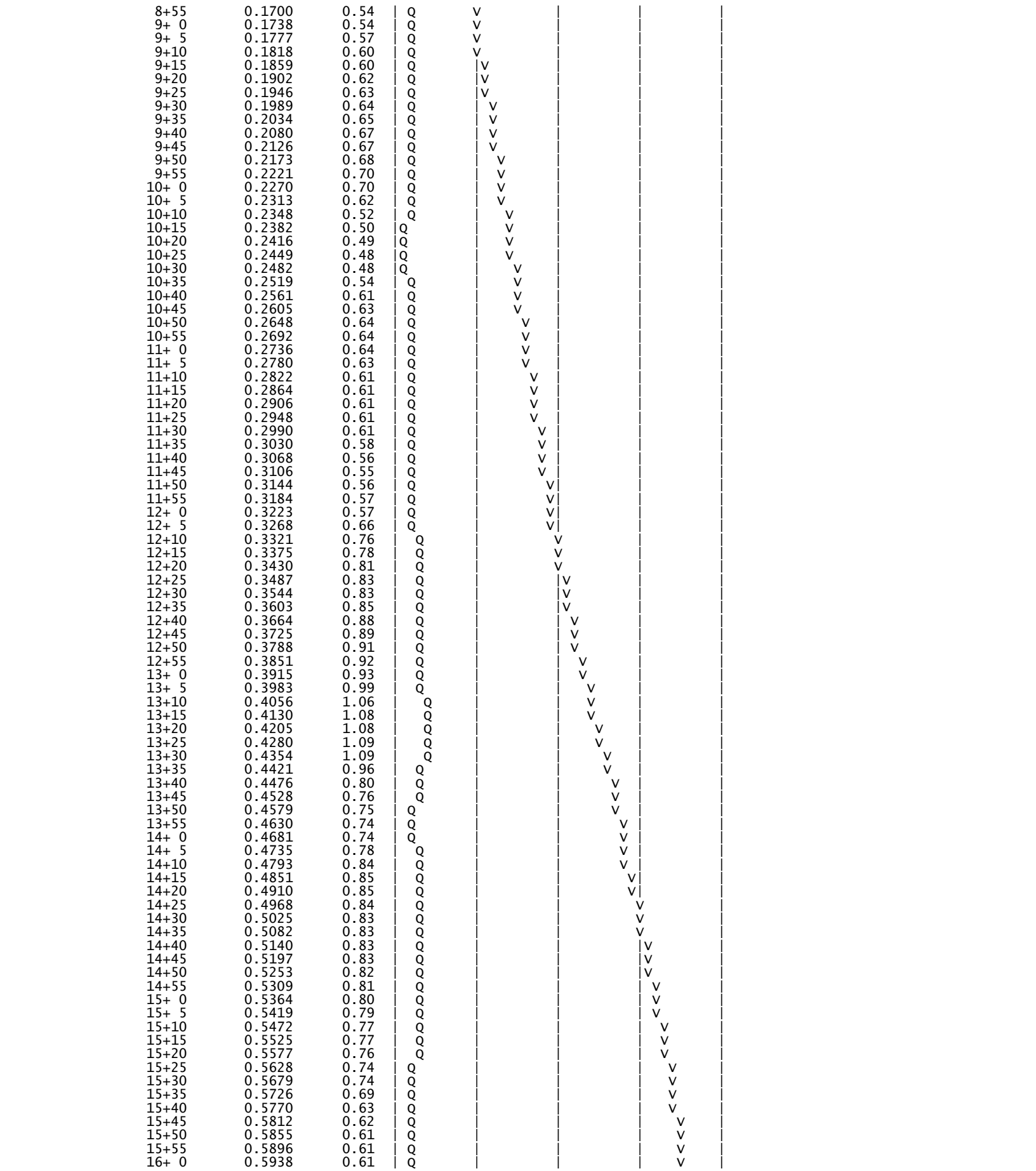
1+45       0.0133      0.10  Q          |          |          |          |
1+50       0.0140      0.11  Q          |          |          |          |
1+55       0.0149      0.12  Q          |          |          |          |
2+ 0       0.0157      0.13  Q          |          |          |          |
2+ 5       0.0166      0.13  QV         |          |          |          |
2+10       0.0175      0.13  QV         |          |          |          |
2+15       0.0184      0.13  QV         |          |          |          |
2+20       0.0192      0.13  QV         |          |          |          |
2+25       0.0201      0.13  QV         |          |          |          |
2+30       0.0210      0.13  QV         |          |          |          |
2+35       0.0220      0.14  QV         |          |          |          |
2+40       0.0230      0.15  QV         |          |          |          |
2+45       0.0241      0.16  QV         |          |          |          |
2+50       0.0252      0.16  QV         |          |          |          |
2+55       0.0263      0.16  QV         |          |          |          |
3+ 0       0.0274      0.16  QV         |          |          |          |
3+ 5       0.0285      0.16  QV         |          |          |          |
3+10       0.0296      0.16  QV         |          |          |          |
3+15       0.0307      0.16  QV         |          |          |          |
3+20       0.0318      0.16  QV         |          |          |          |
3+25       0.0329      0.16  QV         |          |          |          |
3+30       0.0340      0.16  Q V        |          |          |          |
3+35       0.0351      0.16  Q V        |          |          |          |
3+40       0.0362      0.16  Q V        |          |          |          |
3+45       0.0373      0.16  Q V        |          |          |          |
3+50       0.0385      0.17  Q V        |          |          |          |
3+55       0.0398      0.19  Q V        |          |          |          |
4+ 0       0.0411      0.19  Q V        |          |          |          |
4+ 5       0.0424      0.19  Q V        |          |          |          |
4+10       0.0437      0.19  Q V        |          |          |          |
4+15       0.0451      0.19  Q V        |          |          |          |
4+20       0.0465      0.20  Q V        |          |          |          |
4+25       0.0480      0.22  Q V        |          |          |          |
4+30       0.0495      0.22  Q V        |          |          |          |
4+35       0.0510      0.22  Q  V       |          |          |          |
4+40       0.0526      0.22  Q  V       |          |          |          |
4+45       0.0541      0.22  Q  V       |          |          |          |
4+50       0.0557      0.24  Q  V       |          |          |          |
4+55       0.0575      0.25  |Q V       |          |          |          |
5+ 0       0.0592      0.25  |Q V       |          |          |          |
5+ 5       0.0608      0.23  Q  V       |          |          |          |
5+10       0.0622      0.20  Q  V       |          |          |          |
5+15       0.0636      0.20  Q  V       |          |          |          |
5+20       0.0650      0.21  Q  V       |          |          |          |
5+25       0.0665      0.22  Q   V      |          |          |          |
5+30       0.0680      0.22  Q   V      |          |          |          |
5+35       0.0696      0.23  Q   V      |          |          |          |
5+40       0.0714      0.25  |Q  V      |          |          |          |
5+45       0.0731      0.25  |Q  V      |          |          |          |
5+50       0.0749      0.26  |Q  V      |          |          |          |
5+55       0.0766      0.26  |Q  V      |          |          |          |
6+ 0       0.0784      0.26  |Q  V      |          |          |          |
6+ 5       0.0802      0.27  |Q  V      |          |          |          |
6+10       0.0822      0.28  |Q  V      |          |          |          |
6+15       0.0841      0.29  |Q   V     |          |          |          |
6+20       0.0861      0.29  |Q   V     |          |          |          |
6+25       0.0881      0.29  |Q   V     |          |          |          |
6+30       0.0901      0.29  |Q   V     |          |          |          |
6+35       0.0921      0.30  |Q   V     |          |          |          |
6+40       0.0943      0.31  |Q   V     |          |          |          |
6+45       0.0965      0.32  |Q   V     |          |          |          |
6+50       0.0987      0.32  |Q   V     |          |          |          |
6+55       0.1009      0.32  |Q    V    |          |          |          |
7+ 0       0.1031      0.32  |Q    V    |          |          |          |
7+ 5       0.1053      0.32  |Q    V    |          |          |          |
7+10       0.1075      0.32  |Q    V    |          |          |          |
7+15       0.1097      0.32  |Q    V    |          |          |          |
7+20       0.1120      0.33  |Q    V    |          |          |          |
7+25       0.1144      0.35  |Q    V    |          |          |          |
7+30       0.1168      0.35  |Q     V   |          |          |          |
7+35       0.1193      0.36  |Q     V   |          |          |          |
7+40       0.1219      0.38  |Q     V   |          |          |          |
7+45       0.1245      0.38  |Q     V   |          |          |          |
7+50       0.1272      0.39  |Q     V   |          |          |          |
7+55       0.1301      0.41  |Q     V   |          |          |          |
8+ 0       0.1329      0.41  |Q      V  |          |          |          |
8+ 5       0.1359      0.44  |Q      V  |          |          |          |
8+10       0.1392      0.47  |Q      V  |          |          |          |
8+15       0.1424      0.48  |Q      V  |          |          |          |
8+20       0.1457      0.48  |Q      V  |          |          |          |
8+25       0.1490      0.48  |Q       V |          |          |          |
8+30       0.1523      0.48  |Q       V |          |          |          |
8+35       0.1557      0.49  |Q       V |          |          |          |
8+40       0.1592      0.51  | Q       V|          |          |          |
8+45       0.1627      0.51  | Q       V|          |          |          |
8+50       0.1663      0.52  | Q        V          |          |          |
```



8+55	0.1700	0.54	
9+ 0	0.1738	0.54	
9+ 5	0.1777	0.57	
9+10	0.1818	0.60	
9+15	0.1859	0.60	
9+20	0.1902	0.62	
9+25	0.1946	0.63	
9+30	0.1989	0.64	
9+35	0.2034	0.65	
9+40	0.2080	0.67	
9+45	0.2126	0.67	
9+50	0.2173	0.68	
9+55	0.2221	0.70	
10+ 0	0.2270	0.70	
10+ 5	0.2313	0.62	
10+10	0.2348	0.52	
10+15	0.2382	0.50	
10+20	0.2416	0.49	
10+25	0.2449	0.48	
10+30	0.2482	0.48	
10+35	0.2519	0.54	
10+40	0.2561	0.61	
10+45	0.2605	0.63	
10+50	0.2648	0.64	
10+55	0.2692	0.64	
11+ 0	0.2736	0.64	
11+ 5	0.2780	0.63	
11+10	0.2822	0.61	
11+15	0.2864	0.61	
11+20	0.2906	0.61	
11+25	0.2948	0.61	
11+30	0.2990	0.61	
11+35	0.3030	0.58	
11+40	0.3068	0.56	
11+45	0.3106	0.55	
11+50	0.3144	0.56	
11+55	0.3184	0.57	
12+ 0	0.3223	0.57	
12+ 5	0.3268	0.66	
12+10	0.3321	0.76	
12+15	0.3375	0.78	
12+20	0.3430	0.81	
12+25	0.3487	0.83	
12+30	0.3544	0.83	
12+35	0.3603	0.85	
12+40	0.3664	0.88	
12+45	0.3725	0.89	
12+50	0.3788	0.91	
12+55	0.3851	0.92	
13+ 0	0.3915	0.93	
13+ 5	0.3983	0.99	
13+10	0.4056	1.06	
13+15	0.4130	1.08	
13+20	0.4205	1.08	
13+25	0.4280	1.09	
13+30	0.4354	1.09	
13+35	0.4421	0.96	
13+40	0.4476	0.80	
13+45	0.4528	0.76	
13+50	0.4579	0.75	
13+55	0.4630	0.74	
14+ 0	0.4681	0.74	
14+ 5	0.4735	0.78	
14+10	0.4793	0.84	
14+15	0.4851	0.85	
14+20	0.4910	0.85	
14+25	0.4968	0.84	
14+30	0.5025	0.83	
14+35	0.5082	0.83	
14+40	0.5140	0.83	
14+45	0.5197	0.83	
14+50	0.5253	0.82	
14+55	0.5309	0.81	
15+ 0	0.5364	0.80	
15+ 5	0.5419	0.79	
15+10	0.5472	0.77	
15+15	0.5525	0.77	
15+20	0.5577	0.76	
15+25	0.5628	0.74	
15+30	0.5679	0.74	
15+35	0.5726	0.69	
15+40	0.5770	0.63	
15+45	0.5812	0.62	
15+50	0.5855	0.61	
15+55	0.5896	0.61	
16+ 0	0.5938	0.61	

```
16+ 5       0.5968      0.43  |Q       |          |          |     V    |
16+10       0.5983      0.21  Q        |          |          |     V    |
16+15       0.5994      0.16  Q        |          |          |     V    |
16+20       0.6004      0.14  Q        |          |          |     V    |
16+25       0.6013      0.13  Q        |          |          |     V    |
16+30       0.6021      0.13  Q        |          |          |     V    |
16+35       0.6029      0.12  Q        |          |          |     V    |
16+40       0.6036      0.10  Q        |          |          |     V    |
16+45       0.6043      0.10  Q        |          |          |     V    |
16+50       0.6050      0.10  Q        |          |          |     V    |
16+55       0.6056      0.10  Q        |          |          |     V    |
17+ 0       0.6063      0.10  Q        |          |          |     V    |
17+ 5       0.6071      0.12  Q        |          |          |     V    |
17+10       0.6081      0.15  Q        |          |          |     V    |
17+15       0.6092      0.16  Q        |          |          |     V    |
17+20       0.6103      0.16  Q        |          |          |     V    |
17+25       0.6114      0.16  Q        |          |          |     V    |
17+30       0.6125      0.16  Q        |          |          |      V   |
17+35       0.6136      0.16  Q        |          |          |      V   |
17+40       0.6147      0.16  Q        |          |          |      V   |
17+45       0.6158      0.16  Q        |          |          |      V   |
17+50       0.6168      0.15  Q        |          |          |      V   |
17+55       0.6178      0.13  Q        |          |          |      V   |
18+ 0       0.6187      0.13  Q        |          |          |      V   |
18+ 5       0.6195      0.13  Q        |          |          |      V   |
18+10       0.6204      0.13  Q        |          |          |      V   |
18+15       0.6213      0.13  Q        |          |          |      V   |
18+20       0.6222      0.13  Q        |          |          |      V   |
18+25       0.6231      0.13  Q        |          |          |      V   |
18+30       0.6240      0.13  Q        |          |          |      V   |
18+35       0.6248      0.12  Q        |          |          |      V   |
18+40       0.6255      0.10  Q        |          |          |      V   |
18+45       0.6261      0.10  Q        |          |          |      V   |
18+50       0.6267      0.09  Q        |          |          |      V   |
18+55       0.6272      0.07  Q        |          |          |      V   |
19+ 0       0.6277      0.07  Q        |          |          |      V   |
19+ 5       0.6282      0.08  Q        |          |          |       V  |
19+10       0.6288      0.09  Q        |          |          |       V  |
19+15       0.6294      0.09  Q        |          |          |       V  |
19+20       0.6302      0.11  Q        |          |          |       V  |
19+25       0.6310      0.12  Q        |          |          |       V  |
19+30       0.6319      0.13  Q        |          |          |       V  |
19+35       0.6327      0.12  Q        |          |          |       V  |
19+40       0.6334      0.10  Q        |          |          |       V  |
19+45       0.6341      0.10  Q        |          |          |       V  |
19+50       0.6347      0.09  Q        |          |          |       V  |
19+55       0.6351      0.07  Q        |          |          |       V  |
20+ 0       0.6356      0.07  Q        |          |          |       V  |
20+ 5       0.6361      0.08  Q        |          |          |       V  |
20+10       0.6367      0.09  Q        |          |          |       V  |
20+15       0.6374      0.09  Q        |          |          |       V  |
20+20       0.6380      0.10  Q        |          |          |       V  |
20+25       0.6387      0.10  Q        |          |          |       V  |
20+30       0.6394      0.10  Q        |          |          |       V  |
20+35       0.6400      0.10  Q        |          |          |       V  |
20+40       0.6407      0.10  Q        |          |          |       V  |
20+45       0.6413      0.10  Q        |          |          |       V  |
20+50       0.6419      0.08  Q        |          |          |       V  |
20+55       0.6424      0.07  Q        |          |          |       V  |
21+ 0       0.6429      0.07  Q        |          |          |       V  |
21+ 5       0.6434      0.08  Q        |          |          |       V  |
21+10       0.6440      0.09  Q        |          |          |       V  |
21+15       0.6447      0.09  Q        |          |          |        V |
21+20       0.6452      0.08  Q        |          |          |        V |
21+25       0.6457      0.07  Q        |          |          |        V |
21+30       0.6462      0.07  Q        |          |          |        V |
21+35       0.6467      0.08  Q        |          |          |        V |
21+40       0.6473      0.09  Q        |          |          |        V |
21+45       0.6480      0.09  Q        |          |          |        V |
21+50       0.6485      0.08  Q        |          |          |        V |
21+55       0.6490      0.07  Q        |          |          |        V |
22+ 0       0.6495      0.07  Q        |          |          |        V |
22+ 5       0.6500      0.08  Q        |          |          |        V |
22+10       0.6506      0.09  Q        |          |          |        V |
22+15       0.6513      0.09  Q        |          |          |        V |
22+20       0.6518      0.08  Q        |          |          |        V |
22+25       0.6523      0.07  Q        |          |          |        V |
22+30       0.6528      0.07  Q        |          |          |        V |
22+35       0.6532      0.06  Q        |          |          |        V |
22+40       0.6537      0.06  Q        |          |          |        V |
22+45       0.6541      0.06  Q        |          |          |        V |
22+50       0.6545      0.06  Q        |          |          |        V |
22+55       0.6550      0.06  Q        |          |          |        V |
23+ 0       0.6554      0.06  Q        |          |          |        V |
23+ 5       0.6559      0.06  Q        |          |          |        V |
23+10       0.6563      0.06  Q        |          |          |        V |
```

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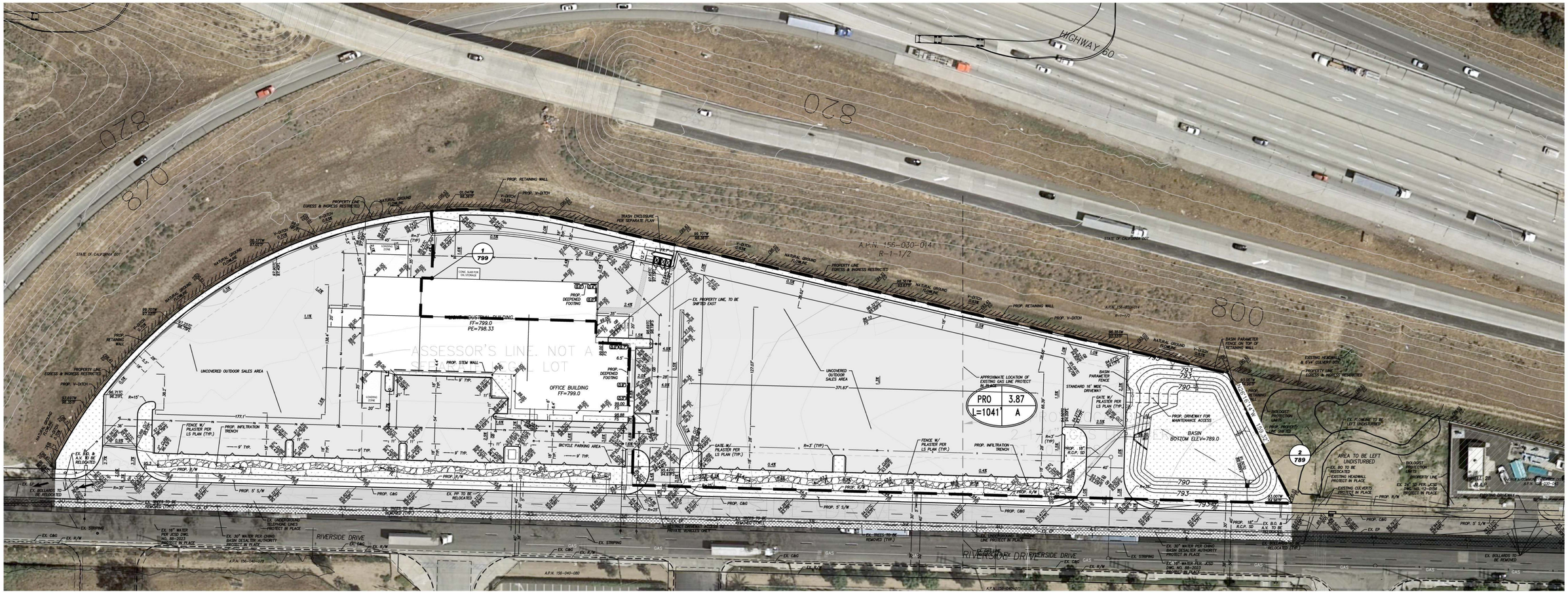
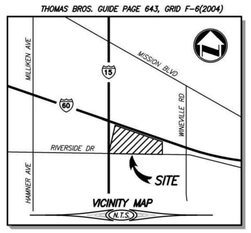
   23+15       0.6568      0.06  Q          |          |          |         v|
   23+20       0.6572      0.06  Q          |          |          |         v|
   23+25       0.6576      0.06  Q          |          |          |         v|
   23+30       0.6581      0.06  Q          |          |          |         v|
   23+35       0.6585      0.06  Q          |          |          |         v|
   23+40       0.6590      0.06  Q          |          |          |         v|
   23+45       0.6594      0.06  Q          |          |          |         v|
   23+50       0.6598      0.06  Q          |          |          |         v|
   23+55       0.6603      0.06  Q          |          |          |         v|
   24+ 0       0.6607      0.06  Q          |          |          |         v|
   24+ 5       0.6610      0.04  Q          |          |          |         v|
   24+10       0.6611      0.01  Q          |          |          |         v|
   24+15       0.6611      0.00  Q          |          |          |         v|
   24+20       0.6611      0.00  Q          |          |          |          v
-------------------------------------------------------------------------------
```

NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY PROPOSED UNIT HYDROGRAPH MAP



0 50 150
25 100 200
SCALE: 1" = 50'



SEC.6 T.2.S. R.6.W

LEGEND

AREA | ACRES
LENGTH | SOIL

NODE / ELEV
Q10=_____ cfs
Q100=_____ cfs
TC=____min
ACRES=

WATERSHED BOUNDARY
FLOW PATH

NEW LIGHT INDUSTRIAL BUILDING/RETAIL FACILITY
JURUPA VALLEY PROPOSED HYDROLOGY MAP

PREPARATION DATE : FEBRUARY 2023

PLAN PREPARED BY:
adkan ENGINEERS
Civil Engineering • Surveying • Planning
6879 Airport Drive, Riverside, CA 92504
Tel:(951) 688-0241 Fax:(951) 688-0599

PLOT DATE: 2/21/2023 11:18 AM

PLOT LOCATION: \\ADK-FS01\ADKANDATA\PROJECTS\OV\10288\ENGINEERING\HYDROLOGY\PROPOSED UNIT.DWG

Basin Size and Flow Calculations

Horiz. : Vert.
4 : 1 = Basin Side Slope

	BASIN PARAMETERS					OUTLET								
Basin Elevation	Depth	Area S.F.	Volume C.F.	Volume AC-FT	Effective Volume AC-FT	Q_1 Orrifice Plate (cfs)	Q_2 Orrifice Plate (cfs)	Q_3 Orrifice Plate (cfs)	Q_4 Orrifice Plate (cfs)	Q_5Orrifice Plate (cfs)	Q_6 Orrifice Plate (cfs)	Q_7Orrifice Plate (cfs)	Q Weir 1 (cfs)	Q Total (cfs)
789.00	0.00	7,946.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
789.50	0.50	8,747.50	4,173.38	0.096	0.096	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046
790.00	1.00	9,549.00	8,747.50	0.201	0.201	0.075	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075
790.50	1.50	10,423.50	13,777.13	0.316	0.316	0.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.095
791.00	2.00	11,298.00	19,244.00	0.442	0.442	0.112	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.112
791.50	2.50	12,241.50	25,234.38	0.579	0.579	0.127	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.127
792.00	3.00	13,185.00	31,696.50	0.728	0.728	0.140	0.000	0.000	0.000	0.000	0.000	0.000	14.128	14.268
792.50	3.50	14,204.50	38,763.38	0.890	0.890	0.152	0.000	0.000	0.000	0.000	0.000	0.000	39.960	40.112
793.00	4.00	15,224.00	46,340.00	1.064	1.064	0.163	0.000	0.000	0.000	0.000	0.000	0.000	73.411	73.574

SUPPORTING DESIGN PARAMETERS

Orifice Coefficient	0.66	Dia of Orrifice	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Gravimetric Constant	32.2 ft/s^2	Eff Dia of Orrifice	0.1417	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Number of Rows	1	Area of Orrifice	0.0158	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Minimum Orrifice Plate Height		Number of Orrifeces	1	1	1	1	1	1	1	1	
Minimum Orrifice Plate Width		Centroid Elev	789.2	0	0	0	0	0	0	0	

. Weir Sharp Crest Weir Coefficient 3.33
Length of Weir 12.00
Elev. at Crest of Weir 791.5

Q100 Elevation Weir Calc		
Basin Weir Calc		
Crest Wier Elev.	791.50	
Q100	9.89	cfs
Weir Length	12	
Weir Coeff.	3.33	
H Weir	0.3942	
Q100 Elevation	**791.89**	

Q100 Elevation Weir Calc		
SPILLWAY Weir Calc		
Crest Wier Elev.	791.90	
Q100	9.89	cfs
Weir Length	25	
Weir Coeff.	3.33	
H Weir	0.24166	
Q100 Elevation	**792.14**	

STORM EVENT	EXISTING CONDITION		PROPOSED CONDITION		BASIN ROUTING		
	VOLUME ac.ft.	CFS	VOLUME ac.ft.	CFS	VOLUME ac.ft.	CFS	Depth
2YR24HR	0.0806	0.133	0.6611	1.088	0.5240	0.121	2.30

```
                    FLOOD HYDROGRAPH ROUTING PROGRAM
                Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                            Study date: 02/21/23

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



      Program License Serial Number 5006

      ---------------------------------------------------------------------
      ********************* HYDROGRAPH INFORMATION **********************

                  From study/file name: PRO242.rte
      ****************************HYDROGRAPH DATA****************************
                  Number of intervals =   292
                  Time interval =    5.0 (Min.)
                  Maximum/Peak flow rate =        1.088 (CFS)
                  Total volume =       0.661 (Ac.Ft)
            Status of hydrographs being held in storage
                     Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ************************************************************************



      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station        1.000 to Point/Station        2.000
      **** RETARDING BASIN ROUTING ****
      ________________________________________________________________________

      User entry of depth-outflow-storage data
      ---------------------------------------------------------------------
      Total number of inflow hydrograph intervals = 292
      Hydrograph time unit =  5.000 (Min.)
      Initial depth in storage basin =   0.00(Ft.)
      ---------------------------------------------------------------------
      ---------------------------------------------------------------------
      Initial basin depth =   0.00 (Ft.)
      Initial basin storage =      0.00 (Ac.Ft)
      Initial basin outflow =   0.00 (CFS)
      ---------------------------------------------------------------------
      ---------------------------------------------------------------------
      Depth vs. Storage and Depth vs. Discharge data:
       Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
            (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
      ---------------------------------------------------------------------
         0.000      0.000      0.000      0.000        0.000
         0.500      0.096      0.046      0.096        0.096
         1.000      0.201      0.075      0.201        0.201
         1.500      0.316      0.095      0.316        0.316
         2.000      0.442      0.112      0.442        0.442
         2.500      0.579      0.127      0.579        0.579
         3.000      0.728     14.268      0.679        0.777
         3.500      0.890     40.112      0.752        1.028
         4.000      1.064     73.574      0.811        1.317
      ---------------------------------------------------------------------
                     Hydrograph Detention Basin Routing
      ---------------------------------------------------------------------

      Graph values: 'I'= unit inflow; 'O'=outflow at time shown
      ---------------------------------------------------------------------
       Time   Inflow  Outflow    Storage                                  Depth
      (Hours)  (CFS)   (CFS)     (Ac.Ft) .0       0.3    0.54    0.82    1.09 (Ft.)
       0.083    0.02    0.00      0.000  O       |       |       |       |     0.00
       0.167    0.05    0.00      0.000  OI      |       |       |       |     0.00
       0.250    0.06    0.00      0.001  OI      |       |       |       |     0.00
       0.333    0.07    0.00      0.001  O I     |       |       |       |     0.01
       0.417    0.09    0.00      0.002  O I     |       |       |       |     0.01
       0.500    0.09    0.00      0.002  O I     |       |       |       |     0.01
       0.583    0.10    0.00      0.003  O I     |       |       |       |     0.02
       0.667    0.10    0.00      0.004  O I     |       |       |       |     0.02
       0.750    0.10    0.00      0.004  O I     |       |       |       |     0.02
       0.833    0.11    0.00      0.005  O  I    |       |       |       |     0.03
       0.917    0.12    0.00      0.006  O  I    |       |       |       |     0.03
       1.000    0.13    0.00      0.007  O  I    |       |       |       |     0.03
       1.083    0.12    0.00      0.007  O  I    |       |       |       |     0.04
       1.167    0.10    0.00      0.008  O I     |       |       |       |     0.04
       1.250    0.10    0.00      0.009  O I     |       |       |       |     0.05
       1.333    0.10    0.00      0.009  O I     |       |       |       |     0.05
       1.417    0.10    0.00      0.010  O I     |       |       |       |     0.05
       1.500    0.10    0.01      0.011  O I     |       |       |       |     0.06
```

```
1.583   0.10    0.01     0.011  o I     |       |       |       |     0.06
1.667   0.10    0.01     0.012  o I     |       |       |       |     0.06
1.750   0.10    0.01     0.013  o I     |       |       |       |     0.07
1.833   0.11    0.01     0.013  o  I    |       |       |       |     0.07
1.917   0.12    0.01     0.014  o  I    |       |       |       |     0.07
2.000   0.13    0.01     0.015  o  I    |       |       |       |     0.08
2.083   0.13    0.01     0.016  o  I    |       |       |       |     0.08
2.167   0.13    0.01     0.016  o  I    |       |       |       |     0.09
2.250   0.13    0.01     0.017  o  I    |       |       |       |     0.09
2.333   0.13    0.01     0.018  o  I    |       |       |       |     0.09
2.417   0.13    0.01     0.019  o  I    |       |       |       |     0.10
2.500   0.13    0.01     0.020  o  I    |       |       |       |     0.10
2.583   0.14    0.01     0.021  o   I   |       |       |       |     0.11
2.667   0.15    0.01     0.022  o   I   |       |       |       |     0.11
2.750   0.16    0.01     0.023  o   I   |       |       |       |     0.12
2.833   0.16    0.01     0.024  o   I   |       |       |       |     0.12
2.917   0.16    0.01     0.025  o   I   |       |       |       |     0.13
3.000   0.16    0.01     0.026  o   I   |       |       |       |     0.13
3.083   0.16    0.01     0.027  o   I   |       |       |       |     0.14
3.167   0.16    0.01     0.028  o   I   |       |       |       |     0.14
3.250   0.16    0.01     0.029  o   I   |       |       |       |     0.15
3.333   0.16    0.01     0.030  o   I   |       |       |       |     0.15
3.417   0.16    0.01     0.031  o   I   |       |       |       |     0.16
3.500   0.16    0.02     0.032  o   I   |       |       |       |     0.16
3.583   0.16    0.02     0.033  o   I   |       |       |       |     0.17
3.667   0.16    0.02     0.034  o   I   |       |       |       |     0.17
3.750   0.16    0.02     0.035  o   I   |       |       |       |     0.18
3.833   0.17    0.02     0.036  o    I  |       |       |       |     0.19
3.917   0.19    0.02     0.037  o    I  |       |       |       |     0.19
4.000   0.19    0.02     0.038  o    I  |       |       |       |     0.20
4.083   0.19    0.02     0.039  o    I  |       |       |       |     0.20
4.167   0.19    0.02     0.040  o    I  |       |       |       |     0.21
4.250   0.19    0.02     0.041  o    I  |       |       |       |     0.22
4.333   0.20    0.02     0.043  o    I  |       |       |       |     0.22
4.417   0.22    0.02     0.044  o     I |       |       |       |     0.23
4.500   0.22    0.02     0.045  o     I |       |       |       |     0.24
4.583   0.22    0.02     0.047  o     I |       |       |       |     0.24
4.667   0.22    0.02     0.048  o     I |       |       |       |     0.25
4.750   0.22    0.02     0.049  o     I |       |       |       |     0.26
4.833   0.24    0.02     0.051  o     I |       |       |       |     0.27
4.917   0.25    0.03     0.052  o      I|       |       |       |     0.27
5.000   0.25    0.03     0.054  o      I|       |       |       |     0.28
5.083   0.23    0.03     0.055  o     I |       |       |       |     0.29
5.167   0.20    0.03     0.057  o    I  |       |       |       |     0.30
5.250   0.20    0.03     0.058  o    I  |       |       |       |     0.30
5.333   0.21    0.03     0.059  o     I |       |       |       |     0.31
5.417   0.22    0.03     0.060  o     I |       |       |       |     0.31
5.500   0.22    0.03     0.062  o     I |       |       |       |     0.32
5.583   0.23    0.03     0.063  o     I |       |       |       |     0.33
5.667   0.25    0.03     0.065  o      I|       |       |       |     0.34
5.750   0.25    0.03     0.066  o      I|       |       |       |     0.34
5.833   0.26    0.03     0.068  o      I|       |       |       |     0.35
5.917   0.26    0.03     0.069  o      I|       |       |       |     0.36
6.000   0.26    0.03     0.071  o      I|       |       |       |     0.37
6.083   0.27    0.03     0.072  |o     I|       |       |       |     0.38
6.167   0.28    0.04     0.074  |o      I       |       |       |     0.38
6.250   0.29    0.04     0.076  |o      I       |       |       |     0.39
6.333   0.29    0.04     0.077  |o      I       |       |       |     0.40
6.417   0.29    0.04     0.079  |o      I       |       |       |     0.41
6.500   0.29    0.04     0.081  |o      I       |       |       |     0.42
6.583   0.30    0.04     0.083  |o      I       |       |       |     0.43
6.667   0.31    0.04     0.084  |o      |I      |       |       |     0.44
6.750   0.32    0.04     0.086  |o      |I      |       |       |     0.45
6.833   0.32    0.04     0.088  |o      |I      |       |       |     0.46
6.917   0.32    0.04     0.090  |o      |I      |       |       |     0.47
7.000   0.32    0.04     0.092  |o      |I      |       |       |     0.48
7.083   0.32    0.04     0.094  |o      |I      |       |       |     0.49
7.167   0.32    0.05     0.096  |o      |I      |       |       |     0.50
7.250   0.32    0.05     0.098  |o      |I      |       |       |     0.51
7.333   0.33    0.05     0.100  |o      |I      |       |       |     0.52
7.417   0.35    0.05     0.102  |o      | I     |       |       |     0.53
7.500   0.35    0.05     0.104  |o      | I     |       |       |     0.54
7.583   0.36    0.05     0.106  |o      | I     |       |       |     0.55
7.667   0.38    0.05     0.108  |o      |  I    |       |       |     0.56
7.750   0.38    0.05     0.110  |o      |  I    |       |       |     0.57
7.833   0.39    0.05     0.113  |o      |  I    |       |       |     0.58
7.917   0.41    0.05     0.115  |o      |   I   |       |       |     0.59
8.000   0.41    0.05     0.117  |o      |   I   |       |       |     0.60
8.083   0.44    0.05     0.120  |o      |   I   |       |       |     0.61
8.167   0.47    0.05     0.123  |o      |    I  |       |       |     0.63
8.250   0.48    0.05     0.126  |o      |    I  |       |       |     0.64
8.333   0.48    0.06     0.129  |o      |     I |       |       |     0.66
8.417   0.48    0.06     0.132  |o      |     I |       |       |     0.67
8.500   0.48    0.06     0.134  |o      |     I |       |       |     0.68
8.583   0.49    0.06     0.137  |o      |     I |       |       |     0.70
8.667   0.51    0.06     0.140  |o      |     I |       |       |     0.71
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 8.750    0.51    0.06      0.144  |O       |      I |        |        |      0.73
 8.833    0.52    0.06      0.147  |O       |       I|        |        |      0.74
 8.917    0.54    0.06      0.150  |O       |       I|        |        |      0.76
 9.000    0.54    0.06      0.153  |O       |       I|        |        |      0.77
 9.083    0.57    0.06      0.157  |O       |        I        |        |      0.79
 9.167    0.60    0.06      0.160  |O       |        |I       |        |      0.81
 9.250    0.60    0.06      0.164  |O       |        |I       |        |      0.82
 9.333    0.62    0.07      0.168  |O       |        | I      |        |      0.84
 9.417    0.63    0.07      0.171  |O       |        | I      |        |      0.86
 9.500    0.64    0.07      0.175  |O       |        | I      |        |      0.88
 9.583    0.65    0.07      0.179  | O      |        |  I     |        |      0.90
 9.667    0.67    0.07      0.183  | O      |        |  I     |        |      0.92
 9.750    0.67    0.07      0.188  | O      |        |  I     |        |      0.94
 9.833    0.68    0.07      0.192  | O      |        |   I    |        |      0.96
 9.917    0.70    0.07      0.196  | O      |        |   I    |        |      0.98
10.000    0.70    0.07      0.200  | O      |        |   I    |        |      1.00
10.083    0.62    0.08      0.204  | O      |        | I      |        |      1.01
10.167    0.52    0.08      0.208  | O      |       I|        |        |      1.03
10.250    0.50    0.08      0.211  | O      |      I |        |        |      1.04
10.333    0.49    0.08      0.214  | O      |      I |        |        |      1.05
10.417    0.48    0.08      0.216  | O      |      I |        |        |      1.07
10.500    0.48    0.08      0.219  | O      |      I |        |        |      1.08
10.583    0.54    0.08      0.222  | O      |       I|        |        |      1.09
10.667    0.61    0.08      0.225  | O      |        |I       |        |      1.11
10.750    0.63    0.08      0.229  | O      |        | I      |        |      1.12
10.833    0.64    0.08      0.233  | O      |        | I      |        |      1.14
10.917    0.64    0.08      0.237  | O      |        | I      |        |      1.16
11.000    0.64    0.08      0.241  | O      |        | I      |        |      1.17
11.083    0.63    0.08      0.244  | O      |        | I      |        |      1.19
11.167    0.61    0.08      0.248  | O      |        | I      |        |      1.21
11.250    0.61    0.08      0.252  | O      |        |I       |        |      1.22
11.333    0.61    0.08      0.255  | O      |        |I       |        |      1.24
11.417    0.61    0.09      0.259  | O      |        |I       |        |      1.25
11.500    0.61    0.09      0.263  | O      |        |I       |        |      1.27
11.583    0.58    0.09      0.266  | O      |        |I       |        |      1.28
11.667    0.56    0.09      0.269  | O      |        I       |        |      1.30
11.750    0.55    0.09      0.273  | O      |        I       |        |      1.31
11.833    0.56    0.09      0.276  | O      |        I       |        |      1.33
11.917    0.57    0.09      0.279  | O      |        I       |        |      1.34
12.000    0.57    0.09      0.282  | O      |        I       |        |      1.35
12.083    0.66    0.09      0.286  | O      |        |  I     |        |      1.37
12.167    0.76    0.09      0.290  | O      |        |     I  |        |      1.39
12.250    0.78    0.09      0.295  | O      |        |      I|        |      1.41
12.333    0.81    0.09      0.300  | O      |        |      I|        |      1.43
12.417    0.83    0.09      0.305  | O      |        |       I        |      1.45
12.500    0.83    0.09      0.310  | O      |        |       I        |      1.47
12.583    0.85    0.09      0.315  | O      |        |        |I      |      1.50
12.667    0.88    0.10      0.320  | O      |        |        | I     |      1.52
12.750    0.89    0.10      0.326  | O      |        |        | I     |      1.54
12.833    0.91    0.10      0.331  | O      |        |        | I     |      1.56
12.917    0.92    0.10      0.337  | O      |        |        |  I    |      1.58
13.000    0.93    0.10      0.343  | O      |        |        |  I    |      1.61
13.083    0.99    0.10      0.349  | O      |        |        |   I   |      1.63
13.167    1.06    0.10      0.355  | O      |        |        |      I|      1.65
13.250    1.08    0.10      0.362  | O      |        |        |      I|      1.68
13.333    1.08    0.10      0.368  |  O     |        |        |      I|      1.71
13.417    1.09    0.10      0.375  |  O     |        |        |       I      1.73
13.500    1.09    0.10      0.382  |  O     |        |        |       I      1.76
13.583    0.96    0.10      0.388  |  O     |        |        |   I   |      1.79
13.667    0.80    0.11      0.394  |  O     |        |      I|       |      1.81
13.750    0.76    0.11      0.398  |  O     |        |     I |       |      1.83
13.833    0.75    0.11      0.403  |  O     |        |    I  |       |      1.84
13.917    0.74    0.11      0.407  |  O     |        |    I  |       |      1.86
14.000    0.74    0.11      0.411  |  O     |        |    I  |       |      1.88
14.083    0.78    0.11      0.416  |  O     |        |      I|       |      1.90
14.167    0.84    0.11      0.421  |  O     |        |       I       |      1.92
14.250    0.85    0.11      0.426  |  O     |        |       |I      |      1.94
14.333    0.85    0.11      0.431  |  O     |        |       I       |      1.96
14.417    0.84    0.11      0.436  |  O     |        |       I       |      1.98
14.500    0.83    0.11      0.441  |  O     |        |       I       |      2.00
14.583    0.83    0.11      0.446  |  O     |        |       I       |      2.01
14.667    0.83    0.11      0.451  |  O     |        |       I       |      2.03
14.750    0.83    0.11      0.456  |  O     |        |       I       |      2.05
14.833    0.82    0.11      0.461  |  O     |        |       I       |      2.07
14.917    0.81    0.11      0.465  |  O     |        |      I|       |      2.09
15.000    0.80    0.12      0.470  |  O     |        |      I|       |      2.10
15.083    0.79    0.12      0.475  |  O     |        |      I|       |      2.12
15.167    0.77    0.12      0.480  |  O     |        |     I |       |      2.14
15.250    0.77    0.12      0.484  |  O     |        |     I |       |      2.15
15.333    0.76    0.12      0.488  |  O     |        |     I |       |      2.17
15.417    0.74    0.12      0.493  |  O     |        |    I  |       |      2.19
15.500    0.74    0.12      0.497  |  O     |        |    I  |       |      2.20
15.583    0.69    0.12      0.501  |  O     |        |   I   |       |      2.22
15.667    0.63    0.12      0.505  |  O     |        | I     |       |      2.23
15.750    0.62    0.12      0.508  |  O     |        | I     |       |      2.24
15.833    0.61    0.12      0.512  |  O     |        |I      |       |      2.25
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15.917	0.61	0.12	0.515	O		I			2.27
16.000	0.61	0.12	0.519	O		I			2.28
16.083	0.43	0.12	0.521	O	I				2.29
16.167	0.21	0.12	0.523	O I					2.29
16.250	0.16	0.12	0.523	OI					2.30
16.333	0.14	0.12	0.523	OI					2.30
16.417	0.13	0.12	0.523	O					2.30
16.500	0.13	0.12	0.524	O					2.30
16.583	0.12	0.12	0.524	O					2.30
16.667	0.10	0.12	0.523	IO					2.30
16.750	0.10	0.12	0.523	IO					2.30
16.833	0.10	0.12	0.523	IO					2.30
16.917	0.10	0.12	0.523	IO					2.30
17.000	0.10	0.12	0.523	IO					2.29
17.083	0.12	0.12	0.523	O					2.29
17.167	0.15	0.12	0.523	OI					2.29
17.250	0.16	0.12	0.523	OI					2.30
17.333	0.16	0.12	0.523	OI					2.30
17.417	0.16	0.12	0.524	OI					2.30
17.500	0.16	0.12	0.524	OI					2.30
17.583	0.16	0.12	0.524	OI					2.30
17.667	0.16	0.12	0.524	OI					2.30
17.750	0.16	0.12	0.525	OI					2.30
17.833	0.15	0.12	0.525	OI					2.30
17.917	0.13	0.12	0.525	O					2.30
18.000	0.13	0.12	0.525	O					2.30
18.083	0.13	0.12	0.525	O					2.30
18.167	0.13	0.12	0.525	O					2.30
18.250	0.13	0.12	0.525	O					2.30
18.333	0.13	0.12	0.525	O					2.30
18.417	0.13	0.12	0.525	O					2.30
18.500	0.13	0.12	0.525	O					2.30
18.583	0.12	0.12	0.525	O					2.30
18.667	0.10	0.12	0.525	IO					2.30
18.750	0.10	0.12	0.525	IO					2.30
18.833	0.09	0.12	0.525	IO					2.30
18.917	0.07	0.12	0.525	IO					2.30
19.000	0.07	0.12	0.524	I O					2.30
19.083	0.08	0.12	0.524	IO					2.30
19.167	0.09	0.12	0.524	IO					2.30
19.250	0.09	0.12	0.523	IO					2.30
19.333	0.11	0.12	0.523	O					2.30
19.417	0.12	0.12	0.523	O					2.30
19.500	0.13	0.12	0.523	O					2.30
19.583	0.12	0.12	0.523	O					2.30
19.667	0.10	0.12	0.523	IO					2.30
19.750	0.10	0.12	0.523	IO					2.30
19.833	0.09	0.12	0.523	IO					2.30
19.917	0.07	0.12	0.523	IO					2.29
20.000	0.07	0.12	0.522	I O					2.29
20.083	0.08	0.12	0.522	IO					2.29
20.167	0.09	0.12	0.522	IO					2.29
20.250	0.09	0.12	0.521	IO					2.29
20.333	0.10	0.12	0.521	IO					2.29
20.417	0.10	0.12	0.521	IO					2.29
20.500	0.10	0.12	0.521	IO					2.29
20.583	0.10	0.12	0.521	IO					2.29
20.667	0.10	0.12	0.521	IO					2.29
20.750	0.10	0.12	0.520	IO					2.29
20.833	0.08	0.12	0.520	IO					2.29
20.917	0.07	0.12	0.520	IO					2.28
21.000	0.07	0.12	0.520	I O					2.28
21.083	0.08	0.12	0.519	IO					2.28
21.167	0.09	0.12	0.519	IO					2.28
21.250	0.09	0.12	0.519	IO					2.28
21.333	0.08	0.12	0.519	IO					2.28
21.417	0.07	0.12	0.518	IO					2.28
21.500	0.07	0.12	0.518	I O					2.28
21.583	0.08	0.12	0.518	IO					2.28
21.667	0.09	0.12	0.517	IO					2.27
21.750	0.09	0.12	0.517	IO					2.27
21.833	0.08	0.12	0.517	IO					2.27
21.917	0.07	0.12	0.517	IO					2.27
22.000	0.07	0.12	0.516	I O					2.27
22.083	0.08	0.12	0.516	IO					2.27
22.167	0.09	0.12	0.516	IO					2.27
22.250	0.09	0.12	0.515	IO					2.27
22.333	0.08	0.12	0.515	IO					2.27
22.417	0.07	0.12	0.515	IO					2.27
22.500	0.07	0.12	0.515	I O					2.26
22.583	0.06	0.12	0.514	I O					2.26
22.667	0.06	0.12	0.514	I O					2.26
22.750	0.06	0.12	0.513	I O					2.26
22.833	0.06	0.12	0.513	I O					2.26
22.917	0.06	0.12	0.513	I O					2.26
23.000	0.06	0.12	0.512	I O					2.26

23.083	0.06	0.12	0.512	I O				2.25
23.167	0.06	0.12	0.511	I O				2.25
23.250	0.06	0.12	0.511	I O				2.25
23.333	0.06	0.12	0.511	I O				2.25
23.417	0.06	0.12	0.510	I O				2.25
23.500	0.06	0.12	0.510	I O				2.25
23.583	0.06	0.12	0.510	I O				2.25
23.667	0.06	0.12	0.509	I O				2.25
23.750	0.06	0.12	0.509	I O				2.24
23.833	0.06	0.12	0.508	I O				2.24
23.917	0.06	0.12	0.508	I O				2.24
24.000	0.06	0.12	0.508	I O				2.24
24.083	0.04	0.12	0.507	I O				2.24
24.167	0.01	0.12	0.507	I O				2.24
24.250	0.00	0.12	0.506	I O				2.23
24.333	0.00	0.12	0.505	I O				2.23
24.417	0.00	0.12	0.504	I O				2.23
24.500	0.00	0.12	0.503	I O				2.22
24.583	0.00	0.12	0.503	I O				2.22
24.667	0.00	0.12	0.502	I O				2.22
24.750	0.00	0.12	0.501	I O				2.22
24.833	0.00	0.12	0.500	I O				2.21
24.917	0.00	0.12	0.499	I O				2.21
25.000	0.00	0.12	0.498	I O				2.21
25.083	0.00	0.12	0.498	I O				2.20
25.167	0.00	0.12	0.497	I O				2.20
25.250	0.00	0.12	0.496	I O				2.20
25.333	0.00	0.12	0.495	I O				2.19
25.417	0.00	0.12	0.494	I O				2.19
25.500	0.00	0.12	0.494	I O				2.19
25.583	0.00	0.12	0.493	I O				2.19
25.667	0.00	0.12	0.492	I O				2.18
25.750	0.00	0.12	0.491	I O				2.18
25.833	0.00	0.12	0.490	I O				2.18
25.917	0.00	0.12	0.490	I O				2.17
26.000	0.00	0.12	0.489	I O				2.17
26.083	0.00	0.12	0.488	I O				2.17
26.167	0.00	0.12	0.487	I O				2.16
26.250	0.00	0.12	0.486	I O				2.16
26.333	0.00	0.12	0.486	I O				2.16
26.417	0.00	0.12	0.485	I O				2.16
26.500	0.00	0.12	0.484	I O				2.15
26.583	0.00	0.12	0.483	I O				2.15
26.667	0.00	0.12	0.482	I O				2.15
26.750	0.00	0.12	0.482	I O				2.14
26.833	0.00	0.12	0.481	I O				2.14
26.917	0.00	0.12	0.480	I O				2.14
27.000	0.00	0.12	0.479	I O				2.14
27.083	0.00	0.12	0.478	I O				2.13
27.167	0.00	0.12	0.478	I O				2.13
27.250	0.00	0.12	0.477	I O				2.13
27.333	0.00	0.12	0.476	I O				2.12
27.417	0.00	0.12	0.475	I O				2.12
27.500	0.00	0.12	0.474	I O				2.12
27.583	0.00	0.12	0.474	I O				2.12
27.667	0.00	0.12	0.473	I O				2.11
27.750	0.00	0.12	0.472	I O				2.11
27.833	0.00	0.12	0.471	I O				2.11
27.917	0.00	0.12	0.470	I O				2.10
28.000	0.00	0.12	0.470	I O				2.10
28.083	0.00	0.11	0.469	I O				2.10
28.167	0.00	0.11	0.468	I O				2.09
28.250	0.00	0.11	0.467	I O				2.09
28.333	0.00	0.11	0.466	I O				2.09
28.417	0.00	0.11	0.466	I O				2.09
28.500	0.00	0.11	0.465	I O				2.08
28.583	0.00	0.11	0.464	I O				2.08
28.667	0.00	0.11	0.463	I O				2.08
28.750	0.00	0.11	0.462	I O				2.07
28.833	0.00	0.11	0.462	I O				2.07
28.917	0.00	0.11	0.461	I O				2.07
29.000	0.00	0.11	0.460	I O				2.07
29.083	0.00	0.11	0.459	I O				2.06
29.167	0.00	0.11	0.459	I O				2.06
29.250	0.00	0.11	0.458	I O				2.06
29.333	0.00	0.11	0.457	I O				2.05
29.417	0.00	0.11	0.456	I O				2.05
29.500	0.00	0.11	0.455	I O				2.05
29.583	0.00	0.11	0.455	I O				2.05
29.667	0.00	0.11	0.454	I O				2.04
29.750	0.00	0.11	0.453	I O				2.04
29.833	0.00	0.11	0.452	I O				2.04
29.917	0.00	0.11	0.451	I O				2.03
30.000	0.00	0.11	0.451	I O				2.03
30.083	0.00	0.11	0.450	I O				2.03
30.167	0.00	0.11	0.449	I O				2.03

30.250	0.00	0.11	0.448	I	O	|	|	|	2.02
30.333	0.00	0.11	0.448	I	O	|	|	|	2.02
30.417	0.00	0.11	0.447	I	O	|	|	|	2.02
30.500	0.00	0.11	0.446	I	O	|	|	|	2.01
30.583	0.00	0.11	0.445	I	O	|	|	|	2.01
30.667	0.00	0.11	0.445	I	O	|	|	|	2.01
30.750	0.00	0.11	0.444	I	O	|	|	|	2.01
30.833	0.00	0.11	0.443	I	O	|	|	|	2.00
30.917	0.00	0.11	0.442	I	O	|	|	|	2.00
31.000	0.00	0.11	0.441	I	O	|	|	|	2.00
31.083	0.00	0.11	0.441	I	O	|	|	|	1.99
31.167	0.00	0.11	0.440	I	O	|	|	|	1.99
31.250	0.00	0.11	0.439	I	O	|	|	|	1.99
31.333	0.00	0.11	0.438	I	O	|	|	|	1.99
31.417	0.00	0.11	0.438	I	O	|	|	|	1.98
31.500	0.00	0.11	0.437	I	O	|	|	|	1.98
31.583	0.00	0.11	0.436	I	O	|	|	|	1.98
31.667	0.00	0.11	0.435	I	O	|	|	|	1.97
31.750	0.00	0.11	0.435	I	O	|	|	|	1.97
31.833	0.00	0.11	0.434	I	O	|	|	|	1.97
31.917	0.00	0.11	0.433	I	O	|	|	|	1.96
32.000	0.00	0.11	0.432	I	O	|	|	|	1.96
32.083	0.00	0.11	0.431	I	O	|	|	|	1.96
32.167	0.00	0.11	0.431	I	O	|	|	|	1.96
32.250	0.00	0.11	0.430	I	O	|	|	|	1.95
32.333	0.00	0.11	0.429	I	O	|	|	|	1.95
32.417	0.00	0.11	0.428	I	O	|	|	|	1.95
32.500	0.00	0.11	0.428	I	O	|	|	|	1.94
32.583	0.00	0.11	0.427	I	O	|	|	|	1.94
32.667	0.00	0.11	0.426	I	O	|	|	|	1.94
32.750	0.00	0.11	0.425	I	O	|	|	|	1.93
32.833	0.00	0.11	0.425	I	O	|	|	|	1.93
32.917	0.00	0.11	0.424	I	O	|	|	|	1.93
33.000	0.00	0.11	0.423	I	O	|	|	|	1.93
33.083	0.00	0.11	0.422	I	O	|	|	|	1.92
33.167	0.00	0.11	0.422	I	O	|	|	|	1.92
33.250	0.00	0.11	0.421	I	O	|	|	|	1.92
33.333	0.00	0.11	0.420	I	O	|	|	|	1.91
33.417	0.00	0.11	0.419	I	O	|	|	|	1.91
33.500	0.00	0.11	0.419	I	O	|	|	|	1.91
33.583	0.00	0.11	0.418	I	O	|	|	|	1.90
33.667	0.00	0.11	0.417	I	O	|	|	|	1.90
33.750	0.00	0.11	0.416	I	O	|	|	|	1.90
33.833	0.00	0.11	0.416	I	O	|	|	|	1.90
33.917	0.00	0.11	0.415	I	O	|	|	|	1.89
34.000	0.00	0.11	0.414	I	O	|	|	|	1.89
34.083	0.00	0.11	0.413	I	O	|	|	|	1.89
34.167	0.00	0.11	0.413	I	O	|	|	|	1.88
34.250	0.00	0.11	0.412	I	O	|	|	|	1.88
34.333	0.00	0.11	0.411	I	O	|	|	|	1.88
34.417	0.00	0.11	0.410	I	O	|	|	|	1.87
34.500	0.00	0.11	0.410	I	O	|	|	|	1.87
34.583	0.00	0.11	0.409	I	O	|	|	|	1.87
34.667	0.00	0.11	0.408	I	O	|	|	|	1.87
34.750	0.00	0.11	0.407	I	O	|	|	|	1.86
34.833	0.00	0.11	0.407	I	O	|	|	|	1.86
34.917	0.00	0.11	0.406	I	O	|	|	|	1.86
35.000	0.00	0.11	0.405	I	O	|	|	|	1.85
35.083	0.00	0.11	0.405	I	O	|	|	|	1.85
35.167	0.00	0.11	0.404	I	O	|	|	|	1.85
35.250	0.00	0.11	0.403	I	O	|	|	|	1.85
35.333	0.00	0.11	0.402	I	O	|	|	|	1.84
35.417	0.00	0.11	0.402	I	O	|	|	|	1.84
35.500	0.00	0.11	0.401	I	O	|	|	|	1.84
35.583	0.00	0.11	0.400	I	O	|	|	|	1.83
35.667	0.00	0.11	0.399	I	O	|	|	|	1.83
35.750	0.00	0.11	0.399	I	O	|	|	|	1.83
35.833	0.00	0.11	0.398	I	O	|	|	|	1.83
35.917	0.00	0.11	0.397	I	O	|	|	|	1.82
36.000	0.00	0.11	0.396	I	O	|	|	|	1.82
36.083	0.00	0.11	0.396	I	O	|	|	|	1.82
36.167	0.00	0.11	0.395	I	O	|	|	|	1.81
36.250	0.00	0.11	0.394	I	O	|	|	|	1.81
36.333	0.00	0.11	0.394	I	O	|	|	|	1.81
36.417	0.00	0.11	0.393	I	O	|	|	|	1.80
36.500	0.00	0.11	0.392	I	O	|	|	|	1.80
36.583	0.00	0.11	0.391	I	O	|	|	|	1.80
36.667	0.00	0.11	0.391	I	O	|	|	|	1.80
36.750	0.00	0.10	0.390	I	O	|	|	|	1.79
36.833	0.00	0.10	0.389	I	O	|	|	|	1.79
36.917	0.00	0.10	0.388	I	O	|	|	|	1.79
37.000	0.00	0.10	0.388	I	O	|	|	|	1.78
37.083	0.00	0.10	0.387	I	O	|	|	|	1.78
37.167	0.00	0.10	0.386	I	O	|	|	|	1.78
37.250	0.00	0.10	0.386	I	O	|	|	|	1.78
37.333	0.00	0.10	0.385	I	O	|	|	|	1.77

37.417	0.00	0.10	0.384	I	O	|	|	|	| 1.77
37.500	0.00	0.10	0.383	I	O	|	|	|	| 1.77
37.583	0.00	0.10	0.383	I	O	|	|	|	| 1.76
37.667	0.00	0.10	0.382	I	O	|	|	|	| 1.76
37.750	0.00	0.10	0.381	I	O	|	|	|	| 1.76
37.833	0.00	0.10	0.381	I	O	|	|	|	| 1.76
37.917	0.00	0.10	0.380	I	O	|	|	|	| 1.75
38.000	0.00	0.10	0.379	I	O	|	|	|	| 1.75
38.083	0.00	0.10	0.378	I	O	|	|	|	| 1.75
38.167	0.00	0.10	0.378	I	O	|	|	|	| 1.74
38.250	0.00	0.10	0.377	I	O	|	|	|	| 1.74
38.333	0.00	0.10	0.376	I	O	|	|	|	| 1.74
38.417	0.00	0.10	0.376	I	O	|	|	|	| 1.74
38.500	0.00	0.10	0.375	I	O	|	|	|	| 1.73
38.583	0.00	0.10	0.374	I	O	|	|	|	| 1.73
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38.833	0.00	0.10	0.372	I	O	|	|	|	| 1.72
38.917	0.00	0.10	0.371	I	O	|	|	|	| 1.72
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39.583	0.00	0.10	0.366	I	O	|	|	|	| 1.70
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40.167	0.00	0.10	0.361	I	O	|	|	|	| 1.68
40.250	0.00	0.10	0.360	I	O	|	|	|	| 1.68
40.333	0.00	0.10	0.359	I	O	|	|	|	| 1.67
40.417	0.00	0.10	0.359	I	O	|	|	|	| 1.67
40.500	0.00	0.10	0.358	I	O	|	|	|	| 1.67
40.583	0.00	0.10	0.357	I	O	|	|	|	| 1.66
40.667	0.00	0.10	0.357	I	O	|	|	|	| 1.66
40.750	0.00	0.10	0.356	I	O	|	|	|	| 1.66
40.833	0.00	0.10	0.355	I	O	|	|	|	| 1.66
40.917	0.00	0.10	0.355	I	O	|	|	|	| 1.65
41.000	0.00	0.10	0.354	I	O	|	|	|	| 1.65
41.083	0.00	0.10	0.353	I	O	|	|	|	| 1.65
41.167	0.00	0.10	0.353	I	O	|	|	|	| 1.64

Remaining water in basin = 0.35 (Ac.Ft)

**********HYDROGRAPH DATA**********

Number of intervals = 494
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 0.121 (CFS)
Total volume = 0.309 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

Section 5 – Riverside County Plates / Reference

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

RCFC & WCD
HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS FOR PERVIOUS AREA

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

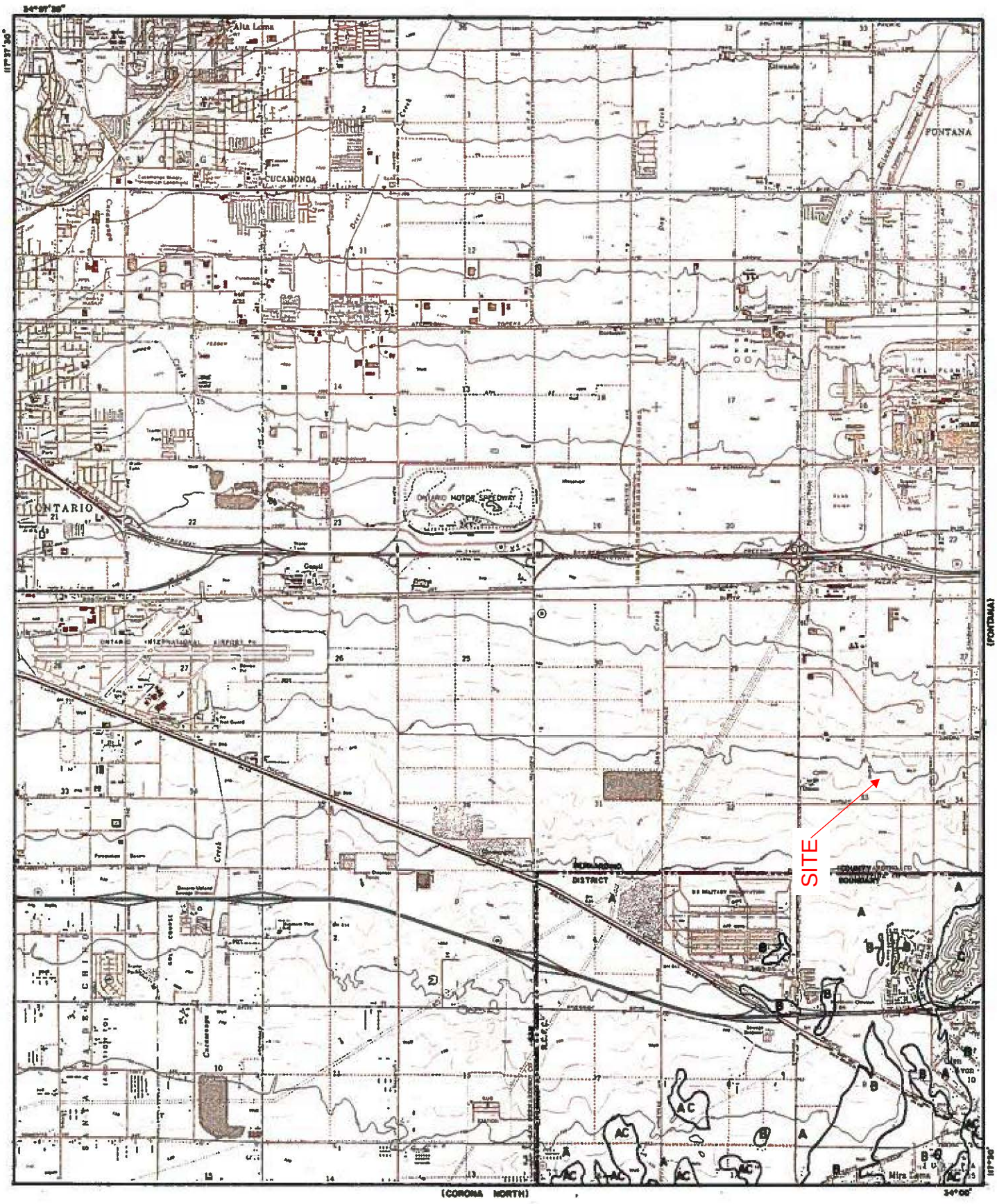
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD
HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE D-5.6



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

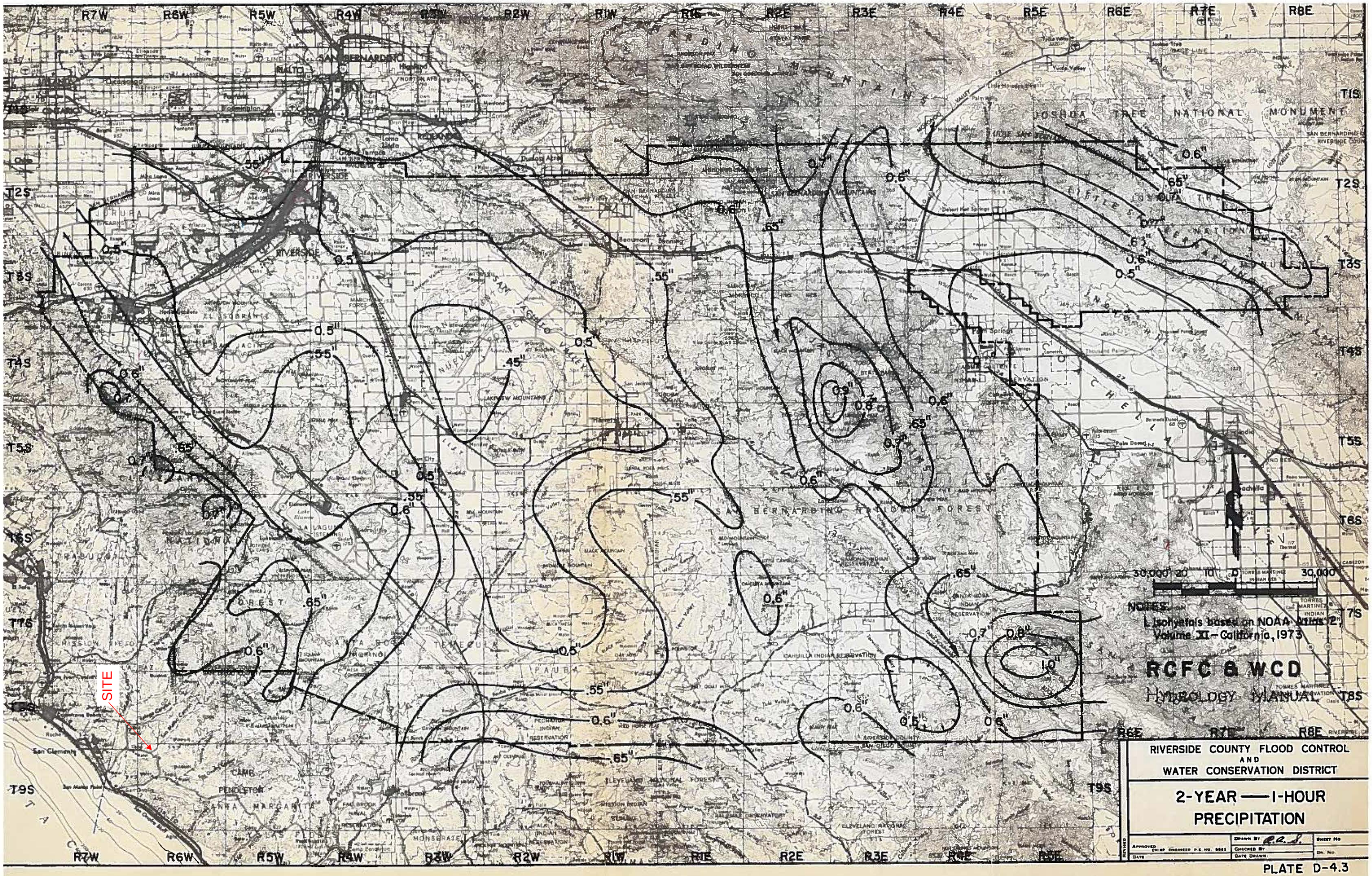
RCFC&WCD

HYDROLOGY MANUAL

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR GUASTI

PLATE C-1.02



NOTES:
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973

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HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

2-YEAR — 1-HOUR PRECIPITATION

PLATE D-4.3

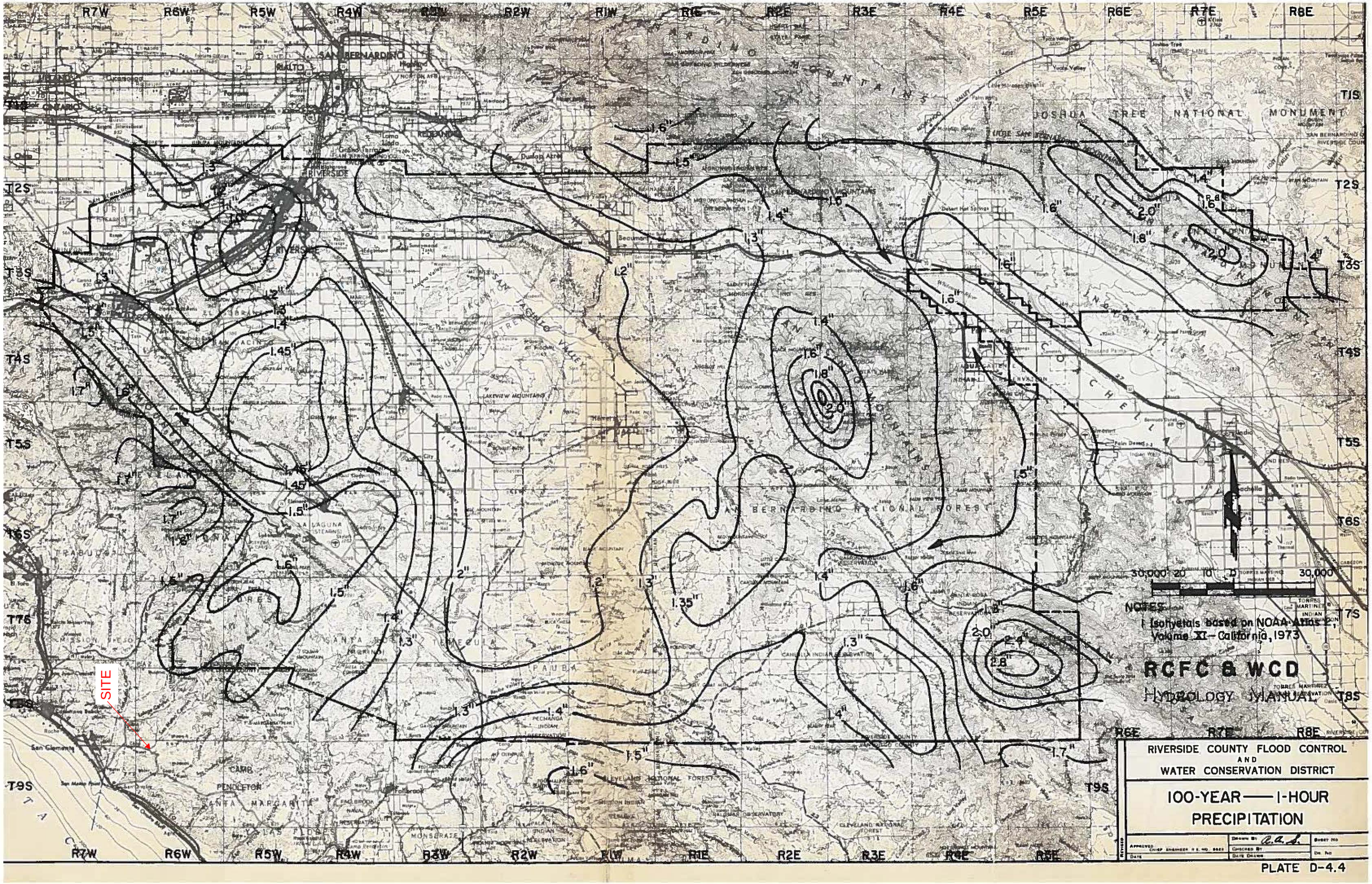
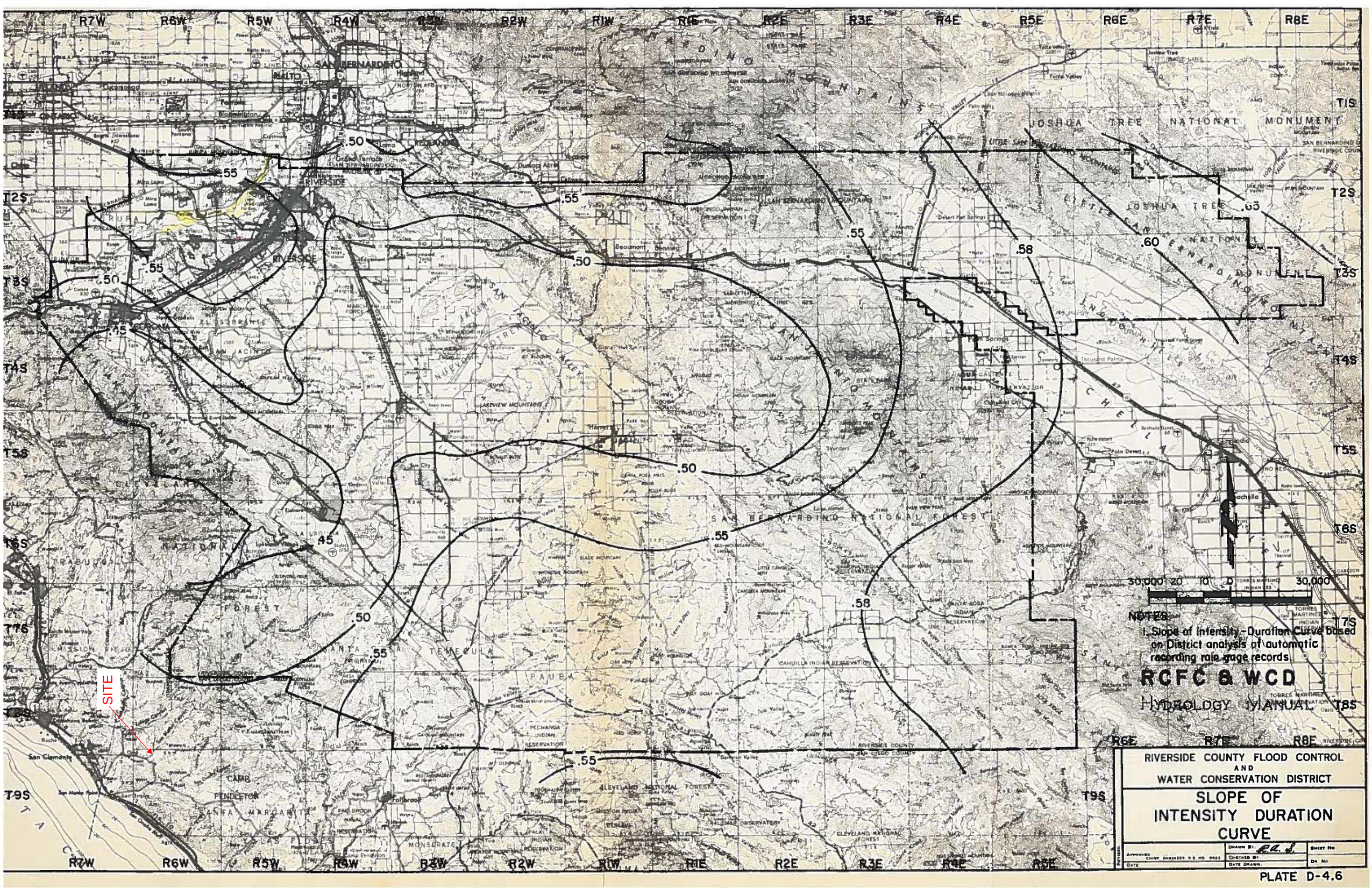

R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E
R3E
R4E
R5E
R6E
R7E
R8E
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
SAN BERNARDINO MOUNTAINS
JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO NATIONAL FOREST
CLEVELAND NATIONAL FOREST
SANTA ANA MOUNTAINS
SANTA ROSA MOUNTAINS
LAKEVIEW MOUNTAINS
RIVERSIDE
SAN BERNARDINO
RIALTO
ONTARIO
CORONA
TEMECULA
MURRIETA
PECHANGA INDIAN RESERVATION
CAHUILLA INDIAN RESERVATION
SANTA ROSA INDIAN RESERVATION
TORRES MARTINEZ INDIAN RESERVATION
SAN JACINTO FAULT ZONE
SAN JACINTO VALLEY
SAN JACINTO MOUNTAINS
SITE
1.2"
1.3"
1.4"
1.45"
1.5"
1.6"
1.7"
1.8"
2.0"
2.4"
2.8"
30,000 20 10 0 30,000
NOTES:
1. Isohyetals based on NOAA Atlas 2, Volume XI – California, 1973
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 1-HOUR PRECIPITATION
APPROVED
CHIEF ENGINEER R.E. NO. 8822
DATE
DRAWN BY
CHECKED BY
DATE DRAWN
SHEET NO
DR. NO
REVISED

PLATE D-4.4


SITE
.45
.50
.55
.58
.60
.63
NOTES:
1. Slope of Intensity-Duration Curve based on District analysis of automatic recording rain gage records.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
SLOPE OF INTENSITY DURATION CURVE
PLATE D-4.6

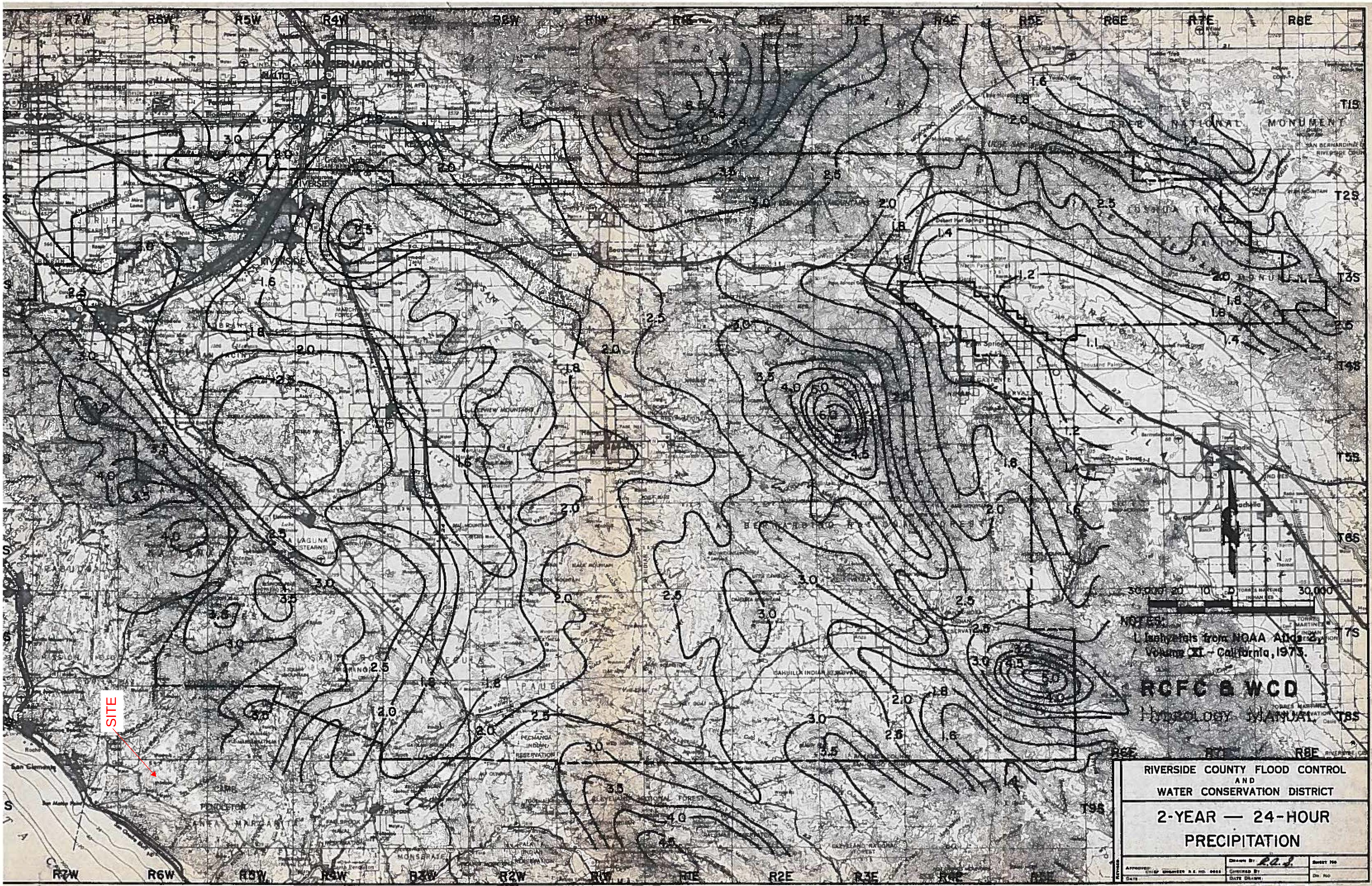
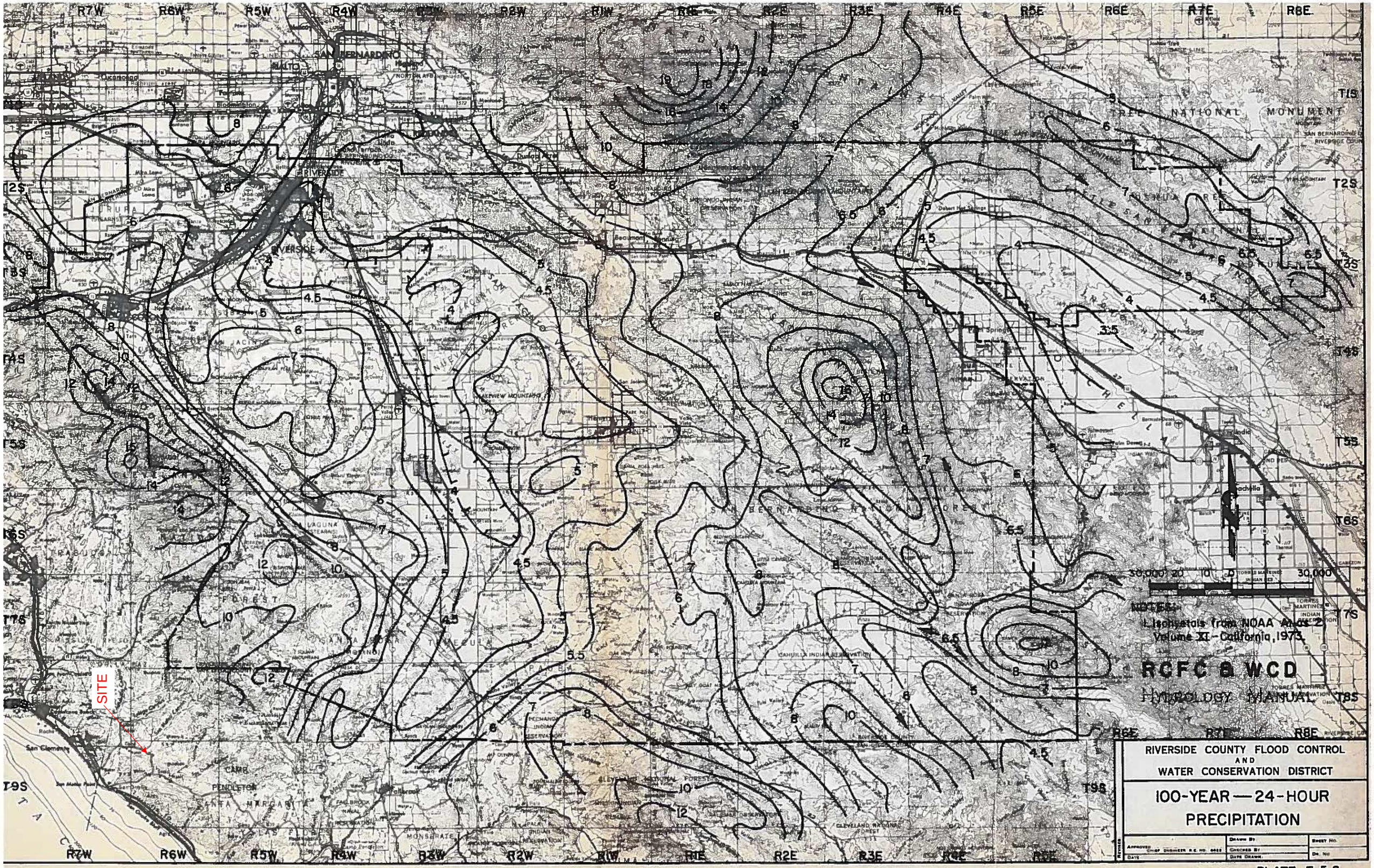

SITE
NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
2-YEAR — 24-HOUR
PRECIPITATION
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E
R3E
R4E
R5E
R6E
R7E
R8E
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
RIVERSIDE
SAN BERNARDINO
LAGUNA
PENDLETON
San Clemente

PLATE E-5.5



NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973.

RCFC & WCD
HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

100-YEAR — 24-HOUR PRECIPITATION

APPROVED CHIEF ENGINEER R.C.E. NO. 6822	DRAWN BY	SHEET NO.
DATE	CHECKED BY	DR. NO.
	DATE DRAWN	

PLATE E-5.6

WESTERN RIVERSIDE COUNTY MULTIPLE SPECIES HABITAT CONSERVATION PLAN CONSISTENCY ANALYSIS AND BIOLOGY RESOURCES ASSESSMENT REPORT

INDUSTRIAL OUTDOOR VENTURES

Prepared for:

MIG
1650 Spruce Street, Suite 106
Riverside, California 92507

Prepared by:

LSA Associates, Inc.
1500 Iowa Avenue, Suite 200
Riverside, California 92507
(951) 781-9310

LSA Project No. MIG2201

LSA

October 2022

TABLE OF CONTENTS

TABLES

APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

ac	acre/acres
APN	Assessor's Parcel Number
CASSA	Criteria Area Species Survey Area
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CNPS	California Native Plant Society
CWA	Clean Water Act
DSF	Delhi sands flower-loving fly
ESA	Environmentally Sensitive Area
ft	foot/feet
HCP	Habitat Conservation Plan
I-15	Interstate 15
NRCS	Natural Resources Conservation Service
OHWM	ordinary high water mark
PQP lands	Public/Quasi-Public lands
project	Industrial Outdoor Ventures Project
RWQCB	Regional Water Quality Control Board
SR-60	State Route 60
USACE	United States Army Corps of Engineers
UWFWS	United States Fish and Wildlife Service
WRCMSHCP	Western Riverside County Multiple Species Habitat Conservation Plan

1.0 EXECUTIVE SUMMARY

LSA was retained by MIG to conduct a Western Riverside County Multiple Species Habitat Conservation Plan (WRCMSHCP) consistency analysis and general biological assessment of the approximately 6.88-acre (ac) Industrial Outdoor Ventures Project (project) site located on the north side of Riverside Drive west of Wineville Avenue in Jurupa Valley, Riverside County, California. The study was conducted to address compliance with the WRCMSHCP and the California Environmental Quality Act (CEQA), and for the identification of potential jurisdictional waters. Results of the WRCMSHCP consistency analysis and general biological assessment are summarized below. The project site is not within a WRCMSHCP Criteria Area or any Public/Quasi-Public lands (PQP lands).

One drainage feature occurs on the project site that is considered WRCMSHCP riverine and is potentially subject to jurisdiction by the California Department of Fish and Wildlife (CDFW), United States Army Corps of Engineers (USACE), and Regional Water Quality Control Board (RWQCB). This feature receives flows from two separate off-site features. The project has been designed to avoid this potential drainage feature by the placement of an Environmentally Sensitive Area (ESA) fence. No other ponded areas or riparian habitat potentially subject to jurisdiction by the CDFW, USACE, or RWQCB were found within the project site.

The site does not contain riparian areas or vernal pools as defined in the WRCMSHCP and does not contain any fairy shrimp habitat. Therefore, focused surveys will not be required for special-status riparian bird or fairy shrimp species.

The project site is within the WRCMSHCP survey area for western burrowing owl (*Athene cunicularia hypugaea*), and suitable habitat for this species is present on site. A focused western burrowing owl breeding season survey was conducted, and western burrowing owl was determined to be absent from the project site. However, due to the presence of suitable habitat, a preconstruction survey will be required within 30 days prior to ground disturbance.

The project site is within WRCMSHCP Survey Area Number 7 for narrow endemic plant species; however, no suitable habitat is present. Therefore, no surveys or further analysis for these species will be required.

The project site is not located within a WRCMSHCP-designated survey area for any other species. This site does contain Delhi series soils, which may provide suitable habitat for the Delhi sands flower-loving fly (DSF; *Rhaphiomidas terminatus abdominalis*). However, 4 consecutive years of survey results were negative, and DSF is determined to be absent from the project site. No surveys for other species will be required.

The project will not be subject to WRCMSHCP Urban/Wildlands interface requirements because the site is not within or adjacent to an identified Conservation Area.

The project is within the Stephens' Kangaroo Rat Habitat Conservation Plan area, and payment of a fee is required.

2.0 INTRODUCTION

LSA was retained by MIG to conduct a WRCMSHCP consistency analysis and general biological resources assessment of the approximately 6.88 ac Industrial Outdoor Ventures Project (project) located on the north side of Riverside Drive west of Wineville Avenue in Jurupa Valley, Riverside County, California (Figure 1; all figures are provided in Appendix A).

The study was conducted to document biological resources within the study area, including those protected under the WRCMSHCP and CEQA, and include a focused breeding season burrowing owl survey and assessment of potential jurisdictional waters. These studies were conducted on July 29 and August 12, 19, and 26, 2022 (July/August) by LSA Biologist Denise Woodard.

2.1 PROJECT AREA

The project area is 6.88 ac in size and consists of Assessor's Parcel Numbers (APNs) 156-030-016, 156-030-017, and 156-030-042. The majority of the site will be developed. The eastern portion of the site is designated to not be disturbed in order to avoid any potential impacts to drainages that have the potential to meet the definition of a riverine area under the WRCMSHCP, waters of the United States under the federal Clean Water Act (CWA), streambed under Fish and Game Code Section 1600, or waters of the State pursuant to the Porter-Cologne Water Quality Control Act. An ESA fence will be placed along the eastern limits of the project construction area to avoid impacts to the potential jurisdictional feature (Figure 2). The project is located within the WRCMSHCP, but is located outside any criteria cell, PQP land, or conservation areas. The project site is located within the WRCMSHCP Species Survey Area for Burrowing Owl and Narrow Endemic Plant Species.

2.2 PROJECT DESCRIPTION

Project activities include the development of a 25,000-square-foot warehouse/retail office building, uncovered outdoor sales area, parking spaces, electric vehicle charging station, a water quality basin, and other infrastructure improvements (Figure 2).

2.3 GENERAL SETTING

The project site (Figure 3) is undeveloped and bordered to the north and west by Interstate 15 (I-15)/State-Route 60 (SR-60) interchange ramps, to the east by industrial development, and to the south by Riverside Drive and industrial development. The site is relatively flat, and elevations range from approximately 790 to 800 feet (ft) above mean sea level. The soils in the study area, as mapped by the Natural Resources Conservation Service (NRCS) Online Web Soil Survey (n.d.), are Delhi fine sand, 2 to 15 percent slopes, wind-eroded (DaD2), and Gorgonio loamy sand, deep, 2 to 8 percent slopes (GlC) as shown on Figure 4. The soils in the study are regularly disced for weed abatement but appear consistent with the mapping.

3.0 RESERVE ASSEMBLY ANALYSIS

3.1 CELL AND CRITERIA ANALYSIS

The WRCMSHCP provides for the assembly of a Conservation Area consisting of Core Areas and Linkages for the conservation of covered species. The Conservation Area is to be assembled from portions of the WRCMSHCP Criteria Area, which consists of quarter-section (i.e., approximately 160 ac) Criteria Cells, each with specific criteria for the species conservation within that cell.

The project site is within the Jurupa Area Plan of the WRCMSHCP, but it is not located a within a Criteria Area or adjacent to a Criteria Area or Conservation Area. Therefore, no Cell or Criteria Analysis is required. The closest Criteria Cell (Number 35) is located immediately east of the I-15/SR-60 interchange. Development has already occurred in that cell. Criteria Cell Number 35 is within Cell Group A of the Jurupa Area Plan, Subunit 3, Delhi Sands Area, which is within Proposed Noncontiguous Habitat Block 1. Conservation objectives of this area pertain to conservation of occupied DSF lands, which is not applicable to this site.

3.2 PUBLIC/QUASI-PUBLIC LANDS ANALYSIS

The project site is not within or adjacent to PQP lands. The closest PQP lands comprise Noncontiguous Habitat Block 2 in the Jurupa Mountains, over 2 miles northeast of the project site. The project will not have any direct or indirect impacts to PQP lands.

4.0 VEGETATION

The vegetation on site consists of nonnative grassland/ruderal as a result of regularly discing for weed abatement and surrounding development. A row of large eucalyptus (*Eucalyptus* sp.) trees is located along Riverside Drive. Dominant species on site include annual bur-sage (*Ambrosia acanthacarpa*), golden crownbeard (*Verbesina encelioides*), Russian thistle (*Salsola tragus*), ripgut brome (*Bromus diandrus*), mouse barley (*Hordeum murinum*), and shortpod mustard (*Hirschfeldia incana*). Table 4.A provides the impact acreages to vegetation, and a complete list of plant species observed on the site is included in Appendix B.

Table 4.A: Impacts to Vegetation

Land Cover Type	Permanent Impacts (acres)	Temporary Impacts (acres)	No Impacts/ No Disturbance (acres)
Ruderal/Nonnative Grassland	6.35	0[1]	0.53
Total Impacts	**6.35**	**0**	**0.53**

Source: Compiled by LSA (2022).
[1] All impacts considered permanent.

5.0 PROTECTION OF SPECIES ASSOCIATED WITH RIPARIAN/RIVERINE AREAS AND VERNAL POOLS (WRCMSHCP SECTION 6.1.2)

Section 6.1.2 of the WRCMSHCP requires assessment of impacts to riparian habitats, riverine areas, and vernal pools, including focused surveys for sensitive riparian bird and fairy shrimp species when suitable habitat is present. The intent of the assessment requirement is to provide for the protection of resources used by WRCMSHCP-covered species, as well as existing and future downstream conservation areas. Riverine/riparian areas and vernal pools are defined in Section 6.1.2 of the WRCMSHCP as follows:

> Riparian/Riverine Areas are lands which contain Habitat dominated by trees, shrubs, persistent emergents, or emergent mosses and lichens, which occur close to or which depend upon soil moisture from a nearby fresh water source; or areas with fresh water flow during all or a portion of the year.
>
> Vernal pools are seasonal wetlands that occur in depression areas that have wetlands indicators of all three parameters (soils, vegetation and hydrology) during the wetter portion of the growing season but normally lack wetlands indicators of hydrology and/or vegetation during the drier portion of the growing season. Obligate hydrophytes and facultative wetlands plant species are normally dominant during the wetter portion of the growing season, while upland species (annuals) may be dominant during the drier portion of the growing season. The determination that an area exhibits vernal pool characteristics, and the definition of the watershed supporting vernal pool hydrology, must be made on a case-by-case basis. Such determinations should consider the length of the time the area exhibits upland and wetland characteristics and the manner in which the area fits into the overall ecological system as a wetland. Evidence concerning the persistence of an area's wetness can be obtained from its history, vegetation, soils, and drainage characteristics, uses to which it has been subjected, and weather and hydrologic records.
>
> **Fairy Shrimp.** For Riverside, vernal pool and Santa Rosa fairy shrimp, mapping of stock ponds, ephemeral pools and other features shall also be undertaken as determined appropriate by a qualified biologist.
>
> With the exception of wetlands created for the purpose of providing wetlands Habitat or resulting from human actions to create open waters or from the alteration of natural stream courses, areas demonstrating characteristics as described above which are artificially created are not included in these definitions.

5.1 RIPARIAN/RIVERINE

5.1.1 Methods

LSA conducted a review of current and historical aerial photography to preliminarily identify if there were any drainage features flowing into or out of the project site or signature patterns on the aerial photographs that would indicate that riparian vegetation was evident and whether there were any drainages. In addition, a previous study (LSA 2019) conducted for the project was reviewed. The project site was assessed for riparian/riverine areas at the time of the July 29 and August 12, 19, and 26, 2022 (July/August) site visits. The assessment included identification and mapping of plant

communities on the site as well as any drainage features on site or flowing into or out of the project site.

5.1.2 Existing Conditions and Results

There is no riparian vegetation on the project site; therefore, there are no areas that would meet the WRCMSHCP definition of riparian areas or that would require surveys for riparian species. There is one drainage feature that meets the WRCMSHCP definition of riverine.

There is a drainage feature fed by a trapezoidal concrete ditch that conveys flows into the northeastern corner of the site. Flows originate from Wineville Road to the east. On-site flows from this drainage feature are conveyed into the storm drain system through a 48-inch-diameter culvert at Riverside Drive. This feature also appears to receive sheet flows that are fed by a culvert under SR-60, north of the project site.

5.1.3 Impacts and Mitigation

The project will avoid effects to the drainage feature and sheet flow from SR-60. The project has been designed to avoid placing fill material or having any other ground disturbance to the riverine areas by the design of the project detention basin, located at least 10 ft from the riverine feature, and the placement of an ESA fence east of the detention basin and project work limits. Because the project will avoid impacts to the on-site drainage features, no mitigation is required.

5.2 VERNAL POOLS

5.2.1 Methods

The project site was assessed for vernal pools at the time of the July/August 2022 site visits. The assessment included a search for depressions, indicators of wetland hydrology, suitable soils, and hydrophytic vegetation. The assessment also included a review of seasonally appropriate aerial photographs from 10/2003, 12/2003, 12/2005, 1/2006, 1/2007, 11/2009, 3/2011, 1/2013, 3/2013. 11/2013, 4/2014, 2/2016, 10/2016, 2/2018, 12/2018, 12/2020 and 2/2022 that were acquired via Google Earth Pro in July 2022.

5.2.2 Existing Conditions and Results

The only drainage feature on site has an outlet and drains to a culvert downstream at Riverside Drive. No ponded areas or features resembling vernal pools were observed on site. The soils mapped and observed on site are loamy sand and fine sand, which are not suitable to support ponding sufficient for vernal pool formation. There are no areas of hydrophytic vegetation on the site. Therefore, there are no vernal pools.

5.3 FAIRY SHRIMP

5.3.1 Methods

The project site was assessed for fairy shrimp habitat at the same time, and using the same methods, as the assessment for vernal pools. The WRCMSHCP calls for habitat assessments for three sensitive species of fairy shrimp: Santa Rosa Plateau fairy shrimp (*Linderiella santarosae*), Riverside

fairy shrimp (*Streptocephalus woottoni*), and vernal pool fairy shrimp (*Branchinecta lynchi*). Santa Rosa Plateau fairy shrimp occur only on the Santa Rosa Plateau of extreme southwest Riverside County. A fourth sensitive species of Southern California (i.e., San Diego fairy shrimp [*Branchinecta sandiegonensis*]) is found primarily in the coastal areas of Orange and San Diego Counties. San Diego fairy shrimp has been found as far inland as the Wildomar area of southwest Riverside County but is not expected in the project area. These sensitive fairy shrimp species inhabit vernal pools as well as stock ponds, large road ruts, or other similar habitats that pond water long enough to allow growth and reproduction. To provide fairy shrimp habitat, a feature must regularly pond water for at least 18 days for vernal pool fairy shrimp (Eriksen and Belk 1999) and 2 months for Riverside fairy shrimp (USFWS 2012). Fairy shrimp do not inhabit flowing waters.

5.3.2 Existing Conditions and Results

As noted above, there are no vernal pools or similar non-flowing aquatic habitats on the project site suitable for fairy shrimp. The site does not have habitat suitable for sensitive fairy shrimp species; therefore, no surveys will be required.

5.4 RIPARIAN BIRDS

5.4.1 Methods

Habitat suitability for riparian birds, including least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and yellow-billed cuckoo (*Coccyzus americanus*), was assessed in conjunction with the assessment for riverine/riparian areas.

5.4.2 Existing Conditions and Results

There are no riparian/riverine areas or any habitat suitable for riparian birds on the project site; therefore, no surveys for riparian birds will be required.

6.0 PROTECTION OF NARROW ENDEMIC PLANT SPECIES (WRCMSHCP SECTION 6.1.3)

Section 6.1.3 of the WRCMSHCP requires focused surveys for specified sensitive plant species if the project is located within a survey area for narrow endemic plant species and suitable habitat is present. The project site is located within a survey area for the three narrow endemic plant species summarized in Table 6.A; however, there is no suitable habitat for these species. Therefore, no surveys for narrow endemic plants will be required.

Table 6.A: Narrow Endemic Plant Species Occurrence Probability on the Project Site

Species	MSHCP Habitat	Growth Form & Blooming Period	Occurrence Probability
San Diego ambrosia *Ambrosia pumila*	Open floodplain terraces on Garretson gravelly fine sandy loams, or in the watershed margins of vernal pools or alkali playas on Las Posas loam in close proximity to Willow silty alkaline soils. Occurs in sparse annual vegetation.	Perennial; Generally non-flowering	**Absent.** No Garretson or Las Posas soils or vernal pools/ alkali playas on site.
Brand's star phacelia *Phacelia stellaris*	Sandy soils of washes or benches in alluvial floodplains. This species is generally dependent on periodic flooding and sediment transport. The WRCMSHCP account for this species states that "within western Riverside County, Brand's phacelia is restricted to sandy benches along the Santa Ana River."	Annual; March–June	**Absent.** No alluvial floodplains on site.
San Miguel savory *Satureja chandleri*	Rocky, gabbroic, and metavolcanic substrates in chaparral or oak woodland.	Perennial; March–May	**Absent.** No chaparral or woodlands on site.

Source: Compiled by LSA (2022).

7.0 ADDITIONAL SURVEY NEEDS AND PROCEDURES (WRCMSHCP SECTION 6.3.2)

WRCMSHCP Section 6.3.2 requires surveys for additional plants, amphibians, small mammals, and burrowing owl for projects located within mapped survey areas.

7.1 CRITERIA AREA PLANT SPECIES

The project is not within a mapped survey area for Criteria Area Species Survey Area (CASSA) plant species.

7.2 AMPHIBIANS

The project is not within a mapped survey area for amphibian species.

7.3 BURROWING OWL

The project site is within the WRCMSHCP burrowing owl survey area. Burrowing owls are found in open and dry grasslands, agricultural and range lands, and desert habitats often associated with burrowing animals. They can also inhabit grass, forb, and shrub stages of pinyon and ponderosa pine habitats. They nest in abandoned burrows of ground squirrels or other animals, in pipes, under piles of rock or debris, and in other similar features.

7.3.1 Methods

A burrowing owl habitat assessment and focused burrow survey were conducted by LSA biologist Denise Woodard in accordance with Step I and Step II, Part A of the *Burrowing Owl Survey Instructions for the Western Riverside County Multiple Species Habitat Conservation Plan Area* (County of Riverside 2006). The habitat assessment and focused survey for burrowing owl burrows were conducted July 29, 2022. The assessment included an evaluation of soil texture, vegetative cover, topography, and the presence of mammal burrows, rock/debris piles, or other areas suitable for nest construction. The burrow surveys were conducted by walking throughout suitable habitat areas and pausing occasionally to scan the surrounding areas through binoculars. Transects were spaced at no more than 80 ft, which allowed for 100 percent visual coverage of suitable habitat. Burrows and other nesting features with potential to be occupied by the burrowing owl encountered during the survey were examined for owl sign (e.g., feathers, pellets, whitewash, and prey remnants). Survey dates, times, and weather conditions are summarized in Table 7.A.

7.3.2 Existing Conditions and Results

The site has low vegetative cover, is mostly devoid of trees, and has concrete debris piles and ground squirrel burrows. These conditions indicate potential habitat for burrowing owl. The entire site is suitable, except for the southern edge where tall trees provide roosting spots for hawks, ravens, and large owls that could prey upon burrowing owl. Several burrows with an opening of at least 4 inches in diameter were found throughout the project site. Potential burrowing owl burrow locations and survey transect lines are shown on Figure 5.

Table 7.A: Burrowing Owl Breeding Season Survey Details

Date	Type of Survey (Times)	Weather Conditions
July 29, 2022	Evening (5:45 PM–7:15 PM)	86–84°F clear skies, wind 5–8 mph
August 12, 2022	Dawn (6:10 AM–7:30 AM)	70–72°F, partly cloudy (10%), wind 1–3 mph
August 19, 2022	Dawn (6:30 AM –8:00 AM)	67–70°F, partly cloudy (5%), wind 1–3 mph
August 26, 2022	Dawn (6:35 AM–8:00 AM)	69–70°F, clear, 0 mph

Source: Compiled by LSA (2022).
°F = degrees Fahrenheit
mph = miles per hour

7.3.3 Impacts and Mitigation

Although no burrowing owl was found, due to the presence of potentially suitable habitat, a WRC MSHCP 30-day preconstruction survey for burrowing owl is required prior to project ground-disturbing activities (e.g., vegetation clearing and grubbing, and tree removal) to ensure that no burrowing owls have colonized the site in the days or weeks preceding the ground-disturbing activities. If burrowing owls are found during the preconstruction survey, the project proponent will need to inform the CDFW and United States Fish and Wildlife Service (USFWS) and prepare a Burrowing Owl Protection and Relocation Plan for approval by these agencies prior to initiating ground disturbance.

7.4 MAMMALS

The project is not within a mapped survey area for mammals.

8.0 INFORMATION ON OTHER SPECIES

8.1 DELHI SANDS FLOWER-LOVING FLY

The WRCMSHCP requires surveys for DSF in most areas of mapped Delhi series soils where suitable habitat exists (WRCMSHCP Section 9). The DSF was listed as an endangered species by the USFWS on September 23, 1993.

The southwestern portion of the project site is located within an area of mapped Delhi soils and (as noted in Chapter 2.0) soil observed throughout the site is sand and loamy sandy, which is consistent with Delhi soils. The site was surveyed for DSF over four consecutive field seasons in 2015, 2016, 2017, and 2018 with negative results (Osborne 2015, 2016, 2017, and 2018). Appendix C provides the 2017 and 2018 survey results. Therefore, this species is considered absent, and no additional survey is required.

8.2 SPECIES NOT ADEQUATELY CONSERVED UNDER WRCMSHCP

Some species that will eventually have full coverage under the WRCMSHCP are not considered adequately conserved until requirements indicated in Table 9-3 of WRCMSHCP Section 9 are met.

8.2.1 Methods

A literature review was conducted to investigate the potential occurrence of special-status species on the project site or in the vicinity. Database records for the *Guasti, Fontana, Ontario, Corona North*, and *Riverside West, California* USGS 7.5-minute quadrangles were searched on July 21, 2022, using Rarefind 5 (CDFW 2022). LSA also reviewed the WRCMSHCP Table 9-3 species. No species noted from Table 9-3 or other special-status species were observed during the site visit.

8.2.2 Results

None of the species listed in WRCMSHCP Table 9-3 and lacking full coverage have been reported from the project site or within 3 miles of the project site, and none were observed during the biological resources assessment conducted on site. Given the habitat quality and small project footprint, none of these species are expected to occur; therefore, the proposed project is not anticipated to affect these species.

9.0 GUIDELINES PERTAINING TO THE URBAN/WILDLANDS INTERFACE (WRCMSHCP SECTION 6.1.4)

To preserve the integrity of areas described as existing or future WRCMSHCP Conservation Areas, the guidelines contained in WRCMSHCP Section 6.1.4 (Urban Wildlands Interface Guidelines) are to be implemented for projects that are located adjacent to either existing conservation or land described for conservation in the WRCMSHCP Criteria Area.

The project site is not located adjacent to conserved lands or lands in the Criteria Area that are described for conservation; therefore, the Urban Wildlands Interface Guidelines do not apply to this project.

10.0 POTENTIAL JURISDICTIONAL WATERS AND STREAMBEDS

The USACE, under Section 404 of the federal CWA, regulates discharges of dredged or fill material into "waters of the United States." These waters include wetlands and non-wetland bodies of water that meet specific criteria, including a connection to interstate commerce. This connection may be direct (through a tributary system linking a stream channel with traditional navigable waters used in interstate or foreign commerce), or it may be indirect (through a connection identified in USACE regulations). The USACE typically regulates as non-wetland waters of the United States any body of water displaying an "ordinary high water mark" (OHWM). In order to be considered a "jurisdictional wetland" under Section 404, an area must possess hydrophytic vegetation, hydric soils, and wetland hydrology.

The CDFW, under Sections 1600 et seq. of the California Fish and Game Code, regulates alterations to lakes, rivers, and streams. A stream is defined by the presence of a channel bed and banks and at least an occasional flow of water.

The RWQCB is responsible for the administration of Section 401 of the CWA through water quality certification of any activity that may result in a discharge to jurisdictional waters of the United States. The RWQCB may also regulate discharges to "waters of the State," including wetlands, under the California Porter-Cologne Water Quality Control Act.

No drainage features, ponded areas, or riparian habitat potentially subject to jurisdiction by the CDFW, USACE, or RWQCB were observed within the impact area of the project. There is a drainage feature fed by a trapezoidal concrete ditch that conveys flows into the northeastern corner of the site. Flows from this drainage feature are conveyed into the storm drain system through a 48-inch-diameter culvert at Riverside Drive. This feature also appears to receive sheet flows from a swale that is fed by a culvert under SR-60, north of the project site. The project has been designed to avoid placing fill material or having any other ground disturbance at the potentially jurisdictional feature/ riverine area by the design of the culvert outlet/riprap from the detention basin located at least 10 ft from this feature and the placement of an ESA fence east of the detention basin and project work limits. Due to the project design of avoidance, no further assessment or permits are required.

The findings and conclusions presented in this report, including the location and extent of wetlands and other waters subject to regulatory jurisdiction, represent the professional opinion of LSA. These findings and conclusions should be considered preliminary until verified by the RWQCB, USACE, and CDFW.

11.0 NESTING BIRDS

During the bird breeding season (typically February 1 through August 31), large trees on or adjacent to the study area may be used by hawks, ravens, or other large birds for nesting. Trees, shrubs, and other vegetation may provide nest sites for smaller birds, and western burrowing owls may nest in ground squirrel burrows, pipes, or similar features.

Most birds and their active nests are protected from "take" (meaning destruction, pursuit, possession, etc.) under the Migratory Bird Treaty Act and/or Sections 3503–3801 of California Fish and Game Code. Activities that cause destruction of active nests, or that cause nest abandonment and subsequent death of eggs or young, may constitute violations of one or both of these laws.

To avoid potential effects during the breeding season to fully protected raptors, special-status bird species, and other nesting birds protected by the California Fish and Game Code, and for compliance with WRCMSHCP Incidental Take Permit Condition 5, the following measures will be implemented:

- A nesting bird preconstruction survey will be conducted by a qualified biologist within 3 days prior to ground-disturbing and vegetation removal activities that occur during the nesting season (February 1 through August 31). Should nesting birds be found, an exclusionary buffer will be established by the qualified biologist. The buffer may be up to 500 ft in diameter, depending on the species of nesting bird found. This buffer will be clearly marked in the field by construction personnel under guidance of the qualified biologist, and construction or clearing will not be conducted within this zone until the qualified biologist determines that the young have fledged or the nest is no longer active. Nesting bird habitat within the study area will be resurveyed during bird breeding season if there is a lapse in construction activities longer than 7 days.

12.0 CEQA COMPLIANCE

12.1 ADOPTED HABITAT CONSERVATION PLANS

Section 10(a)(2)(A) of the 1973 Federal Endangered Species Act requires the preparation of a Habitat Conservation Plan (HCP) for incidental take of threatened or endangered species when there is no federal agency involvement in a project. Continuing land development may cause incidental take of listed species and, therefore, HCPs have been prepared for areas within western Riverside County. The WRCMSHCP and the Stephens' Kangaroo Rat HCP are the principal HCPs in western Riverside County. The USFWS regional office maintains a current list of HCPs for the Southern California region.

The project site is within the WRCMSHCP area and is the subject of this report. The project site is also within the Stephens' Kangaroo Rat HCP fee area. Focused surveys for Stephens' kangaroo rat will not be required for this project, but a fee will be assessed.

12.2 THREATENED AND ENDANGERED SPECIES

The USFWS and CDFW may list species as threatened or endangered under the Federal and State Endangered Species Acts. The USFWS can designate critical habitat that identifies specific areas, either occupied or unoccupied, that are essential to the conservation of a listed species. Critical habitat areas may require special management considerations or protections. The USFWS and CDFW have issued permits for the take of most threatened and endangered species within the WRCMSHCP Plan Area. The WRCMSHCP covers impacts to these species. However, if a project has the involvement of a federal agency, that agency is required to address impacts to listed species and critical habitat by consulting with the USFWS. The USFWS has indicated in the permit issued for the WRCMSHCP that, in such cases, the consultation will be expedited and that no restrictions will be imposed on the project beyond those specified in the WRCMSHCP.

Delhi soils are present on the project site for the DSF. The site was surveyed for DSF over four consecutive field seasons in 2015, 2016, 2017, and 2018 with negative results (Osborne 2015, 2016, 2017, and 2018). Appendix C provides the 2017 and 2018 survey results. Therefore, this species is considered absent, and no additional survey is required. No other threatened or endangered species are expected to occur on the project site.

12.3 OTHER SPECIAL-STATUS SPECIES

Other special-status species may occur on the proposed project site. The CDFW, USFWS, local agencies, and special interest groups, such as the California Native Plant Society (CNPS), maintain lists of species that they consider to be in need of monitoring. Legal protection for special-status species varies widely.

The special-status species listed in Table 12.A may be expected to occur in the general project vicinity but are not covered under the WRCMSHCP or are not adequately conserved by the WRCMSHCP at this time. Some of these species have a low potential of occurring on the project site. However, none of these species that may be present are listed as threatened or endangered under State or federal law, and the site does not contain high-quality habitat for any of these species. Therefore, any impacts to these species by the project would not be substantial. Neither additional surveys nor additional conservation measures will be required for this project for these species.

12.4 WILDLIFE MOVEMENT, CORRIDORS, AND NURSERY SITES

Wildlife movement includes seasonal migration along corridors as well as daily movements for foraging. Migration corridors may include areas of unobstructed movement of deer, riparian corridors providing cover for migrating birds, routes between breeding waters and upland habitat for amphibians, and between roosting and feeding areas for birds.

The project site is located adjacent to the I-15/SR-60 interchange, a major road, and existing development that already restrict wildlife movement in the project vicinity. The project site is not within a WRCMSHCP-designated wildlife corridor or linkage. The proposed project would not substantially limit wildlife movement.

12.5 NATURAL COMMUNITIES OF INTEREST

Riparian habitats, oak woodlands, and vernal pools are among the natural communities of interest to the CDFW. There are no riparian communities, vernal pools, or other sensitive plant communities on the project site.

12.6 WETLANDS

A formal jurisdictional delineation has not been conducted on site. There is a drainage feature on the site that flows to a culvert beneath Riverside Drive. The drainage did not contain hydrophytic vegetation associated with wetlands at the time of the July/August field surveys. The project plans have been designed to avoid the potential jurisdictional areas, including any potential wetlands, by the placement of an ESA fence as previously discussed in Chapter 10.0. Therefore, there will be no impacts to any wetlands on the project site.

12.7 LOCAL POLICIES AND ORDINANCES PROTECTING BIOLOGICAL RESOURCES

City and County General Plans and development ordinances may include regulations or policies governing biological resources. For example, policies may include tree preservation, locally designated species survey areas, local species of interest, and significant ecological areas.

The project will not be in conflict with local policies or ordinances applicable to biological resources.

Table 12.A: Special-Status Species Potentially Occurring in the Project Vicinity That are Not Adequately Covered by the WRCMshcp

Species	Status	Description	Activity Period	Occurrence Probability
Plants				
Chaparral sand-verbena *Abronia villosa* var. *aurita*	US: – CA: 1B	Sandy areas (generally flats and benches along washes) in chaparral and coastal sage scrub, and improbably in desert dunes or other sandy areas, below 5,300 feet in elevation. In California, reported from Riverside, San Diego, Imperial, Los Angeles, and Ventura Counties. Believed extirpated from Orange County. Also reported from Arizona and Mexico (Baja California). Plants reported from desert communities are likely misidentified.	Blooms mostly March through August (annual or perennial herb)	**Absent.** No suitable habitat (sandy areas in chaparral or coastal sage scrub).
Marsh sandwort *Arenaria paludicola*	US: FE CA: SE/1B	Boggy areas in freshwater marshes and swamps below 560 feet in elevation. Known to presently occur only in San Luis Obispo County (at Oso Flaco Lake and Morro Bay). Believed extirpated from Los Angeles, San Francisco, Santa Cruz, Riverside, and San Bernardino Counties, and from the State of Washington. The last known record of this species in Riverside, San Bernardino, or Los Angeles Counties is from 1900.	Blooms May through August (perennial herb)	**Absent.** No marshes on site.
Lucky morning-glory *Calystegia felix*	US: – CA: 3	Wetland and marshy areas, sometimes alkaline, sometimes artificially watered, from 100 to 700 feet in elevation. All of the known extant occurrences are associated with well-watered landscaping on recently completed industrial, commercial, and residential developments in Chino within a historical area of artesian springs. Older collections are from areas that are now heavily urbanized areas (including one from South Los Angeles and another from Pico Rivera in Los Angeles County). Known to occur only in western San Bernardino County. Presumed extirpated from Riverside and Los Angeles Counties.	Blooms March through September (annual or perennial rhizomatous herb)	**Absent.** No marshes or wetlands on site.
Salt marsh bird's-beak *Chloropyron maritimum* spp. *maritimum*	US: FE CA: SE/1B	Coastal dunes and salt marshes. In California, known from Los Angeles, Orange, Santa Barbara, San Bernardino, San Diego, San Luis Obispo, and Ventura Counties. Historical collections referred to this taxon from alkaline meadow in the vicinity of San Bernardino Valley and from interior San Diego County are intermediate to *C. maritimus* ssp. *canescens*. Also occurs in Mexico.	Blooms May through October (annual herb)	**Absent.** No coastal dunes or marshes on site.
California saw-grass *Cladium californicum*	US: – CA: 2B	Marshes and seeps below 2,000 feet in elevation. In California, known from Inyo, Riverside, Santa Barbara, San Bernardino, and San Luis Obispo Counties. Believed to be extirpated from Los Angeles and perhaps San Bernardino Counties. Also occurs in Arizona, New Mexico, Nevada, Texas, Utah, and Mexico.	Blooms June through September	**Absent.** No wet areas on site.

Table 12.A: Special-Status Species Potentially Occurring in the Project Vicinity That are Not Adequately Covered by the WRCMshcp

Species	Status	Description	Activity Period	Occurrence Probability
Mesa horkelia *Horkelia cuneata* ssp. *puberula*	US: – CA: 1B	Sandy or gravelly soils in chaparral, or rarely in cismontane woodland or coastal scrub at 200 to 2,700 feet in elevation. Known only from San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Bernardino Counties, California. Believed extirpated from Riverside and San Diego Counties.	Blooms February through July, sometimes to September (perennial herb)	**Absent.** No chaparral, cismontane woodland, or coastal scrub on site. Believed extirpated from area.
Parish's desert-thorn *Lycium parishii*	US: – CA: 2B	Coastal scrub and Sonoran desert scrub at 440 to 3,300 feet in elevation. In California, known from Imperial and San Diego Counties. Report from Riverside County is based on a misidentification. Known only historically from San Bernardino County (benches and/or foothills north of San Bernardino).	Blooms March through April (deciduous shrub)	**Absent.** No coastal scrub or Sonoran desert scrub on site.
Parish's bush mallow *Malacothamnus parishii*	US: – CA: 1A	Known only from one occurrence in 1895, in chaparral and coastal sage scrub at 1,600 feet in elevation in the vicinity of San Bernardino. Presumed extinct.	Blooms June through July (deciduous shrub)	**Absent.** Presumed extinct. Only a historical record from the site vicinity.
Pringle's monardella *Monardella pringlei*	US: – CA: 1A	Sandy hills in coastal sage scrub at 980 to 1,300 feet in elevation. Known only from two occurrences west of Colton. Last seen in 1941. Habitat lost to urbanization. Presumed extinct.	Blooms May through June	**Absent.** No coastal sage scrub on site.
White rabbit-tobacco *Pseudognaphalium leucocephalum*	US: – CA: 2B	Sand and gravel at the edges of washes or mouths of steep canyons at 0 to 7,000 feet in elevation. In California, known from Los Angeles, Orange, Riverside, Santa Barbara, San Diego, San Luis Obispo, and Ventura Counties. Also occurs in Arizona, New Mexico, Texas, and Mexico.	Blooms usually August through November (perennial herb)	**Absent.** No edges of washes or mouths of steep canyons on site.
Chaparral ragwort *Senecio aphanactis*	US: – CA: 2B	Openings (especially alkaline flats) in cismontane woodland, coastal sage scrub, and chaparral at 50 to 2,600 feet in elevation. Known in California from Alameda, Contra Costa, Fresno, Los Angeles, Merced, Monterey, Orange, Riverside, Santa Barbara, Santa Clara, San Diego, San Luis Obispo, Solano, and Ventura Counties. Also occurs in Baja California.	Blooms January through April (annual herb)	**Absent.** No woodland, scrub or chaparral on site.
Salt Spring checkerbloom *Sidalcea neomexicana*	US: – CA: 2B	Alkaline springs and brackish marshes below 5,000 feet in elevation. In California, known only from Kern, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties. Believed extirpated from Los Angeles County. Also known from Arizona, New Mexico, Nevada, Utah, and Mexico.	Blooms March through June (perennial herb)	**Absent.** No alkaline or brackish habitats on site.
Prairie wedge grass *Sphenopholis obtusata*	US: – CA: 2B	Wet meadows, stream banks, and ponds at 1,000 to 6,600 feet in elevation. Widely distributed. In Southern California, known only from San Bernardino, Riverside (Santa Ana River), and perhaps San Diego Counties.	Blooms April through July (perennial herb)	**Absent.** No wet areas on site.

Table 12.A: Special-Status Species Potentially Occurring in the Project Vicinity That are Not Adequately Covered by the WRCMshcp

Species	Status	Description	Activity Period	Occurrence Probability
San Bernardino aster *Symphyotrichum defoliatum*	US: – CA: 1B	Vernally wet sites (e.g., ditches, streams, and springs) in many plant communities below 6,700 feet in) elevation. In California, known from Ventura, Kern, San Bernardino, Los Angeles, Orange, Riverside, and San Diego Counties. May also occur in San Luis Obispo County. In the western Riverside County area, this species is scarce, and documented only from Temescal and San Timoteo Canyons (*The Vascular Plants of Western Riverside County, California*. F.M. Roberts Jr. et al., 2004).	Blooms July through November (perennial herb)	**Absent.** No suitable wet areas on site.
Rigid fringepod *Thysanocarpus rigidus*	US: – CA: 1B	Dry rocky slopes, in oak, pine, or juniper woodland at 2,000 to 7,200 feet in elevation. In California, known from Los Angeles, Riverside, San Bernardino, and San Diego Counties. Also occurs in Mexico.	Blooms February through May (annual herb)	**Absent.** Woodland is not present on site. Site is outside elevation range of species.
Fish				
Santa Ana speckled dace *Rhinichthys osculus* ssp. 3	US: – CA: SSC	Found in the headwaters of the Santa Ana and San Gabriel River drainages. Found in riffles in small streams and shore areas with abundant gravel and rock.	Year-round	**Absent.** No streams on site.
Reptiles				
Southern California legless lizard *Anniella stebbinsi*	US: – CA: SSC	Inhabits sandy or loose loamy soils with high moisture content under sparse vegetation in Southern California.	Nearly year round, at least in southern areas	**Absent.** No loose or moist soils on site.
California glossy snake *Arizona elegans occidentalis*	US: – CA: SSC	Scrub and grassland habitats, often with loose or sandy soils. Patchily distributed from the eastern portion of San Francisco Bay to southern San Joaquin Valley and in non-desert areas of southern California. Also occurs in Baja California, Mexico.	Most active March through June (nocturnal)	**Low.** Grasslands, with loose or sandy soils present on site. However, habitat is marginal due to development on all sides of the small <7 ac site.
Two-striped garter snake *Thamnophis hammondii*	US: – CA: SSC	Highly aquatic. Only in or near permanent sources of water. Streams with rocky beds supporting willows or other riparian vegetation. From Monterey County to northwest Baja California.	Diurnal, year-round	**Absent.** No water on site.
Birds				
Yellow rail *Coturnicops noveboracensis*	US: – CA: SSC	Inhabits freshwater marshes as a very local breeder in the northeastern interior of California and as a winter visitor (early October to mid-April) on the coast and in the Suisun Marsh region.	Year-round	**Absent.** No freshwater marshes on site.
California black rail *Laterallus jamaicensis coturniculus*	US: – CA: ST/CFP	Requires shallow water in salt marshes, freshwater marshes, wet meadows, or flooded grassy vegetation. Prefers areas of moist soil vegetated by fine-stemmed emergent plants, rushes, grasses, or sedges, with scattered small pools. Known from coastal California, northwestern Baja California, the lower Imperial Valley, and the lower Colorado River of Arizona and California. Now extirpated from virtually all of coastal Southern California.	Year-round	**Absent.** No wet areas on site.

Table 12.A: Special-Status Species Potentially Occurring in the Project Vicinity That are Not Adequately Covered by the WRCMshcp

Species	Status	Description	Activity Period	Occurrence Probability
Mammals				
Pallid bat *Antrozous pallidus*	US: – CA: SSC	Most common in open, dry habitats with rocky areas for roosting. Day roosts in caves, crevices, rocky outcrops, tree hollows or crevices, mines and occasionally buildings, culverts, and bridges. Night roosts may be more open sites, such as porches and open buildings. Grasslands, shrublands, woodlands, and forest in western North America.	Year-round, nocturnal	**Low.** No rocky areas nearby.
Western mastiff bat *Eumops perotis californicus*	US: – CA: SSC	Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc. Roosts in crevices in vertical cliff faces, high buildings, and tunnels, and travels widely when foraging.	Year-round, nocturnal	**Low.** No roosting habitat but may forage on site.
Western yellow bat *Lasiurus xanthinus*	US: – CA: SSC	Found mostly in desert and desert riparian areas of the southwestern United States, but also expanding its range with the increased usage of native and nonnative ornamental palms in landscaping. Individuals typically roost amid dead fronds of palms in desert oases but have also been documented roosting in cottonwood trees. Forage over many habitats.	Year-round, nocturnal	**Absent.** Site is not in a desert area, and no palm plantings in vicinity.
Pocketed free-tailed bat *Nyctinomops femorosaccus*	US: – CA: SSC	Usually associated with cliffs, rock outcrops, or slopes. May roost in buildings (including roof tiles) or caves. Rare in California, where it is found in Riverside, San Diego, Imperial, and possibly Los Angeles Counties. More common in Mexico.	Year-round, nocturnal	**Absent.** No nesting or foraging habitat on site.
Big free-tailed bat *Nyctinomops macrotis*	US: – CA: SSC	Inhabits rugged, rocky canyon country in southwestern United States. Found from northern South America and the Caribbean Islands northward to the western United States. In the southwestern United States, populations appear to be scattered.	Probably year-round	**Absent.** No nesting or foraging habitat on site.

Source: Compiled by LSA (2022).

US: Federal Classification

FE = Listed as Endangered.

CA: State Classifications

SE = State-listed as Endangered.
ST = State-listed as Threatened.
CFP = California Fully Protected. Refers to animals protected from take under Fish and Game Code Sections 3511, 4700, 5050, and 5515.
SSC = Species of Special Concern. Refers to animals with vulnerable or seriously declining populations.
SA = Special Animal. Refers to any other animal monitored by the Natural Diversity Data Base, regardless of its legal or protection status

1A = California Rare Plant Rank 1A. Presumed extinct in California.
1B = California Rare Plant Rank 1B. Rare, threatened or endangered in California and elsewhere.
2B = California Rare Plant Rank 2. Rare, threatened or endangered in California, but more common elsewhere.
3 = California Rare Plant Rank 3. A review list of plants about which more information is needed.

ac = acres
WRCMSHCP = Western Riverside County Multiple Species Habitat Conservation Plan

12.8 INDIRECT EFFECTS

Indirect impacts to surrounding areas as a result of the project may include, but are not limited to, increased dust, noise, lighting, traffic, and storm water runoff. Because of the small scale of the project and its location within a landscape that is already highly disturbed or developed, substantial indirect impacts to sensitive biological resources are not anticipated.

12.9 CUMULATIVE EFFECTS

Project construction will contribute to the incremental loss of nonnative grassland in the region, including potential habitat for some special-status species. Cumulative impacts potentially include habitat fragmentation, increased edge effects, reduced habitat quality, and increased wildlife mortality. The WRCMSHCP provides a comprehensive approach to the regional conservation of these habitats and, as a regional plan, serves to provide mitigation for cumulative impacts to covered species. Project compliance and consistency with the WRCMSHCP ensures that any cumulative impacts to covered species are effectively mitigated. Special-status species that are not covered by the WRCMSHCP also benefit from the surveys, conservation, and other measures of the WRCMSHCP because they occupy many of the same habitats.

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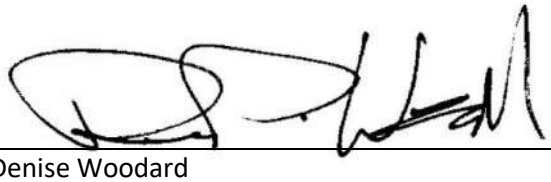
14.0 CERTIFICATION STATEMENT

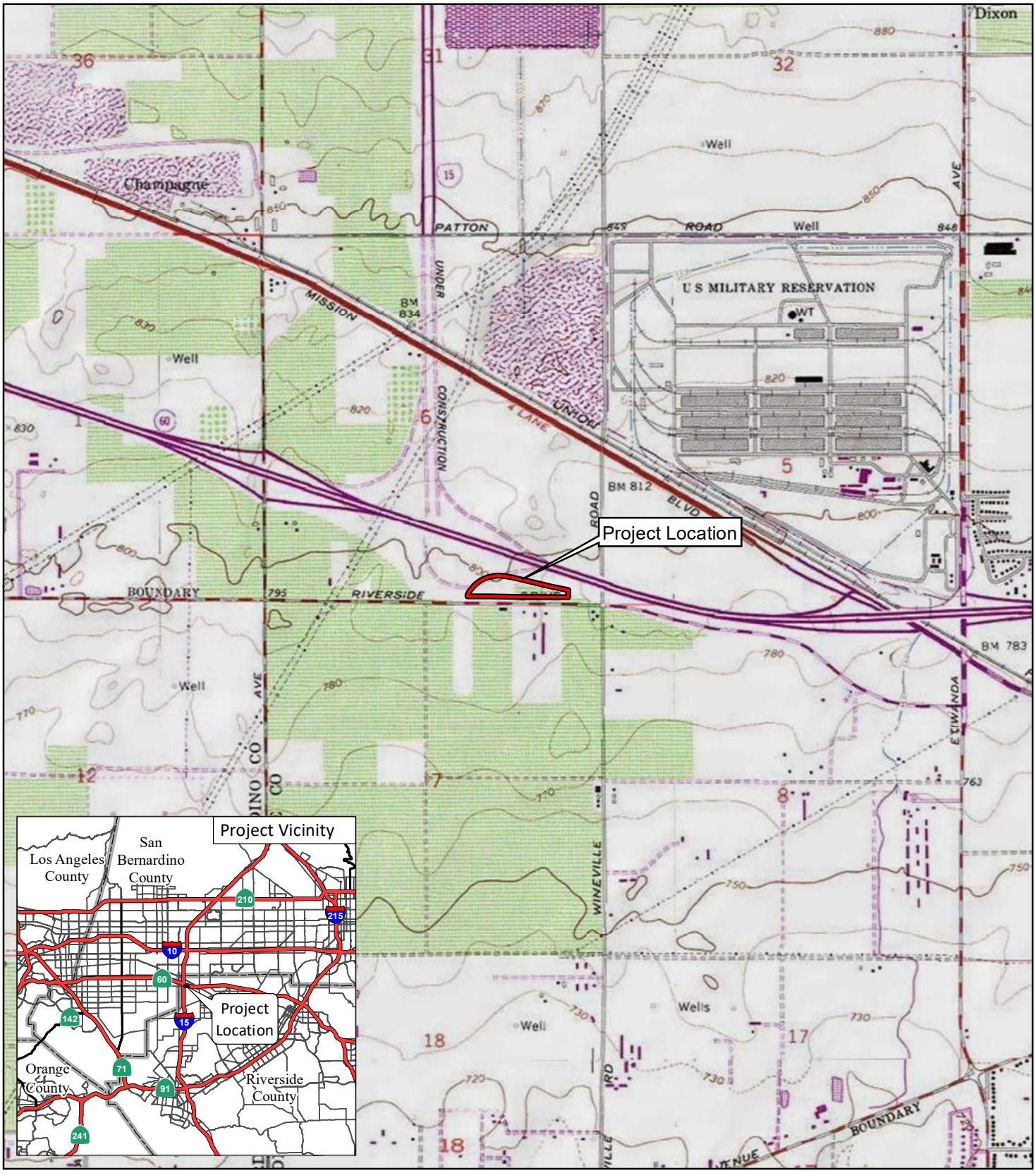
I hereby certify that the statements furnished in this report present the data and information required for this biological evaluation and the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

Date: October 5, 2022 Signature: 

Denise Woodard

APPENDIX A

FIGURES



LSA

LEGEND

Project Location

FIGURE 1

N

0 1000 2000

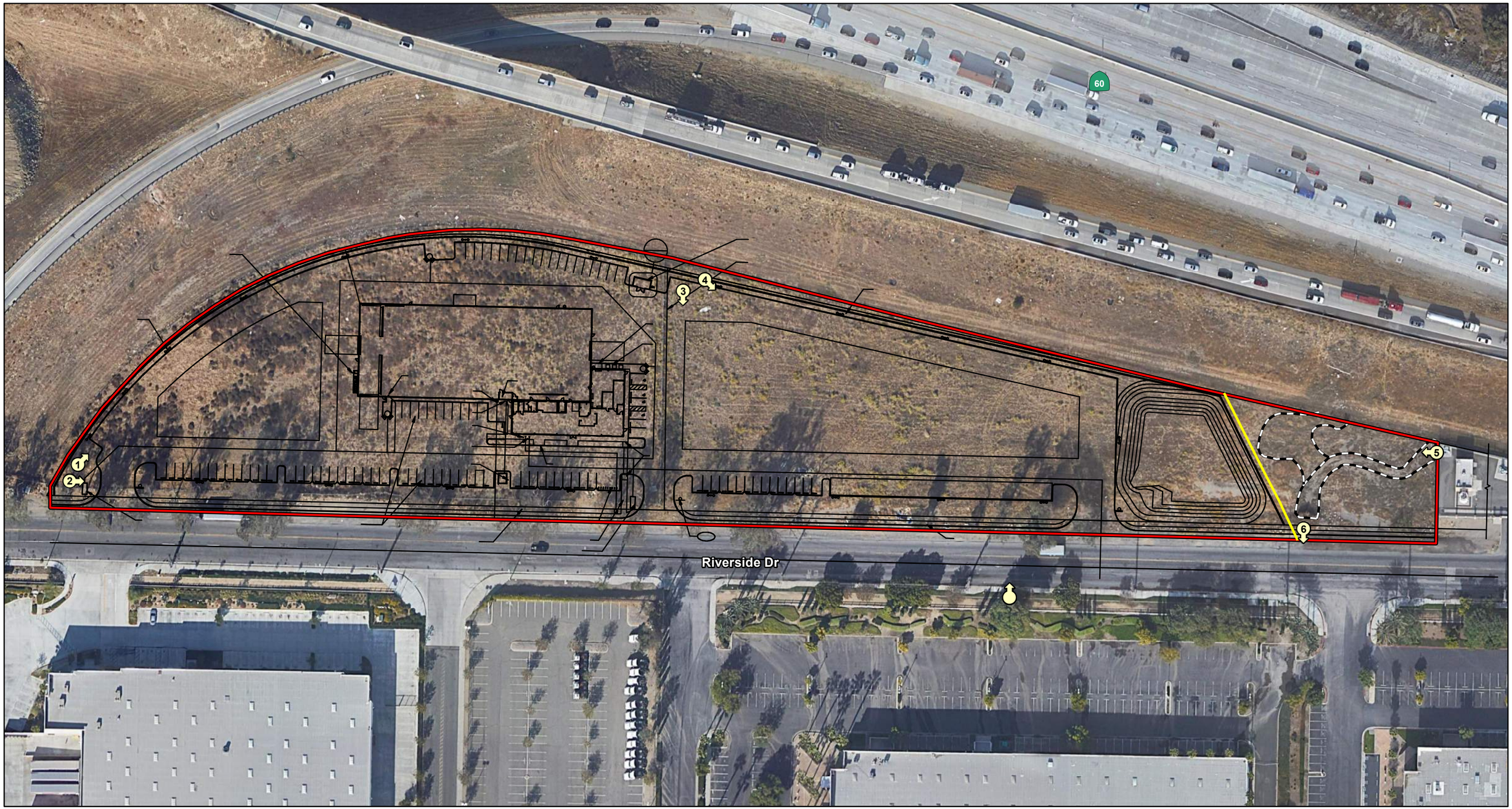
FEET

SOURCE: USGS 7.5' Quad: Guasti(1981), Corona North (1981), CA

I:\MIG2201\GIS\MXD\Bio\ProjectLocation.mxd (9/30/2022)

Industrial Outdoor Ventures

Regional and Project Location



LSA

LEGEND

- Biological Study Area
- Potential Jurisdictional Waters
- Photo Location
- Proposed Environmentally Sensitive Area (ESA) Fence (to be verified prior to construction)

0 50 100
FEET

SOURCE: Google (2021); Adkan (9/23/2022)

I:\MIG2201\GIS\MXD\Bio\BioResources.mxd (9/30/2022)

Note: All vegetation within the Biological Study Area is non-native grassland/ruderal

FIGURE 2

Industrial Outdoor Ventures

Biological Resources, Site Plan, ESA Fence, and Photograph Locations

1. View facing northeast. Photograph taken August 12, 2022.

2. View facing east. Photograph taken August 12, 2022.

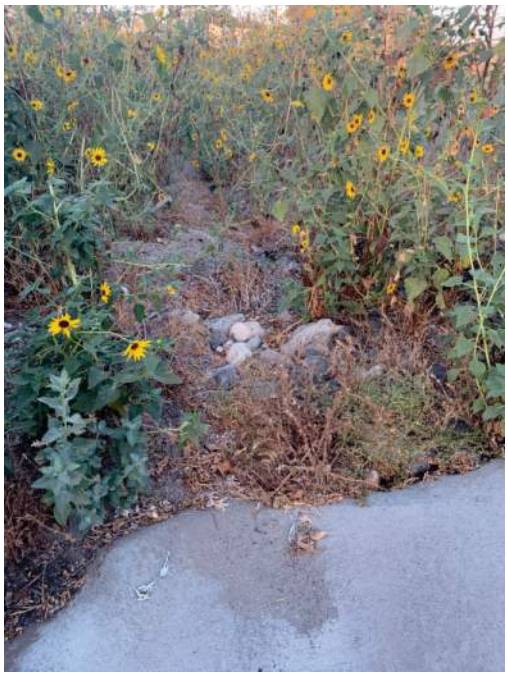
3. View facing south. Photograph taken August 12, 2022.

4. View facing east. Photograph taken August 12, 2022.

LSA

FIGURE 3

Industrial Outdoor Ventures
Site Photographs



5. View facing west of drainage feature.
Photograph taken August 26, 2022.

6. View facing south of culvert at Riverside Avenue.
Photograph taken August 12, 2022.

LSA

FIGURE 3

Industrial Outdoor Ventures
Site Photographs

I:\MIG2201\G\Photos_Bio.cdr (9/30/2022)

LSA

LEGEND

Biological Study Area

Soils

DaD2 -Delhi fine sand, 2 to 15 percent slopes, wind-eroded

GlC - Gorgonio loamy sand, deep, 2 to 8 percent slopes

0 70 140
FEET

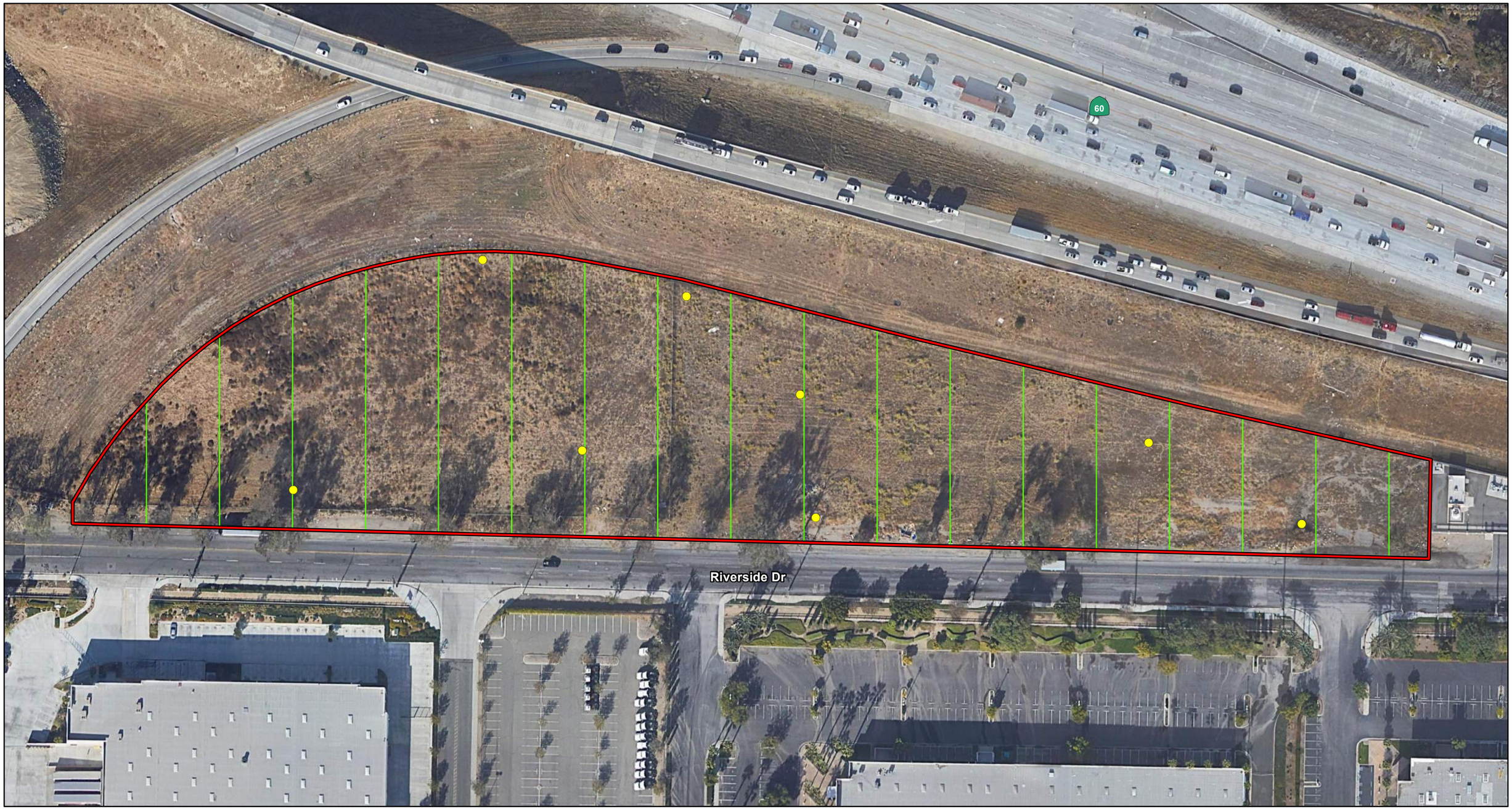
SOURCE:Bing (2018); Ssurgo (2018)

I:\AHR1901\GIS\MXD\Bio\Soils.mxd (7/1/2019)

FIGURE 4

Ahern Rentals

Soils Within Biological Study Area



LSA

LEGEND

- Biological Study Area
- Potential Burrowing Owl Burrow
- Burrowing Owl Transect (every 80 ft)

0 50 100
FEET

SOURCE: Google (2021)

I:\MIG2201\GIS\MXD\Bio\BUOW_Survey.mxd (9/30/2022)

FIGURE 5

Industrial Outdoor Ventures

Burrowing Owl Survey

APPENDIX B

PLANT AND ANIMAL SPECIES OBSERVED

* = Nonnative species

MAGNOLIID FLOWERING PLANTS

Amaranthaceae	**Amaranth Family**
Amaranthus albus	White amaranth
Asteraceae	**Sunflower Family**
Ambrosia acanthicarpa	Annual bur-sage
*Centaurea melitensis**	Maltese star-thistle
Erigeron canadensis	Canadian horseweed
Helianthus annuus	Common sunflower
Heterotheca grandiflora	Telegraph weed
*Oncosiphon pilulifer**	Stinknet
*Verbesina encelioides**	Golden crownbeard
Boraginaceae	**Borage Family**
Amsinckia sp.	Fiddleneck
Brassicaceae	**Mustard Family**
*Hirschfeldia incana**	Shortpod mustard
*Sisymbrium irio**	London rocket
Chenopodiaceae	**Saltbush Family**
*Salsola tragus**	Russian thistle
Fabaceae	**Pea Family**
Acmispon americanus	Spanish clover
Lamiaceae	**Mint Family**
*Marrubium vulgare**	Horehound
Polygonaceae	**Buckwheat Family**
Eriogonum fasciculatum	California buckwheat
Solanaceae	**Nightshade Family**
*Nicotiana glauca**	Tree tobacco

MONOCOTS FLOWERING PLANTS

Poaceae	**Grass Family**
*Bromus diandrus**	Ripgut brome
Bromus rubens	Red brome
*Hordeum murinum**	Mouse barley
*Schismus barbatus**	Common Mediterranean grass

REPTILES

Phrynosomatidae	**Phrynosomatid Lizards**
Uta stansburiana	Common side-blotched lizard

BIRDS

Columbidae	**Pigeons and Doves**
*Columba livia**	Rock pigeon
Zenaida macroura	Mourning dove
Trochilidae	**Hummingbirds**
Calypte anna	Anna's hummingbird
Accipitridae	**Kites, Hawks, and Eagles**
Buteo jamaicensis	Red-tailed hawk
Tyrannidae	**Tyrant Flycatchers**
Sayornis nigricans	Black phoebe
Corvidae	**Crows and Ravens**
Corvus brachyrhynchos	American crow
Hirundinidae	**Swallows**
Petrochelidon pyrrhonota	Cliff swallow
Mimidae	**Mockingbirds and Thrashers**
Mimus polyglottos	Northern mockingbird
Sturnidae	**Starlings**
*Sturnus vulgaris**	European starling
Passeridae	**Old World Sparrows**
*Passer domesticus**	House sparrow
Fringillidae	**Finches**
Haemorhous mexicanus	House finch
Spinus psaltria	Lesser goldfinch

MAMMALS

Sciuridae	**Squirrels**
Spermophilus beecheyi	California ground squirrel
Geomyidae	**Pocket Gophers**
Thomomys bottae	Botta's pocket gopher
Leporidae	**Rabbits and Hares**
Sylvilagus audubonii	Desert cottontail

APPENDIX C

DELHI SANDS FLOWER-LOVING FLY FOCUSED 2017 AND 2018 SURVEYS

THIRD YEAR FOCUSED SURVEY FOR DELHI SANDS FLOWER-LOVING FLY (*Rhaphiomidas terminatus abdominalis*) ON A 7-acre SITE IN MIRA LOMA, RIVERSIDE COUNTY, CALIFORNIA

Prepared for:

Mr. Keith A. Wade, J. D.
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Ahern Rentals, Inc.
8350 Eastgate Road
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Prepared by:

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Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509

October 10, 2017

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THIRD YEAR FOCUSED SURVEY FOR DELHI SANDS FLOWER-LOVING FLY (*Rhaphiomidas terminatus abdominalis*) ON A 7-acre SITE IN MIRA LOMA, RIVERSIDE COUNTY, CALIFORNIA

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Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509

The undersigned certify this report to be a complete and accurate account of the findings and conclusions of a third year, 2017 focused survey for Delhi Sands Flower-loving Fly (*Rhaphiomidas terminatus abdominalis*) on a 7-acre site, Mira Loma, Riverside County, California.

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October 10, 2017

SUMMARY

Mr.Keith Wade, on behalf Ahern Rentals, Inc., has requested a third year focused survey to assess the presence or absence of Delhi Sands Flower-Loving Fly (DSF, *Rhaphiomidas terminatus abdominalis*) on a 7-acre site in Mira Loma, Riverside County, California. To assess this site for potential as habitat for the federally endangered DSF, and to determine presence or absence of DSF on the site, a habitat evaluation and focused survey for DSF were undertaken in 2015 and 2016 with negative results for DSF, and for a third season in 2017, a series of 24 field visits, totaling 13.60 hours, were conducted on the site from July 11 to September 20, 2017 again with negative results for DSF.

The site has soils mapped as Delhi sands, and consists of open, vacant parcels. Habitat conditions on the site are uniform sand supporting annual grassland and forb vegetation, representing *Moderate Quality* to *High Quality* habitat potential for the DSF.

Delhi Sands Flower-Loving Fly was not observed on the site during the course of this third year, 2017 field season. The subject site does not support a population of the Delhi Sands Flower-Loving Fly. No special status plant or animal species (species of concern) were encountered in the course of this survey.

1.0 INTRODUCTION

This report presents the methods and results of a Delhi Sands Flower-Loving Fly (DSF, *Rhaphiomidas terminatus abdominalis***)** focused survey for a 7-acre site, in Mira Loma, Riverside County. The site has been surveyed for DSF over three consecutive field seasons in 2015, 2016 and 2017 with negative results. The DSF was listed as an endangered species by the U.S. Fish and Wildlife Service on September 23, 1993 (USFWS 1993).

The survey site is located on the Guaste, California USGS 7.5-minute quadrangle map, Township 2 South, Range 6 West, in the southeast corner of Section 6. Latitude ranges from approximately 34° 01’ 7.4” to 34° 01’ 10.8” N and Longitude from 117° 32’ 36.5” to 117° 23’ 54.3”W. Figure 1 shows the general vicinity of the survey site at 50% scale on the Guaste, California USGS 7.5-minute quadrangle map. Figure 2 displays the survey site at 200% scale on this USGS quadrangle. This site is located on the north side of E. Riverside Drive (between E. Riverside Drive and Highway 60), immediately west of Wineville Rd., in Mira Loma, Riverside County, CA.

The DSF was not found on the subject site during the course of surveys for either years 2015, 2016 (Osborne 2015, 2016) or 2017. We conclude that the subject site does not support a population of the Delhi Sands Flower-Loving Fly.

2.0 NATURAL HISTORY OF THE DELHI SANDS FLOWER-LOVING FLY

Delhi Sands Flower-loving fly belongs to a genus (*Rhaphiomidas*) of flies that have long been known as “giant flower loving flies”. There are more than 30 species of these flies, distributed across the southwestern United States and northern Mexico. These flies are huge by the

standards set by most flies – with size among the species ranging from approximately 1.5 centimeters up to 3, and even 4 centimeters, usually gray, tan, rust or yellow in color. All species of *Rhaphiomidas* are associated with rather arid, sandy habitats, with most species living on dune systems of inland desert valleys, rivers, deltas, and beach strands. A few species are found in sandy washes, alluvial benches and remnant glacial moraines. Many species of these flies often hover before flowers in the manner of hummingbirds, using a long, thin, tubular proboscis (mouth-part), with which the flies probe for nectar – hence a traditional name "giant flower-loving flies". Smaller flies of the family Apioceridae, once considered very closely related to *Rhaphiomidas* were formerly called "flower-loving flies".

The DSF is only known to occur in association with Delhi sand deposits, presumably occupied the once extensive dune system of the upper Santa Ana River Valley, including portions of what is now the City of Colton, west through portions of the City of Mira Loma, and south to the Santa Ana River. Today, DSF exists on only a few disjunct sites (USFWS 1997) within a radius of about eight miles in southwestern San Bernardino and northwestern Riverside Counties (Colton, Rialto, Fontana, and Mira Loma). More than 95 percent of known DSF habitat was considered eliminated by development, agriculture and other land management practices by 1993 (Smith 1993, USFWS 1996 *in* Kingsley 1996), however, this proportion is now nearer 98 to 99% due to these ongoing processes. Many of the last remaining fragments of DSF habitat are currently under pressure by land management efforts such as heavy disking, irrigation, manure dumping, and gravel dumping. There is presently an estimated 1,200 acres of habitat that can support this species (USFWS 1997), but this estimate likely includes lands needing extensive habitat restoration.

Adult DSF flight period is typically August and September, when individual adults emerge, reproduce and die. The adult life span of an individual DSF lasts for a few days and adults do not live beyond the flight period (Kiyani 1995). Adult DSF are highly mobile, agile fliers. Male DSF are frequently seen flying low through habitat, using apparently random, circuitous paths around and between shrubs in search of females. Such "cruising" behavior often covers areas on the scale of 1000 square meters in the time span of a minute. Alternatively, male DSF are often seen flying about an open patch of ground (ca 100 square meters) such as along a dirt path or dune blow-out area. Here, males may repetitively land and rest on one or another object (such as small dried plants) in the area, and such rests are interrupted by periods of patrolling flight (apparently territorial) about the spot. When alarmed, these insects tend to fly rapidly in more or less a straight line – often covering distances of 100 meters in less than 6 seconds. Adult DSF are known to nectar at flowers of California buckwheat and California croton.

DSF, like other *Rhaphiomidas* species, appears to have, at minimum, an annual life cycle (because of the annual flight). However, it has been widely believed that the underground larval/pupal stage may persist for additional years, depending upon various environmental factors such as annual rainfall, food availability and weather conditions during the flight season (many desert *Rhaphiomidas* species do not appear after a drought year and often, substantial flights occur only sporadically over the years). Though it has long been known that *Rhaphiomidas* larvae develop underground, until recently the specific biology (larval biology, habits and food requirements) were not known for any *Rhaphiomidas* species. In 2003, an extensive excavation in known habitat of *Rhaphiomidas trochilus* (Osborne and Ballmer 2014)

recovered very large and strange looking fly larvae - we inferred as *Rhaphiomidas* and which were later confirmed to be those of *R. trochilus* based on DNA analysis. The biology of *R. trochilus* is likely informative of *Rhaphiomidas* species in general and DSF in particular. Based on observations of captive *R. trochilus* larvae (Osborne and Ballmer 2014) it is reasonable to conclude that they are mobile opportunistic predators of soft-bodied, sand-inhabiting insects. Larvae from Sand Ridge, Kern County, CA were maintained in captivity for several months, during which they burrowed actively through sand maintained with slight moisture content (similar to the damp sand where they were found). They fed on larvae of a scarab beetle (Scarabaeidae) and an unidentified bee fly (Diptera: Bombyliidae), which were also recovered from Sand Ridge, and larvae of paper wasps (*Polistes* sp.) which were removed from their nests and buried in the sand. Captive larvae grew and molted after feeding; but, when not fed for extended periods of time, they molted again – losing weight and size in the process. Some larvae were observed to repeat the growth and "shrinkage" cycle multiple times. One larva survived about 17 months in captivity; because it was captured nine months after the most recent flight season, it was at least two years old at time of death. This larva molted four times while undergoing five cycles of growth and shrinkage driven by variable food availability. Its final dry weight was slightly smaller than the typical dry weight of an adult male *R. trochilus*. The ability of *R. trochilus* larvae to molt down during times of scarce food resources could allow an extended and indeterminate larval growth period, but with maturation and appearance of adults always during summer months. This may also explain the common observations that populations of various *Rhaphiomidas* species apparently exhibit little or no adult emergence in some years (especially years of below normal precipitation).

The brief adult life span and active, random search mate-locating behavior of DSF males (typical of all *Rhaphiomidas* species) indicates that relatively high population density and/or nearly synchronous adult emergence are likely crucial to survival of populations. Protracted *Rhaphiomidas* larval biology and staggered (across years) adult emergence must enhance population momentum and cross generational gene flow, and the requirement of abundant and diverse insect prey on which larvae develop – all explain why DSF populations appear as long-term entities (persisting for decades) associated with ecologically intact dune habitats; and why some populations, even though small numbers of adults emerge during flight seasons, eventually fail. These doomed "ghost populations" dwindle down to extinction after overall ecological health of habitat is compromised by various forms of ecological diminishment – ever increasing portions of habitat developed, agricultural use, incessant recreational vehicle use, annual disking of the vegetation community and upper soil column, encroachment of exotic plants, etc.

2.1 DSF Habitat Characteristics

DSF is typically found in areas of unconsolidated sandy soils (Delhi series) supporting an open community of native and exotic plant species. Dominant plants are typically California buckwheat (*Eriogonum fasciculatum*), California croton (*Croton californicus*), telegraph weed (*Heterotheca grandiflora*), and deerweed (*Acmespon scoparius*) but many exotic species often dominate on DSF habitat as well. DSF have been found in habitats that do not support these dominant plant species, and plant species composition may not be directly relevant to larval development (due to likely predatory or parasitic habit of DSF larvae). Adult DSF are anecdotally believed to nectar at

flowers of California buckwheat and California croton, though such a habitat is rare at best and not yet documented. Many other plant species are common, including Thurber's eriogonum (*Eriogonum thurberi*), autumn vinegar weed (*Lessingia glandulifera*), and sapphire eriastrum (*Eriastrum sapphirinum*). Non native plant species also occur in DSF habitat (and incidentally, virtually everywhere). DSF habitat also supports other associated insects such as flies and wasps considered as indicator species – *Apiocera convergens, Apiocera chrysolasia, Ligyra gozophylax, Campsomeris tolteca, Trielis alcione,* and *Nemomydas pantherinus.* Over 350 insect species have been found on one DSF site, and DSF habitat is typically marked by high abundance and diversity of predatory and parasitic insect groups including many highly specialized families of flies, wasps, bees, beetles, and antlions. The Delhi Sands community is one of California's unique natural communities containing an array of native plants and animals, some of which are found nowhere else. One plant species, Pringle's monardella, (*Monardella pringlei*) is already presumed extinct, as no living individuals have been observed in many years. Several species of insects and some vertebrates, which inhabit the Delhi Sands dunes system, are as endangered as the DSF, but no one has yet petitioned to have them officially declared Endangered. These include the convergent flower-loving fly *Apiocera convergens*, a newly discovered species of Jerusalem cricket, (*Stenopelmatus* sp.), a new species of camel cricket (*Ceuthophilus* sp.) and an endemic subspecies of butterfly *Apodemia mormo nigrescens* (Emmel and Emmel 1998). The other apiocerid fly (*Apiocera chrysolasia*), although known from approximately six general localities, is only common within the Delhi sands.

3.0 METHODOLOGY

3.1 DSF Survey Guidelines

Interim General Survey Guidelines for the DSF have been suggested by the USFWS (1996). By following these guidelines, DSF presence or absence survey results may be deemed acceptable to the USFWS (rejection of survey results may result where the guidelines are not followed). The guidelines indicate that focused DSF surveys should be conducted wherever Delhi sands are present within the presumed range of DSF, twice weekly (two days per week) during the single annual flight period (usually from July 1 to September 20). Recent early season DSF discoveries lead the USFWS to recommend a survey season from July 15 to September 20 for 2003 and a survey season from July 1 to September 20 from the year 2004. Weather conditions must be suitable for DSF activity at the times survey work is pursued. The DSF is generally active when daytime temperatures exceed 80 degrees Fahrenheit (°F), but may fly with slightly cooler temperatures in bright sunlight.

3.2 Habitat Assessment Methods

Osborne examined the subject site to rate its potential to support DSF (Osborne 2015). Photographs were taken of the site from various perspectives. Habitat suitability for DSF was evaluated using indicators of potential DSF habitat including: presence and abundance of loose, unconsolidated Delhi sands with low organic contamination; degree of habitat disturbance indicated by plant species composition and disposition of soil surface, presence and abundance of native sand associated plants such as *Croton californicus*, *Heterotheca grandiflora, Eriogonum thurberi* and *Eriogonum fasciculatum*. These plants are actually more an indication of relative

disturbance regimen – conditions with lesser disturbance being of higher quality for DSF. Presence and abundance of Delhi sands associated insects such as *Apiocera convergens, Apiocera chrysolasia* and (to a lesser extent) *Nemomydas pantherinus*, noted throughout the course of focused surveys, serve as further indicators of DSF habitat quality. Potential DSF habitat has been further evaluated on the basis of overall insect diversity and abundance, particularly with respect to sand associated predators and parasitoids.

In the course of previous work Osborne (2003, Osborne et al. 2003) developed a means of rating habitat on site for potential to support DSF, rating areas within any site based on a scale of 1 to 5, with 5 being the best quality and most suitable habitat based on the following scheme:

1. Developed areas, non-Delhi sands soils with high clay, silt, and/or gravel content. Delhi sands extensively and deeply covered by dumping of exotic soils, rubble, trash, manure, or organic debris. *Unsuitable.*

2. Delhi sands are present but the soil characteristics include a predominance of exotic soils such as alluvial materials, or predominance of other foreign contamination as gravels, manure, or organic debris. Severe and frequent disturbance (such as a maintenance yard or high use roadbed). *Very Low Quality.*

3. Moderately contaminated Delhi sands. Delhi sands with moderate to high disturbance (such as annual disking). Sufficient Delhi Sands are present to prevent soil compaction (related to contamination by foreign soils). Some sandy soils exposed on the surface due to fossorial animal activity. *Low Quality.*

4. Abundant clean Delhi Sands with little or no foreign soils (such as alluvial material) present. Moderate abundance of exposed sands on the soil surface. Low vegetative cover. Evidence of moderate degree of fossorial animal activity by vertebrates and invertebrates. May represent high quality habitat with mild or superficial disturbance. *Moderate Quality*

5. Sand dune habitat with clean Delhi Sands. High abundance of exposed sands on the soil surface. Low vegetative cover. Evidence (soil surface often gives under foot) of high degree of fossorial animal activity by vertebrates and invertebrates. Sand associated plant and arthropod species may be abundant. *High Quality*

It should be noted that habitat qualities often vary spatially within a site so that conditions on a site fall within a range of qualities. Further, overall habitat quality is affected by the overall habitat area on a site, such that very small areas diminish the overall habitat value of a site. It is also important to note that suitable habitats, even rated as high quality for DSF, are very rarely actually occupied by DSF. These ratings are more informative on mitigation and conservation measures in the event that DSF is found on any particular site. Use of this habitat rating system is somewhat subjective and best undertaken by a biologist who has extensive experience with *Rhaphiomidas* species. While investigating the subject site, Osborne subjected the site to an analysis of this kind so as to give a general estimate of overall habitat conditions relevant to DSF potential.

3.3 Focused Survey Methods

Following the USFWS Interim General Survey Guidelines, we surveyed all portions of the subject site at least twice a week, between the hours of 1000 and 1400 (Table 1). In the case of this survey, site acreage indicated a minimum of 34 minutes per visit, with site visits twice a week. A minimal survey effort thus would require 13.6 hours over the 12-week season. The client realized the implications of a skipped year of survey, and by July 11, 2017, requested the continued survey. Missed survey dates for the first week of survey were compensated with additional survey efforts in succeeding weeks. For the 2017 field season, the subject site was surveyed on 24 dates, totaling at least 13.6 field hours, with site visits made from July 11, to September 20, 2017. Focused DSF surveys were conducted by Kendall H. Osborne, Permit # TE-837760-10, Dr. Jeremiah George (under Osborne's permit), Rick Rogers # TE-844465-1, David K. Faulkner # TE-838743-6, and Eric S. Renfro # TE-142436-2, a team which incidentally boasts a combined 243 years of entomological experience. The survey protocol, as set forth in the Interim General Guidelines for the Delhi Sands flower-loving fly survey, is designed to maximize the validity of a presence/absence determination.

Osborne photographed the property from several perspectives to document existing conditions. Notes were taken on vegetative cover and plant species composition, abundance and diversity and species composition of insects and other animals, soil types, degree and nature of disturbance, surface cover, organic content, compaction, current land management practices, existing development, and conditions of surrounding vicinity and proximity of other DSF populations.

Table 1. Dates, personnel, times and conditions for focused DSF survey work (2017).

Date	Biologist	Hours	Weather Conditions
7/11/2017	R. Rogers	1000-1034	clear, winds 0-3 mph, 89-95° *F*
7/14/2017	K. Osborne	1325-1400	clear, winds 5-7 mph, 94° *F*
7/16/2017	K. Osborne	1251-1326	20% clouds, overcast, winds 2-9 mph, 92° *F*, humid
7/18/2017	E. Renfro	1242-1317	clear, winds 3-6 mph, 91-92° *F*
7/21/2017	D. Faulkner	1000-1035	haze/clear, winds 0-1 mph, 87-88° *F*
7/23/2017	E. Renfro	1255-1329	clear, winds 2-3 mph, 92-93° *F*
7/25/2017	K. Osborne	1310-1344	10-25% clouds, patchy, winds 0-5 mph, 89° *F*
7/27/2017	K. Osborne	1209-1243	clear, winds 3-6 mph, 90° *F*
7/30/2017	R. Rogers	1000-1034	clear, winds 0-4 mph, 85-86° *F*
8/2/2017	D. Faulkner	1000-1034	90-95% clouds, overcast, winds 0-1 mph, 84-85° *F*
8/5/2017	E. Renfro	1255-1325	clear, winds 1-2 mph, 91-92° *F*
8/8/2017	R. Rogers	1030-1104	clear, winds 1-4 mph, 88-90° *F*
8/12/2017	D. Faulkner	1000-1034	clear, haze, winds 1-2 mph, 80-81° *F*
8/16/2017	K. Osborne	1305-1339	clear, winds 0-4 mph, 83-84° *F*
8/20/2017	D. Faulkner	1000-1034	50% clouds, haze, patchy, clear, winds 0-1 mph, 74-76° *F*
8/25/2017	J. George	1250-1324	clear, winds 10 mph, 86-88° *F*
8/30/2017	K. Osborne	1259-1333	clear, winds 0-7 mph, 108° *F*
9/1/2017	D. Faulkner	1000-1034	clear, haze, winds 1-3 mph, 93-95° *F*
9/4/2017	R. Rogers	1010-1044	5% patchy clouds, winds 0-4 mph, 89-94° *F*
9/8/2017	D. Faulkner	1000-1034	clear, haze, winds 1-2 mph, 80-81° *F*
9/10/2017	K. Osborne	1000-1034	clear, calm, 85-89° *F*

9/13/2017	R. Rogers	1040-1114	clear, winds 1-5 mph, 88° *F*
9/16/2017	K. Osborne	1006-1040	100% overcast, winds 3-5 mph, 73-75° *F*
9/20/2017	R. Rogers	1040-1115	100% overcast, winds 1-3 mph, 80-82° *F*

4.0 RESULTS

4.1 Survey Results

Delhi Sands Flower-Loving Fly (DSF, *Rhaphiomidas terminatus abdominalis*) was not observed on the subject site during the course of this year 2017 survey season. Lists of plants and insects observed during the course of all surveys for 2015 through 2017 are given in the appendix.

4.3 Existing Environment and Community

4.3.1 Adjacent lands

The survey area is bounded on the south, E. Riverside Drive, and commercial development beyond. A freeway interchange, Hwy 15 and Hwy 60 is west and north of the site. Municipal Water district facilities are on the eastern boundary of the site.

4.3.2 Topography

The site is generally flat throughout all portions. Elevation on the site is approximately 800 feet.

4.3.3 Soils

Knecht (1971) indicated the site to consist of Delhi fine sands. These sands are evident throughout the site.

4.3.4 Vegetation

The survey area is generally characterized as highly disturbed due to a history of annual disking, and supports low vegetative diversity of an early successional type. Dominant plants are golden crownbeard (*Verbesina encelioides*), Russian thistle (*Salsola tragus*) and summer mustard (*Hirschfeldia incana*). A stand of *Eucalyptus* lines portions the southern site boundary along E. Riverside Rd. Figures 3-7 present representative views of the survey site and habitats. Figure 8 provides a key as to where on the site these photographs were taken. Table 1 (Appendix A) provides a list of plant species encountered on the survey site. No special status plant species (species of concern) were encountered in the course of this survey. Field conditions on the site did not substantially vary between the 2015, 2016 and 2017 field seasons.

4.3.5 Insect Community

At least 90 insect species were observed over the course of the 2015, 2016, and 2017 field seasons. A list of most insect species observed is presented in the appendix (Table 2, Appendix A). The

insect community encountered on the subject site was relatively species depauparate as compared to undisturbed ecological communities occurring on Delhi sands, but included Apioceridae, Asilidae, Scoliidae, Mymerliontidae, Crabronidae and Sphecidae. Indicators of potential high quality of DSF habitat found on the subject site during the course of the current survey include *Apiocera convergens* and *Campsomeris tolteca*.

5.0 CONCLUSIONS

Delhi Sands Flower-loving fly is absent from the site. Finding of the presence of Delhi sands on the survey site, and the observations of Mydidae (*Nemomydas pantherinus*), Apioceridae (*A. convergens*), and Asilidae, along with the overall habitat ratings made for the site and the historic presence of DSF nearby to the northwest, have suggested some degree of habitat suitability and potential for DSF. After the course of three field seasons of DSF survey with negative results, we conclude that the project site does not support a population of DSF.

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7.0 FIGURES

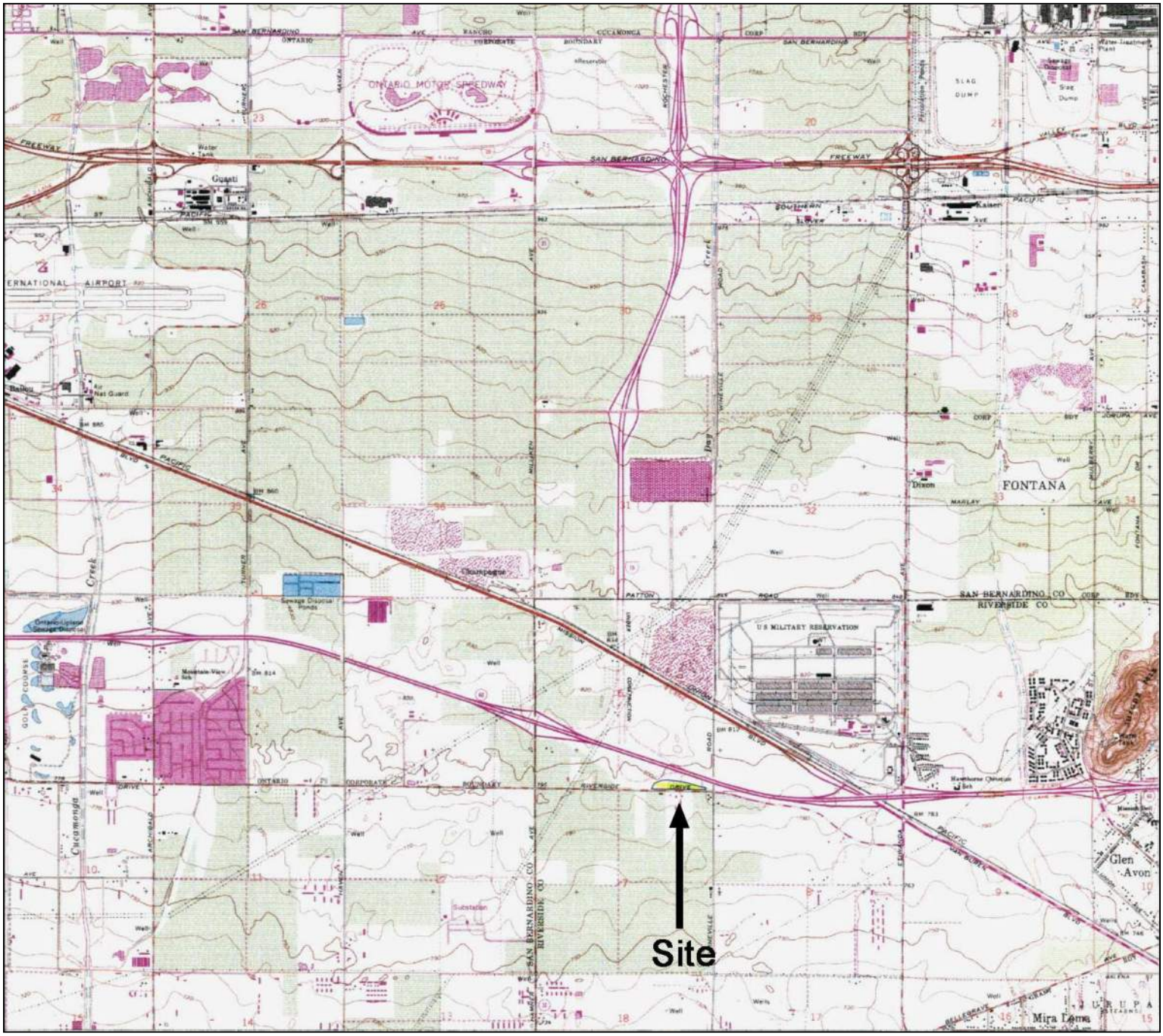
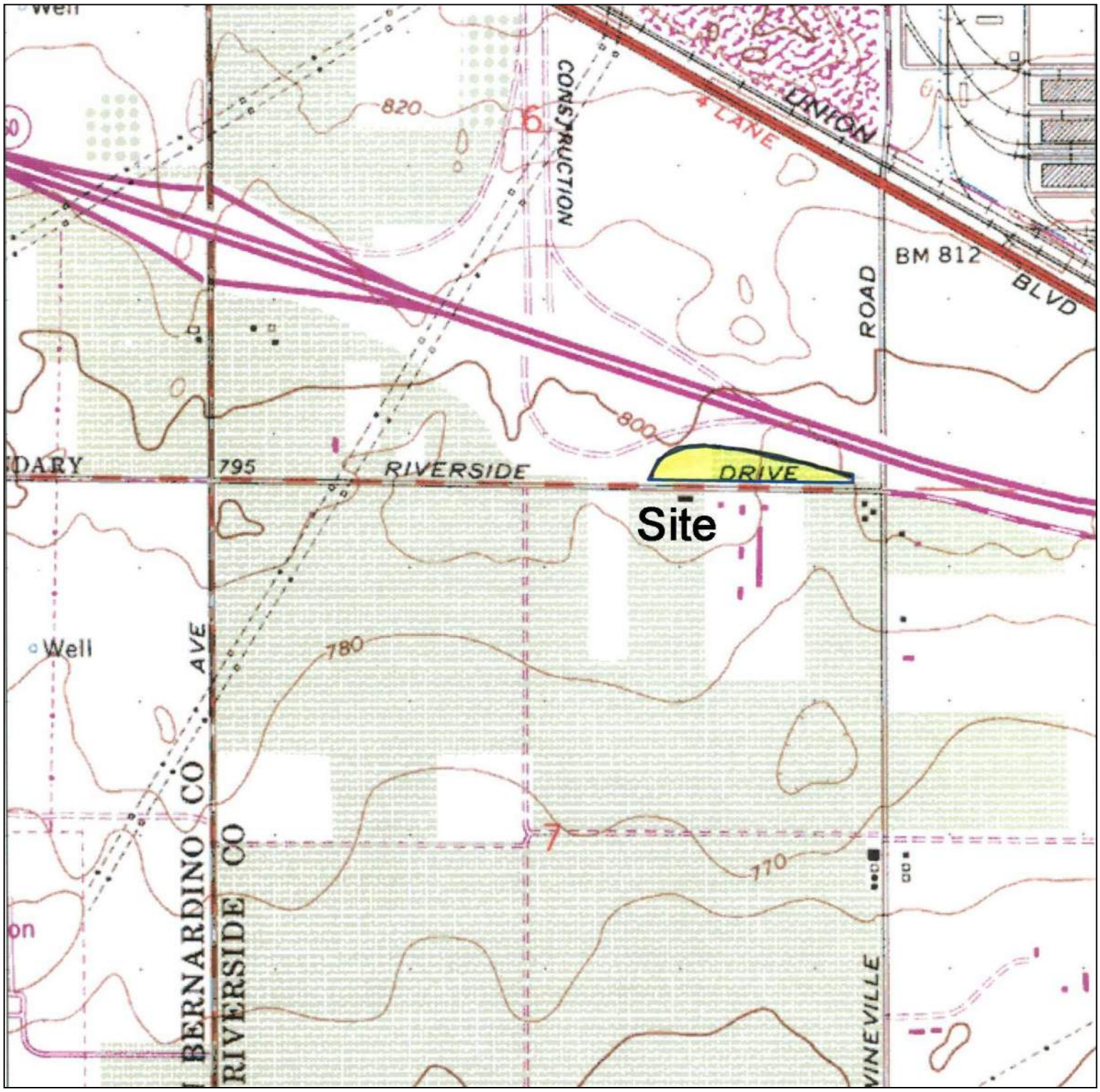


Figure 1. General vicinity of survey site, Guaste, California USGS 7.5" quadrangle at 50%. 7-acre site is outlined in blue and highlighted in yellow (arrow).



= 100 meters **N**

Figure 2. Survey site, Guaste, California USGS 7.5" quadrangle at 200%. 7-acre site is outlined in blue and highlighted in yellow.

Figure 3. Photograph (2016) of the eastern boundary of the survey site (wall at left), looking to the north from the side of E. Riverside Dr.

Figure 4. Photograph (2017) of eastern portions of the survey site.. View looks west northwest from the southern edge of the site near its eastern end (along E. Riverside Dr.). *Eucalyptus* stands which line the roadside are seen at right. Part of the Hwy 15-Hwy 60 interchange is seen in the background off site.

Figure 5. Photograph (2016) of central portions of the survey site. View looks north from the central, southern edge of the site (along E. Riverside Dr.). Part of the Hwy 15-Hwy 60 interchange is seen in the background off site. The fence at left is not a site boundary, but merely crosses the site, separating parcels.

Figure 6 Photograph (2016) of the western portion of the site looking to the east from the southwestern corner of the site. *Eucalyptus* stands along E. Riverside Dr. are seen at left.

Figure 7. Photograph (2017) of central portions of the survey site. View looks east from the central, southern edge of the site (along E. Riverside Rd.).

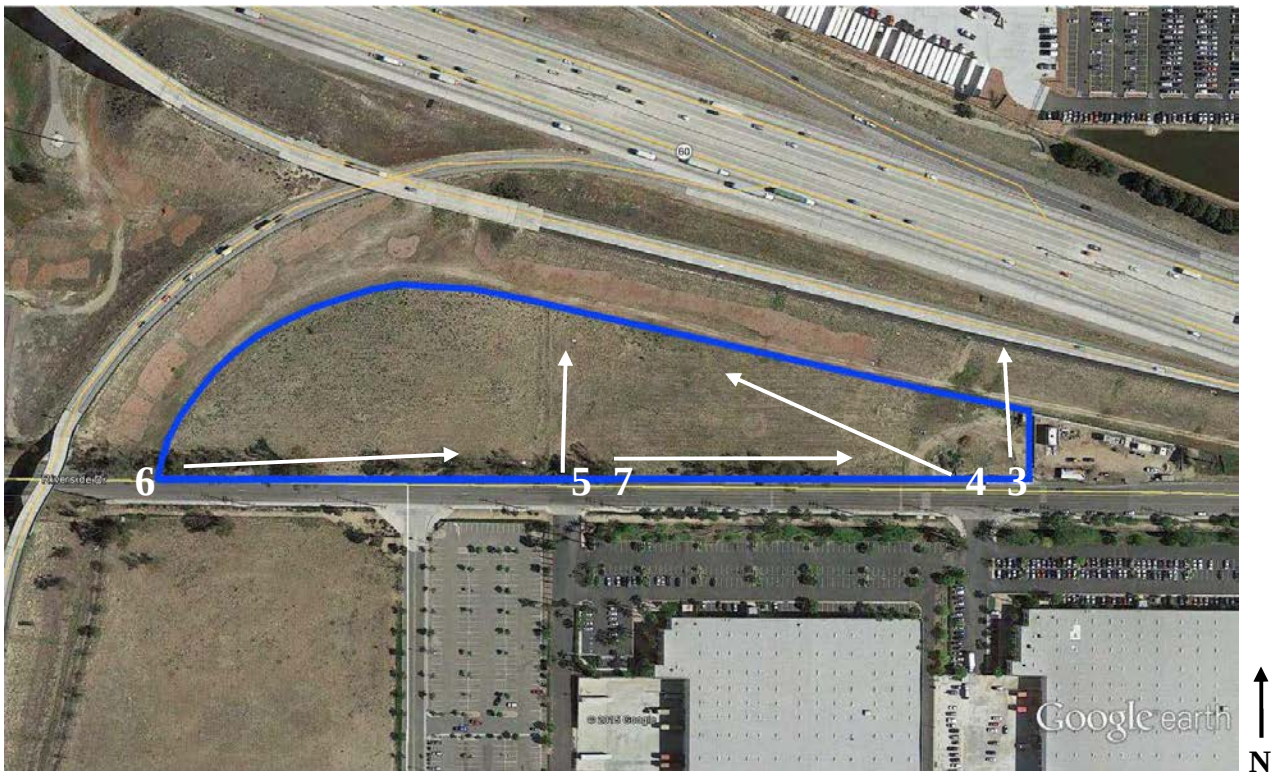


Figure 8. Approximate locations around survey site from which photographs were taken (base of arrows). Arrow indicates the direction a photograph was taken. Numbers next to the arrows indicate figure numbers (Figures 3-7).

8.0 APPENDIX

Appendix A

Table A1. Plant species encountered on the survey site (2015, 2016 and 2017).

FAMILY	*Species*
ASTERACEAE	
Western ragweed	*Ambrosia acanthicarpa*
thistle	*Ciricium*
horseweed	*Conyza canadensis*
sunflower	*Helianthus annua*
telegraphweed	*Heterotheca grandiflora*
prickly lettus	*Lactuca serriola*
golden crownbeard	*Verbesina encelioides*
BORAGINACEAE	
ranchers fiddleneck	*Amsinkia intermedia*
BRASSICACEAE	
shortpod mustard	*Hirschfeldia incana*
London rocket	*Sisymbrium irio*
CHENOPODIACEAE	
lamb's quarters	*Chenopodium album*
Russian thistle	*Salsola tragus*
EUPHORBIACEAE	
California croton	*Croton californicus*
FABACEAE	
Spanish clover	*Lotus purshianus*
alfalfa	*Medicago alba*
MYRTACEAE	
Eucalyptus	*Eucalyptus*
POLYGONACEAE	
Cal buckwheat	*Eriogonum fasciculatum*
ZYGOPHYLLACEAE	
Puncture vine	*Tribulus terrestris*
POACEAE	
slender oat	*Avena barbata*
Foxtail chess/red brome	*Bromus madritensis*
Shismus	*Schismus barbatus*

Table A2. Insects encountered on the survey site (2015, 2016 and 2017).

ORDER	FAMILY	Species
Diptera	Mydidae	*Nemomydas pantherinus*
	Apioceridae	*Apiocera convergens*
	Asilidae	*Efferia albibarbis*
		Mallophora fautrix
		Stenopogon brevisculus
		Stenopogon lomae
	Bombyliidae	*Geron sp.*
		Neodiplocampta mira
		Poecilognathus
		Poecilognathus sulphura
		Thyridanthrax atrata
		Villa molitor
	Syrphidae	*Baccha clavata*
		Copestylum mexicana
		Eristalis aenea
		Paragus tibialis
		Pseudodoros clavatus
		Syritta pipiens
	Muscidae	*Musca domestica*
	Sarcophagidae	*Sarcophaga sp*
	Tachinidae	*Archytas sp.*
		Trichopoda pennipes
	Tephritidae	unidentified
	Dolichopodidae	*Condylostylus pilicornis*
Hymenoptera	Crabionidae	*Gastrosericina sp.*
		Tachytes distinctus
		Bembix comatus
		Philanthus multimaculatus
	Sphecidae	*Ammophila azteca*
		Haplomelinus albitomentosus
		Prionyx parkeri
		Prionyx thomae
		Sceliphron caementarium
	Scoliidae	*Campsomeris tolteca*
	Vespidae	*Polistes apachus*
	Andrenidae	*Perdita*
	Apidae	*Melissodes sp.*
		Svastra texana
		Anthophora
		Apis mellifera
		Diadasia
	Halictidae	*Agapostemon*

Hymenoptera	Halictidae	*Lasioglossum*
	Megachilidae	unidentified
	Formicidae	*Pogonomyrmex californicus*
Coleoptera	Chrysomelidae	*Coscinoptera aeneipennis*
		Chrysophtharta
	Coccinellidae	*Coccinella septempunctata*
		Hippodamia convergens
	Curculionidae	*Apleurus albitomentosa*
	Meloidae	*Nemognatha lurida*
	Scarabaeidae	*Cotinus mutabilis*
	Tenebrionidae	*Eleodes gracilis*
Neuroptera	Mymerliontidae	*Brachynemurus*
		Brachynemurus
Lepidoptera	Danaidae	*Danaus plexippus*
	Nymphalidae	*Junonia coenia*
		Vanessa cardui
		Vanessa virginiensis
	Pieridae	*Colias eurytheme*
		Pieris rapae
		Pontia protodice
	Lycaenidae	*Brephidium exilis*
		Leptotes marina
		Strymon melinus
	Hesperiidae	*Hylephila phyleus*
		Lerodia eufala
		Pyrgus albescens
	Arctiidae	*Estigmene acrea*
Heteroptera (Hemiptera)	Largidae	*Largus sp.*
	Pentatomidae	*Bagrada hilaris*
		Chlorochroa sayi
		Chlorochroa uhleri
		Trichopepla aurorae
	Reduviidae	*Sinea diadema*
	Reduviidae	*Zelus renardii*
	Scutelleridae	*Euptychodera corrugata*
Heteroptera (Auchenorrhyncha)	Cicadellidae	*Homolodisca lacerta*
	Membracidae	unidentified
Orthoptera	Acrididae	*Psoloessa thamnogaea*
		Schistocerca nitens
		Trimerotropis californica
		Trimerotropis pallidipennis
Mantodea	Mantidae	*Iris oratoria*
Odonata	Aeshnidae	*Anax junius*
		Aeshna multicolor

Odonata	Libellulidae	*Pantala flavescens* *Pantala hymenaea* *Tramea onusta* *Pachydiplax longipennis*

Appendix B

Correspondence with USFWS
Field Notes

Ken H. Osborne (permit #TE837760-10)
Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509
(951) 360-6461

July 11, 2017

Attn: Ms. Stacey Love.
USFWS Carlsbad Field Office
Fish and Wildlife Service
2177 Salk Avenue, Ste 250
Carlsbad, CA 92008

RE: Intent to conduct the third year protocol survey for Delhi Sands Giant Flower-loving fly on a 7-acre site in Mira Loma, Riverside County. Request for protocol deviation.

Dear Ms. Love,

I write to notify you of intent to conduct the third year of protocol survey for Delhi Sands Giant Flower-loving fly (*Rhaphiomidas terminatus abdminalis*) on an approximately 7-acre site in Mira Loma, Riverside County. In addition, due to the late initiation of this study, I request permission to deviate from USFWS recommended survey protocol to perform two additional dates of survey during the second and third weeks of July in order to compensate for the missed survey dates from the first week of July.

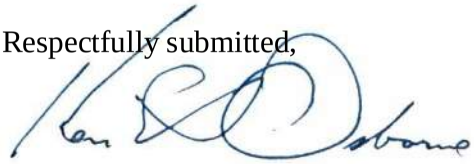
After driving past this site in the last week, and discovering that the site remains undeveloped (after completing two successive years of DSF surveys for my client), I again advised (same advice given in my previous report) my client of the implications for their project following a missed season of DSF survey and USFWS policy regarding maintenance of current status of these surveys. In response, Mr. Wade, representing Ahern Rentals, Inc., has requested we continue the surveys for this season.

This site is located on the north side of Riverside Avenue and south of the southeastern quadrant of the Hwy I-15/Hwy 60 interchange (the site being sandwiched between Riverside Ave., and the freeway interchange).

The site may be located on the Guasti, California USGS 7.5-minute quadrangle map, Township 2 South, Range 6 West, on the southeastern corner of Section 6. The attached map shows the site on a portion of this map at 200% scale.

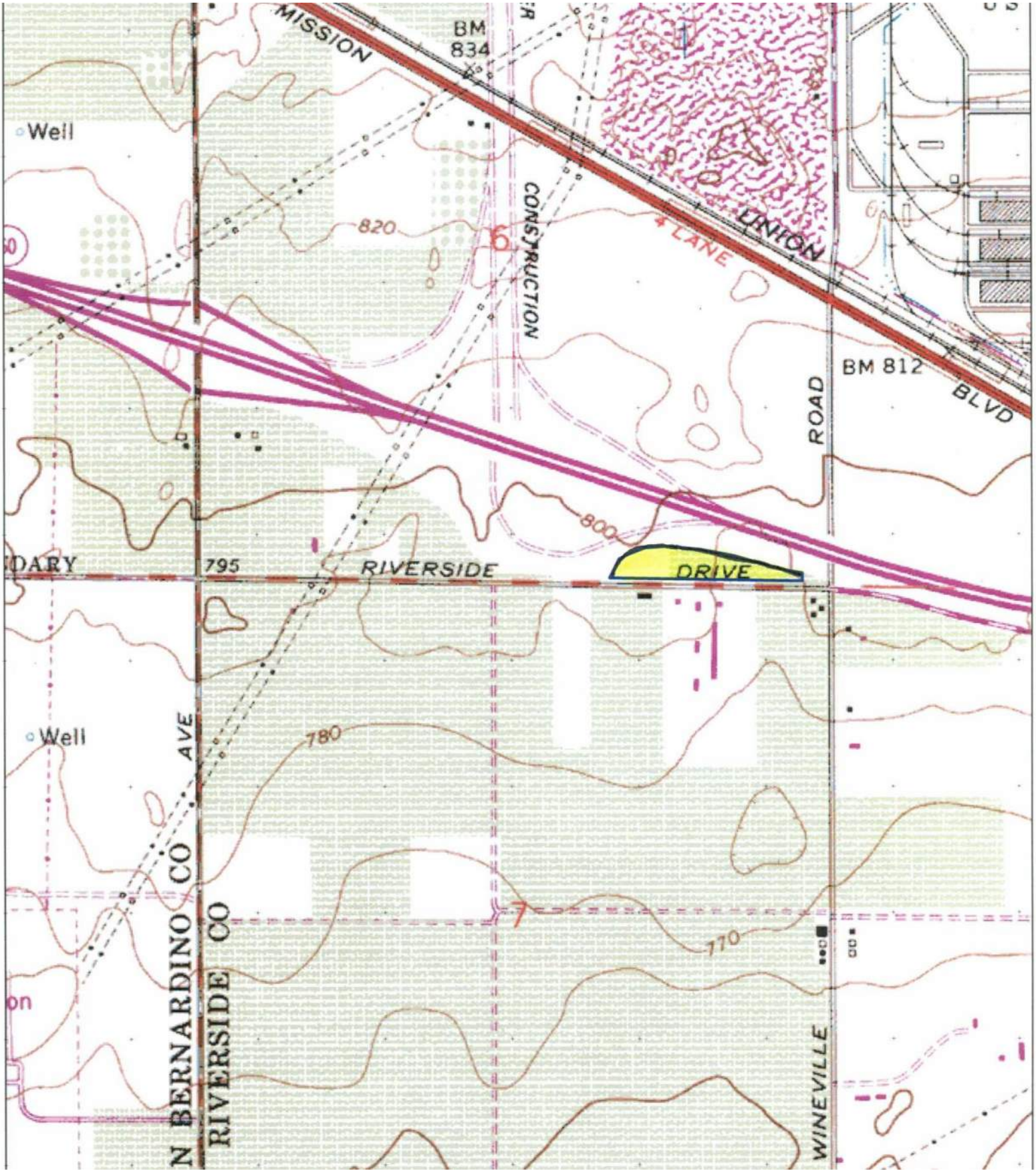
If you have any questions or comments regarding this survey, please feel free to contact me.

Respectfully submitted,



Ken H. Osborne

cc. Keith Wade (Ahern Rentals, Inc.)



= 100 meters

N

General vicinity of survey site, Guasti, California USGS 7.5" quadrangle at 200%. Approximately 7-acre site is highlighted in yellow.

Re: Notification for third year of fly surveys for 7-acre Mira Loma site; and request deviation from protocol.

HG
Hund, Geary
Fri 7/14, 9:22 PM
You;
Karin Cleary-Rose (karin_cleary-rose@fws.gov);
stacey love (stacey_love@fws.gov);
Keith Wade (KEITHAW@ahern.com)

Dear Ken,

Disregard my request for the details of your make-up surveys. I found them in you attached notification letter. Your proposal is acceptable.

Geary

On Fri, Jul 14, 2017 at 2:18 PM, Hund, Geary <geary_hund@fws.gov> wrote:

Dear Mr. Osborne,

Thank you for the notification. Please consider this email our approval for you to deviate from the survey guidelines for the Delhi Sands flower-loving fly as requested in your email dated July 11, 2017:

"I also request permission to deviate from protocol in order to perform make-up surveys to compensate for the lost first week of July. "

Please provide me with the details of your proposal for make-up surveys.

Thank you,

Geary

On Tue, Jul 11, 2017 at 8:18 AM, Ken Osborne <euproserpinus@msn.com> wrote:

Good morning Ms. Love,

Please find attached my notification of intent to conduct a third year of surveys for the Delhi Sands Flower-loving fly on the 7-acre site in Mira Loma we have investigated over the previous two years, on behalf of Ahern Rentals, Inc. I also request permission to deviate from protocol in order to perform make-up surveys to compensate for the lost first week of July. Recently seeing this site not developed after two consecutive years of fly surveys, and the dire implications for my client's project after a missed season of survey . . . . !

Thank you,

Ken

Ken H. Osborne
Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509
(951) 360-6461

Delhi sands flower-loving fly – General Field Form

Date 6/4/2017 Overall Time 34 min. Job Ahern

Surveyor Rick Rogers Survey Partner(s) 0

Mileage 44467

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	clear patchy overcast drizzle shower	0-1	89
10:15	0	clear patchy overcast drizzle shower	1-2	95
10:20	0	clear patchy overcast drizzle shower	0-1	95
Stop 10:34	0	clear patchy overcast drizzle shower	2-3	96

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____
Mydids ____ Apiocerids ____ Sphecids ✓
Pompillids ____ Scoliids ____ Chrysidids ____
Other insects of note Bembix comata, Lusiloglossum sp., Cotinus Liris sp. (sm.) Pieris protodice, Nemognatha sp. Metasternodes sp. (sm., brown), Strymon melinus, Largus sp., Homalodisca

Vertebrates: ____

Comments:

entire area plowed!

Delhi sands flower-loving fly – General Field Form

Date July 13, 2016 Overall Time 34 min Job DFA/K(Cooley)

Surveyor Rick Rogers Survey Partner(s) 0

Mileage 130882

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 11:30	0	(clear) patchy overcast drizzle shower	3-5	94
11:40	0	(clear) patchy overcast drizzle shower	3-4	94
11:50	0	(clear) patchy overcast drizzle shower	3-5	94
Stop 12:04	0	(clear) patchy overcast drizzle shower	3-5	94

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids ✓

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Effenia albibarbis, Aplomyia albitomentosa, Sinea sp., Villa molitor, Brachymyrmex sp. (lg. Antlion)

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/14/17 Overall Time 125 - 200 Job Ahern Rental.

Surveyor RHO Survey Partner(s) _____

Mileage 5229 on site.

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 125	0	(clear) patchy overcast drizzle shower	5-7	94
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 200	0	(clear) patchy overcast drizzle shower	5-6	94

Biological elements:

Rhaphiomidas terminatus ? _____ time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Mallophora, Bagrada, Bombix, Eucalyptus chrysomelid Meloid. T.p.

Vertebrates: _____

Comments:

Heavily disked.

Delhi sands flower-loving fly – General Field Form

Date 7/16/17 Overall Time 1251 - 126 Job Ahern

Surveyor KMO Survey Partner(s) G

Mileage 9296

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1251	20	clear patchy (overcast) drizzle shower	2-5(to 9)	92 Humid
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 126	20	clear patchy (overcast) drizzle shower	5-8	

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____
Mydids ____ Apiocerids ____ Sphecids ____
Pompillids ____ Scoliids ____ Chrysidids ____
Other insects of note Mayo Mosca,

Vertebrates: Ub RODO

Comments:

Delhi sands flower-loving fly - General Form

(07 mph)

Date 7/18/2017 Overall Time 12:42 - 1:17 Jobs Ahern

Surveyor Eric Rentto Survey Partner(s) N/A

Overall Mileage _____

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 12:42	0	(clear) patchy overcast drizzle shower	5-6	91
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1:17	0	(clear) patchy overcast drizzle shower	3-4	92

Site #	Time	Mileage on site
	to	
	to	
	to	
	to	
	to	
	to	
	to	
	to	
	to	
	to	
	to	

Biological elements:

Rhaphiomidas terminatus ? N/A unc _____ sex _____ numbers _____.

Other arthropods (general) Bombyliids _____ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Comments: Dust bowl / Planet Dune

Vertebrates: _____

Osborne Biological Consulting

Copies
Cell: 951-756-1018

Delhi sands flower-loving fly – General Field Form

Date 21 JUL 2017 Overall Time 35 MINUTES Job FHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) Ø

Mileage (194238) 63mi from RB.

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	Ø haze	(clear) patchy overcast drizzle shower	0-1	87°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1035	Ø haze	(clear) patchy overcast drizzle shower	0-1	88°

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ✓
Mydids ____ Apiocerids ____ Sphecids ✓
Pompillids ____ Scoliids ____ Chrysidids ____
Other insects of note Bombix, Pogonomyrmex, Asilid ♂ (brown), long-horn Bees on composites.

Plants: *Croton* ✓ Telegraph weed ____ *Eriogonum fasciculatum* ____
Eriogonum thurberi ____ other *Eriogonum* ____ *Oenothera* ____
Camissonia ____ *Eriastrum* ____
Others: Tumbleweed, composites

Vertebrates: lizards

Comments:

Disked habitat, >25 Croton

Delhi sands flower-loving fly – General Field Form

Date 7/23/2017 Overall Time 12:55 - 13:29 Job Ahern

Surveyor Eric Rentro Survey Partner(s) N/A

Mileage _____

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 12:55	0	clear patchy overcast drizzle shower	2-3	92
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 13:29	0	clear patchy overcast drizzle shower	2-3	93

Biological elements:

Rhaphiomidas terminatus ? x time N/A sex ____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids ✓

Mydids ____ Apiocerids ____ Sphecids ____

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Villa Molitor, Cotinus texana, Eucelia sp.

Plants: *Croton* ____ Telegraph weed ____ *Eriogonum fasciculatum* ____

Eriogonum thurberi ____ other *Eriogonum* ____ *Oenothera* ____

Camissonia ____ *Eriastrum* ____

Others: _____

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/25/17 Overall Time 1110 - 1144 Job Ahern

Surveyor K A Osborne Survey Partner(s) ø

Mileage 9846

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1110	25	clear (patchy) overcast drizzle shower	0-5	89
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1144	10	clear (patchy) overcast drizzle shower	0-5	89

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Bombyx Blue Lycaenid type

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/27/2017 Overall Time 1209 - 1243 Job Ahern

Surveyor K. H. Osborne Survey Partner(s) Ø

Mileage 9920

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1209	c	(clear) patchy overcast drizzle shower	4-6	90
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1243	c	(clear) patchy overcast drizzle shower	3-5	90

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ✓

Mydids ____ Apiocerids ____ Sphecids ____

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note ____

Hym 2 cuckoo, Vanessa, Melissa, Malophora,

Vertebrates: Cottontail

Comments:

9 N

Delhi sands flower-loving fly – General Field Form

Date Jul 30, 2017 Overall Time 34 min. Job Ahern

Surveyor Rick Rogers Survey Partner(s) 0

Mileage 11480

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	(clear) patchy overcast drizzle shower	0 – 0	85
10:15	0	(clear) patchy overcast drizzle shower	1 – 2	85
10:20	0	(clear) patchy overcast drizzle shower	1 – 4	86
Stop 10:34	0	(clear) patchy overcast drizzle shower	2 – 3	86

Biological elements:

Rhaphiomidas terminatus ? _____time ______ sex _____ numbers ____.

Other arthropods (general) Bombyliids _______ Asilids ✓ _______

Mydids ______ Apiocerids __________ Sphecids ✓

Pompillids____________Scoliids______________ Chrysidids __________

Other insects of note Pieris protodice, Cotinus, Nemognatha lurida Melecta sp. (sm. brown), Diadasia sp., Agapostemon texana Aschna multicolor, Cocinoplura cupripennis (Chrysomelidae) Ammophila azteca, Paragus tibialis, Pantala flavescens

Vertebrates:

Comments:

Copies

Delhi sands flower-loving fly – General Field Form

Date 2 Aug 2017 Overall Time _____ Job (5 SITES) AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) ∅

Mileage _____ (195542) (64 miles)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	90%	clear patchy (overcast) drizzle shower	∅	84°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	95%	clear patchy (overcast) drizzle shower	0-1	85°

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____
Mydids ____ Apiocerids ____ Sphecids ✓
Pompillids ____ Scoliids ____ Chrysidids ____
Other insects of note MANTID (immature), long-horn bees, Bombyx, Tephritid fruitfly

Plants: *Croton* ✓ Telegraph weed ____ *Eriogonum fasciculatum* ____
Eriogonum thurberi ____ other *Eriogonum* ____ *Oenothera* ____
Camissonia ____ *Eriastrum* ____
Others: ____

Vertebrates: Doves.

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/5/2017 Overall Time 12:55 - 1:25 Job Ahern

Surveyor Eric Rentso Survey Partner(s) N/A

Mileage _____

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 12:55	0	(clear) patchy overcast drizzle shower	1-2	91
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1:25	0	(clear) patchy overcast drizzle shower	1-2	92

Biological elements:

Rhaphiomidas terminatus ? ___ time N/A sex ___ numbers ___.

Other arthropods (general) Bombyliids ___ Asilids ___

Mydids ___ Apiocerids ✓ Sphecids ✓

Pompillids ___ Scoliids ___ Chrysidids ___

Other insects of note *Megachilidae* sp., *Apiocera convergens*

Plants: *Croton* ___ Telegraph weed ___ *Eriogonum fasciculatum* ___

Eriogonum thurberi ___ other *Eriogonum* ___ *Oenothera* ___

Camissonia ___ *Eriastrum* ___

Others: ___

Vertebrates: ___

Comments:

Delhi sands flower-loving fly – General Field Form

Date Aug 8, 2017 Overall Time 34 min. Job Alcorn

Surveyor Rick Rogers Survey Partner(s) 0

Mileage 46489

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:30	0	(clear) patchy overcast drizzle shower	1-3	88
10:40	0	(clear) patchy overcast drizzle shower	2-4	89
10:50	0	(clear) patchy overcast drizzle shower	1-4	90
Stop 11:04	0	(clear) patchy overcast drizzle shower	1-2	90

Biological elements:

Rhaphiomidas terminatus ? ____time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ✓

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Leptodes marina, Pieris protodice, Nemognatha lurida, Homalodisca Lanqus sp., Peredita sp., Paragus tibialis, Mallophora fautrix, Lins sp., Lins bratoria (nymph)

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 12 Aug 2017 Overall Time _____ Job AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) ∅

Mileage _____ (196883)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	∅ HAZE	(clear) patchy overcast drizzle shower	1-2	80°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	∅ HAZE	(clear) patchy overcast drizzle shower	1-2	81°

Biological elements:

Rhaphiomidas terminatus ? _____ time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____
Mydids _____ Apiocerids _____ Sphecids ✓
Pompillids _____ Scoliids _____ Chrysidids _____
Other insects of note Bombinf, Pogonomyrmex, meliidae bees, Vespids.

Plants: *Croton* ✓ Telegraph weed _____ *Eriogonum fasciculatum* ___
Eriogonum thurberi _____ other *Eriogonum* _____ *Oenothera* _____
Camissonia _____ *Eriastrum* _____
Others: _____

Vertebrates: Red-tail hawk, ground squirrel

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/16/17 Overall Time 105 – 139 Job Ahern

Surveyor KHC Survey Partner(s) —

Mileage 1672

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 105	0	(clear) patchy overcast drizzle shower	0	84
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 139	0	(clear) patchy overcast drizzle shower	2–4	83

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Cotinus, Muscoy, Melisodes, Pentatomid on Horkelia, Meloid, Iris, Xylocopa, P.C. V. molitor

Vertebrates: _____

Comments:

Generally very few insects on this disturbed site.

Delhi sands flower-loving fly – General Field Form

Date 20 Aug 2017 Overall Time _____ Job AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) Ø

Mileage _____ (198093)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	50%	clear (patchy) overcast drizzle shower	0-1	74°
1015	Ø HAZE	(clear) patchy overcast drizzle shower	0-1	74°
		clear patchy overcast drizzle shower		
Stop 1034	Ø	(clear) patchy overcast drizzle shower	0-1	76°

Biological elements:

Rhaphiomidas terminatus ? _____ time _____ sex _____ numbers _____.

Other arthropods (general) Bombyliids ✓ Asilids _____

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Membracids, Microbombyliids, Bombus

Plants: *Croton* ✓ Telegraph weed _____ *Eriogonum fasciculatum* _____

Eriogonum thurberi _____ other *Eriogonum* _____ *Oenothera* _____

Camissonia _____ *Eriastrum* _____

Others: _____

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/25/2017 Overall Time _____ Job AHERU

Surveyor Jeremiah D George Survey Partner(s) _____

Mileage _____

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1250	Hazy	(clear) patchy overcast drizzle shower	10mph SSW	86°F
1320	Hazy	(clear) patchy overcast drizzle shower	10mph	88°F
		clear patchy overcast drizzle shower		
Stop		clear patchy overcast drizzle shower		

Biological elements:

Rhaphiomidas terminatus ? NO time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____
Mydids _____ Apiocerids _____ Sphecids _____
Pompillids _____ Scoliids _____ Chrysidids _____
Other insects of note Tenebrio sp., perdita on croton, large neurop-agrionidae, Bombex,

Plants: *Croton* ✓ Telegraph weed ✓ *Eriogonum fasciculatum* ✓ – Adjacent on CALTRANS ROW.
Eriogonum thurberi _____ other *Eriogonum* _____ *Oenothera* _____
Camissonia _____ *Eriastrum* _____
Others: ϕ Amsinkia,

Vertebrates: UTA, 2

Comments:

SITE completely mowed ✓ – looks relatively Recent. SOILS very good on East end, WEST side has good sandy BUT WITH clear history of some AG. ϕ OR Disced.

Delhi sands flower-loving fly – General Field Form

Date 8/30/2017 Overall Time 1259 – 133 Job Ahern

Surveyor KHOsborne Survey Partner(s) Ø

Mileage 3286

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1259	0	(clear) patchy overcast drizzle shower	0 – 5	108
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 133	0	(clear) patchy overcast drizzle shower	4 – 7	108

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____
Mydids ____ Apiocerids ____ Sphecids ____
Pompillids ____ Scoliids ____ Chrysidids ____
Other insects of note Pseudomyrmex, T. [illegible] [illegible].

Vertebrates: RODO, [illegible],

Comments:

Delhi sands flower-loving fly – General Field Form

Date 1 Sept 2017 Overall Time _____ Job AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) ∅

Mileage _____ (200048)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	∅ HAZE	(clear) patchy overcast drizzle shower	1-2	93°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	∅ HAZE	(clear) patchy overcast drizzle shower	2-3	95°

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____
Mydids ____ Apiocerids ____ Sphecids ____
Pompillids ____ Scoliids ____ Chrysidids ____
Other insects of note H. convergens, Pogonomyrmex, Halictid bee, Andrenid bee

Plants: *Croton* ✓ Telegraph weed ____ *Eriogonum fasciculatum* ____
Eriogonum thurberi ____ other *Eriogonum* ____ *Oenothera* ____
Camissonia ____ *Eriastrum* ____
Others: only plants are >20 croton, Sunflowers - mostly along fence.

Vertebrates: Red-tail HAWK, small lizards

Comments:

FEW INSECTS - Very limited vegetation

Delhi sands flower-loving fly – General Field Form

Date Sept 4, 2017 Overall Time 34 min. Job Ahern

Surveyor Rick Rogers Survey Partner(s) 0

Mileage 49944

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:10	5	clear (patchy) overcast drizzle shower	0 – 0	89
10:20	5	clear (patchy) overcast drizzle shower	1 – 3	93
10:30	5	clear (patchy) overcast drizzle shower	2 – 3	93
Stop 10:44	5	clear (patchy) overcast drizzle shower	2 – 4	94

Biological elements:

Rhaphiomidas terminatus ? _____ time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Melissodes sp. (sm. brown), Agapostemon texana, Pantalla hymenea, Pantalla flavescens, Geron sp., Dioctesia sp. H. phyleeus, Eristalinus aeneus, Iris oratoria (nymph)

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8 Sept 2017 Overall Time _____ Job AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) ø

Mileage _____ (200357)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	ø HAZE	(clear) patchy overcast drizzle shower	1-2	80°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	ø HAZE	(clear) patchy overcast drizzle shower	1-2	81°

Biological elements:

Rhaphiomidas terminatus ? _____ time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Bombyliid, M. domestica, small bees.

Plants: *Croton* _____ Telegraph weed _____ *Eriogonum fasciculatum* ___

Eriogonum thurberi _____ other *Eriogonum* _____ *Oenothera* _____

Camissonia _____ *Eriastrum* _____

Others: _____

Vertebrates: _____

Comments:

Very little Croton still in flower

Delhi sands flower-loving fly – General Field Form

Date 9/10/2017 Overall Time 1000 – 1034 Job Haven

Surveyor KAOsborne Survey Partner(s) ø

Mileage 4033

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	1	(clear) patchy overcast drizzle shower	0	85
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	1	clear patchy overcast drizzle shower	0	89

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Muscq, Sarcophaga

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date Sept-13, 2017 Overall Time 34 min. Job Ahern

Surveyor Rick Rogers Survey Partner(s) 0

Mileage 51205

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:40	0	(clear) patchy overcast drizzle shower	2-5	88
10:50	0	(clear) patchy overcast drizzle shower	2-4	88
11:00	0	(clear) patchy overcast drizzle shower	1-4	88
Stop 11:14	0	(clear) patchy overcast drizzle shower	2-5	88

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____
Mydids _____ Apiocerids _____ Sphecids _____
Pompillids _____ Scoliids _____ Chrysidids _____
Other insects of note Melissodes sp. (Sm. brown), Homalopsis sp., Pantalla flavescens, Agapostemon texana, Cynthia cardui, Eristalinus sp.

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 9/16/2017 Overall Time 1006-1040 Job Ahern

Surveyor K.H. Osborne Survey Partner(s) ø

Mileage 4283 on site.

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1006	100	clear patchy (overcast) drizzle shower	3-4	73
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1040	100	clear patchy (overcast) drizzle shower	3-5	75

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Mosca, Ants, Meloidae, Largid, Black Chrysomelid Bombix & Lotanis

Plants: *Croton* ____ Telegraph weed ____ *Eriogonum fasciculatum* ____

Eriogonum thurberi ____ other *Eriogonum* ____ *Oenothera* ____

Camissonia ____ *Eriastrum* ____

Others: ____

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date Sept. 20, 2017 Overall Time 34 min. Job Ahern

Surveyor ~~52332~~ Rick Rogers Survey Partner(s) 0

Mileage 52332

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:40	100	clear patchy (overcast) drizzle shower	1-3	80
10:55	100	clear patchy (overcast) drizzle shower	1-3	81
11:10	100	clear patchy (overcast) drizzle shower	1-2	81
Stop 11:25	100	~~clear~~ ~~patchy~~ (overcast) ~~drizzle~~ ~~shower~~	1-2	82

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Melessodes sp. (sm. brown), Trichiidae (sm. grns), Agapostemon texana, H. phyleus, Pantalla hymaenea, Sarcophaga sp. (lg.) Bembix comata, Cynthia cardui,

Vertebrates: _____

Comments:

FOURTH YEAR FOCUSED SURVEY FOR DELHI SANDS FLOWER-LOVING FLY (*Rhaphiomidas terminatus abdominalis*) ON A 7-acre SITE IN MIRA LOMA, RIVERSIDE COUNTY, CALIFORNIA

Prepared for:

Mr. Keith A. Wade, J. D.
Economic Development Project Manager
Ahern Rentals, Inc.
8350 Eastgate Road
Henderson, NV 891015

Prepared by:

Kendall H. Osborne
Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509

October 19, 2018

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FOURTH YEAR FOCUSED SURVEY FOR DELHI SANDS FLOWER-LOVING FLY (*Rhaphiomidas terminatus abdominalis*) ON A 7-acre SITE IN MIRA LOMA, RIVERSIDE COUNTY, CALIFORNIA

Prepared for

Mr. Keith A. Wade, J. D.
Economic Development Project Manager
Ahern Rentals, Inc.
8350 Eastgate Road
Henderson, NV 891015

Prepared by

Kendall H. Osborne
Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509

The undersigned certify this report to be a complete and accurate account of the findings and conclusions of a fourth year, 2018 focused survey for Delhi Sands Flower-loving Fly (*Rhaphiomidas terminatus abdominalis*) on a 7-acre site, Mira Loma, Riverside County, California.

Ken H. Osborne
6675 Avenue Juan Diaz
Riverside, CA 92509

David K. Faulkner
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Rancho Dominguez, CA 90220

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Torrance, CA 90501

October 19, 2018

SUMMARY

Mr.Keith Wade, on behalf Ahern Rentals, Inc., has requested a fourth year focused survey to assess the presence or absence of Delhi Sands Flower-Loving Fly (DSF, *Rhaphiomidas terminatus abdominalis*) on a 7-acre site in Mira Loma, Riverside County, California. To assess this site for potential as habitat for the federally endangered DSF, and to determine presence or absence of DSF on the site, a habitat evaluation and focused survey for DSF were undertaken in 2015, 2016, and 2017 with negative results for DSF, and for a fourth season in 2018, a series of 24 field visits, totaling 13.60 hours, were conducted on the site from July 3 to September 20, 2018 again with negative results for DSF.

The site has soils mapped as Delhi sands, and consists of open, vacant parcels. Habitat conditions on the site are uniform sand supporting annual grassland and forb vegetation, representing *Moderate Quality* to *High Quality* habitat potential for the DSF.

Delhi Sands Flower-Loving Fly was not observed on the site during the course of this fourth year, 2017 field season. The subject site does not support a population of the Delhi Sands Flower-Loving Fly. No special status plant or animal species (species of concern) were encountered in the course of this survey.

1.0 INTRODUCTION

This report presents the methods and results of a Delhi Sands Flower-Loving Fly (DSF, *Rhaphiomidas terminatus abdominalis***)** focused survey for a 7-acre site, in Mira Loma, Riverside County. The site has been surveyed for DSF over four consecutive field seasons in 2015, 2016, 2017, and 2018 with negative results. The DSF was listed as an endangered species by the U.S. Fish and Wildlife Service on September 23, 1993 (USFWS 1993).

The survey site is located on the Guaste, California USGS 7.5-minute quadrangle map, Township 2 South, Range 6 West, in the southeast corner of Section 6. Latitude ranges from approximately 34° 01’ 7.4” to 34° 01’ 10.8” N and Longitude from 117° 32’ 36.5” to 117° 23’ 54.3”W. Figure 1 shows the general vicinity of the survey site at 50% scale on the Guaste, California USGS 7.5-minute quadrangle map. Figure 2 displays the survey site at 200% scale on this USGS quadrangle. This site is located on the north side of E. Riverside Drive (between E. Riverside Drive and Highway 60), immediately west of Wineville Rd., in Mira Loma, Riverside County, CA.

The DSF was not found on the subject site during the course of surveys for any of the years 2015 through 2018 (Osborne 2015, 2016, 2017). We again conclude that the subject site does not support a population of the Delhi Sands Flower-Loving Fly.

2.0 NATURAL HISTORY OF THE DELHI SANDS FLOWER-LOVING FLY

Delhi Sands Flower-loving fly belongs to a genus (*Rhaphiomidas*) of flies that have long been known as “giant flower loving flies”. There are more than 30 species of these flies, distributed across the southwestern United States and northern Mexico. These flies are huge by the

standards set by most flies – with size among the species ranging from approximately 1.5 centimeters up to 3, and even 4 centimeters, usually gray, tan, rust or yellow in color. All species of *Rhaphiomidas* are associated with rather arid, sandy habitats, with most species living on dune systems of inland desert valleys, rivers, deltas, and beach strands. A few species are found in sandy washes, alluvial benches and remnant glacial moraines. Many species of these flies often hover before flowers in the manner of hummingbirds, using a long, thin, tubular proboscis (mouth-part), with which the flies probe for nectar – hence a traditional name "giant flower-loving flies". Smaller flies of the family Apioceridae, once considered very closely related to *Rhaphiomidas* were formerly called "flower-loving flies".

The DSF is only known to occur in association with Delhi sand deposits, presumably occupied the once extensive dune system of the upper Santa Ana River Valley, including portions of what is now the City of Colton, west through portions of the City of Mira Loma, and south to the Santa Ana River. Today, DSF exists on only a few disjunct sites (USFWS 1997) within a radius of about eight miles in southwestern San Bernardino and northwestern Riverside Counties (Colton, Rialto, Fontana, and Mira Loma). More than 95 percent of known DSF habitat was considered eliminated by development, agriculture and other land management practices by 1993 (Smith 1993, USFWS 1996 *in* Kingsley 1996), however, this proportion is now nearer 98 to 99% due to these ongoing processes. Many of the last remaining fragments of DSF habitat are currently under pressure by land management efforts such as heavy disking, irrigation, manure dumping, and gravel dumping. There is presently an estimated 1,200 acres of habitat that can support this species (USFWS 1997), but this estimate likely includes lands needing extensive habitat restoration.

Adult DSF flight period is typically August and September, when individual adults emerge, reproduce and die. The adult life span of an individual DSF lasts for a few days and adults do not live beyond the flight period (Kiyani 1995). Adult DSF are highly mobile, agile fliers. Male DSF are frequently seen flying low through habitat, using apparently random, circuitous paths around and between shrubs in search of females. Such "cruising" behavior often covers areas on the scale of 1000 square meters in the time span of a minute. Alternatively, male DSF are often seen flying about an open patch of ground (ca 100 square meters) such as along a dirt path or dune blow-out area. Here, males may repetitively land and rest on one or another object (such as small dried plants) in the area, and such rests are interrupted by periods of patrolling flight (apparently territorial) about the spot. When alarmed, these insects tend to fly rapidly in more or less a straight line – often covering distances of 100 meters in less than 6 seconds. Adult DSF are known to nectar at flowers of California buckwheat and California croton.

DSF, like other *Rhaphiomidas* species, appears to have, at minimum, an annual life cycle (because of the annual flight). However, it has been widely believed that the underground larval/pupal stage may persist for additional years, depending upon various environmental factors such as annual rainfall, food availability and weather conditions during the flight season (many desert *Rhaphiomidas* species do not appear after a drought year and often, substantial flights occur only sporadically over the years). Though it has long been known that *Rhaphiomidas* larvae develop underground, until recently the specific biology (larval biology, habits and food requirements) were not known for any *Rhaphiomidas* species. In 2003, an extensive excavation in known habitat of *Rhaphiomidas trochilus* (Osborne and Ballmer 2014)

recovered very large and strange looking fly larvae - we inferred as *Rhaphiomidas* and which were later confirmed to be those of *R. trochilus* based on DNA analysis. The biology of *R. trochilus* is likely informative of *Rhaphiomidas* species in general and DSF in particular. Based on observations of captive *R. trochilus* larvae (Osborne and Ballmer 2014) it is reasonable to conclude that they are mobile opportunistic predators of soft-bodied, sand-inhabiting insects. Larvae from Sand Ridge, Kern County, CA were maintained in captivity for several months, during which they burrowed actively through sand maintained with slight moisture content (similar to the damp sand where they were found). They fed on larvae of a scarab beetle (Scarabaeidae) and an unidentified bee fly (Diptera: Bombyliidae), which were also recovered from Sand Ridge, and larvae of paper wasps (*Polistes* sp.) which were removed from their nests and buried in the sand. Captive larvae grew and molted after feeding; but, when not fed for extended periods of time, they molted again – losing weight and size in the process. Some larvae were observed to repeat the growth and "shrinkage" cycle multiple times. One larva survived about 17 months in captivity; because it was captured nine months after the most recent flight season, it was at least two years old at time of death. This larva molted four times while undergoing five cycles of growth and shrinkage driven by variable food availability. Its final dry weight was slightly smaller than the typical dry weight of an adult male *R. trochilus*. The ability of *R. trochilus* larvae to molt down during times of scarce food resources could allow an extended and indeterminate larval growth period, but with maturation and appearance of adults always during summer months. This may also explain the common observations that populations of various *Rhaphiomidas* species apparently exhibit little or no adult emergence in some years (especially years of below normal precipitation).

The brief adult life span and active, random search mate-locating behavior of DSF males (typical of all *Rhaphiomidas* species) indicates that relatively high population density and/or nearly synchronous adult emergence are likely crucial to survival of populations. Protracted *Rhaphiomidas* larval biology and staggered (across years) adult emergence must enhance population momentum and cross generational gene flow, and the requirement of abundant and diverse insect prey on which larvae develop – all explain why DSF populations appear as long-term entities (persisting for decades) associated with ecologically intact dune habitats; and why some populations, even though small numbers of adults emerge during flight seasons, eventually fail. These doomed "ghost populations" dwindle down to extinction after overall ecological health of habitat is compromised by various forms of ecological diminishment – ever increasing portions of habitat developed, agricultural use, incessant recreational vehicle use, annual disking of the vegetation community and upper soil column, encroachment of exotic plants, etc.

2.1 DSF Habitat Characteristics

DSF is typically found in areas of unconsolidated sandy soils (Delhi series) supporting an open community of native and exotic plant species. Dominant plants are typically California buckwheat (*Eriogonum fasciculatum*), California croton (*Croton californicus*), telegraph weed (*Heterotheca grandiflora*), and deerweed (*Acmespon scoparius*) but many exotic species often dominate on DSF habitat as well. DSF have been found in habitats that do not support these dominant plant species, and plant species composition may not be directly relevant to larval development (due to likely predatory or parasitic habit of DSF larvae). Adult DSF are anecdotally believed to nectar at

flowers of California buckwheat and California croton, though such a habitat is rare at best and not yet documented. Many other plant species are common, including Thurber's eriogonum (*Eriogonum thurberi*), autumn vinegar weed (*Lessingia glandulifera*), and sapphire eriastrum (*Eriastrum sapphirinum*). Non native plant species also occur in DSF habitat (and incidentally, virtually everywhere). DSF habitat also supports other associated insects such as flies and wasps considered as indicator species – *Apiocera convergens, Apiocera chrysolasia, Ligyra gozophylax, Campsomeris tolteca, Trielis alcione,* and *Nemomydas pantherinus.* Over 350 insect species have been found on one DSF site, and DSF habitat is typically marked by high abundance and diversity of predatory and parasitic insect groups including many highly specialized families of flies, wasps, bees, beetles, and antlions. The Delhi Sands community is one of California's unique natural communities containing an array of native plants and animals, some of which are found nowhere else. One plant species, Pringle's monardella, (*Monardella pringlei*) is already presumed extinct, as no living individuals have been observed in many years. Several species of insects and some vertebrates, which inhabit the Delhi Sands dunes system, are as endangered as the DSF, but no one has yet petitioned to have them officially declared Endangered. These include the convergent flower-loving fly *Apiocera convergens*, a newly discovered species of Jerusalem cricket, (*Stenopelmatus* sp.), a new species of camel cricket (*Ceuthophilus* sp.) and an endemic subspecies of butterfly *Apodemia mormo nigrescens* (Emmel and Emmel 1998). The other apiocerid fly (*Apiocera chrysolasia*), although known from approximately six general localities, is only common within the Delhi sands.

3.0 METHODOLOGY

3.1 DSF Survey Guidelines

Interim General Survey Guidelines for the DSF have been suggested by the USFWS (1996). By following these guidelines, DSF presence or absence survey results may be deemed acceptable to the USFWS (rejection of survey results may result where the guidelines are not followed). The guidelines indicate that focused DSF surveys should be conducted wherever Delhi sands are present within the presumed range of DSF, twice weekly (two days per week) during the single annual flight period (usually from July 1 to September 20). Recent early season DSF discoveries lead the USFWS to recommend a survey season from July 15 to September 20 for 2003 and a survey season from July 1 to September 20 from the year 2004. Weather conditions must be suitable for DSF activity at the times survey work is pursued. The DSF is generally active when daytime temperatures exceed 80 degrees Fahrenheit (°F), but may fly with slightly cooler temperatures in bright sunlight.

3.2 Habitat Assessment Methods

Osborne examined the subject site to rate its potential to support DSF (Osborne 2015). Photographs were taken of the site from various perspectives. Habitat suitability for DSF was evaluated using indicators of potential DSF habitat including: presence and abundance of loose, unconsolidated Delhi sands with low organic contamination; degree of habitat disturbance indicated by plant species composition and disposition of soil surface, presence and abundance of native sand associated plants such as *Croton californicus, Heterotheca grandiflora, Eriogonum thurberi* and *Eriogonum fasciculatum*. These plants are actually more an indication of relative

disturbance regimen – conditions with lesser disturbance being of higher quality for DSF. Presence and abundance of Delhi sands associated insects such as *Apiocera convergens, Apiocera chrysolasia* and (to a lesser extent) *Nemomydas pantherinus*, noted throughout the course of focused surveys, serve as further indicators of DSF habitat quality. Potential DSF habitat has been further evaluated on the basis of overall insect diversity and abundance, particularly with respect to sand associated predators and parasitoids.

In the course of previous work Osborne (2003, Osborne et al. 2003) developed a means of rating habitat on site for potential to support DSF, rating areas within any site based on a scale of 1 to 5, with 5 being the best quality and most suitable habitat based on the following scheme:

1. Developed areas, non-Delhi sands soils with high clay, silt, and/or gravel content. Delhi sands extensively and deeply covered by dumping of exotic soils, rubble, trash, manure, or organic debris. *Unsuitable.*

2. Delhi sands are present but the soil characteristics include a predominance of exotic soils such as alluvial materials, or predominance of other foreign contamination as gravels, manure, or organic debris. Severe and frequent disturbance (such as a maintenance yard or high use roadbed). *Very Low Quality.*

3. Moderately contaminated Delhi sands. Delhi sands with moderate to high disturbance (such as annual disking). Sufficient Delhi Sands are present to prevent soil compaction (related to contamination by foreign soils). Some sandy soils exposed on the surface due to fossorial animal activity. *Low Quality.*

4. Abundant clean Delhi Sands with little or no foreign soils (such as alluvial material) present. Moderate abundance of exposed sands on the soil surface. Low vegetative cover. Evidence of moderate degree of fossorial animal activity by vertebrates and invertebrates. May represent high quality habitat with mild or superficial disturbance. *Moderate Quality*

5. Sand dune habitat with clean Delhi Sands. High abundance of exposed sands on the soil surface. Low vegetative cover. Evidence (soil surface often gives under foot) of high degree of fossorial animal activity by vertebrates and invertebrates. Sand associated plant and arthropod species may be abundant. *High Quality*

It should be noted that habitat qualities often vary spatially within a site so that conditions on a site fall within a range of qualities. Further, overall habitat quality is affected by the overall habitat area on a site, such that very small areas diminish the overall habitat value of a site. It is also important to note that suitable habitats, even rated as high quality for DSF, are very rarely actually occupied by DSF. These ratings are more informative on mitigation and conservation measures in the event that DSF is found on any particular site. Use of this habitat rating system is somewhat subjective and best undertaken by a biologist who has extensive experience with *Rhaphiomidas* species. While investigating the subject site, Osborne subjected the site to an analysis of this kind so as to give a general estimate of overall habitat conditions relevant to DSF potential.

3.3 Focused Survey Methods

Following the USFWS Interim General Survey Guidelines, we surveyed all portions of the subject site at least twice a week, between the hours of 1000 and 1400 (Table 1). In the case of this survey, site acreage indicated a minimum of 34 minutes per visit, with site visits twice a week. A minimal survey effort thus would require 13.6 hours over the 12-week season. For the 2018 field season, the subject site was surveyed on 24 dates, totaling at least 13.6 field hours, with site visits made from July 3, to September 20, 2017. Focused DSF surveys were conducted by Kendall H. Osborne, Permit # TE-837760-10, David K. Faulkner # TE-838743-6, and Eric S. Renfro # TE-142436-2. The survey protocol, as set forth in the Interim General Guidelines for the Delhi Sands flower-loving fly survey, is designed to maximize the validity of a presence/absence determination.

Osborne photographed the property from several perspectives to document existing conditions. Notes were taken on vegetative cover and plant species composition, abundance and diversity and species composition of insects and other animals, soil types, degree and nature of disturbance, surface cover, organic content, compaction, current land management practices, existing development, and conditions of surrounding vicinity and proximity of other DSF populations.

Table 1. Dates, personnel, times and conditions for focused DSF survey work (2018).

Date	Biologist	Hours	Weather Conditions
3-Jul	K. Osborne	1000-1034	10% clouds to clear, calm, 75-78° *F.*
7-Jul	E. Renfro	1000-1034	clear, winds 1 mph, 105-107° *F.*
9-Jul	K. Osborne	1000-1034	80-90% overcast, winds 4-6 mph, 99-100° *F.*
12-Jul	E. Renfro	1000-1034	clear, winds 1 mph, 84-86° *F.*
17-Jul	E. Renfro	1000-1034	clear, winds 1 mph, 81-83° *F.*
19-Jul	K. Osborne	1000-1034	clear, winds 0-4 mph, 85-87° *F.*
22-Jul	E. Renfro	1000-1034	clear, winds 1-2 mph, 85° *F.*
26-Jul	E. Renfro	1000-1034	clear, winds 2 mph, 88-89° *F.*
31-Jul	E. Renfro	1000-1034	30-15% patchy clouds, winds 1 mph, 87-88° *F.*
3-Aug	D. Faulkner	1000-1034	clear, winds 1-2 mph, 84-88° *F.*
6-Aug	E. Renfro	1000-1034	clear, winds 2 mph, 86-91° *F.*
9-Aug	E. Renfro	1000-1034	clear, winds 1 mph, 91-93° *F.*
12-Aug	K. Osborne	1255-1329	5% patchy clouds, winds 0-2 mph, 92° *F.*
14-Aug	D. Faulkner	1000-1034	clear, winds 0-1 mph, 80-82° *F.*
19-Aug	K. Osborne	1255-1329	clear, winds 0-2 mph, 94-95° *F.*
23-Aug	K. Osborne	1000-1034	clear, calm, 79-83° *F.*
26-Aug	K. Osborne	1306-1340	clear, winds 0-5 mph, 83-85° *F.*
29-Aug	K. Osborne	1325-1359	clear, winds 0-5 mph, 92-93° *F.*
3-Sep	K. Osborne	1000-1034	20% patchy clouds, clearing, humid, winds 0-1 mph, 75-78° *F.*
6-Sep	D. Faulkner	1000-1034	clear, winds 1-2 mph, 78-80° *F.*
9-Sep	E. Renfro	1000-1034	clear, winds 1 mph, 87-89° *F.*
12-Sep	K. Osborne	1000-1034	clear, calm, 74° *F.*
16-Sep	K. Osborne	1000-1034	clear, winds 0-2 mph, 78-82° *F.*
20-Sep	K. Osborne	1322-1356	clear, winds 2-5 mph, 90-91° *F.*

4.0 RESULTS

4.1 Survey Results

Delhi Sands Flower-Loving Fly (DSF, *Rhaphiomidas terminatus abdominalis*) was not observed on the subject site during the course of this year 2017 survey season. Lists of plants and insects observed during the course of all surveys for 2015 through 2018 are given in the appendix.

4.3 Existing Environment and Community

4.3.1 Adjacent lands

The survey area is bounded on the south, E. Riverside Drive, and commercial development beyond. A freeway interchange, Hwy 15 and Hwy 60 is west and north of the site. Municipal Water district facilities are on the eastern boundary of the site.

4.3.2 Topography

The site is generally flat throughout all portions. Elevation on the site is approximately 800 feet.

4.3.3 Soils

Knecht (1971) indicated the site to consist of Delhi fine sands. These sands are evident throughout the site.

4.3.4 Vegetation

The survey area is generally characterized as highly disturbed due to a history of annual disking, and supports low vegetative diversity of an early successional type. Dominant plants are golden crownbeard (*Verbesina encelioides*), Russian thistle (*Salsola tragus*) and summer mustard (*Hirschfeldia incana*). A stand of *Eucalyptus* lines portions the southern site boundary along E. Riverside Rd. Figures 3-7 present representative views of the survey site and habitats. Figure 8 provides a key as to where on the site these photographs were taken. Table 1 (Appendix A) provides a list of plant species encountered on the survey site. No special status plant species (species of concern) were encountered in the course of this survey. Field conditions on the site did not substantially vary between the 2015, 2016, 2017, and 2018 field seasons.

4.3.5 Insect Community

At least 99 insect species were observed over the course of the 2015, 2016, 2017, and 2018 field seasons. A list of most insect species observed is presented in the appendix (Table 2, Appendix A). The insect community encountered on the subject site was relatively species depauparate as compared to undisturbed ecological communities occurring on Delhi sands, but included Apioceridae, Asilidae, Scoliidae, Mymerliontidae, Crabronidae and Sphecidae. Indicators of

potential high quality of DSF habitat found on the subject site during the course of the current survey include *Apiocera convergens* and *Campsomeris tolteca.*

5.0 CONCLUSIONS

Delhi Sands Flower-loving fly is absent from the site. Finding of the presence of Delhi sands on the survey site, and the observations of Mydidae (*Nemomydas pantherinus*), Apioceridae (*A. convergens*), and Asilidae, along with the overall habitat ratings made for the site and the historic presence of DSF nearby to the northwest and continued DSF presence only 1.5 km north of our study site (J. George pers com 2018), have suggested some degree of habitat suitability and potential for DSF. After the course of four field seasons of DSF survey with negative results, we conclude that the project site does not support a population of DSF.

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7.0 FIGURES

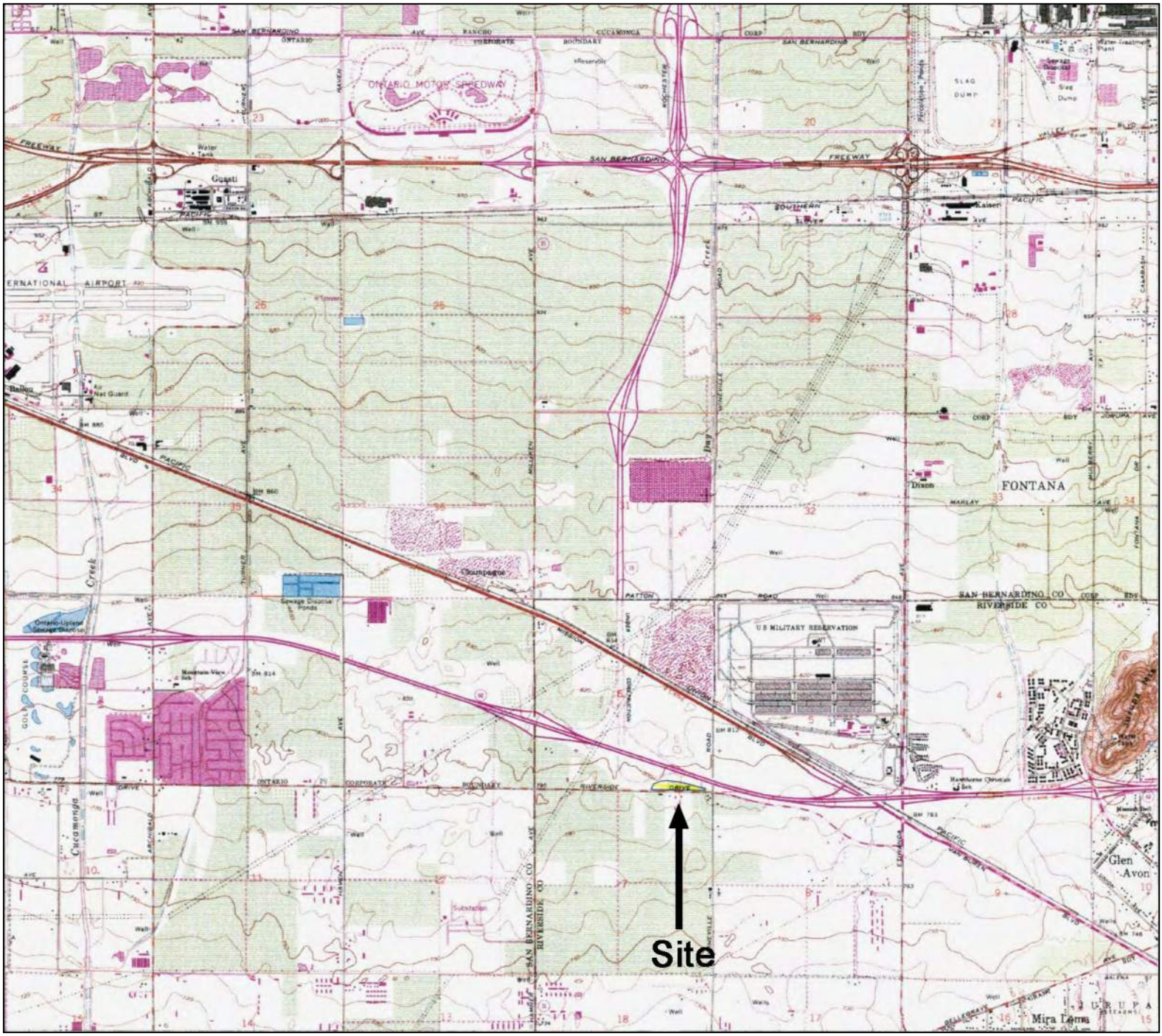


Figure 1. General vicinity of survey site, Guaste, California USGS 7.5" quadrangle at 50%. 7-acre site is outlined in blue and highlighted in yellow (arrow).

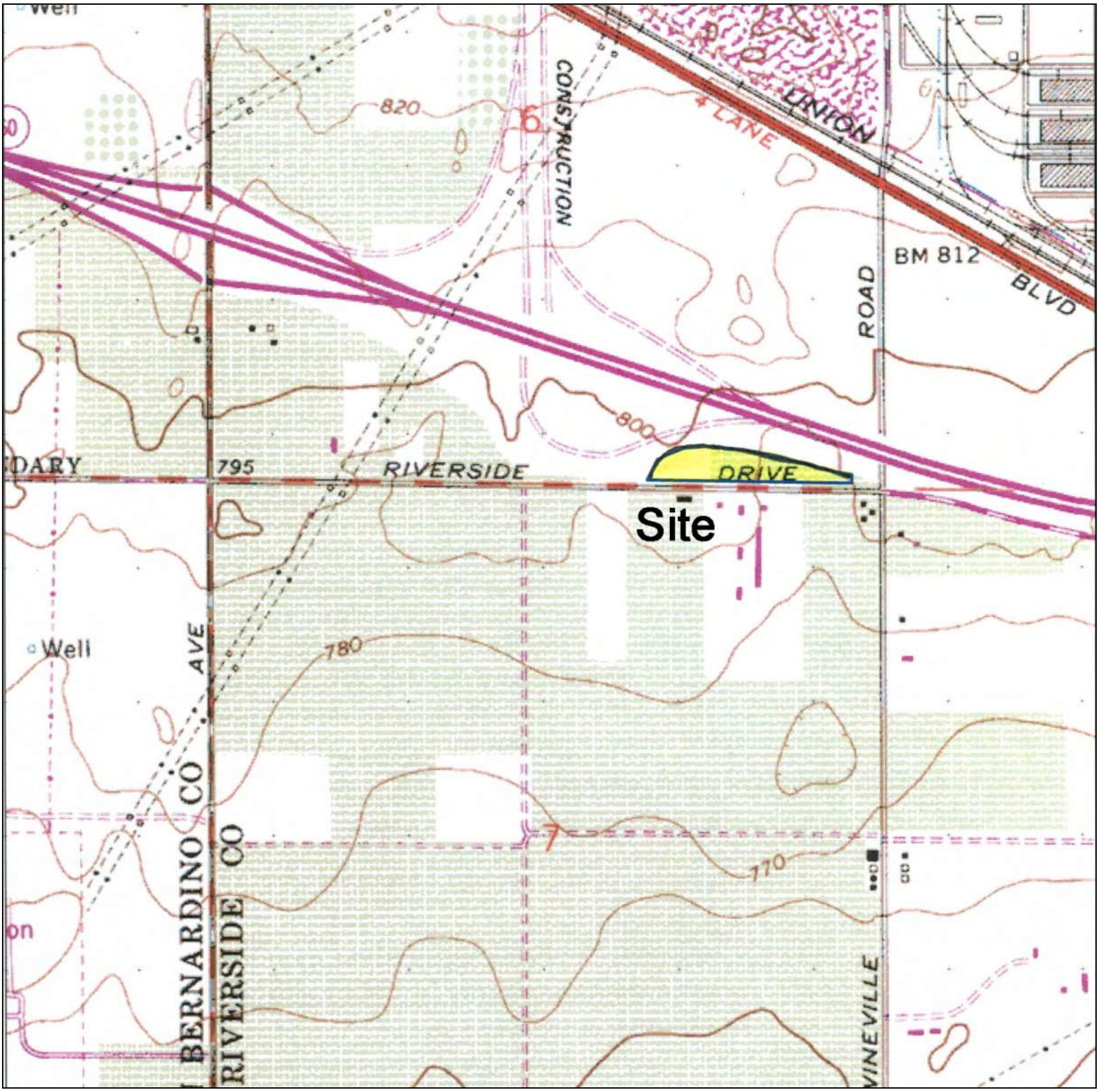


Figure 2. Survey site, Guaste, California USGS 7.5" quadrangle at 200%. 7-acre site is outlined in blue and highlighted in yellow.

Figure 3. Photograph (2016) of the eastern boundary of the survey site (wall at left), looking to the north from the side of E. Riverside Dr.

Figure 4. Photograph (2017) of eastern portions of the survey site.. View looks west northwest from the southern edge of the site near its eastern end (along E. Riverside Dr.). *Eucalyptus* stands which line the roadside are seen at right. Part of the Hwy 15-Hwy 60 interchange is seen in the background off site.

Figure 5. Photograph (2018) of central portions of the survey site. View looks south from the central, northern edge of the site. The fence at left is not a site boundary, but merely crosses the site, separating parcels.

Figure 6 Photograph (2016) of the western portion of the site looking to the east from the southwestern corner of the site. *Eucalyptus* stands along E. Riverside Dr. are seen at left.

Figure 7. Photograph (2018) of central portions of the survey site. View looks northeast from the central, southern edge of the site (along E. Riverside Rd.).

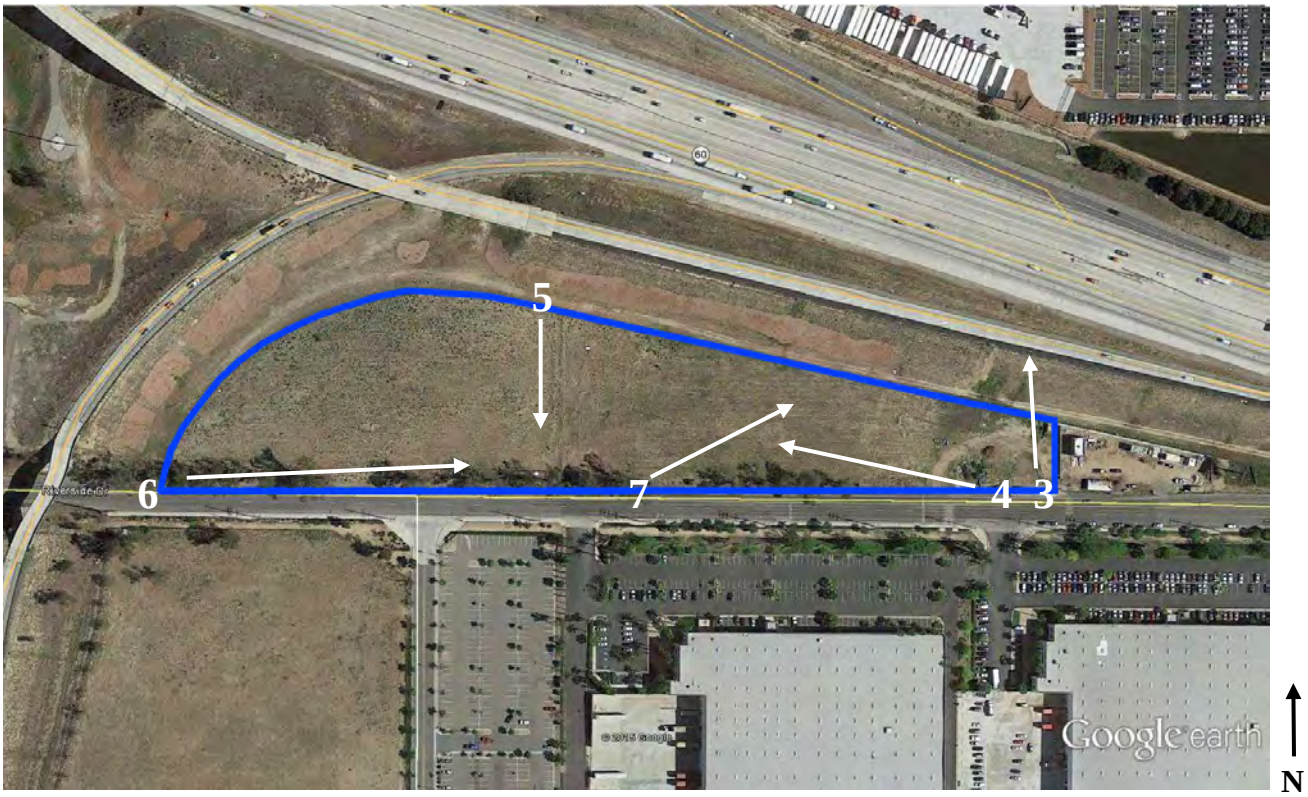


Figure 8. Approximate locations around survey site from which photographs were taken (base of arrows). Arrow indicates the direction a photograph was taken. Numbers next to the arrows indicate figure numbers (Figures 3-7).

8.0 APPENDIX

Appendix A

Table A1. Plant species encountered on the survey site (2015 through 2018).

FAMILY	*Species*
ASTERACEAE	
Western ragweed	*Ambrosia acanthicarpa*
thistle	*Ciricium*
horseweed	*Conyza canadensis*
sunflower	*Helianthus annua*
telegraphweed	*Heterotheca grandiflora*
prickly lettus	*Lactuca serriola*
golden crownbeard	*Verbesina encelioides*
BORAGINACEAE	
ranchers fiddleneck	*Amsinkia intermedia*
BRASSICACEAE	
shortpod mustard	*Hirschfeldia incana*
London rocket	*Sisymbrium irio*
CHENOPODIACEAE	
lamb's quarters	*Chenopodium album*
Russian thistle	*Salsola tragus*
EUPHORBIACEAE	
California croton	*Croton californicus*
FABACEAE	
Spanish clover	*Lotus purshianus*
alfalfa	*Medicago alba*
MYRTACEAE	
Eucalyptus	*Eucalyptus*
POLYGONACEAE	
Cal buckwheat	*Eriogonum fasciculatum*
ZYGOPHYLLACEAE	
Puncture vine	*Tribulus terrestris*
POACEAE	
slender oat	*Avena barbata*
Foxtail chess/red brome	*Bromus madritensis*
Shismus	*Schismus barbatus*

Table A2. Insects encountered on the survey site (2015 through 2018).

ORDER	FAMILY	Species
Diptera	Mydidae	*Nemomydas pantherinus*
	Apioceridae	*Apiocera convergens*
	Asilidae	*Efferia albibarbis*
		Mallophora fautrix
		Stenopogon brevisculus
		Stenopogon lomae
	Bombyliidae	*Geron sp.*
		Neodiplocampta mira
		Poecilognathus
		Poecilognathus sulphura
		Thyridanthrax atrata
		Villa molitor
	Syrphidae	*Baccha clavata*
		Copestylum mexicana
		Eristalis aenea
		Paragus tibialis
		Pseudodoros clavatus
		Syritta pipiens
	Muscidae	*Musca domestica*
	Sarcophagidae	*Sarcophaga sp*
	Tachinidae	*Archytas sp.*
		Trichopoda pennipes
	Tephritidae	unidentified
	Dolichopodidae	*Condylostylus pilicornis*
Hymenoptera	Crabionidae	*Gastrosericina sp.*
		Cerceris
		Bembix comatus
		Oxybellus
		Philanthus multimaculatus
		Tachytes distinctus
	Sphecidae	*Ammophila azteca*
		Haplomelinus albitomentosus
		Prionyx parkeri
		Prionyx thomae
		Sceliphron caementarium
	Scoliidae	*Campsomeris tolteca*
	Vespidae	*Polistes apachus*
	Andrenidae	*Perdita*
	Apidae	*Melissodes sp.*
		Svastra texana
		Anthophora
		Apis mellifera

Hymenoptera	Apidae	*Diadasia*
	Halictidae	*Agapostemon*
Hymenoptera	Halictidae	*Lasioglossum*
	Megachilidae	unidentified
	Formicidae	*Pogonomyrmex californicus*
Coleoptera	Chrysomelidae	*Coscinoptera aeneipennis*
		Chrysophtharta
		Saxinis
	Coccinellidae	*Coccinella septempunctata*
		Hippodamia convergens
	Curculionidae	*Apleurus albitomentosa*
	Meloidae	*Nemognatha lurida*
	Scarabaeidae	*Cotinus mutabilis*
	Tenebrionidae	*Eleodes gracilis*
Neuroptera	Mymerliontidae	*Brachynemurus*
		Brachynemurus
Lepidoptera	Danaidae	*Danaus plexippus*
	Nymphalidae	*Junonia coenia*
		Vanessa cardui
		Vanessa virginiensis
	Pieridae	*Colias eurytheme*
		Pieris rapae
		Pontia protodice
	Lycaenidae	*Brephidium exilis*
		Hemiargus ceraunus
		Leptotes marina
		Plebejus acmon
		Strymon melinus
	Hesperiidae	*Hylephila phyleus*
		Lerodia eufala
		Pyrgus albescens
	Arctiidae	*Estigmene acrea*
Heteroptera (Hemiptera)	Largidae	*Largus sp.*
	Pentatomidae	*Bagrada hilaris*
		Chlorochroa sayi
		Chlorochroa uhleri
		Trichopepla aurorae
	Reduviidae	*Sinea diadema*
	Reduviidae	*Zelus renardii*
	Scutelleridae	*Euptychodera corrugata*
	Tingidae	
Heteroptera (Auchenorrhyncha)	Cicadellidae	*Homolodisca lacerta*
	Membracidae	unidentified
Orthoptera	Acrididae	*Psoloessa thamnogaea*

Orthoptera	Acrididae	*Schistocerca nitens*
		Trimerotropis californica
		Trimerotropis pallidipennis
Mantodea	Mantidae	*Iris oratoria*
Odonata	Aeshnidae	*Anax junius*
		Aeshna multicolor
Odonata	Libellulidae	*Pantala flavescens*
		Pantala hymenaea
		Tramea onusta
		Pachydiplax longipennis
		Parithemis intensa
		Sympetrum corruptum
	Coenagrionidae	*Enallagma*

Appendix B

Correspondence with USFWS
Field Notes

Ken H. Osborne (permit #TE837760)
Osborne Biological Consulting
6675 Avenue Juan Diaz
Riverside, CA 92509
(951) 360-6461

July 19, 2018

Attn: Ms. Stacey Love.
USFWS Carlsbad Field Office
Fish and Wildlife Service
2177 Salk Avenue, Ste 250
Carlsbad, CA 92008

RE: Intent to conduct the fourth year protocol survey for Delhi Sands Giant Flower-loving fly on a 7-acre site in Mira Loma, Riverside County.

Dear Ms. Love,

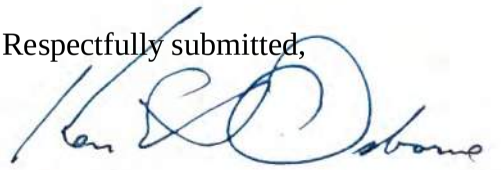
I write to notify you of intent to conduct the fourth year of protocol survey for Delhi Sands Giant Flower-loving fly (*Rhaphiomidas terminatus abdminalis*) on an approximately 7-acre site in Mira Loma, Riverside County.

Mr. Wade, representing Ahern Rentals, Inc., has requested we continue the surveys for this season. This site is located on the north side of Riverside Avenue and south of the southeastern quadrant of the Hwy I-15/Hwy 60 interchange (the site being sandwiched between Riverside Ave., and the freeway interchange).

The site may be located on the Guasti, California USGS 7.5-minute quadrangle map, Township 2 South, Range 6 West, on the southeastern corner of Section 6. The attached map shows the site on a portion of this map at 200% scale.

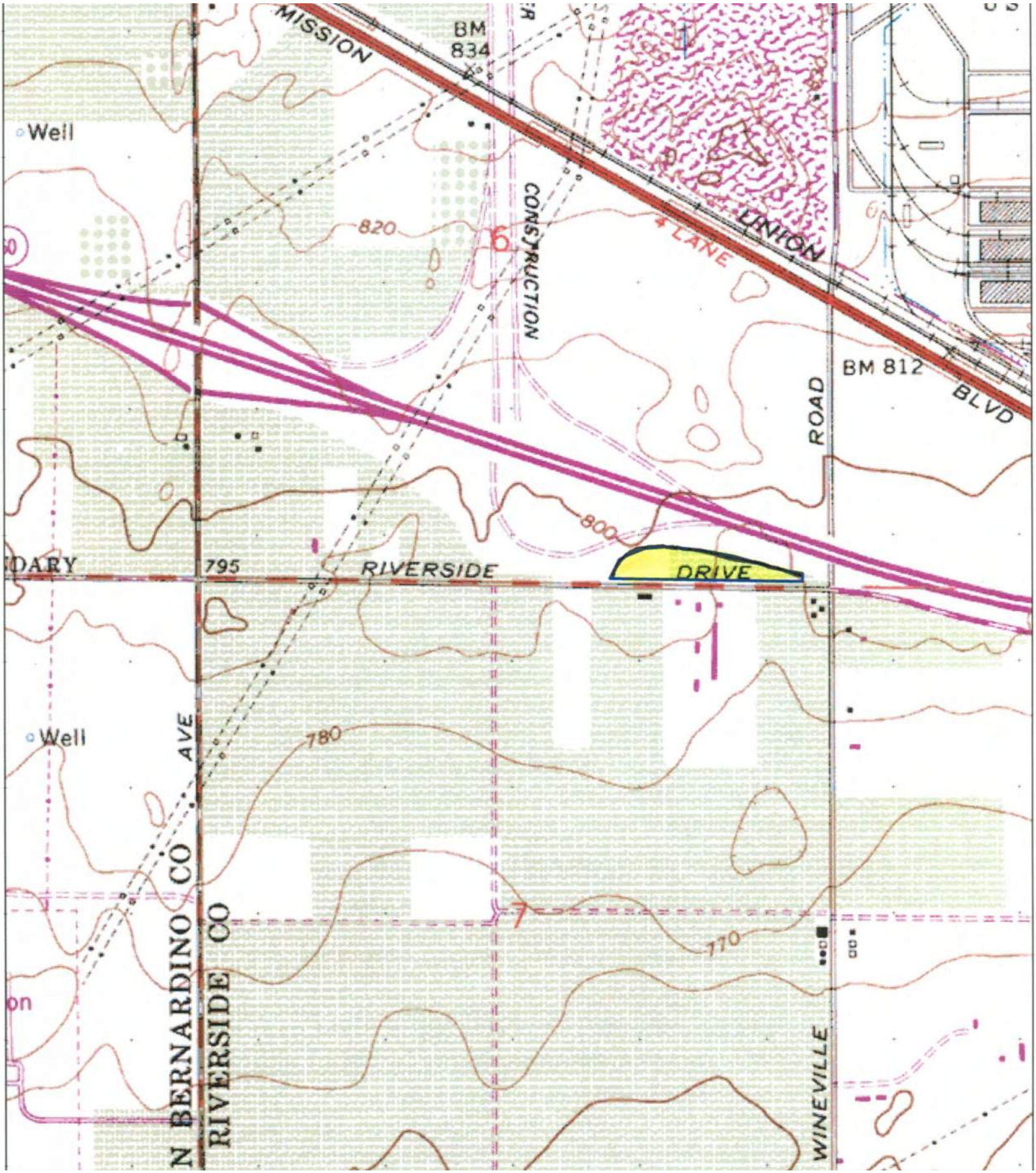
If you have any questions or comments regarding this survey, please feel free to contact me.

Respectfully submitted,



Ken H. Osborne

cc. Keith Wade (Ahern Rentals, Inc.)



= 100 meters

N

General vicinity of survey site, Guasti, California USGS 7.5" quadrangle at 200%. Approximately 7-acre site is highlighted in yellow.

Delhi sands flower-loving fly – General Field Form

Date 7/3/2018 Overall Time 1040 - 1034 Job Ahern

Surveyor RHO Survey Partner(s) 0

Mileage 3123

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1040	10% over clouds	clear patchy overcast drizzle shower	calm	75@1040
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	0	clear patchy overcast drizzle shower	calm	78

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

S. lomae (common) Saccophaga

Vertebrates: MUSO CLSW Ata Sc laterophorus

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/7/2018 Overall Time 34 min. Job Ahern (34 min)

Surveyor E. Rentio 142436-2 Survey Partner(s) N/A

Mileage Beg. 190905

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	clear patchy overcast drizzle shower	1	105
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	clear patchy overcast drizzle shower	1	107

clear sky

Biological elements:

Rhaphiomidas terminatus ? N/A time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ____

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Megachile sp., Halictidae

Vertebrates: ____

Comments: Hot! not much insect flight. Plant coverage minimal.

Delhi sands flower-loving fly – General Field Form

Date 7/9/18 Overall Time 110 - 144 Job Thorn

Surveyor K A Osborne Survey Partner(s) -

Mileage 3376

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 110	90	clear patchy (overcast) drizzle shower	-	99
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 144	80	clear patchy (overcast) drizzle shower	4 - 6	100

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/12/2018 Overall Time 34 min Job Ahern

Surveyor 142436-2 (Rentsu) Survey Partner(s) N/A

Mileage 191375

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	clear patchy overcast drizzle shower	1	84
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	clear patchy overcast drizzle shower	1	86

Biological elements:

Rhaphiomidas terminatus ? ____ time N/A sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Sceliphron caementarium, megachile Halictids *(chrysomelidae (black color) Apis mellifera) Polistes apachus Agapostemon sp., Arziidae

*Saxinis sp

Vertebrates: ____

Comments: More flight of insects. Cooler?

Delhi sands flower-loving fly – General Field Form

Date 7/17/2018 Overall Time 34 min Job Ahern

Surveyor Renjso 142436-2 Survey Partner(s) N/A

Mileage _____ (191823 start)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	clear patchy overcast drizzle shower	1	81
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	clear patchy overcast drizzle shower	1	83

Biological elements:

Rhaphiomidas terminatus ? ____ time N/A sex N/A numbers ____.

Other arthropods (general) Bombyliids _____ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Megachilidae Agapostemon melliventris, Enallagma sp., Strymon melinus, Cotinus texana Ammophila sp., Bembix comata

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/19/18 Overall Time 10⁰⁵ - 1034 Job Ahern

Surveyor K A Osborne Survey Partner(s) 0

Mileage 3805

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10⁰⁵	0	(clear circled) patchy overcast drizzle shower	0-4	85
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	0	(clear circled) patchy overcast drizzle shower	0	87

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ✓

Mydids ____ Apiocerids ____ Sphecids ____

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note

T. californica Bogrado Lorp psykod, Cotinus, Steyman, Ellesia, Sarcophaga

Vertebrates: CAKI

Comments:

Amsinckia s. irio, Avena, Bromus diandrus, B. rubens, Brassica tournefortii

From beginning of season : clay soils dumped along roadside.

Delhi sands flower-loving fly – General Field Form

Date 7/22/2018 Overall Time 34 min Job Ahern

Surveyor 142436-2 Survey Partner(s) N/A

Mileage 191165

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	(clear) patchy overcast drizzle shower	1	85
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	(clear) patchy overcast drizzle shower	2	85

Biological elements:

Rhaphiomidas terminatus ? ____ time ~~N/A~~ sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ✓

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Ffesia sp. Meyachilidae sp., Agapostemon texana, Ammophila sp.? Saxinis sp., Apis mellifera, Pantala flavescens, Enallagma sp., Melissodes tristis, Colletes texana, sharpshooter species.

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/26/2018 Overall Time 34 minutes) Job Ahern

Surveyor 142436-2 Ref. Survey Partner(s) N/A

Mileage 192601

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	(clear) patchy overcast drizzle shower	2	88
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	(clear) patchy overcast drizzle shower	2	89

Biological elements:

Rhaphiomidas terminatus ? ____time ____ sex N/A numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Bembix comata, Apis mellifera, Megachilidae sp. Oxybelus sp., Cercesis sp.

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 7/31/2018 Overall Time 34 minutes Job Ahern

Surveyor 142436-2 (Rentso) Survey Partner(s) N/A

Mileage 193032

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	30	clear patchy overcast drizzle shower	1	87
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	15-20	clear patchy overcast drizzle shower	1	88

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

N/A

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Megachilidae, Halictids, Bembix comata, Cerceris sp., Philanthus sp.

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 3 Aug 2018 Overall Time 34 minutes Job AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) ∅

Mileage (243750) (64 mi from START)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	∅	(clear) patchy overcast drizzle shower	1-2	84°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034		(clear) patchy overcast drizzle shower	1-2	88°

Biological elements:

Rhaphiomidas terminatus ? No time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____
Mydids _____ Apiocerids _____ Sphecids _____
Pompillids _____ Scoliids _____ Chrysidids _____
Other insects of note Fiery skipper, Mellisodes bee, Pogonomyrmex, chinch bugs, Mirids, Tephritid fruit flies, A. mellifera, Megachile sp., Bagada bugs Andrenid bee, Agapostomen bee, Arctiid larvae, Acmon blue Tachnid fly.

Vertebrates: Doves, lizards

Comments:

Clear with haze - more vegetation than last year, limited filling. Croton, composites, Tumbleweed

Delhi sands flower-loving fly – General Field Form

Date 8/6/2018 Overall Time 34 min. Job Ahern

Surveyor 142436-2 (Reuss) Survey Partner(s) N/A

Mileage 193362

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	clear patchy overcast drizzle shower	2	86
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	clear patchy overcast drizzle shower	2	91

Biological elements:

Rhaphiomidas terminatus ? ____ time N/A sex ____ numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Trampa onusta, Copestylum mexicana Megachilidae, Halictidae, Sceliphron caementarium Apis mellifera, Asilidae, Plebejus acmon (acmon blue) Agapostemon sp., Bembix comata

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/9/2018 Overall Time 34 minutes Job Ahern

Surveyor 1424186-2 Pentro Survey Partner(s) N/A

Mileage 193672

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	(clear) patchy overcast drizzle shower	1	91
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	(clear) patchy overcast drizzle shower	1	93

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex N/A numbers ____.

Other arthropods (general) Bombyliids ____ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Sceliphron caementarium, Apis mellifera, Styrmon melinus, Hylephila phyleus, Apidae, Plebejus acmon, Thaenicia sericata, Prionyx parkeri, Ammophila sp., Colinus texana, Meyachilidae sp.

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/12/18 Overall Time 1255 - 129 Job Ahern

Surveyor KAO Survey Partner(s) ø

Mileage 495

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1255	5	(clear) patchy overcast drizzle shower	0-2	92
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 129	5	(clear) patchy overcast drizzle shower	0	92

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Copestes Stagmomantis Tachinid (large, black)

Dolichopodid Melissodes Estigmene. malophora

Vertebrates: _____

Sceloporus

Comments:

Delhi sands flower-loving fly – General Field Form

Date 14 Aug 2018 Overall Time 34 min. (on site) Job AHERN

Surveyor DAVID K. FAULKNER Survey Partner(s) Ø

Mileage 243985 (64 mi. from start)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	Ø	(clear) patchy overcast drizzle shower	0–1	80°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	Ø	(clear) patchy overcast drizzle shower	0–1	82°

Biological elements:

Rhaphiomidas terminatus ? No time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note A. mellifera, Asilid (Efferia ♀), Mud dauber, Colias sp. (yellow) Bombyliid (small), Halictid bees, B. mixtus, grasshoppers, Cotinus (most in Eucalyptus), Arctiid larvae common

Vertebrates: _____

Comments:

Clear with haze – scattered clouds over Mountains

Delhi sands flower-loving fly – General Field Form

Date 8/19/18 Overall Time 1255 - 129 Job Ahern

Surveyor KA Osborne Survey Partner(s) ø

Mileage 4532

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1255	0	(clear) patchy overcast drizzle shower	0	95
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 129	0	(clear) patchy overcast drizzle shower	0-2	94

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Colias P. occidentalis E. editha Strymon Leptotes Hemaris

Vertebrates: none

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/23/2018 Overall Time 1000 – 1034 Job Ahern

Surveyor KMO Survey Partner(s) S

Mileage 4625

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	0	(clear) patchy overcast drizzle shower	0	79
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	0	(clear) patchy overcast drizzle shower	0	83

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Hemiargus C., Strymon, P. sonan. Cotinis, Musca

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 8/26/2018 Overall Time 106 - 140 Job Ahern

Surveyor KWO Survey Partner(s) JS

Mileage 4793

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 106	0	clear patchy overcast drizzle shower	0-5	83
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 140	0	clear patchy overcast drizzle shower	0-5	85

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Vertebrates: _____

Delhi sands flower-loving fly – General Field Form

Date 8/29/18 Overall Time 1125 - 1159 Job Alamo

Surveyor KAO Survey Partner(s) JS

Mileage 4.9 - 7.2

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1125	1	(clear) patchy overcast drizzle shower	0-5	92
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1159	1	(clear) patchy overcast drizzle shower	0-3	93

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids ____ Apiocerids ✓ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note A. convergens, Cotinus, Strumon

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 9/3/2018 Overall Time 1000 – 1034 Job Ahern

Surveyor KAO Survey Partner(s) C

Mileage 5040

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	20	(clear) (patchy) overcast drizzle shower	0	75
1015	0	(clear) patchy overcast drizzle shower	.	
		clear patchy overcast drizzle shower		
Stop 1034	0	(clear) patchy overcast drizzle shower	0 – 1	78 Humid

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids _____

Mydids _____ Apiocerids ✓ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Cotinus Strymon Brephidium, Pieris, Colias. Tc. Pc., A. convergens 9+66, V. molitor, V. mexicana, Mexican Amberwing ♀ Musca

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 6 Sept 2018 Overall Time 34 Min. Job AHERN SITE

Surveyor DAVID K. FAULKNER Survey Partner(s) Ø

Mileage (246339) (64mi from START)

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	Ø	(clear) patchy overcast drizzle shower	1-2	78°
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	Ø	(clear) patchy overcast drizzle shower	1-2	80°

Biological elements:

Rhaphiomidas terminatus ? NO. time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids ✓

Mydids _____ Apiocerids _____ Sphecids ✓

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

Ammophila, Efferia sp. - Nothing else not already noted.

Vertebrates: Ground squirrels, Crows.

Comments:

Clear with haze (sky)

Delhi sands flower-loving fly – General Field Form

Date 9/9/2018 Overall Time 34 min Job Ahern

Surveyor 142436-2 (Rentsch) Survey Partner(s) N/A

Mileage 194644

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10:00	0	(clear) patchy overcast drizzle shower	1	~~86~~ 87
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 10:34	0	(clear) patchy overcast drizzle shower	1	89

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

N/A

Other arthropods (general) Bombyliids ✓ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ✓

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note Prionyx parkeri, Villa molitor, Iris oratoria, Vanessa cardui, Pyrgus albescens, Strymon melanis, Copestylum mexicana, Curculonidae, Megachile sp., Eristalis arbustorum

Vertebrates: ____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 9/12/2018 Overall Time 10AM – 1034 Job Ahern

Surveyor KAD Survey Partner(s) 0

Mileage 5429

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 10AM	0	(clear) patchy overcast drizzle shower	0	74
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	0	(clear) patchy overcast drizzle shower	0	74

Biological elements:

Rhaphiomidas terminatus ? _____time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids _____ Asilids _____

Mydids _____ Apiocerids ✓ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note _____

A. convergens n>20 Bombyliids, P.c., Hybophila

Vertebrates: _____

Comments:

Delhi sands flower-loving fly – General Field Form

Date 9/16/18 Overall Time 10^00 - 10^34 Job Ahern

Surveyor K H Osborne Survey Partner(s) 0

Mileage 5676

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 1000	0	(clear) patchy overcast drizzle shower	0 – 1	78
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 1034	0	(clear) patchy overcast drizzle shower	0 – 2	82

Biological elements:

Rhaphiomidas terminatus ? ____ time ____ sex ____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids ____

Mydids ____ Apiocerids ____ Sphecids ____

Pompillids ____ Scoliids ____ Chrysidids ____

Other insects of note V. molitor, Stenopelmatus, Brachinus, Hyles lineata, Colias, Leptotes, Melissodes, Trimerotropis c. Anax, Sympetrum, Tiegids

Vertebrates:

Comments:

Delhi sands flower-loving fly – General Field Form

Date 9/20/18 Overall Time 122 – 156 Job Ahern

Surveyor K A Osborne Survey Partner(s) 0

Mileage 5830

Weather:

Time (24 hr)	% Cloud	Sky	Winds (mph)	Temp (F)
Start 122	C	(clear) patchy overcast drizzle shower	2 - 4	90
		clear patchy overcast drizzle shower		
		clear patchy overcast drizzle shower		
Stop 156		clear patchy overcast drizzle shower	2 - 5	91

Biological elements:

Rhaphiomidas terminatus ? _____ time _____ sex _____ numbers ____.

Other arthropods (general) Bombyliids ✓ Asilids _____

Mydids _____ Apiocerids _____ Sphecids _____

Pompillids _____ Scoliids _____ Chrysidids _____

Other insects of note Hybomitra lasiophthalma, Bombyliidae, Stylogaster V. molitor

Vertebrates: _____

Comments: