WorleyParsons
resources & energy

CALCULATION COVER SHEET

CLIENT	Bright Source Energy Inc.
PROJECT	Ivanpah – Solar Power Plant – San Bernardino County, CA
SUBJECT	Preliminary Stormwater Management, Vegetated Mulch and Dust Suppression Calculations
JOB NUMBER	52003201
WBS NUMBER	531
CALCULATION NO.:	52003201-0-DC-531-C-002
PAGE 1 OF	83

DESCRIPTION/PURPOSE

The Preliminary Stormwater Management, Vegetated Mulch and Dust Suppression calculations were preformed to support the permit process of the proposed Ivanpah Solar Power Plant. Ivanpah Solar Power consist of (3) individual sites; Ivanpah 1, Ivanpah 2, and Invanpah 3.

METHOD OF ANALYSIS

Use the SCS Method to estimate peak runoff from each of the (3) post development site conditions. The preliminary stormwater calculations analysis's runoff from post developed site conditions. The following storm events were analyzed: 100 year-24hr, 100 year-6 hour, 10 year-24hour and a 10 year-6 hour storm events for each of the individual sites. See Attachments E and Attachment F for the method of analysis for the assumptions in the Vegetated Mulch and Dust Suppression calculations.

CODES AND STANDARDS

None applicable.

INFORMATION SOURCES

1. San Bernardino County, Hydrology Manual, August 1986.
2. "Detention Basin Design Criteria for San Bernardino", and associated County of San Bernardino, and associated County of Bernardino interoffice memo date Sep. 4, 1987.
3. Wanielista, Martin, Robert Kersten and Ron Eaglin. Hydrology: Water Quantity and Quality Control, Second Edition. Canada: John Wiley & Son, Inc, 1997.
4. "Precipitation-Frequency Atlas of the United States, NOAA Atlas 14, Volume 1, Version 4, 2006
5. Bentley Systems, "StormCAD", Service Pack 2.
6. Haestad Method, "PondPack", Version 9.0.

ASSUMPTIONS

Assumptions will be included with the calculations.

CONCLUSIONS OR RESULTS

See pipe summary for piping design of the Runoff detention basin modifications.

REV	DATE	DESCRIPTION	PAGES REVISED	PAGES ADDED	PAGES DELETED	BY/DATE	REV/DATE	LDE/DATE
D								
C								
B								
A	07/30/07	ORIGINAL ISSUE	NA	NA	NA	KH 08/09/07	G. Melton 08/09/07	DAW 08/09/07

CALCULATION CRITERIA

The calculation shall consist of the following:

1. The volume of mulch estimated based on assumptions listed in Attachment E.
2. Calculate the peak runoff for the preliminary post development sites, Ivanpah 1, Ivanpah 2, and Ivanpah 3.
3. The volume of water estimated based on assumptions listed in Attachment F.

SITE CONDITIONS

Site topographic conditions are an undisturbed desert environment. The future site will have +/-5 square miles of Solar Heliostat Fields with associated Power Blocks and interconnecting road system. The proposed grade has a west to east slope of an approximate 4-6% grade and will be similar to existing throughout the site except with in the Power Block area and Receiving Towers.

CALCULATIONS

General Approach: Use the SCS Method to estimate peak runoff from each of the (3) post development site conditions. The preliminary stormwater calculations analysis's runoff from only the Power Block areas and how it is routed into a runoff infiltration and evaporation collection basin. Haestad PondPack was used to determine the estimated amount of runoff from the site. (2) Calculate an estimated volume of vegetation to be mulched on site due to the clearing of the existing site to for the future Power Blocks, Heliostat Fields and associated road arteries. Preliminary assumptions were used to estimate the volume of vegetative mulch within the disturbed areas and to estimate the volume of water for pre construction dust control. (3) The estimate volume of water to be distributed across disturbed areas for dust control during construction.

CONCLUSION

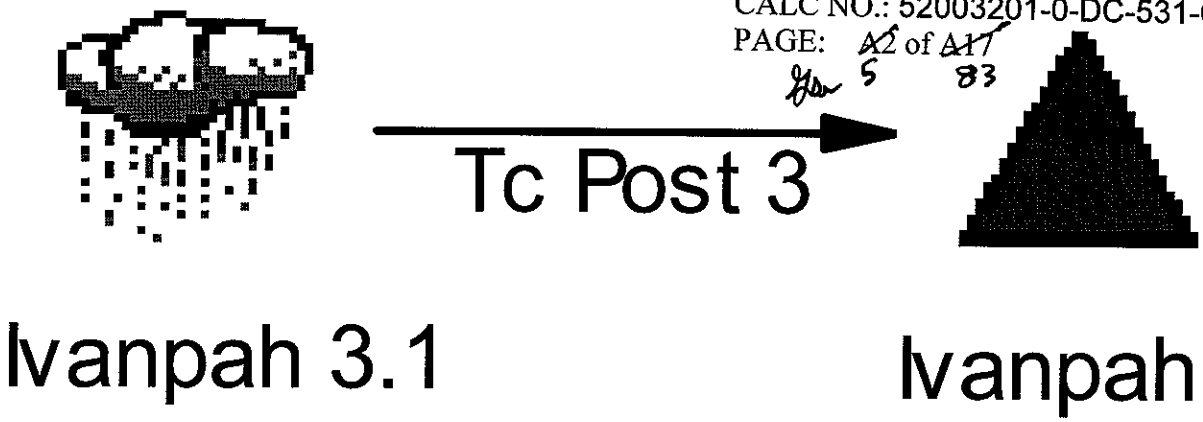
These preliminary calculations are for submittal to the California Energy Commission (CEC) submittal only.

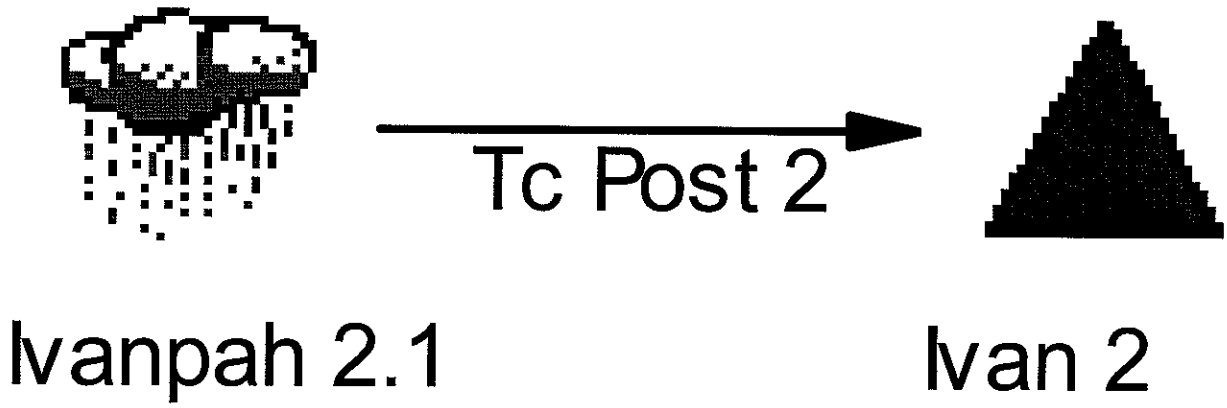
ATTACHMENTS

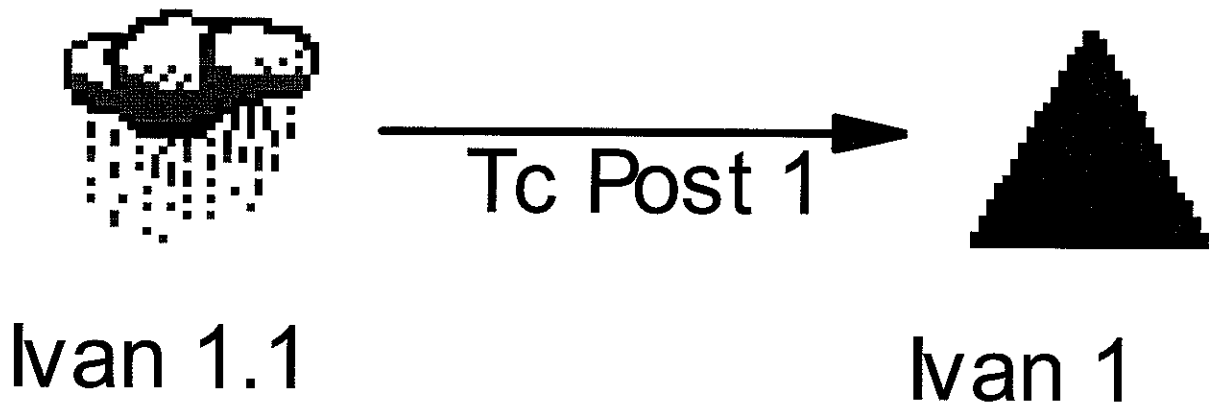
ATTACHMENT A	100 year – 24 hour runoff
ATTACHMENT B	100 year – 6 hour runoff
ATTACHMENT C	10 year – 24 hour runoff
ATTACHMENT D	10 year – 6 hour runoff
ATTACHMENT E	Volume of Vegetated Mulch
ATTACHMENT F	Volume of Water for Dust Suppression
ATTACHMENT G	Reference Information

ATTACHMENT A

100 year – 24 hour runoff


Tc Post 3
Ivanpah 3.1
Ivanpah 3


Tc Post 2
Ivanpah 2.1
Ivan 2


Tc Post 1
Ivan 1.1
Ivan 1

JOB TITLE
==========

Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

Ivan TP40..... Design Storms 2.01

********** RAINFALL DATA **********

TypeII 24hr.... Dev100
Synthetic Curve 3.01

********** TC CALCULATIONS **********

IVAN 1.1..... Tc Calcs 4.01

IVANPAH 2.1..... Tc Calcs 4.03

IVANPAH 3.1..... Tc Calcs 4.05

********** CN CALCULATIONS **********

IVAN 1.1..... Runoff CN-Area 5.01

IVANPAH 2.1..... Runoff CN-Area 5.02

IVANPAH 3.1..... Runoff CN-Area 5.03

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Ivan TP40

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev100	3.2800	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*IVAN 1	JCT	100	94.068		12.0000	541.78		
IVAN 1.1	AREA	100	94.068		12.0000	541.78		
*IVAN 2	JCT	100	94.122		12.5000	538.92		
IVANPAH 2.1	AREA	100	94.122		12.5000	538.92		
*IVANPAH 3	JCT	100	173.357		12.5000	1182.22		
IVANPAH 3.1	AREA	100	173.357		12.5000	1182.22		

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
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Title... Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Ivan TP40

Storm Tag Name = Dev100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 3.2800 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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::
TIME OF CONCENTRATION CALCULATOR
::

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft
Avg.Velocity	.91	ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6010.28	ft
Slope	.060000	ft/ft
Unpaved		
Avg.Velocity	3.95	ft/sec

Segment #2 Time: .4224 hrs

==========
Total Tc: .5135 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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w 13

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6219.48	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .4371 hrs

==========
Total Tc: .5283 hrs
==========

TITLE: Preliminary Stormwater Management, ~~Vegetated Mulch Dust~~ Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~A12~~ 15 of ~~A17~~ 83

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TIME OF CONCENTRATION CALCULATOR

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~A13~~ 16 of ~~A17~~ 83

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft
Avg.Velocity	.91	ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	8781.19	ft
Slope	.060000	ft/ft
Unpaved		
Avg.Velocity	3.95	ft/sec

Segment #2 Time: .6172 hrs

Total Tc: .7083 hrs

TITLE: Preliminary Stormwater Management, ~~Vegetated Mulch Dust Suppression~~ Calculations
CALC NO.: 52003201-0-DC-531-C-002
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Tc Equations used...

==== SCS TR-55 Sheet Flow ====

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ====

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.330			83.00
Graded Desert Landscape	77	886.893			77.00
Buildings	98	.867			98.00
Gravel Roads	76	13.710			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.05 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	56.750			83.00
Graded Desert Landscape	77	835.900			77.00
Buildings	98	1.662			98.00
Gravel Roads	76	14.488			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.40 (77)

Preliminary Stormwater Management Vegetated Mulch Dust Suppression Calculation
~~Att6A~~ Dz ~~A7~~

Calc ID 52003201-0-DC531.C-002

RUNOFF CURVE NUMBER DATA

::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.354			83.00
Graded Desert Landscape	77	1619.533			77.00
Buildings	98	1.799			98.00
Gravel Roads	76	28.914			76.00

COMPOSITE AREA & WEIGHTED CN ---> 1657.600 77.03 (77)

::

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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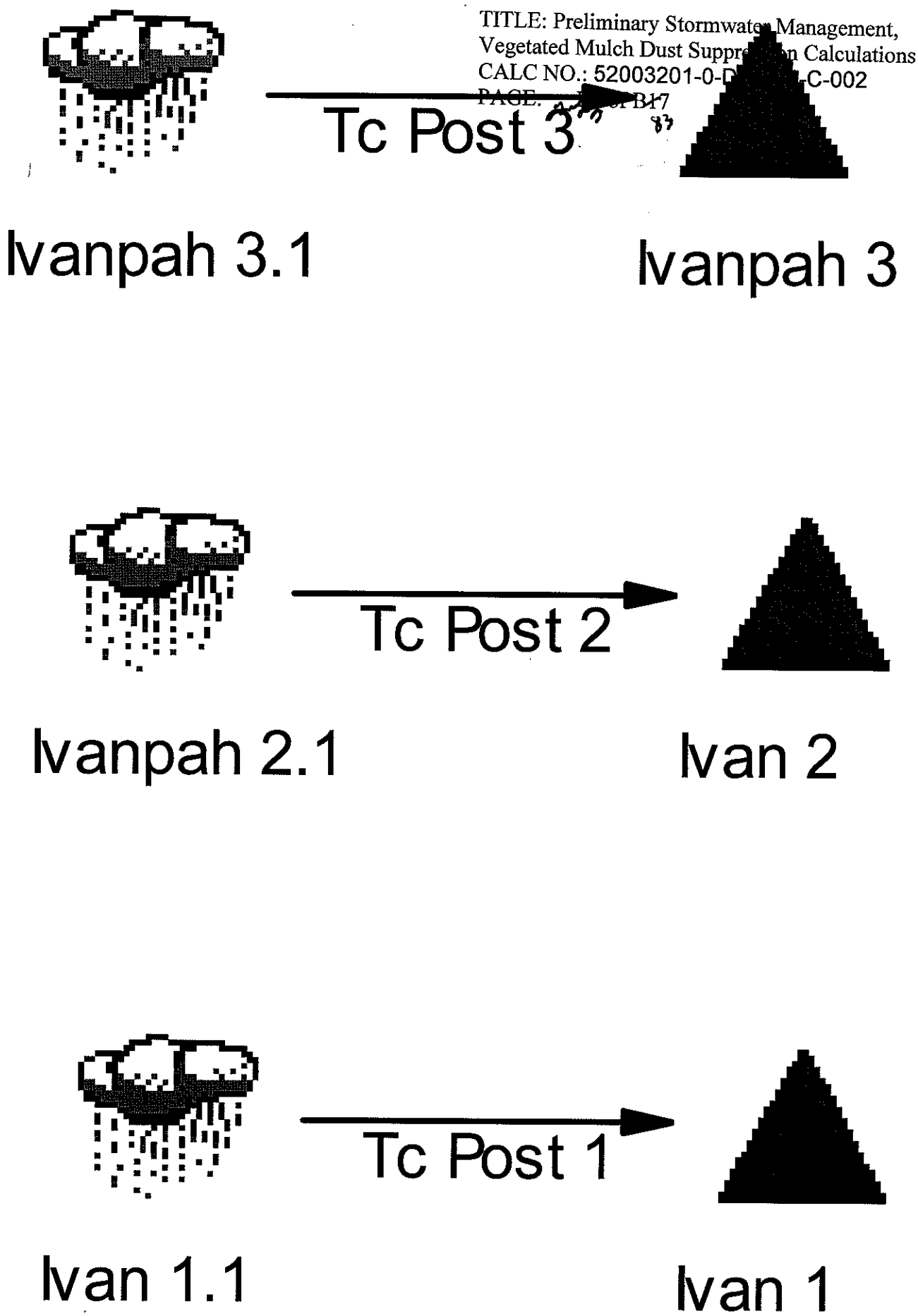
```
----- I -----
IVAN 1.1... 4.01, 5.01
Ivan TP40... 2.01
IVANPAH 2.1... 4.03, 5.02
IVANPAH 3.1... 4.05, 5.03

----- T -----
TypeII  24hr Dev100... 3.01

----- W -----
Watershed... 1.01
```

ATTACHMENT B

100 year – 6 hour runoff


Tc Post 3
Ivanpah 3.1
Ivanpah 3
Tc Post 2
Ivanpah 2.1
Ivan 2
Tc Post 1
Ivan 1.1
Ivan 1

JOB TITLE
==========

Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

Ivan TP40..... Design Storms 2.01

********** RAINFALL DATA **********

100yr, 6hr..... Dev100
Time-Depth Curve 3.01

********** TC CALCULATIONS **********

IVAN 1.1..... Tc Calcs 4.01

IVANPAH 2.1..... Tc Calcs 4.03

IVANPAH 3.1..... Tc Calcs 4.05

********** CN CALCULATIONS **********

IVAN 1.1..... Runoff CN-Area 5.01

IVANPAH 2.1..... Runoff CN-Area 5.02

IVANPAH 3.1..... Runoff CN-Area 5.03

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Ivan TP40

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev100	2.8300	Time-Depth Curve	100yr, 6hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*IVAN 1	JCT	100	72.013		6.0000	278.58		
IVAN 1.1	AREA	100	72.013		6.0000	278.58		
*IVAN 2	JCT	100	72.042		6.0000	278.59		
IVANPAH 2.1	AREA	100	72.042		6.0000	278.59		
*IVANPAH 3	JCT	100	131.696		6.0000	499.31		
IVANPAH 3.1	AREA	100	131.696		6.0000	499.31		

~~TITLE: Preliminary Stormwater Management,~~
Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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Title... Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Ivan TP40

Storm Tag Name = Dev100

Data Type, File, ID = Time-Depth Curve 100yr, 6hr
Storm Frequency = 100 yr
Total Rainfall Depth= 2.8300 in
Duration Multiplier = 1
Resulting Duration = 6.0000 hrs
Resulting Start Time= .0000 hrs Step= 1.0000 hrs End= 6.0000 hrs

SYNTHETIC CUMULATIVE RAINFALL(in)
Output Time increment = 1.0000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.0000	.4717	.9433	1.4150	1.8860
5.0000	2.3580	2.8300			

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
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TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
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::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6010.28	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .4224 hrs

==========
Total Tc: .5135 hrs
==========

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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31

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft
Avg.Velocity	.91	ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6219.48	ft
Slope	.060000	ft/ft
Unpaved		
Avg.Velocity	3.95	ft/sec

Segment #2 Time: .4371 hrs

==========
Total Tc: .5283 hrs
==========

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
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::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	8781.19	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .6172 hrs

==========
Total Tc: .7083 hrs
==========

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
~~CALC NO.: 52003201-0-DC~~-531-C-002
PAGE: ~~B13~~ 34 of ~~B17~~ 83

```
-----------------------------------------------
Tc Equations used...
-----------------------------------------------

==== SCS TR-55 Sheet Flow ==========================

     Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

     Where:  Tc = Time of concentration, hrs
             n  = Mannings n
             Lf = Flow length, ft
             P  = 2yr, 24hr Rain depth, inches
             Sf = Slope, %


==== SCS TR-55 Shallow Concentrated Flow ==============================

     Unpaved surface:
     V  = 16.1345 * (Sf**0.5)

     Paved surface:
     V  = 20.3282 * (Sf**0.5)

     Tc = (Lf / V) / (3600sec/hr)

     Where:  V  = Velocity, ft/sec
             Sf = Slope, ft/ft
             Tc = Time of concentration, hrs
             Lf = Flow length, ft
```

File.... Y:\Ivanpah\Civil\Calcs\Copy of Drainage Area Ivanpah - Post Development -100yr-6h

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~B14~~ 35 of ~~B17~~ 83

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.330			83.00
Graded Desert Landscape	77	886.893			77.00
Buildings	98	.867			98.00
Gravel Roads	76	13.710			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.05 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~B15~~ of ~~B57~~ 36 43

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	56.750			83.00
Graded Desert Landscape	77	835.900			77.00
Buildings	98	1.662			98.00
Gravel Roads	76	14.488			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.40 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~B16~~ of ~~B17~~ 37 83

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.354			83.00
Graded Desert Landscape	77	1619.533			77.00
Buildings	98	1.799			98.00
Gravel Roads	76	28.914			76.00
COMPOSITE AREA & WEIGHTED CN --->		1657.600			77.03 (77)

TITLE: Preliminary Stormwater Mgmt
Vegetated Mulch Dust Suppression Calc.
CALC NO. 52003201-0-DC-531-C002

~~BIT~~ of BIT
~~Sh~~ 38 83

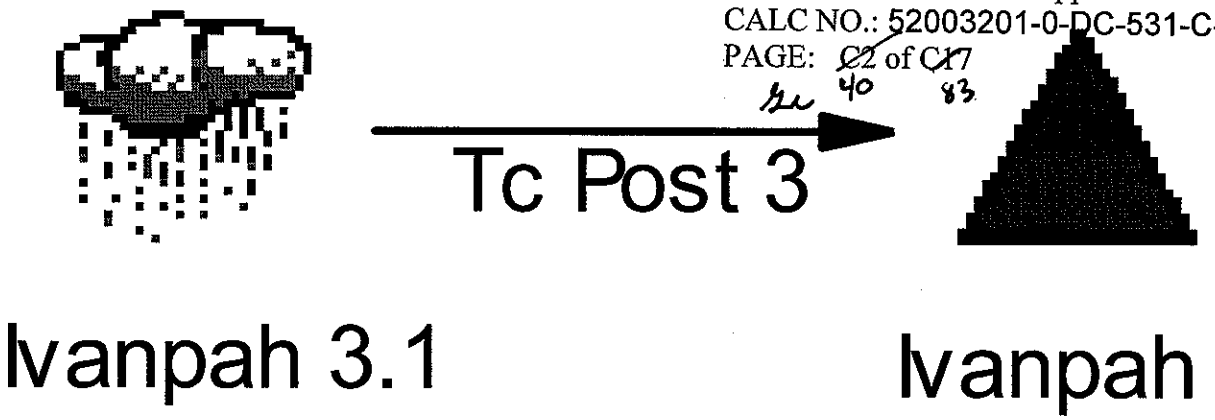
----- 1 -----
100yr, 6hr Dev100... 3.01

----- I -----
IVAN 1.1... 4.01, 5.01
Ivan TP40... 2.01
IVANPAH 2.1... 4.03, 5.02
IVANPAH 3.1... 4.05, 5.03

----- W -----
Watershed... 1.01

ATTACHMENT C

10 year – 24 hour runoff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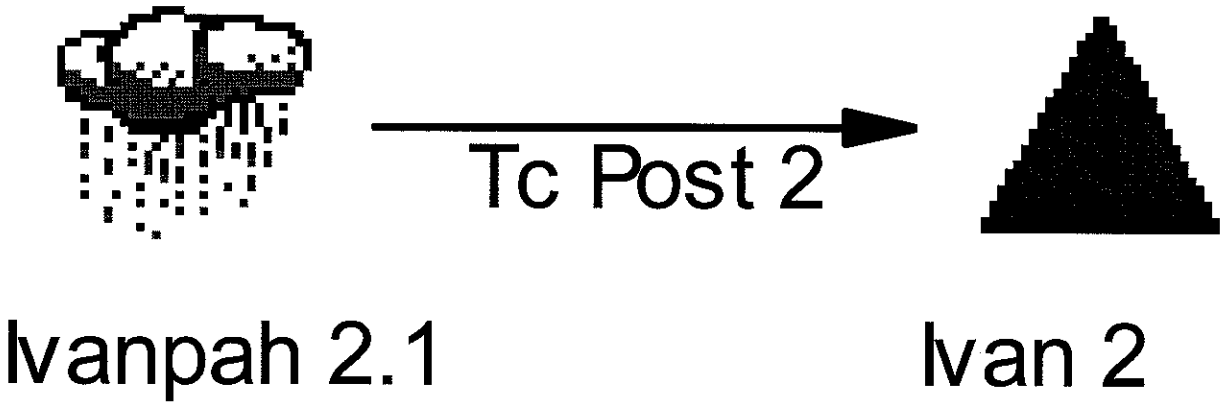
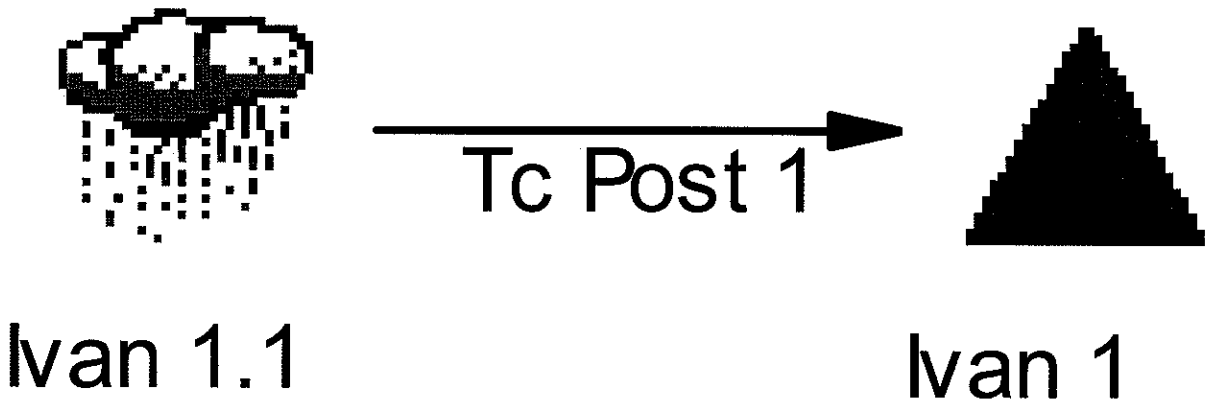
Ivanpah 3.1
Ivanpah 3


Tc Post 2
Ivanpah 2.1
Ivan 2


Tc Post 1
Ivan 1.1
Ivan 1

JOB TITLE
==========

Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

Ivan TP40..... Design Storms 2.01

********** RAINFALL DATA **********

TypeII 24hr.... Dev 10
Synthetic Curve 3.01

********** TC CALCULATIONS **********

IVAN 1.1..... Tc Calcs 4.01

IVANPAH 2.1..... Tc Calcs 4.03

IVANPAH 3.1..... Tc Calcs 4.05

********** CN CALCULATIONS **********

IVAN 1.1..... Runoff CN-Area 5.01

IVANPAH 2.1..... Runoff CN-Area 5.02

IVANPAH 3.1..... Runoff CN-Area 5.03

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Ivan TP40

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 10	1.9200	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*IVAN 1	JCT	10	29.790		12.5000	161.32		
IVAN 1.1	AREA	10	29.790		12.5000	161.32		
*IVAN 2	JCT	10	29.849		12.5000	164.73		
IVANPAH 2.1	AREA	10	29.849		12.5000	164.73		
*IVANPAH 3	JCT	10	55.372		12.5000	336.45		
IVANPAH 3.1	AREA	10	55.372		12.5000	336.45		

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C6~~ of ~~C17~~ 44 83

Title... Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Ivan TP40

Storm Tag Name = Dev 10

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 1.9200 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C7~~ of ~~C17~~ 45 83

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.000	.001	.002	.003	.004
.5000	.005	.006	.007	.008	.009
1.0000	.011	.012	.013	.014	.015
1.5000	.016	.017	.018	.020	.021
2.0000	.022	.023	.024	.026	.027
2.5000	.028	.029	.031	.032	.033
3.0000	.035	.036	.037	.038	.040
3.5000	.041	.042	.044	.045	.047
4.0000	.048	.049	.051	.052	.054
4.5000	.055	.057	.058	.060	.061
5.0000	.063	.065	.066	.068	.070
5.5000	.071	.073	.075	.076	.078
6.0000	.080	.082	.084	.085	.087
6.5000	.089	.091	.093	.095	.097
7.0000	.099	.101	.103	.105	.107
7.5000	.109	.111	.113	.116	.118
8.0000	.120	.122	.125	.127	.130
8.5000	.132	.135	.138	.141	.144
9.0000	.147	.150	.153	.157	.160
9.5000	.163	.166	.170	.173	.177
10.0000	.181	.185	.189	.194	.199
10.5000	.204	.209	.215	.221	.228
11.0000	.235	.243	.251	.261	.271
11.5000	.283	.307	.354	.431	.568
12.0000	.663	.682	.699	.713	.725
12.5000	.735	.743	.751	.759	.766
13.0000	.772	.778	.784	.789	.794
13.5000	.799	.804	.808	.812	.816
14.0000	.820	.824	.827	.831	.834
14.5000	.838	.841	.844	.847	.850
15.0000	.854	.856	.859	.862	.865
15.5000	.868	.870	.873	.875	.878
16.0000	.880	.882	.885	.887	.889
16.5000	.891	.893	.895	.898	.900
17.0000	.902	.904	.906	.908	.910
17.5000	.912	.914	.915	.917	.919
18.0000	.921	.923	.925	.926	.928
18.5000	.930	.931	.933	.935	.936
19.0000	.938	.939	.941	.942	.944
19.5000	.945	.947	.948	.949	.951
20.0000	.952	.953	.955	.956	.957
20.5000	.958	.960	.961	.962	.964
21.0000	.965	.966	.967	.968	.970
21.5000	.971	.972	.973	.975	.976

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C8~~ of ~~C17~~ 46 83

CUMULATIVE RAINFALL FRACTIONS
Output Time increment = .1000 hrs
Time on left represents time for first value in each row.

Time hrs					
22.0000	.977	.978	.979	.981	.982
22.5000	.983	.984	.985	.986	.988
23.0000	.989	.990	.991	.992	.993
23.5000	.994	.996	.997	.998	.999
24.0000	1.000				

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6010.28	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .4224 hrs

==========
Total Tc: .5135 hrs
==========

TITLE: Preliminary Stormwater Management, ~~Vegetated Mulch Dust Suppression~~ Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C10~~ of ~~C17~~
48 63

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C11~~ 49 of ~~C17~~ 83

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6219.48	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .4371 hrs

==========
Total Tc: .5283 hrs
==========

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: C12 of C17 50 83

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: C13 of C17
~~81~~ 83

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	8781.19	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .6172 hrs

Total Tc: .7083 hrs

TITLE: Preliminary Stormwater Management, ~~Vegetated Mulch Dust Suppression~~ Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: C14 of ~~C17~~ 52 83

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

File.... Y:\Ivanpah\Civil\Calcs\Copy of Drainage Area Ivanpah - Post Development - 10yr -

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C15~~ of ~~C17~~ 53 83

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.330			83.00
Graded Desert Landscape	77	886.893			77.00
Buildings	98	.867			98.00
Gravel Roads	76	13.710			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.05 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C16~~ of ~~C17~~ 54 83

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	56.750			83.00
Graded Desert Landscape	77	835.900			77.00
Buildings	98	1.662			98.00
Gravel Roads	76	14.488			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.40 (77)

Title: Preliminary Stormwater Mngmt
Vegetative Mulch Dust Suppression Calc
Calc No 52003201-0-DC-531-C-002

RUNOFF CURVE NUMBER DATA

Dft BJ 8/7/07
Ck SS

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.354			83.00
Graded Desert Landscape	77	1619.533			77.00
Buildings	98	1.799			98.00
Gravel Roads	76	28.914			76.00
COMPOSITE AREA & WEIGHTED CN --->		1657.600			77.03 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~C17~~ of ~~C17~~
Hh 56 83

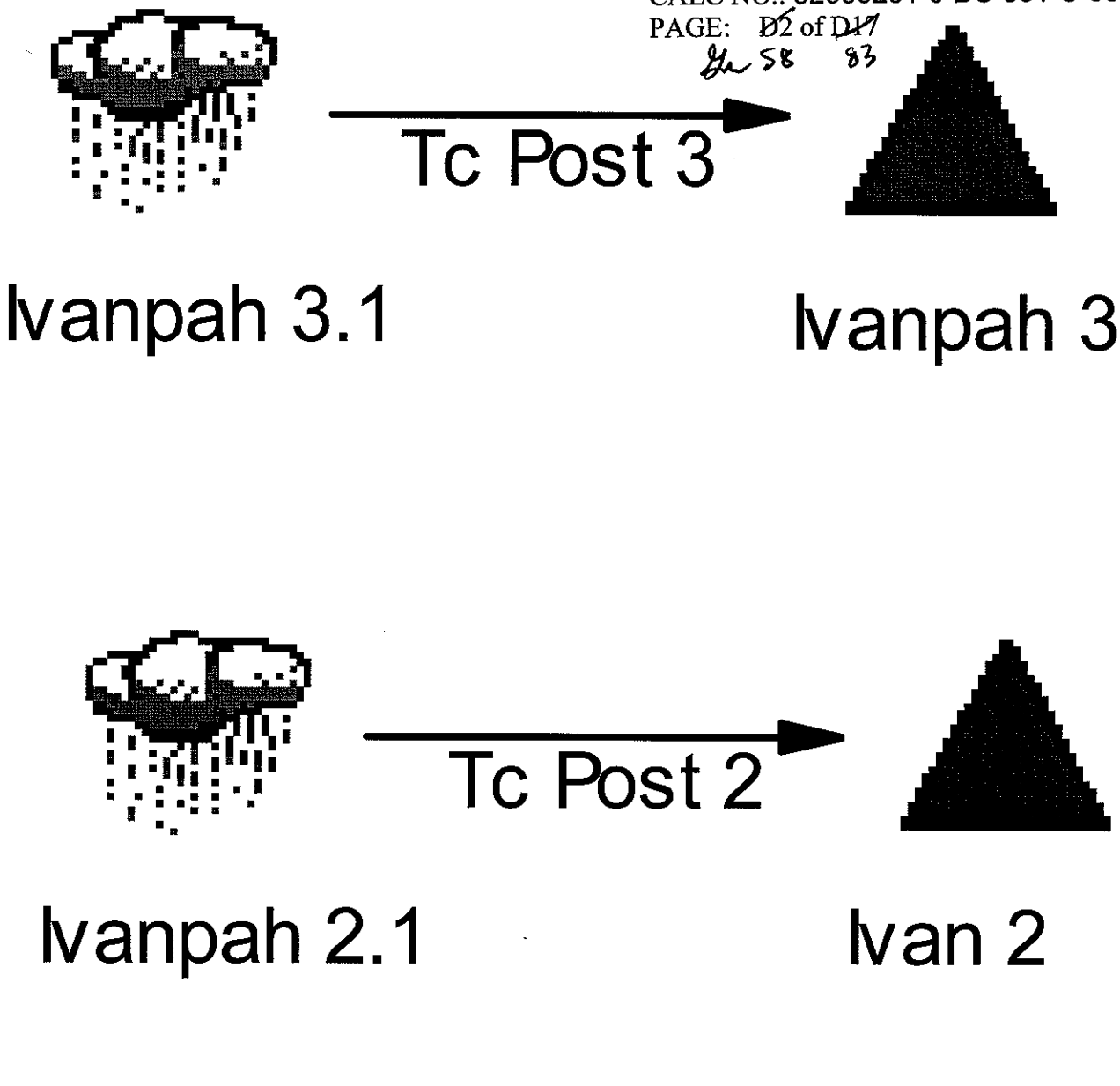
```
----- I -----
IVAN 1.1... 4.01, 5.01
Ivan TP40... 2.01
IVANPAH 2.1... 4.03, 5.02
IVANPAH 3.1... 4.05, 5.03

----- T -----
TypeII  24hr Dev 10... 3.01

----- W -----
Watershed... 1.01
```

ATTACHMENT D

10 year – 6 hour runoff


Tc Post 3
Ivanpah 3.1
Ivanpah 3
Tc Post 2
Ivanpah 2.1
Ivan 2
Tc Post 1
Ivan 1.1
Ivan 1

JOB TITLE
==========

Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: D4 of D17

********** MASTER SUMMARY **********

Watershed..... Master Network Summary 1.01

********** DESIGN STORMS SUMMARY **********

Ivan TP40..... Design Storms 2.01

********** RAINFALL DATA **********

10yr, 6hr..... Dev 10
Time-Depth Curve 3.01

********** TC CALCULATIONS **********

IVAN 1.1..... Tc Calcs 4.01

IVANPAH 2.1..... Tc Calcs 4.03

IVANPAH 3.1..... Tc Calcs 4.05

********** CN CALCULATIONS **********

IVAN 1.1..... Runoff CN-Area 5.01

IVANPAH 2.1..... Runoff CN-Area 5.02

IVANPAH 3.1..... Runoff CN-Area 5.03

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Ivan TP40

Return Event	Total Depth in	Rainfall Type	RNF ID
Dev 10	1.6000	Time-Depth Curve	10yr, 6hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
*IVAN 1	JCT	10	18.968		6.0000	99.13		
IVAN 1.1	AREA	10	18.968		6.0000	99.13		
*IVAN 2	JCT	10	18.977		6.0000	99.02		
IVANPAH 2.1	AREA	10	18.977		6.0000	99.02		
*IVANPAH 3	JCT	10	34.726		6.0000	174.85		
IVANPAH 3.1	AREA	10	34.726		6.0000	174.85		

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D6~~ of ~~D17~~ 62 83

Title... Project Date: 8/1/2007
Project Engineer: Brian Gilbert
Project Title: Post Developement Flow
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = Ivan TP40

Storm Tag Name = Dev 10

Data Type, File, ID = Time-Depth Curve 10yr, 6hr
Storm Frequency = 10 yr
Total Rainfall Depth= 1.6000 in
Duration Multiplier = 1
Resulting Duration = 6.0000 hrs
Resulting Start Time= .0000 hrs Step= 1.0000 hrs End= 6.0000 hrs

File.... Y:\Ivanpah\Civil\Calcs\Copy of Drainage Area Ivanpah - Post Development -10yr-6hr

SYNTHETIC CUMULATIVE RAINFALL(in)
Output Time increment = 1.0000 hrs
Time on left represents time for first value in each row.

Time hrs					
.0000	.0000	.2666	.5333	.8000	1.0666
5.0000	1.3333	1.6000			

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D7~~ of ~~D17~~
Pr 63 83

::
TIME OF CONCENTRATION CALCULATOR
::

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D8~~ of ~~D17~~
64 83

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft
Avg.Velocity	.91	ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6010.28	ft
Slope	.060000	ft/ft
Unpaved		
Avg.Velocity	3.95	ft/sec

Segment #2 Time: .4224 hrs

Total Tc: .5135 hrs

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D9~~ of ~~D17~~ 93
Pr 65

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

File.... Y:\Ivanpah\Civil\Calcs\Copy of Drainage Area Ivanpah - Post Development -10yr-6hr

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D10~~ of ~~D17~~ 66 85

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	6219.48	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .4371 hrs

==========
Total Tc: .5283 hrs
==========

TITLE: Preliminary Stormwater Management,
Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D11 of D17~~
Sh 67 83

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

TIME OF CONCENTRATION CALCULATOR

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
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Segment #1: Tc: TR-55 Sheet

Mannings n	.0200	
Hydraulic Length	300.00	ft
2yr, 24hr P	1.1400	in
Slope	.050000	ft/ft

Avg.Velocity .91 ft/sec

Segment #1 Time: .0911 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length	8781.19	ft
Slope	.060000	ft/ft
Unpaved		

Avg.Velocity 3.95 ft/sec

Segment #2 Time: .6172 hrs

Total Tc: .7083 hrs

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 5200320-0-DC-531-C-002 1
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Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

```
Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where:  Tc = Time of concentration, hrs
        n  = Mannings n
        Lf = Flow length, ft
        P  = 2yr, 24hr Rain depth, inches
        Sf = Slope, %
```

==== SCS TR-55 Shallow Concentrated Flow ==========

```
Unpaved surface:
V  = 16.1345 * (Sf**0.5)

Paved surface:
V  = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where:  V  = Velocity, ft/sec
        Sf = Slope, ft/ft
        Tc = Time of concentration, hrs
        Lf = Flow length, ft
```

File.... Y:\Ivanpah\Civil\Calcs\Copy of Drainage Area Ivanpah - Post Development -10yr-6hr

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D14~~ of ~~D17~~ 70 83

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	7.330			83.00
Graded Desert Landscape	77	886.893			77.00
Buildings	98	.867			98.00
Gravel Roads	76	13.710			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.05 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D15~~ of ~~D17~~ Yu 71 ----- 83

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Asphalt Road	83	56.750			83.00
Graded Desert Landscape	77	835.900			77.00
Buildings	98	1.662			98.00
Gravel Roads	76	14.488			76.00
COMPOSITE AREA & WEIGHTED CN --->		908.800			77.40 (77)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Asphalt Road	83	7.354			83.00
Graded Desert Landscape	77	1619.533			77.00
Buildings	98	1.799			98.00
Gravel Roads	76	28.914			76.00
COMPOSITE AREA & WEIGHTED CN --->		1657.600			77.03 (77)

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-0-DC-531-C-002
PAGE: ~~D17~~ 73 of ~~D17~~ 83

```
----- 1 -----
10yr, 6hr Dev 10... 3.01

----- I -----
IVAN 1.1... 4.01, 5.01
Ivan TP40... 2.01
IVANPAH 2.1... 4.03, 5.02
IVANPAH 3.1... 4.05, 5.03

----- W -----
Watershed... 1.01
```

ATTACHMENT E

Volume of Vegetated Mulch

Given: Provide an estimate of the total mass to be burned/mulched onsite.

Debris assumptions:

a) Entire site will be disturbed.

b) All 3 areas (north, south, & middle) total approximately 4 $^{(sq\ mi)}$.

c) Roots will require little disturbance. Each 100 $^{(ft2)}$ area will create an average row of debris of 2$^{(ft)}$ diameter by 3$^{(ft)}$ long, approximately 10 ^{ft3} or 0.37 $^{(cu\ yds/100(ft2))}$. This will be mulched into a 2 ^{ft3} volume (i.e. 2 $^{ft3/100(ft2)}$).

Calculation

Pre-mulched Debris pile:

$4^{(sq\ mi)} \times 640^{(ac/sq\ mi)} \times 43560^{(ft2/ac)}/100^{(ft2)} \times 0.37^{(cu\ yds/100ft2)} = 412600^{(cu\ yds)}$

Mulch:

$4^{(sq\ mi)} \times 640^{(ac/sq\ mi)} \times 43560^{(ft2/ac)}/100^{(ft2)} \times 2^{(cu\ ft)} / 27^{(ft3/cu\ yds)} = 82602^{(cu\ yds)}$

ATTACHMENT F

Volume of Water for Dust Suppression

WorleyParsons resources & energy	CLIENT NAME: Bright Source Energy Inc. PROJECT NAME: Ivanpah – Solar Power Plant – San Bernardino, CA				JOB NO.: 52003201	
STANDARD CALCULATION SHEET	SUBJECT: Preliminary Stormwater Management, Vegetated Mulch and Dust Suppression Calculations				CALC NO.: 52003201-0-DC-531-002	
	REVISION	A	B	C	D	Page 77 of 83
	ORIGINATOR:	CKH				
	REVIEWER:	G. Melton				
	DATE:	08/09/07				

Given: Provide an estimate of the total water requirements for dust control.

Water assumptions:

a) 0.05 ft of water will be required over entire site.

Calculation

$4^{(sq\ mi)} \times 640^{(ac/sq\ mi)} \times 43560^{(ft2/ac)} \times 0.05^{(ft)} \times 7.48^{(ft3/gal)} = 41{,}706{,}086^{(gal)}$

ATTACHMENT G

Reference Information

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations
CALC NO.: 52003201-C-031-C-002
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POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

California 35.558253 N 115.472558 W 3005 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Fri Aug 10 2007

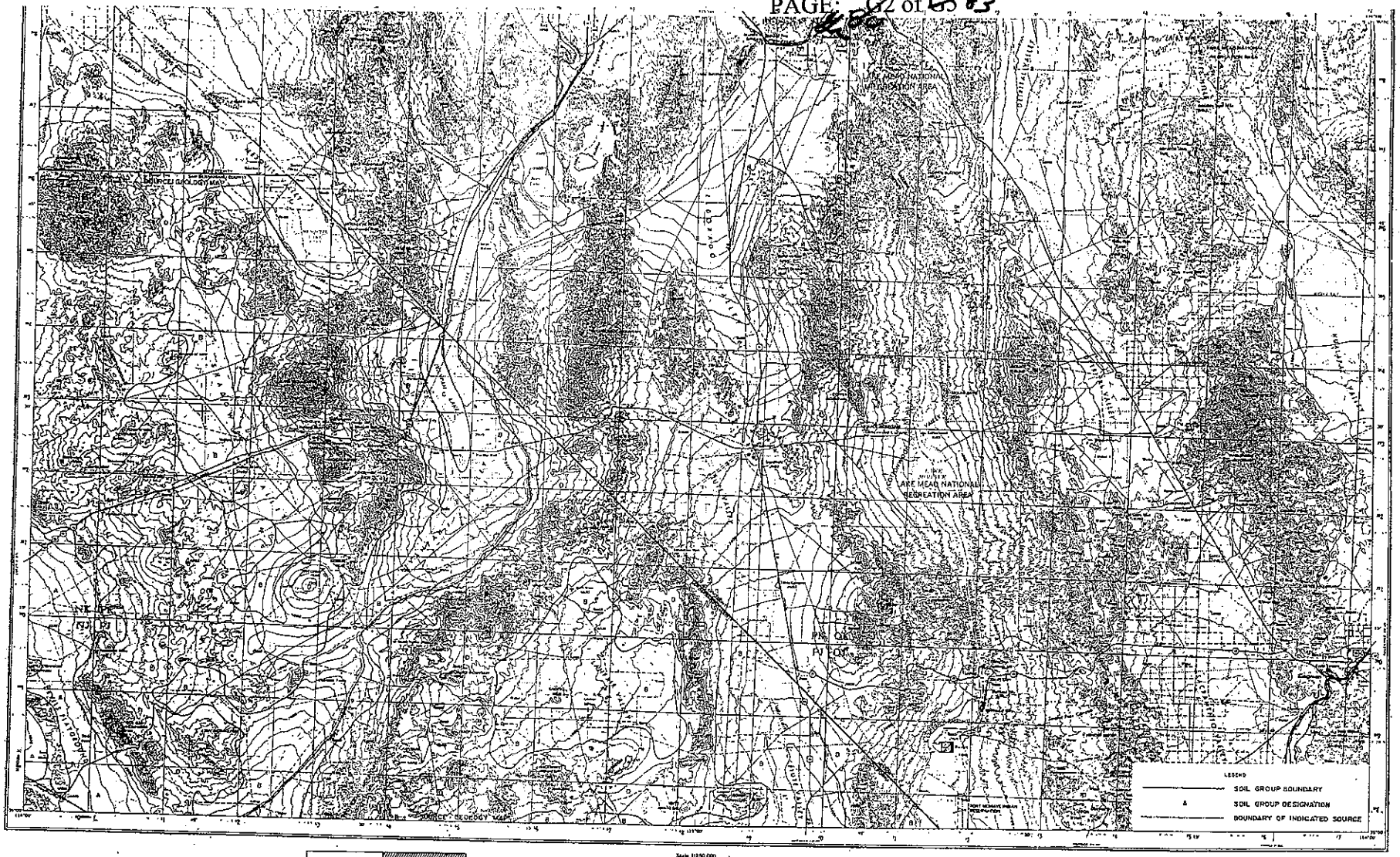
Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | D

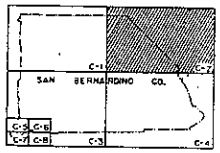
Precipitation Frequency Estimates (inches)

AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	0.15	0.23	0.29	0.39	0.48	0.60	0.68	0.84	1.01	1.02	1.11	1.26	1.40	1.52	1.76	2.04	2.30	2.53
5	0.24	0.37	0.46	0.62	0.76	0.93	1.04	1.28	1.53	1.55	1.65	1.87	2.06	2.25	2.63	3.08	3.49	3.92
10	0.31	0.47	0.59	0.79	0.98	1.19	1.32	1.60	1.90	1.92	2.04	2.29	2.49	2.71	3.20	3.75	4.27	4.84
25	0.41	0.62	0.77	1.04	1.28	1.56	1.70	2.05	2.41	2.44	2.56	2.84	3.03	3.28	3.89	4.58	5.24	6.02
50	0.49	0.75	0.92	1.25	1.54	1.89	2.03	2.42	2.82	2.84	2.97	3.26	3.43	3.70	4.39	5.17	5.94	6.90
100	0.58	0.89	1.10	1.48	1.83	2.26	2.40	2.83	3.24	3.28	3.42	3.70	3.83	4.10	4.88	5.76	6.63	7.78
200	0.68	1.04	1.29	1.74	2.15	2.68	2.83	3.28	3.70	3.74	3.89	4.15	4.27	4.50	5.36	6.32	7.29	8.66
500	0.84	1.28	1.59	2.14	2.65	3.33	3.49	3.98	4.38	4.43	4.56	4.80	4.89	5.07	5.98	7.05	8.14	9.81
1000	0.98	1.50	1.86	2.50	3.09	3.91	4.09	4.59	4.98	5.03	5.12	5.37	5.43	5.60	6.44	7.58	8.75	10.67

Text version of table

* These precipitation frequency estimates are based on an annual maxima series. AEP is the Annual Exceedance Probability. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

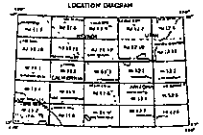




INDEX MAP

CONTOUR INTERVAL 200 FEET
TRANSVERSE MERCATOR PROJECTION
BASE MAP REPRODUCED FROM U.S.G.S. "KINGMAN" TOPOGRAPHIC MAP

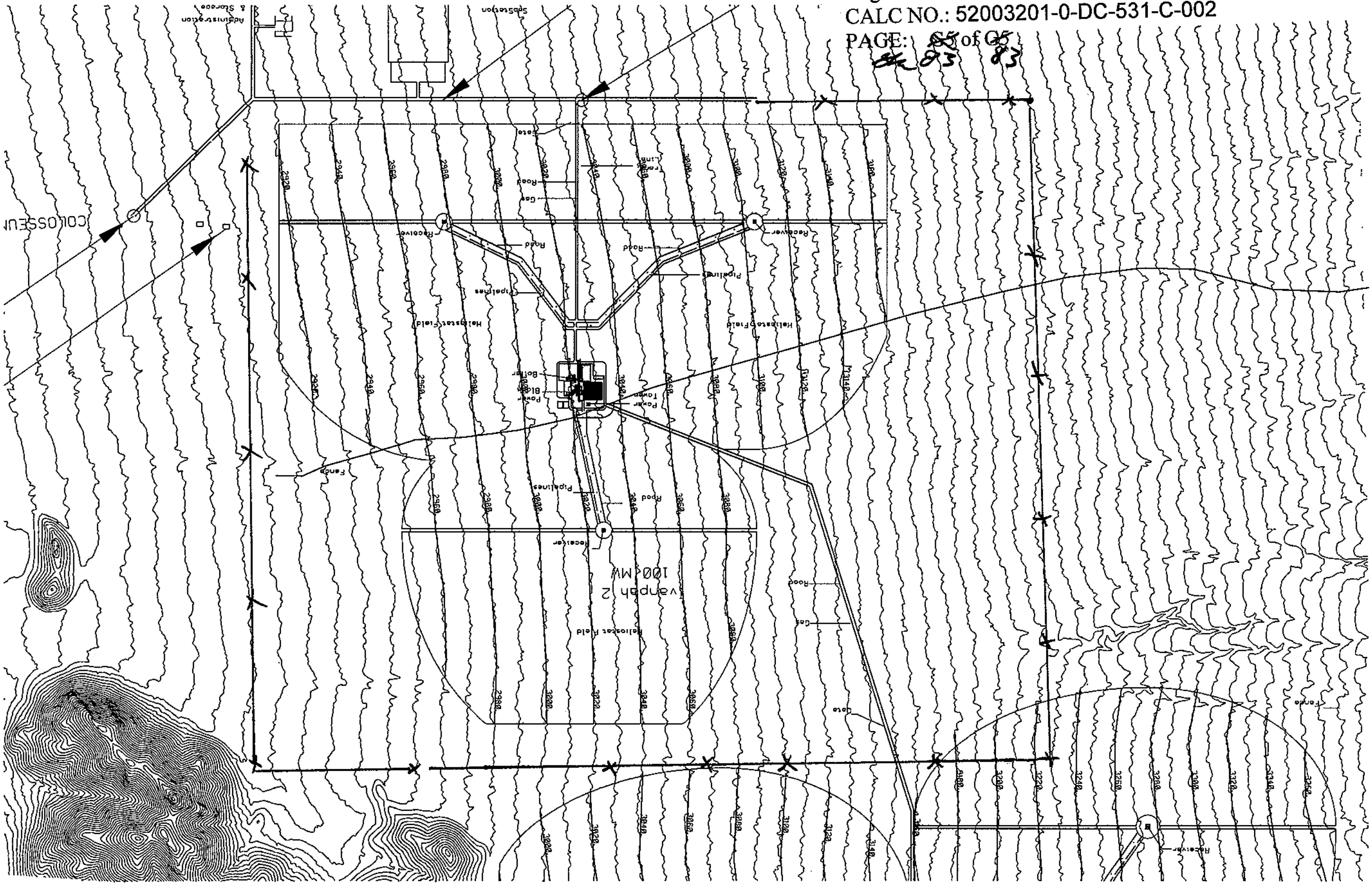
SCALE REDUCED BY 1/2



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
NORTHEAST AREA

FIGURE C-10


COLOSSEUM
Administration & Storage
SubStation
Ivanpah 2
100 MW
Heliostat Field
Receiver
Power Tower
Power Block
Boiler
Pipelines
Road
Gas
Gate
Fence

TITLE: Preliminary Stormwater Management,
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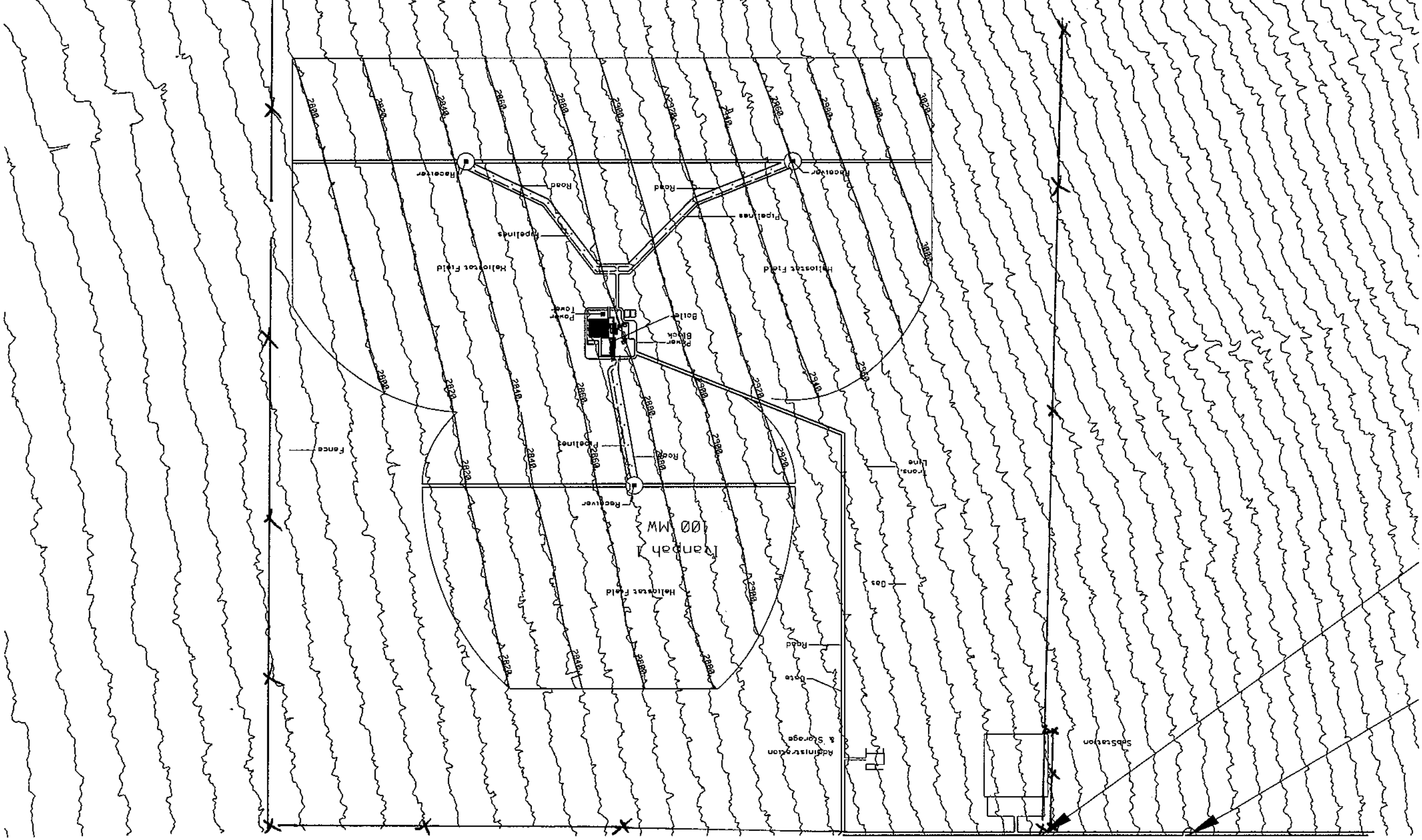

TITLE: Preliminary Stormwater Management, Vegetated Mulch Dust Suppression Calculations

CALC NO.: 52003201-D-DC-531-C-002

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