APPENDICES 9.4 & 9.5
FOR
CORTARO FARMS ROAD
IMPROVEMENTS
UNION PACIFIC RAILROAD TO
THORNYDALE ROAD
(90% PLAN SUBMITTAL)
W.O. # 4TCFIT

October 28, 2002

Prepared by:

MMLA, Inc.
800 E. Wetmore Road, Suite 110
Tucson, AZ 85719

MMLA 99067-01-600

APPENDICES 9.4 & 9.5
FOR
CORTARO FARMS ROAD IMPROVEMENTS
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
(90% PLAN SUBMITTAL)
W.O. # 4TCFIT

Location:
This project is located in portions of
Sections 25 and 26, Township 12 South, Range 12 East
and Section 30, Township 12 South, Range 13 East,
within Pima County, Arizona

Prepared for:
Pima County Department of Transportation
201 North Stone Avenue, 3rd Floor
Tucson, Arizona 85701

October 28, 2002

Registered Professional Engineer (Civil)
CERTIFICATE NO.
11700
THOMAS P.
McGOVERN
DATE SIGNED 11/5/02
ARIZONA, U.S.A.

Prepared by:

MMLA Inc.
800 E. Wetmore Road, Suite 110
Tucson, AZ 85719

MMLA 99067-01-600

INLET ANALYSIS

PAVEMENT DRAINAGE CALCULATIONS

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: OS-1

WATERSHED AREA (A): .27 acres

LENGTH OF WATERCOURSE (Lc): 128. ft

LENGTH TO CENTER OF GRAVITY (Lca): 64. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

128. 1.7

MEAN SLOPE (Sc): .0130 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	1.90	1.89	1.88	1.87	1.87	1.86
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.08	1.45	1.71	2.03	2.32	2.62

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed OS-1

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
235+50	234+22	128	varies	0.27	0.94	5	6.7	1.70	0.00	1.70	0.0130	0.0200		0.20	7.9

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-A1	234+12	Type 3, 4' Wing	0.20	1.44	0.26

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed OS-1
STA 235+50 TO 234+22

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0130
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.700
T	Width of Spread (ft)	7.94

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.601
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.52

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed OS-1
STA 234+12

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0130
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.700
T	Width of Spread (ft)	7.94

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.601
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.52

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	10.82
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.846
Qi	Intercepted Flow (cfs)	1.439
Qb	By-pass Flow (cfs)	0.261

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: OS-2

WATERSHED AREA (A): .20 acres

LENGTH OF WATERCOURSE (Lc): 128. ft

LENGTH TO CENTER OF GRAVITY (Lca): 64. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

128. 1.7

MEAN SLOPE (Sc): .0130 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	1.90	1.89	1.88	1.87	1.87	1.86
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	.80	1.08	1.26	1.50	1.72	1.94

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed OS-2
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
235+50	234+22	128	varies	0.20	0.94	5	6.7	1.26	0.00	1.26	0.0130	0.0200		0.18	7.0

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-A2	234+12	Type 3, 4' Wing	0.18	1.17	0.09

Computed by: SP Checked by: _____ Date: 4/29/2002

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FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed OS-2
STA 235+50 TO 234+22

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0130
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.260
T	Width of Spread (ft)	7.01

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.660
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	2.36

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed OS-2
STA 234+12

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0130
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.260
T	Width of Spread (ft)	7.01

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.660
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	2.36

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.14
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.927
Qi	Intercepted Flow (cfs)	1.168
Qb	By-pass Flow (cfs)	0.092

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: OS-3

WATERSHED AREA (A): .15 acres

LENGTH OF WATERCOURSE (Lc): 125. ft

LENGTH TO CENTER OF GRAVITY (Lca): 63. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

125. .3

MEAN SLOPE (Sc): .0022 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.79	3.76	3.74	3.73	3.72	3.71
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	.60	.81	.95	1.13	1.29	1.45

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed OS-3

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
106+25	107+50	125	54	0.15	0.94	5	6.7	0.98	0.00	0.98	0.0022	0.0200		0.23	9.1

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)

Computed by: SP Checked by: _____ Date: 4/29/2002

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FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed OS-3
STA 106+25 TO 107+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0022
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.980
T	Width of Spread (ft)	9.12

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.538
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	1.12

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: OS-4

WATERSHED AREA (A): .18 acres

LENGTH OF WATERCOURSE (Lc): 148. ft

LENGTH TO CENTER OF GRAVITY (Lca): 74. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

148. .3

MEAN SLOPE (Sc): .0022 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	4.20	4.16	4.15	4.13	4.12	4.11
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	.72	.97	1.14	1.35	1.55	1.74

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed OS-4

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
106+02	107+50	148	varies	0.18	0.94	5	6.7	1.13	0.00	1.13	0.0022	0.0200		0.24	9.7

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)

Computed by: SP Checked by: _____ Date: 4/29/2002

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FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed OS-4
STA 106+02 TO 107+50

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0022
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.130
T	Width of Spread (ft)		9.66

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.513
d	Depth at Curb (ft)		0.24
V	Average Velocity	(ft/sec)	1.16

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: A

WATERSHED AREA (A): 2.19 acres

LENGTH OF WATERCOURSE (Lc): 1642. ft

LENGTH TO CENTER OF GRAVITY (Lca): 821. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

1642. 15.4

MEAN SLOPE (Sc): .0094 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	10.02	9.93	9.89	9.86	9.83	9.81
SOLUTION OF Tc (MINUTES):	6	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.148	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.771	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	8.33	11.78	13.83	16.46	18.85	21.21

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed A

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
234+22	232+00	222	45	0.23	0.94	5	6.7	1.45	0.26	1.71	0.0050	0.0200		0.24	9.7
232+00	229+50	250	varies	0.30	0.94	5	6.7	1.89	0.09	1.98	0.0050	0.0200		0.25	10.3
229+50	227+50	200	varies	0.28	0.94	5	6.7	1.76	0.18	1.94	0.0055	0.0200		0.24	10.0
227+50	225+00	250	varies	0.35	0.94	5	6.7	2.20	0.18	2.38	0.0126	0.0200		0.23	9.2
225+00	224+00	100	varies	0.14	0.94	5	6.7	0.88	2.38	3.26	0.0135	0.0200		0.25	10.3
224+00	221+00	300	varies	0.40	0.94	5	6.7	2.52	0.38	2.90	0.0135	0.0200		0.24	9.8
221+00	218+50	250	varies	0.35	0.94	5	6.7	2.20	0.25	2.45	0.0120	0.0200		0.23	9.4
218+50	217+80	70	varies	0.13	0.94	5	6.7	0.82	5.49	6.31	---	0.0100			
218+10	217+98	15	varies	0.01	0.94	5	6.7	0.06	5.40	5.46	---	0.0127			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-A4	232+00	Type 3, 4' Wing	0.24	1.62	0.09
CB-A7	229+50	Type 3, 4' Wing	0.25	1.80	0.18
CB-A9	227+50	Type 3, 4' Wing	0.24	1.76	0.18
CB-B1	224+00	Type 3, 8' Wing	0.25	2.88	0.38
CB-C2	221+00	Type 3, 8' Wing	0.24	2.65	0.25
CB-C4	218+60	Type 3, 8' Wing	0.23	2.36	0.09
	217+80(49+00W)	12' Depressed Curb	0.50	6.31	0.00
	217+95 (49+00E)	11' Depressed Curb	0.48	5.46	0.00

Computed by: SP Checked by: _____ Date: 10/24/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 234+22 TO 232+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.710
T	Width of Spread (ft)		9.68

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.512
d	Depth at Curb (ft)		0.24
V	Average Velocity	(ft/sec)	1.74

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 232+00 TO 229+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.980
T	Width of Spread (ft)	10.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.487
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.80

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 229+50 TO 227+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0055
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.940
T	Width of Spread (ft)	9.99

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	1.86

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 227+50 TO 225+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0126
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.380
T	Width of Spread (ft)	9.18

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.535
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	2.69

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 225+00 TO 224+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0135
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.260
T	Width of Spread (ft)	10.27

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.486
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	2.97

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 224+00 TO 221+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0135
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.900
T	Width of Spread (ft)	9.80

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.506
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	2.89

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 221+00 TO 218+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0120
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.450
T	Width of Spread (ft)	9.38

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.526
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	2.65

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 232+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.710
T	Width of Spread (ft)	9.68

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.512
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	1.74

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	8.75
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.945
Qi	Intercepted Flow (cfs)	1.616
Qb	By-pass Flow (cfs)	0.094

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 229+50

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.980
T	Width of Spread (ft)	10.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.487
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.80

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.51
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.909
Qi	Intercepted Flow (cfs)	1.800
Qb	By-pass Flow (cfs)	0.180

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 227+50

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0055
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.940
T	Width of Spread (ft)	9.99

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	1.86

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.60
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.905
Qi	Intercepted Flow (cfs)	1.755
Qb	By-pass Flow (cfs)	0.185

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 224+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0135
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.260
T	Width of Spread (ft)	10.27

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.486
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	2.97

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	15.80
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.883
Qi	Intercepted Flow (cfs)	2.878
Qb	By-pass Flow (cfs)	0.382

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 221+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0135
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.900
T	Width of Spread (ft)	9.80

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.506
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	2.89

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	14.78
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.914
Qi	Intercepted Flow (cfs)	2.651
Qb	By-pass Flow (cfs)	0.249

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed A
STA 218+60

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0120
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.450
T	Width of Spread (ft)	9.38

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.526
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	2.65

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	13.08
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.963
Qi	Intercepted Flow (cfs)	2.361
Qb	By-pass Flow (cfs)	0.089

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: B

WATERSHED AREA (A): 2.30 acres

LENGTH OF WATERCOURSE (Lc): 1572. ft

LENGTH TO CENTER OF GRAVITY (Lca): 786. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

1572. 14.7

MEAN SLOPE (Sc): .0093 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	9.79	9.70	9.66	9.62	9.60	9.58
SOLUTION OF Tc (MINUTES):	6	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.148	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.771	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	8.74	12.37	14.52	17.28	19.80	22.28

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed B

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
234+22	232+75	147	85	0.29	0.94	5	6.7	1.83	0.09	1.92	0.0050	0.0200		0.25	10.1
232+75	231+25	150	84	0.29	0.94	5	6.7	1.83	0.16	1.99	0.0050	0.0200		0.25	10.3
231+25	229+75	150	varies	0.27	0.94	5	6.7	1.70	0.18	1.88	0.0050	0.0200		0.25	10.1
229+75	228+00	175	varies	0.29	0.94	5	6.7	1.83	0.15	1.98	0.0050	0.0200		0.25	10.3
228+00	226+50	150	67	0.23	0.94	5	6.7	1.45	0.15	1.60	0.0084	0.0200		0.21	8.5
226+50	225+00	150	64	0.22	0.94	5	6.7	1.39	1.60	2.99	0.0126	0.0200		0.25	10.1
225+00	221+00	400	varies	0.47	0.94	5	6.7	2.96	0.26	3.22	0.0135	0.0200		0.25	10.2
221+00	218+50	250	42	0.24	0.94	5	6.7	1.51	0.37	1.88	0.0120	0.0200		0.21	8.4

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-A3	232+75	Type 3, 4' Wing	0.25	1.76	0.16
CB-A5	231+25	Type 3, 4' Wing	0.25	1.81	0.18
CB-A6	229+75	Type 3, 4' Wing	0.25	1.73	0.15
CB-A8	228+00	Type 3, 4' Wing	0.25	1.80	0.18
CB-A10	225+00	Type 3, 8' Wing	0.25	2.73	0.26
CB-C1	221+00	Type 3, 8' Wing	0.25	2.85	0.37
CB-C3	218+60	Type 3, 8' Wing	0.21	1.88	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 234+22 TO 232+75

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.920
T	Width of Spread (ft)		10.14

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.492
d	Depth at Curb (ft)		0.25
V	Average Velocity	(ft/sec)	1.79

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 232+75 TO 231+25

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.990
T	Width of Spread (ft)		10.28

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.486
d	Depth at Curb (ft)		0.25
V	Average Velocity	(ft/sec)	1.81

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 231+25 TO 229+75

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.880
T	Width of Spread (ft)		10.05

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.496
d	Depth at Curb (ft)		0.25
V	Average Velocity	(ft/sec)	1.78

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 229+75 TO 228+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.980
T	Width of Spread (ft)	10.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.487
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.80

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 228+00 TO 226+50

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0084
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.600
T	Width of Spread (ft)		8.48

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.571
d	Depth at Curb (ft)		0.21
V	Average Velocity	(ft/sec)	2.10

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 226+50 TO 225+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0126
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.990
T	Width of Spread (ft)	10.06

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.495
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	2.83

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 225+00 TO 221+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0135
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.220
T	Width of Spread (ft)	10.22

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.489
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	2.96

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 221+00 TO 218+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0120
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.880
T	Width of Spread (ft)	8.42

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.574
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	2.50

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 232+75

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.920
T	Width of Spread (ft)	10.14

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.492
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.79

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.35
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.917
Qi	Intercepted Flow (cfs)	1.761
Qb	By-pass Flow (cfs)	0.159

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 231+25

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.990
T	Width of Spread (ft)	10.28

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.486
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.81

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.54
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.908
Qi	Intercepted Flow (cfs)	1.806
Qb	By-pass Flow (cfs)	0.184

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 229+75

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.880
T	Width of Spread (ft)	10.05

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.496
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.78

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.23
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.922
Qi	Intercepted Flow (cfs)	1.734
Qb	By-pass Flow (cfs)	0.146

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 228+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.980
T	Width of Spread (ft)	10.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.487
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.80

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.51
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.909
Qi	Intercepted Flow (cfs)	1.800
Qb	By-pass Flow (cfs)	0.180

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 225+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0126
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.990
T	Width of Spread (ft)	10.06

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.495
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	2.83

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	14.81
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.913
Qi	Intercepted Flow (cfs)	2.730
Qb	By-pass Flow (cfs)	0.260

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 221+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0135
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.220
T	Width of Spread (ft)	10.22

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.489
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	2.96

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	15.69
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.886
Qi	Intercepted Flow (cfs)	2.854
Qb	By-pass Flow (cfs)	0.366

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed B
STA 218+60

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0120
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.880
T	Width of Spread (ft)	8.42

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.574
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	2.50

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	11.25
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.999
Qi	Intercepted Flow (cfs)	1.878
Qb	By-pass Flow (cfs)	0.002

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: C

WATERSHED AREA (A): .39 acres

LENGTH OF WATERCOURSE (Lc): 275. ft

LENGTH TO CENTER OF GRAVITY (Lca): 138. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

275. 1.4

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	4.41	4.37	4.36	4.34	4.33	4.32
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.55	2.10	2.46	2.93	3.36	3.78

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA
Highway: Cortaro Farms Road
Location: Watershed C
Project No.: 99067-01

DESIGN DATA
Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
217+80	215+65	205	varies	0.22	0.94	5	6.7	1.39	0.00	1.39	0.0050	0.0200		0.22	8.9
215+65	215+05	60	varies	0.08	0.94	5	6.7	0.50	2.02	2.52	---	0.0050			
215+05	214+55	50	varies	0.09	0.94	5	6.7	0.57	2.00	2.57	---	0.0150			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-C5	215+65	Type 3, 4' Wing	0.22	1.37	0.02
	215+25(49+05E)	5' Depressed Curb	0.48	2.52	0.00
	214+90(49+05W)	5' Depressed Curb	0.49	2.57	0.00

Computed by: SP Checked by: _____ Date: 10/24/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed C
STA 217+80 TO 215+65

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.390
T	Width of Spread (ft)		8.90

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.549
d	Depth at Curb (ft)		0.22
V	Average Velocity	(ft/sec)	1.66

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed C
STA 215+65

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.390
T	Width of Spread (ft)	8.90

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.549
d	Depth at Curb (ft)	0.22
V	Average Velocity (ft/sec)	1.66

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	7.78
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.984
Qi	Intercepted Flow (cfs)	1.368
Qb	By-pass Flow (cfs)	0.022

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: D

WATERSHED AREA (A): .41 acres

LENGTH OF WATERCOURSE (Lc): 315. ft

LENGTH TO CENTER OF GRAVITY (Lca): 158. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

315. 1.6

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	4.79	4.74	4.72	4.71	4.70	4.69
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.63	2.21	2.59	3.08	3.53	3.97

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed D

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
217+40	215+00	240	58	0.32	0.94	5	6.7	2.01	0.00	2.01	0.0050	0.0200		0.25	10.3
215+00	214+25	75	varies	0.09	0.94	5	6.7	0.57	0.19	0.76	0.0050	0.0200		0.18	6.9

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-C6	215+05	Type 3, 4' Wing	0.25	1.82	0.19
CB-C7	214+28	Type 3, 4' Wing	0.18	0.76	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed D
STA 217+40 TO 215+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.010
T	Width of Spread (ft)	10.32

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.484
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.81

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed D
STA 215+00 TO 214+25

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.760
T	Width of Spread (ft)	6.92

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.666
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	1.45

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed D
STA 215+05

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.010
T	Width of Spread (ft)	10.32

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.484
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.81

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	9.59
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.905
Qi	Intercepted Flow (cfs)	1.819
Qb	By-pass Flow (cfs)	0.191

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed D
STA 214+28

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.760
T	Width of Spread (ft)	6.92

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.666
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	1.45

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	5.53
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	0.760
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: E

WATERSHED AREA (A): .22 acres

LENGTH OF WATERCOURSE (Lc): 165. ft

LENGTH TO CENTER OF GRAVITY (Lca): 83. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

165. 1.5

MEAN SLOPE (Sc): .0089 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	2.58	2.55	2.54	2.53	2.53	2.52
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	.88	1.18	1.39	1.65	1.89	2.13

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed E

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
214+55	212+90	165	varies	0.22	0.94	5	6.7	1.39	0.00	1.39	0.0089	0.0200		0.20	7.9

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
SC-1	213+00	9' Scupper	0.20	1.39	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed E
STA 214+55 TO 212+80

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0089
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.390
T	Width of Spread (ft)	7.90

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.603
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.08

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed E
STA 213+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0089
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.390
T	Width of Spread (ft)	7.90

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.603
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.08

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	8.86
L	Curb-Opening Length (ft)	9.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	1.390
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: E1

WATERSHED AREA (A): .09 acres

LENGTH OF WATERCOURSE (Lc): 35. ft

LENGTH TO CENTER OF GRAVITY (Lca): 18. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

35. .2

MEAN SLOPE (Sc): .0051 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	1.27	1.26	1.25	1.25	1.24	1.24
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	.36	.48	.57	.68	.77	.87

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed E1

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
212+35	211+90	45	varies	0.09	0.94	5	6.7	0.57	4.45	5.02	---	0.0200			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-C8	212+25(48+66)	Type 4 w/ 2 EF-1 Grates	0.36	5.02	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: F

WATERSHED AREA (A): .34 acres

LENGTH OF WATERCOURSE (Lc): 340. ft

LENGTH TO CENTER OF GRAVITY (Lca): 170. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

340. 5.1

MEAN SLOPE (Sc): .0150 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.23	3.20	3.19	3.18	3.17	3.16
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.35	1.83	2.15	2.56	2.93	3.29

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed F

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
213+20	209+80	340	43	0.34	0.94	5	6.7	2.14	0.00	2.14	0.0150	0.0200		0.21	8.5

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
SC-2	209+85	13' Scupper	0.21	2.14	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed F
STA 213+20 TO 209+80

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0150
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.140
T	Width of Spread (ft)		8.48

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.571
d	Depth at Curb (ft)		0.21
V	Average Velocity	(ft/sec)	2.80

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed F
STA 209+85

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.150
T	Width of Spread (ft)	8.50

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.570
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	2.81

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	12.77
L	Curb-Opening Length (ft)	13.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	2.150
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: G

WATERSHED AREA (A): 1.06 acres

LENGTH OF WATERCOURSE (Lc): 855. ft

LENGTH TO CENTER OF GRAVITY (Lca): 428. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

855. 12.8

MEAN SLOPE (Sc): .0150 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	5.62	5.57	5.54	5.52	5.51	5.50
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	4.22	5.70	6.69	7.97	9.12	10.27

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed G
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
211+90	208+00	390	varies	0.50	0.94	5	6.7	3.15	0.00	3.15	0.0150	0.0200		0.24	9.9
208+00	205+00	300	varies	0.33	0.94	5	6.7	2.08	0.38	2.46	0.0150	0.0200		0.22	9.0
205+00	203+35	165	60	0.23	0.94	5	6.7	1.45	0.14	1.59	0.0150	0.0200		0.19	7.5

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-D1	208+00	Type 3, 8' Wing	0.24	2.77	0.38
CB-D3	205+05	Type 3, 8' Wing	0.22	2.32	0.14
SC-3	203+40	11' Scupper	0.19	1.59	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed G
STA 211+90 TO 208+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.150
T	Width of Spread (ft)	9.92

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.501
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.06

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed G
STA 208+00 TO 205+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.460
T	Width of Spread (ft)	8.98

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.545
d	Depth at Curb (ft)	0.22
V	Average Velocity (ft/sec)	2.90

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed G
STA 205+00 TO 203+35

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.590
T	Width of Spread (ft)	7.50

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.628
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	2.62

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed G
STA 208+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.150
T	Width of Spread (ft)	9.92

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.501
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.06

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	15.87
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.881
Qi	Intercepted Flow (cfs)	2.774
Qb	By-pass Flow (cfs)	0.376

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed G
STA 205+05

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.460
T	Width of Spread (ft)	8.98

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.545
d	Depth at Curb (ft)	0.22
V	Average Velocity (ft/sec)	2.90

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	13.79
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.944
Qi	Intercepted Flow (cfs)	2.322
Qb	By-pass Flow (cfs)	0.138

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed G
STA 203+40

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.590
T	Width of Spread (ft)	7.50

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.628
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	2.62

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	10.76
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	1.590
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: H

WATERSHED AREA (A): .71 acres

LENGTH OF WATERCOURSE (Lc): 525. ft

LENGTH TO CENTER OF GRAVITY (Lca): 263. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

525. 7.9

MEAN SLOPE (Sc): .0150 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	4.19	4.15	4.14	4.12	4.11	4.10
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	2.83	3.82	4.48	5.34	6.11	6.88

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed H

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
208+65	205+50	315	varies	0.50	0.94	5	6.7	3.15	0.00	3.15	0.0150	0.0200		0.24	9.9
205+50	203+40	210	varies	0.21	0.94	5	6.7	1.32	0.38	1.70	0.0150	0.0200		0.20	7.7

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-D2	205+50	Type 3, 8' Wing	0.24	2.77	0.38
CB-D4	203+42	Type 3, 8' Wing	0.20	1.70	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed H
STA 208+65 TO 205+50

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0150
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		3.150
T	Width of Spread (ft)		9.92

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.501
d	Depth at Curb (ft)		0.24
V	Average Velocity	(ft/sec)	3.06

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed H
STA 205+50 TO 203+40

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.700
T	Width of Spread (ft)	7.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.615
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.66

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed H
STA 205+50

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.150
T	Width of Spread (ft)	9.92

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.501
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.06

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	15.87
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.881
Qi	Intercepted Flow (cfs)	2.774
Qb	By-pass Flow (cfs)	0.376

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed H
STA 203+42

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0150
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.700
T	Width of Spread (ft)	7.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.615
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.66

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	11.18
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.999
Qi	Intercepted Flow (cfs)	1.699
Qb	By-pass Flow (cfs)	0.001

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: I

WATERSHED AREA (A): 1.37 acres

LENGTH OF WATERCOURSE (Lc): 1160. ft

LENGTH TO CENTER OF GRAVITY (Lca): 580. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

1160. 9.7

MEAN SLOPE (Sc): .0084 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	8.51	8.44	8.40	8.37	8.35	8.33
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	5.46	7.37	8.65	10.30	11.79	13.27

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed I

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
203+35	200+50	285	varies	0.33	0.94	5	6.7	2.08	0.00	2.08	0.0079	0.0200		0.23	9.6
200+50	198+00	250	varies	0.26	0.94	5	6.7	1.64	0.32	1.96	0.0050	0.0200		0.25	10.2
198+00	195+50	250	51	0.29	0.94	5	6.7	1.83	0.17	2.00	0.0050	0.0200		0.25	10.3
195+50	194+00	150	51	0.18	0.94	5	6.7	1.13	0.19	1.32	0.0099	0.0200		0.20	7.6
194+00	191+75	225	varies	0.31	0.94	5	6.7	1.95	1.32	3.27	0.0155	0.0200		0.24	10.0

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-E1	200+50	Type 3, 4' Wing	0.23	1.76	0.32
CB-E3	198+00	Type 3, 4' Wing	0.25	1.79	0.17
CB-F1	195+50	Type 3, 4' Wing	0.25	1.81	0.19
CB-F2	191+77	Type 3, 8' Wing	0.24	2.83	0.44

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVillie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 203+35 TO 200+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0079
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.080
T	Width of Spread (ft)	9.55

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.518
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	2.18

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 200+50 TO 198+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.960
T	Width of Spread (ft)	10.22

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.489
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.80

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 198+00 TO 195+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.000
T	Width of Spread (ft)	10.30

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.485
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.81

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 195+50 TO 194+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0099
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.320
T	Width of Spread (ft)	7.57

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.624
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.14

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 194+00 TO 191+75

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.270
T	Width of Spread (ft)	10.00

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.13

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 200+50

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0079
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.080
T	Width of Spread (ft)	9.55

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.518
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	2.18

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	10.84
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.845
Qi	Intercepted Flow (cfs)	1.758
Qb	By-pass Flow (cfs)	0.322

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 198+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.960
T	Width of Spread (ft)	10.22

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.489
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.80

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.46
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.912
Qi	Intercepted Flow (cfs)	1.787
Qb	By-pass Flow (cfs)	0.173

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 195+50

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.000
T	Width of Spread (ft)	10.30

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.485
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.81

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.56
L	Curb-Opening Length (ft)	7.00
e	Inlet Efficiency	0.906
Qi	Intercepted Flow (cfs)	1.813
Qb	By-pass Flow (cfs)	0.187

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed I
STA 191+77

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.270
T	Width of Spread (ft)	10.00

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.13

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	16.33
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.867
Qi	Intercepted Flow (cfs)	2.834
Qb	By-pass Flow (cfs)	0.436

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: J

WATERSHED AREA (A): .62 acres

LENGTH OF WATERCOURSE (Lc): 460. ft

LENGTH TO CENTER OF GRAVITY (Lca): 230. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

460. 2.6

MEAN SLOPE (Sc): .0057 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	5.72	5.67	5.65	5.63	5.61	5.60
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	2.47	3.34	3.92	4.66	5.34	6.00

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed J
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
202+30	200+00	230	varies	0.32	0.94	5	6.7	2.02	0.00	2.02	0.0063	0.0200		0.24	9.9
200+00	197+70	230	varies	0.30	0.94	5	6.7	1.89	0.00	1.89	0.0050	0.0200		0.25	10.1

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-E2	200+00	Type 3, 8' Wing	0.22	2.02	0.00
CB-E4	197+70	Type 3, 8' Wing	0.25	1.89	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed J
STA 202+30 TO 200+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0063
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.020
T	Width of Spread (ft)	9.88

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.503
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	1.98

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed J
STA 200+00 TO 197+60

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.890
T	Width of Spread (ft)		10.07

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.495
d	Depth at Curb (ft)		0.25
V	Average Velocity	(ft/sec)	1.79

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed J
STA 200+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0063
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.020
T	Width of Spread (ft)	9.88

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.503
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	1.98

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	10.13
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	2.020
Qb	By-pass Flow (cfs)	0.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed J
STA 197+70

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.890
T	Width of Spread (ft)	10.07

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.495
d	Depth at Curb (ft)	0.25
V	Average Velocity (ft/sec)	1.79

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	9.26
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	1.890
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: K

WATERSHED AREA (A): 8.03 acres

LENGTH OF WATERCOURSE (Lc): 5960. ft

LENGTH TO CENTER OF GRAVITY (Lca): 2980. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

5960. 149.9

MEAN SLOPE (Sc): .0252 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	14.64	14.51	14.45	14.40	14.36	14.33
SOLUTION OF Tc (MINUTES):	9	8	7	7	6	6
RAINFL INT. @ Tc (IN/HR):	3.549	4.931	6.037	7.117	8.537	9.558
RUNOFF RATE @ Tc (IN/HR):	3.226	4.586	5.671	6.749	8.147	9.167
PEAK DISCHARGE (CFS) :	26.	37.	46.	55.	66.	74.

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed K

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
196+50	195+00	150	51	0.18	0.94	5	6.7	1.13	0.00	1.13	0.0064	0.0360		0.21	5.6
195+00	193+00	200	varies	0.25	0.94	5	6.7	1.57	1.13	2.70	0.0136	0.0360		0.26	6.8
193+00	190+00	300	60	0.41	0.94	5	6.7	2.58	2.70	5.28	0.0155	0.0360		0.32	8.5
190+00	187+00	300	60	0.41	0.94	5	6.7	2.58	5.28	7.86	0.0155	0.0360		0.37	9.9
187+00	185+00	200	60	0.28	0.94	5	6.7	1.76	1.13	2.89	0.0155	0.0360		0.26	6.8
185+00	179+00	600	varies	0.69	0.94	5	6.7	4.35	2.89	7.24	0.0155	0.0360		0.36	9.6
179+00	175+00	400	varies	0.54	0.94	5	6.7	3.40	0.89	4.29	0.0230	0.0360		0.28	7.3
175+00	169+00	600	varies	0.70	0.94	5	6.7	4.41	4.29	8.70	0.0317	0.0360		0.34	9.0
169+00	166+00	300	varies	0.45	0.94	5	6.7	2.83	8.70	11.53	0.0317	0.0360		0.37	10.0
166+00	161+00	500	varies	0.63	0.94	5	6.7	3.97	2.50	6.47	0.0270	0.0360		0.31	8.3
161+00	157+00	400	varies	0.54	0.94	5	6.7	3.40	6.47	9.87	0.0260	0.0360		0.37	10.0
157+00	148+00	900	varies	1.41	0.94	5	6.7	8.88	1.47	10.35	0.0260	0.0360		0.37	10.0
148+00	139+00	900	varies	1.20	0.94	5	6.7	7.56	1.68	9.24	0.0360	0.0360		0.34	9.0
139+00	136+90	210	varies	0.34	0.94	5	6.7	2.14	1.60	3.74	0.0340	0.0200		0.22	9.0

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-G2	187+00	Type 3, 12' Wing	0.37	6.73	1.13
CB-H1	179+00	Type 3, 12' Wing	0.36	6.35	0.89
CB-K2	166+00	Type 3, 16' Wing	0.37	9.03	2.50
CB-L3	157+00	Type 3, 16' Wing	0.36	8.40	1.47
CB-M2	148+00	Type 3, 16' Wing	0.37	8.67	1.68
CB-N3	139+00	Type 3, 16' Wing	0.34	7.64	1.60
CB-N4	137+00	Type 3, 8' and 12' Wings	0.22	3.74	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 196+50 TO 195+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0064
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.130
T	Width of Spread (ft)	5.61

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.704
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	1.95

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 195+00 TO 193+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0135
SX	Pavement Cross Slope	(ft/ft)	0.0360
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.700
T	Width of Spread (ft)		6.78

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.618
d	Depth at Curb (ft)		0.26
V	Average Velocity	(ft/sec)	3.21

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 193+00 TO 190+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0155
SX	Pavement Cross Slope	(ft/ft)	0.0360
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		5.280
T	Width of Spread (ft)		8.53

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.519
d	Depth at Curb (ft)		0.32
V	Average Velocity	(ft/sec)	4.00

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 190+00 TO 187+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	7.860
T	Width of Spread (ft)	9.91

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.460
d	Depth at Curb (ft)	0.37
V	Average Velocity (ft/sec)	4.41

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 187+00 TO 185+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.890
T	Width of Spread (ft)	6.78

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.618
d	Depth at Curb (ft)	0.26
V	Average Velocity (ft/sec)	3.44

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 185+00 TO 179+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0155
SX	Pavement Cross Slope	(ft/ft)	0.0360
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		7.240
T	Width of Spread (ft)		9.61

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.471
d	Depth at Curb (ft)		0.36
V	Average Velocity	(ft/sec)	4.32

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 179+00 TO 175+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0230
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.290
T	Width of Spread (ft)	7.31

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.585
d	Depth at Curb (ft)	0.28
V	Average Velocity (ft/sec)	4.40

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 175+00 TO 169+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0317
SX	Pavement Cross Slope	(ft/ft)	0.0360
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		8.700
T	Width of Spread (ft)		9.00

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.497
d	Depth at Curb (ft)		0.34
V	Average Velocity	(ft/sec)	5.92

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 169+00 TO 166+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0317
SX	Pavement Cross Slope	(ft/ft)	0.0360
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		11.530
T	Width of Spread (ft)		10.01

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.456
d	Depth at Curb (ft)		0.37
V	Average Velocity	(ft/sec)	6.35

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 166+00 TO 161+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0270
SX	Pavement Cross Slope	(ft/ft)	0.0360
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		6.470
T	Width of Spread (ft)		8.29

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.531
d	Depth at Curb (ft)		0.31
V	Average Velocity	(ft/sec)	5.18

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 161+00 TO 157+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	9.870
T	Width of Spread (ft)	9.80

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.464
d	Depth at Curb (ft)	0.36
V	Average Velocity (ft/sec)	5.67

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 157+00 TO 148+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	10.350
T	Width of Spread (ft)	9.98

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.457
d	Depth at Curb (ft)	0.37
V	Average Velocity (ft/sec)	5.74

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 148+00 TO 139+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0360
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	9.240
T	Width of Spread (ft)	8.98

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.34
V	Average Velocity (ft/sec)	6.31

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 139+00 TO 136+90

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0340
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		3.740
T	Width of Spread (ft)		9.01

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.543
d	Depth at Curb (ft)		0.22
V	Average Velocity	(ft/sec)	4.37

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 187+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	7.860
T	Width of Spread (ft)	9.91

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.460
d	Depth at Curb (ft)	0.37
V	Average Velocity (ft/sec)	4.41

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	22.74
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.856
Qi	Intercepted Flow (cfs)	6.730
Qb	By-pass Flow (cfs)	1.130

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 179+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	7.240
T	Width of Spread (ft)	9.61

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.471
d	Depth at Curb (ft)	0.36
V	Average Velocity (ft/sec)	4.32

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	21.79
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.877
Qi	Intercepted Flow (cfs)	6.353
Qb	By-pass Flow (cfs)	0.887

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 166+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0317
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	11.530
T	Width of Spread (ft)	10.01

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.456
d	Depth at Curb (ft)	0.37
V	Average Velocity (ft/sec)	6.35

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	33.19
L	Curb-Opening Length (ft)	19.00
e	Inlet Efficiency	0.783
Qi	Intercepted Flow (cfs)	9.032
Qb	By-pass Flow (cfs)	2.498

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 157+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	9.870
T	Width of Spread (ft)	9.80

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.464
d	Depth at Curb (ft)	0.36
V	Average Velocity (ft/sec)	5.67

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	29.13
L	Curb-Opening Length (ft)	19.00
e	Inlet Efficiency	0.851
Qi	Intercepted Flow (cfs)	8.395
Qb	By-pass Flow (cfs)	1.475

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 148+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	10.350
T	Width of Spread (ft)	9.98

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.457
d	Depth at Curb (ft)	0.37
V	Average Velocity (ft/sec)	5.74

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	29.86
L	Curb-Opening Length (ft)	19.00
e	Inlet Efficiency	0.838
Qi	Intercepted Flow (cfs)	8.674
Qb	By-pass Flow (cfs)	1.676

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 139+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0360
SX	Pavement Cross Slope (ft/ft)	0.0360
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	9.240
T	Width of Spread (ft)	8.98

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.34
V	Average Velocity (ft/sec)	6.31

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	30.53
L	Curb-Opening Length (ft)	19.00
e	Inlet Efficiency	0.827
Qi	Intercepted Flow (cfs)	7.638
Qb	By-pass Flow (cfs)	1.602

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed K
STA 137+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0340
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.740
T	Width of Spread (ft)	9.01

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.543
d	Depth at Curb (ft)	0.22
V	Average Velocity (ft/sec)	4.37

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	21.04
L	Curb-Opening Length (ft)	23.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	3.740
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: L

WATERSHED AREA (A): 1.28 acres

LENGTH OF WATERCOURSE (Lc): 905. ft

LENGTH TO CENTER OF GRAVITY (Lca): 453. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

905. 12.9

MEAN SLOPE (Sc): .0143 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

40. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %
60. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	5.93	5.88	5.85	5.83	5.82	5.81
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	5.10	6.89	8.08	9.62	11.02	12.40

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed L
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
190+65	187+00	365	60	0.50	0.94	5	6.7	3.15	0.00	3.15	0.0155	0.0200		0.24	9.9
187+00	185+00	200	varies	0.26	0.94	5	6.7	1.64	0.02	1.66	0.0155	0.0200		0.20	7.6
185+00	182+85	215	51.5	0.25	0.94	5	6.7	1.57	1.66	3.23	0.0155	0.0200		0.24	10.0
182+85	181+60	125	varies	0.27	0.94	5	6.7	1.70	0.42	2.12	---	0.0200			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-G1	187+00	Type 3, 12' Wing	0.24	3.13	0.02
CB-G3	182+85	Type 3, 8' Wing	0.24	2.81	0.42
SC-4	181+60 (48+75)	4' Scupper	0.50	2.12	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed L
STA 190+65 TO 187+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0155
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		3.150
T	Width of Spread (ft)		9.85

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.504
d	Depth at Curb (ft)		0.24
V	Average Velocity	(ft/sec)	3.10

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed L
STA 187+00 TO 185+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.660
T	Width of Spread (ft)	7.58

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.623
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.68

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/28/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed L
STA 185+00 TO 182+85

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.230
T	Width of Spread (ft)	9.95

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.500
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.12

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed L
STA 187+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.150
T	Width of Spread (ft)	9.85

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.504
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.10

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	15.99
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.993
Qi	Intercepted Flow (cfs)	3.129
Qb	By-pass Flow (cfs)	0.021

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/28/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed L
STA 182+85

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.230
T	Width of Spread (ft)	9.95

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.500
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	3.12

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	16.22
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.870
Qi	Intercepted Flow (cfs)	2.811
Qb	By-pass Flow (cfs)	0.419

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: M

WATERSHED AREA (A): .29 acres

LENGTH OF WATERCOURSE (Lc): 200. ft

LENGTH TO CENTER OF GRAVITY (Lca): 100. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

200. 3.1

MEAN SLOPE (Sc): .0155 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	2.32	2.30	2.29	2.28	2.27	2.27
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.16	1.56	1.83	2.18	2.50	2.81

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed M
STA 181+60 TO 179+60

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.830
T	Width of Spread (ft)	7.90

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.604
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.74

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed M
STA 179+60

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0155
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.830
T	Width of Spread (ft)	7.90

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.604
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	2.74

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	11.74
L	Curb-Opening Length (ft)	12.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	1.830
Qb	By-pass Flow (cfs)	0.000

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed M

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
181+60	179+60	200	varies	0.29	0.94	5	6.7	1.83	0.00	1.83	0.0155	0.0200		0.20	7.9

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
SC-5	179+60	12' Scupper	0.20	1.83	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: N

WATERSHED AREA (A): 1.03 acres

LENGTH OF WATERCOURSE (Lc): 725. ft

LENGTH TO CENTER OF GRAVITY (Lca): 363. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

725. 17.4

MEAN SLOPE (Sc): .0241 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % B, CN= 83, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	4.21	4.17	4.16	4.14	4.13	4.12
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	4.10	5.54	6.50	7.74	8.87	9.98

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed N

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
179+60	178+20	140	varies	0.31	0.94	5	6.7	1.95	0.00	1.95	0.0160	0.0200		0.21	8.1
178+20	176+00	220	42	0.21	0.94	5	6.7	1.32	1.95	3.27	0.0210	0.0200		0.23	9.4
176+00	172+35	365	varies	0.51	0.94	5	6.7	3.21	0.55	3.76	0.0290	0.0200		0.23	9.3

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-I1	176+00	Type 3, 8' Wing	0.23	2.72	0.55
CB-J1	172+37	Type 3, 8' and 12' Wings	0.23	3.76	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed N
STA 179+60 TO 178+20

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0160
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.950
T	Width of Spread (ft)	8.05

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.594
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	2.82

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed N
STA 178+20 TO 176+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0210
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.270
T	Width of Spread (ft)	9.41

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.524
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	3.52

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed N
STA 176+00 TO 172+35

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0290
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.760
T	Width of Spread (ft)	9.33

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.528
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	4.11

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed N
STA 176+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0210
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.270
T	Width of Spread (ft)	9.41

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.524
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	3.52

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	17.49
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.832
Qi	Intercepted Flow (cfs)	2.721
Qb	By-pass Flow (cfs)	0.549

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed N
STA 172+37

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0290
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.760
T	Width of Spread (ft)	9.33

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.528
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	4.11

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	20.36
L	Curb-Opening Length (ft)	23.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	3.760
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: O

WATERSHED AREA (A): 1.83 acres

LENGTH OF WATERCOURSE (Lc): 1205. ft

LENGTH TO CENTER OF GRAVITY (Lca): 603. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft	INCREMENTAL CHANGE IN ELEV (Hi) - ft
1205.	36.1

MEAN SLOPE (Sc): .0300 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	5.23	5.18	5.16	5.14	5.13	5.12
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	7.29	9.85	11.56	13.75	15.75	17.72

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed O

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
172+35	171+05	130	varies	0.37	0.94	5	6.7	2.33	0.00	2.33	0.0317	0.0200		0.19	7.5
171+05	168+00	305	42	0.29	0.94	5	6.7	1.83	2.33	4.16	0.0317	0.0200		0.23	9.5
168+00	165+00	300	varies	0.38	0.94	5	6.7	2.39	0.53	2.92	0.0317	0.0200		0.21	8.3
165+00	163+50	150	varies	0.21	0.94	5	6.7	1.32	2.92	4.24	0.0300	0.0200		0.24	9.7
163+50	160+30	320	varies	0.58	0.94	5	6.7	3.65	0.54	4.19	0.0260	0.0200		0.24	10.0

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-K1	168+00	Type 3, 12' Wing	0.23	3.63	0.53
CB-K3	163+50	Type 3, 12' Wing	0.24	3.70	0.54
CB-K4	160+45	Type 3, 8' and 12' Wings	0.24	4.19	0.00

Computed by: SP Checked by: _____ Date: 9/30/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 172+35 TO 171+05

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0317
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.330
T	Width of Spread (ft)		7.52

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.626
d	Depth at Curb (ft)		0.19
V	Average Velocity	(ft/sec)	3.82

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 171+05 TO 168+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0317
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.160
T	Width of Spread (ft)	9.54

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.518
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	4.36

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 168+00 TO 165+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0317
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.920
T	Width of Spread (ft)	8.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.583
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	4.02

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 165+00 TO 163+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0300
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.240
T	Width of Spread (ft)	9.72

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.510
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.28

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 163+50 TO 160+30

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.190
T	Width of Spread (ft)	9.96

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.499
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.04

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 168+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0317
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.160
T	Width of Spread (ft)	9.54

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.518
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	4.36

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	22.01
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.873
Qi	Intercepted Flow (cfs)	3.630
Qb	By-pass Flow (cfs)	0.530

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 163+50

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0300
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.240
T	Width of Spread (ft)	9.72

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.510
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.28

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	21.97
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.873
Qi	Intercepted Flow (cfs)	3.703
Qb	By-pass Flow (cfs)	0.537

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed O
STA 160+45

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.190
T	Width of Spread (ft)	9.96

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.499
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.04

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	21.13
L	Curb-Opening Length (ft)	23.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	4.190
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: P

WATERSHED AREA (A): 3.19 acres

LENGTH OF WATERCOURSE (Lc): 2110. ft

LENGTH TO CENTER OF GRAVITY (Lca): 1055. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

2110. 65.7

MEAN SLOPE (Sc): .0311 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	7.21	7.14	7.12	7.09	7.07	7.06
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	13.	17.	20.	24.	27.	31.

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed P

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
159+20	159+00	20	varies	0.30	0.94	5	6.7	1.89	0.00	1.89	0.0143	0.0124		0.19	10.8
160+30	158+05	225	varies	0.55	0.94	5	6.7	3.46	0.06	3.52	0.0260	0.0200		0.23	9.3
158+05	155+00	305	42	0.29	0.94	5	6.7	1.83	0.76	2.59	0.0260	0.0200		0.21	8.2
155+00	153+00	200	varies	0.24	0.94	5	6.7	1.51	2.59	4.10	0.0260	0.0200		0.24	9.9
153+00	148+00	500	varies	0.66	0.94	5	6.7	4.16	0.42	4.58	0.0310	0.0200		0.24	10.0
148+00	145+00	300	varies	0.42	0.94	5	6.7	2.65	0.70	3.35	0.0360	0.0200		0.21	8.5
145+00	143+00	200	varies	0.25	0.94	5	6.7	1.57	3.35	4.92	0.0360	0.0200		0.24	10.0
143+00	139+40	360	varies	0.48	0.94	5	6.7	3.02	0.94	3.96	0.0360	0.0200		0.23	9.1

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-L1	159+01	Type 3, 8' Wing	0.21	1.83	0.06
CB-L2	158+05	Type 3, 8' Wing	0.23	2.76	0.76
CB-L4	153+00	Type 3, 12' Wing	0.24	3.68	0.42
CB-M1	148+00	Type 3, 12' Wing	0.24	3.88	0.70
CB-N1	143+00	Type 3, 12' Wing	0.24	3.98	0.94
CB-N2	139+51	Type 3, 8' and 12' Wings	0.23	3.96	0.00

Computed by: SP Checked by: _____ Date: 10/22/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 159+20 TO 159+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0143
SX	Pavement Cross Slope (ft/ft)	0.0124
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.890
T	Width of Spread (ft)	10.81

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.514
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	2.41

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 160+30 TO 158+05

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.520
T	Width of Spread (ft)	9.28

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.530
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	3.89

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 158+05 TO 155+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.590
T	Width of Spread (ft)	8.19

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.586
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	3.62

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 155+00 TO 153+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.100
T	Width of Spread (ft)	9.87

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.503
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.02

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 153+00 TO 148+00

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0310
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		4.580
T	Width of Spread (ft)		9.96

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.499
d	Depth at Curb (ft)		0.24
V	Average Velocity	(ft/sec)	4.42

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 148+00 TO 145+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0360
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.350
T	Width of Spread (ft)	8.52

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.569
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	4.36

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 145+00 TO 143+00

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0360
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.920
T	Width of Spread (ft)	9.95

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.500
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.76

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 143+00 TO 139+40

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0360
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.960
T	Width of Spread (ft)	9.12

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.538
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	4.52

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 159+01

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0143
SX	Pavement Cross Slope (ft/ft)	0.0124
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.890
T	Width of Spread (ft)	10.81

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.514
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	2.41

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	12.88
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.969
Qi	Intercepted Flow (cfs)	1.831
Qb	By-pass Flow (cfs)	0.059

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 158+05

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.520
T	Width of Spread (ft)	9.28

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.530
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	3.89

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	19.14
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.785
Qi	Intercepted Flow (cfs)	2.765
Qb	By-pass Flow (cfs)	0.755

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 153+00

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0260
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.100
T	Width of Spread (ft)	9.87

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.503
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.02

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	20.87
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.898
Qi	Intercepted Flow (cfs)	3.682
Qb	By-pass Flow (cfs)	0.418

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 148+00

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0310
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.580
T	Width of Spread (ft)	9.96

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.499
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	4.42

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	23.13
L	Curb-Opening Length (ft)	15.00
e	Inlet Efficiency	0.848
Qi	Intercepted Flow (cfs)	3.883
Qb	By-pass Flow (cfs)	0.697

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed P
STA 139+51

Curb Opening Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0360
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.960
T	Width of Spread (ft)	9.12

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.538
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	4.52

Inlet Interception

		Curb-Opening
	Inlet Type	
LT	Length for 100% Inteception (ft)	22.02
L	Curb-Opening Length (ft)	23.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	3.960
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: Q

WATERSHED AREA (A): 1.22 acres

LENGTH OF WATERCOURSE (Lc): 600. ft

LENGTH TO CENTER OF GRAVITY (Lca): 300. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

600. 13.4

MEAN SLOPE (Sc): .0223 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.87	3.84	3.82	3.81	3.80	3.79
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	4.86	6.56	7.70	9.17	10.50	11.82

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed Q
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
139+40	136+00	340	varies	0.47	0.94	5	6.7	2.96	0.00	2.96	0.0280	0.0200		0.21	8.5
136+00	135+50	100	varies	0.08	0.94	5	6.7	0.50	2.96	3.46	0.0230	0.0200		0.23	9.5
135+50	134+25	125	varies	0.23	0.94	5	6.7	1.45	0.68	2.13	0.0090	0.0200		0.23	9.4
134+25	133+39	86	84	0.17	0.94	5	6.7	1.07	2.13	3.20	0.0040	0.0200		0.30	13.0
132+15	133+00	85	varies	0.20	0.94	5	6.7	1.26	0.00	1.26	0.0070	0.0200		0.20	8.0
133+00	133+39	39	84	0.08	0.94	5	6.7	0.50	1.26	1.76	---	0.0200			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-N5	135+50	Type 3, 8' Wing	0.23	2.78	0.68
	134+25	86' Slotted Drain	0.30	3.20	0.00
	to				
CB-N6	133+39	Type 5	0.34	1.76	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q
STA 139+40 TO 136+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0280
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.960
T	Width of Spread (ft)	8.52

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.568
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	3.84

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q
STA 136+00 TO 135+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0230
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.460
T	Width of Spread (ft)	9.45

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.522
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	3.69

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q
STA 135+50 TO 134+25

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0090
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.130
T	Width of Spread (ft)	9.39

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.525
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	2.30

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/17/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q
STA 134+25 TO 133+39

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0040
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		3.200
T	Width of Spread (ft)		12.96

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.396
d	Depth at Curb (ft)		0.30
V	Average Velocity	(ft/sec)	1.86

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q
STA 135+50

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0230
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.460
T	Width of Spread (ft)	9.45

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.522
d	Depth at Curb (ft)	0.23
V	Average Velocity (ft/sec)	3.69

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	18.43
L	Curb-Opening Length (ft)	11.00
e	Inlet Efficiency	0.805
Qi	Intercepted Flow (cfs)	2.785
Qb	By-pass Flow (cfs)	0.675

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/17/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q
STA 134+25 TO 133+39

Slotted Drain Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0040
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.200
T	Width of Spread (ft)	12.96

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.396
d	Depth at Curb (ft)	0.30
V	Average Velocity (ft/sec)	1.86

Inlet Interception

	Inlet Type	Slotted Drain
LT	Length for 100% Inteception (ft)	18.78
L	Slotted Drain Length (ft)	86.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	3.200
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: Q1

WATERSHED AREA (A): .19 acres

LENGTH OF WATERCOURSE (Lc): 185. ft

LENGTH TO CENTER OF GRAVITY (Lca): 93. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

185. .9

MEAN SLOPE (Sc): .0050 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.47	3.44	3.43	3.41	3.40	3.40
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	.76	1.02	1.20	1.43	1.64	1.84

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed Q1 (Hartman Lane)

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
47+00	48+85	185	44	0.19	0.94	5	6.7	1.20	0.00	1.20	0.0050	0.0100		0.19	12.7

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-X4	48+82	Type 5, 15' Slotted Drain	0.19	1.20	0.00

Computed by: SP Checked by: _____ Date: 10/23/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 10/23/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q1
STA 47+00 TO 48+85

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0100
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.200
T	Width of Spread (ft)	12.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.467
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	1.38

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: Q2

WATERSHED AREA (A): .32 acres

LENGTH OF WATERCOURSE (Lc): 300. ft

LENGTH TO CENTER OF GRAVITY (Lca): 150. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

300. 5.4

MEAN SLOPE (Sc): .0181 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	2.78	2.75	2.74	2.73	2.73	2.72
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.28	1.72	2.02	2.40	2.75	3.10

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed Q2 (Hartman Lane)

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
41+50	44+50	300	varies	0.32	0.94	5	6.7	2.02	0.00	2.02	0.0181	0.0150		0.15	10.1

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
SC-6	44+24	35' Scupper	0.15	2.02	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVillie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q2
STA 41+50 TO 44+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Uniform
S	Longitudinal Slope (ft/ft)	0.0181
SX	Pavement Cross Slope (ft/ft)	0.0150
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.020
T	Width of Spread (ft)	10.05

Gutter Flow

W	Gutter Width (ft)	0.00
SW	Gutter Cross Slope (ft/ft)	0.0150
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.000
d	Depth at Curb (ft)	0.15
V	Average Velocity (ft/sec)	2.67

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q2
STA 44+24

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Uniform
S	Longitudinal Slope (ft/ft)	0.0181
SX	Pavement Cross Slope (ft/ft)	0.0150
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.020
T	Width of Spread (ft)	10.05

Gutter Flow

W	Gutter Width (ft)	0.00
SW	Gutter Cross Slope (ft/ft)	0.0150
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.000
d	Depth at Curb (ft)	0.15
V	Average Velocity (ft/sec)	2.67

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	35.94
L	Curb-Opening Length (ft)	35.00
e	Inlet Efficiency	0.999
Qi	Intercepted Flow (cfs)	2.017
Qb	By-pass Flow (cfs)	0.003

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: Q3

WATERSHED AREA (A): .84 acres

LENGTH OF WATERCOURSE (Lc): 270. ft

LENGTH TO CENTER OF GRAVITY (Lca): 135. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

270. 3.3

MEAN SLOPE (Sc): .0121 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.06	3.04	3.02	3.01	3.00	3.00
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	3.35	4.52	5.30	6.31	7.23	8.14

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed Q3 (Hartman Lane)

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
45+35	46+45	110	varies	0.15	0.94	5	6.7	0.94	0.00	0.94	0.0181	0.0150		0.11	7.5
46+45	48+05	160	varies	0.22	0.94	5	6.7	1.39	1.94	3.33	0.0080	0.0150		0.22	11.0
130+07	131+00	93	55	0.12	0.94	5	6.7	0.76	0.00	0.76	0.0030	0.0200		0.20	7.7
48+05	50+00	195	varies	0.35	0.94	5	6.7	2.20	3.45	5.65	---	0.0050			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-N8	131+00	Type 5	0.20	0.64	0.12
CB-X3	48+73	Type 5, 68' Slotted Drain	0.14	5.65	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q3
STA 45+35 TO 46+45

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Uniform
S	Longitudinal Slope (ft/ft)	0.0181
SX	Pavement Cross Slope (ft/ft)	0.0150
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.940
T	Width of Spread (ft)	7.54

Gutter Flow

W	Gutter Width (ft)	0.00
SW	Gutter Cross Slope (ft/ft)	0.0150
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.000
d	Depth at Curb (ft)	0.11
V	Average Velocity (ft/sec)	2.20

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q3
STA 46+45 TO 48+05

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0080
SX	Pavement Cross Slope	(ft/ft)	0.0150
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.940
T	Width of Spread (ft)		11.00

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.485
d	Depth at Curb (ft)		0.22
V	Average Velocity	(ft/sec)	2.02

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q3
STA 130+07 TO 131+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0030
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.760
T	Width of Spread (ft)	7.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.615
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	1.19

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed Q3
STA 131+00

Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0030
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		0.760
T	Width of Spread (ft)		7.71

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.615
d	Depth at Curb (ft)		0.20
V	Average Velocity	(ft/sec)	1.19

Inlet Interception

			Reticuline
	Inlet Type		
L	Grate Length (ft)		3.33
WGR	Grate Width (ft)		1.97
e	Inlet Efficiency		0.849
Qi	Intercepted Flow	(cfs)	0.645
Qb	By-pass Flow	(cfs)	0.115

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: R

WATERSHED AREA (A): 1.10 acres

LENGTH OF WATERCOURSE (Lc): 350. ft

LENGTH TO CENTER OF GRAVITY (Lca): 175. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

350. 3.6

MEAN SLOPE (Sc): .0103 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.82	3.79	3.77	3.76	3.75	3.74
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	4.38	5.92	6.95	8.27	9.47	10.65

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed R

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
136+90	134+25	265	varies	0.43	0.94	5	6.7	2.71	0.00	2.71	0.0120	0.0200		0.24	9.8
134+25	133+39	86	varies	0.12	0.94	5	6.7	0.76	2.71	3.47	0.0040	0.0200		0.31	12.4
130+07	131+50	143	82	0.27	0.94	5	6.7	1.70	0.00	1.70	0.0050	0.0200		0.24	9.7
131+50	132+50	100	varies	0.16	0.94	5	6.7	1.01	1.70	2.71	0.0050	0.0200		0.28	11.6
132+50	133+39	89	varies	0.12	0.94	5	6.7	0.76	2.71	3.47	0.0040	0.0200		0.31	12.4

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
	134+25	86' Slotted Drain	0.31	3.47	0.00
	to				
	133+39				
	132+50	89' Slotted Drain	0.31	3.47	0.00
	to				
	133+39				
CB-N7	133+39	Type 5			

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 136+90 TO 134+25

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0120
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.710
T	Width of Spread (ft)	9.77

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.508
d	Depth at Curb (ft)	0.24
V	Average Velocity (ft/sec)	2.72

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/17/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 134+25 TO 133+39

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0040
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		3.470
T	Width of Spread (ft)		13.38

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.384
d	Depth at Curb (ft)		0.31
V	Average Velocity	(ft/sec)	1.89

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 130+07 TO 131+50

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.700
T	Width of Spread (ft)		9.65

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.513
d	Depth at Curb (ft)		0.24
V	Average Velocity	(ft/sec)	1.74

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 131+50 TO 132+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.710
T	Width of Spread (ft)	11.62

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.436
d	Depth at Curb (ft)	0.28
V	Average Velocity (ft/sec)	1.94

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/17/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 132+50 TO 133+39

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0040
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.470
T	Width of Spread (ft)	13.38

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.384
d	Depth at Curb (ft)	0.31
V	Average Velocity (ft/sec)	1.89

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/17/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 134+25 TO 133+39

Slotted Drain Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0040
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.470
T	Width of Spread (ft)	13.38

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.384
d	Depth at Curb (ft)	0.31
V	Average Velocity (ft/sec)	1.89

Inlet Interception

	Inlet Type	Slotted Drain
LT	Length for 100% Inteception (ft)	19.53
L	Slotted Drain Length (ft)	86.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	3.470
Qb	By-pass Flow (cfs)	0.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/17/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed R
STA 132+50 TO 133+39

Slotted Drain Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0040
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.470
T	Width of Spread (ft)	13.38

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.384
d	Depth at Curb (ft)	0.31
V	Average Velocity (ft/sec)	1.89

Inlet Interception

	Inlet Type	Slotted Drain
LT	Length for 100% Inteception (ft)	19.53
L	Slotted Drain Length (ft)	89.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	3.470
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: S

WATERSHED AREA (A): 1.91 acres

LENGTH OF WATERCOURSE (Lc): 820. ft

LENGTH TO CENTER OF GRAVITY (Lca): 410. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

820. 4.8

MEAN SLOPE (Sc): .0059 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	7.98	7.91	7.88	7.85	7.83	7.81
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	7.61	10.28	12.06	14.35	16.44	18.50

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed S

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
130+07	128+00	207	varies	0.19	0.94	5	6.7	1.20	0.00	1.20	0.0060	0.0200		0.21	8.1
128+00	122+75	525	varies	0.79	0.94	5	6.7	4.98	1.20	6.18	0.0060	0.0200		0.35	15.5
117+16	118+75	159	57	0.21	0.94	5	6.7	1.32	0.00	1.32	0.0050	0.0200		0.22	8.7
118+75	120+15	140	varies	0.29	0.94	5	6.7	1.83	4.25	6.08	0.0050	0.0200		0.36	15.9
120+15	122+75	260	72	0.43	0.94	5	6.7	2.71	1.36	4.07	---	0.0200			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)	
CB-O1	122+75	Type 5, 15' Slotted Drain	0.35	5.73	0.45	→ Carry over to sump @ 121+88
CB-S2	118+67	Type 5, 10' Slotted Drain	0.22	1.32	0.00	
CB-Q2	120+15	Type 5, 10' Slotted Drain	0.36	5.17	0.91	→ Carry over to sump @ 121+88
CB-P2	121+88	Type 5, 10' Slotted Drain	0.31	4.07	0.00	

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVillie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 130+07 TO 128+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0060
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.200
T	Width of Spread (ft)	8.07

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.593
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	1.73

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 128+00 TO 122+75

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0060
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	6.180
T	Width of Spread (ft)	15.47

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.336
d	Depth at Curb (ft)	0.35
V	Average Velocity (ft/sec)	2.54

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 117+16 TO 118+75

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.320
T	Width of Spread (ft)	8.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.558
d	Depth at Curb (ft)	0.22
V	Average Velocity (ft/sec)	1.64

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 118+75 TO 120+15

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	6.080
T	Width of Spread (ft)	15.93

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.327
d	Depth at Curb (ft)	0.36
V	Average Velocity (ft/sec)	2.36

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/16/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 122+75

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0060
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		6.180
T	Width of Spread (ft)		15.47

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.336
d	Depth at Curb (ft)		0.35
V	Average Velocity	(ft/sec)	2.54

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	28.76	15.00	0.73	4.541	1.639
Reticuline	1.97	3.33	0.73	1.191	0.448
Combination			0.93	5.732	0.448

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 05/01/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 118+67

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.320
T	Width of Spread (ft)		8.71

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.558
d	Depth at Curb (ft)		0.22
V	Average Velocity	(ft/sec)	1.64

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	12.90	10.00	0.93	1.230	0.090
Reticuline	1.97	3.33	1.00	0.090	0.000
Combination			1.00	1.320	0.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/16/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S
STA 120+15

Slotted Drain and Grate Inlet

Roadway and Discharge Data

	Cross Slope		Composite
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		6.080
T	Width of Spread (ft)		15.93

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.327
d	Depth at Curb (ft)		0.36
V	Average Velocity (ft/sec)		2.36

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	27.16	10.00	0.56	3.419	2.661
Reticuline	1.97	3.33	0.66	1.755	0.906
Combination			0.85	5.174	0.906

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed S1

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
(1/2 of Offsite C.P. 30)		---	---	---	---	---	---	4.25	0.00	4.25	0.0043	0.0200		0.29	14.5

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-R1	119+18 (48+93)	Type 3, 16' Wing	0.29	4.25	0.00

Computed by: SP Checked by: _____ Date: 9/30/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S1
STA 119+18 (48+93 on Cerius Stravenue)

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Uniform
S	Longitudinal Slope (ft/ft)	0.0043
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.250
T	Width of Spread (ft)	14.53

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0200
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.326
d	Depth at Curb (ft)	0.29
V	Average Velocity (ft/sec)	2.01

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	16.04
L	Curb-Opening Length (ft)	19.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	4.250
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: S2

WATERSHED AREA (A): .27 acres

LENGTH OF WATERCOURSE (Lc): 164. ft

LENGTH TO CENTER OF GRAVITY (Lca): 82. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

164. .7

MEAN SLOPE (Sc): .0040 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.53	3.50	3.48	3.47	3.46	3.45
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.08	1.45	1.71	2.03	2.32	2.62

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed S2
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
117+16	117+70	54	70	0.09	0.94	5	6.7	0.57	0.00	0.57	0.0020	0.0200		0.19	7.4
117+70	118+80	110	70	0.18	0.94	5	6.7	1.13	0.57	1.70	0.0050	0.0100		0.21	14.7

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-S1	118+77	Type 5	0.21	1.70	0.00
	to	with			
	117+70	110' Slotted Drain			

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVillie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S2
STA 117+16 TO 117+70

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0020
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.570
T	Width of Spread (ft)	7.44

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.631
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	0.95

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S2
STA 117+70 TO 118+80

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0100
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.700
T	Width of Spread (ft)		14.71

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.406
d	Depth at Curb (ft)		0.21
V	Average Velocity	(ft/sec)	1.48

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed S2
STA 117+70 TO 118+80

Slotted Drain Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0100
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.700
T	Width of Spread (ft)	14.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.406
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	1.48

Inlet Interception

	Inlet Type	Slotted Drain
LT	Length for 100% Inteception (ft)	17.59
L	Slotted Drain Length (ft)	110.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	1.700
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: T

WATERSHED AREA (A): 1.72 acres

LENGTH OF WATERCOURSE (Lc): 890. ft

LENGTH TO CENTER OF GRAVITY (Lca): 445. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

890. 5.2

MEAN SLOPE (Sc): .0058 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	8.39	8.31	8.28	8.25	8.23	8.21
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	6.85	9.25	10.86	12.93	14.81	16.66

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed T

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
130+78	128+50	228	81	0.42	0.94	5	6.7	2.65	0.00	2.65	0.0060	0.0200		0.27	11.1
128+50	126+50	200	varies	0.34	0.94	5	6.7	2.14	2.65	4.79	0.0060	0.0200		0.32	14.0
126+50	125+00	150	varies	0.23	0.94	5	6.7	1.45	4.79	6.24	0.0060	0.0200		0.35	15.5
125+00	122+75	225	varies	0.34	0.94	5	6.7	2.14	6.24	8.38	0.0060	0.0200		0.39	17.4
119+45	120+25	80	varies	0.07	0.94	5	6.7	0.44	0.00	0.44	0.0050	0.0030		0.13	16.9
120+25	122+75	250	varies	0.32	0.94	5	6.7	2.02	0.43	2.45	---	0.0175			

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-O2	122+75	Type 5, 20' Slotted Drain	0.39	7.95	0.43
CB-Q1	120+25	Type 5, 10' Slotted Drain	0.13	0.44	0.00
CB-P1	121+88	Type 5, 10' Slotted Drain	0.22	2.45	0.00

→ Carry over to sump @ 121+88

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 130+78 TO 128+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0060
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.650
T	Width of Spread (ft)	11.11

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.454
d	Depth at Curb (ft)	0.27
V	Average Velocity (ft/sec)	2.07

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 128+50 TO 126+50

Gutter Flow Parameters

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0060
SX	Pavement Cross Slope	(ft/ft)	0.0200
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		4.790
T	Width of Spread (ft)		14.02

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.368
d	Depth at Curb (ft)		0.32
V	Average Velocity	(ft/sec)	2.38

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/26/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 126+50 TO 125+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0060
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	6.240
T	Width of Spread (ft)	15.53

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.335
d	Depth at Curb (ft)	0.35
V	Average Velocity (ft/sec)	2.54

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 125+00 TO 122+75

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0060
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	8.380
T	Width of Spread (ft)	17.40

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.301
d	Depth at Curb (ft)	0.39
V	Average Velocity (ft/sec)	2.73

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/16/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 119+45 TO 120+25

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0030
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.440
T	Width of Spread (ft)	16.89

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.530
d	Depth at Curb (ft)	0.13
V	Average Velocity (ft/sec)	0.87

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 122+75

Curb Opening Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0060
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	8.380
T	Width of Spread (ft)	17.40

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	2.00
Eo	Gutter Flow Ratio	0.301
d	Depth at Curb (ft)	0.39
V	Average Velocity (ft/sec)	2.73

Inlet Interception

	Inlet Type	Curb-Opening
LT	Length for 100% Inteception (ft)	22.33
L	Curb-Opening Length (ft)	19.00
e	Inlet Efficiency	0.967
Qi	Intercepted Flow (cfs)	8.107
Qb	By-pass Flow (cfs)	0.273

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/16/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed T
STA 120+25

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0030
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		0.440
T	Width of Spread (ft)		16.89

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.530
d	Depth at Curb (ft)		0.13
V	Average Velocity	(ft/sec)	0.87

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	9.80	10.00	1.00	0.440	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	0.440	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: U

WATERSHED AREA (A): .31 acres

LENGTH OF WATERCOURSE (Lc): 237. ft

LENGTH TO CENTER OF GRAVITY (Lca): 119. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

237. 1.4

MEAN SLOPE (Sc): .0059 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	3.78	3.74	3.73	3.71	3.70	3.70
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.24	1.67	1.96	2.33	2.67	3.00

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed U

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
117+16	116+25	91	56	0.12	0.94	5	6.7	0.76	0.00	0.76	0.0030	0.0200		0.20	7.7
116+25	115+60	65	56	0.08	0.94	5	6.7	0.50	0.76	1.26	0.0080	0.0150		0.19	9.2
115+60	115+15	45	58	0.06	0.94	5	6.7	0.38	1.26	1.64	0.0080	0.0050		0.18	20.2
115+15	114+79	36	61	0.05	0.94	5	6.7	0.31	0.00	0.31					

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-T1	115+15	Type 5	0.18	1.64	0.00
	to	with			
	115+60	45' Slotted Drain			

Computed by: SP Checked by: _____ Date: 9/30/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed U
STA 117+16 TO 116+25

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0030
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.760
T	Width of Spread (ft)	7.71

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.615
d	Depth at Curb (ft)	0.20
V	Average Velocity (ft/sec)	1.19

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed U
STA 116+25 TO 115+60

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0150
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.260
T	Width of Spread (ft)	9.18

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.566
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	1.84

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed U
STA 115+60 TO 115+15

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0050
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.640
T	Width of Spread (ft)	20.21

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.359
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	1.50

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed U
STA 115+60 TO 115+15

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0080
SX	Pavement Cross Slope	(ft/ft)	0.0050
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		1.640
T	Width of Spread (ft)		20.21

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.359
d	Depth at Curb (ft)		0.18
V	Average Velocity	(ft/sec)	1.50

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	22.88	45.00	1.00	1.640	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	1.640	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: V

WATERSHED AREA (A): .46 acres

LENGTH OF WATERCOURSE (Lc): 293. ft

LENGTH TO CENTER OF GRAVITY (Lca): 147. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

293. 1.8

MEAN SLOPE (Sc): .0063 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	4.18	4.15	4.13	4.11	4.10	4.10
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	1.83	2.47	2.90	3.46	3.96	4.46

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road
Location: Watershed V
Project No.: 99067-01

DESIGN DATA

Frequency: 10 years
P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in
n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
117+16	116+15	101	70	0.16	0.94	5	6.7	1.01	0.00	1.01	0.0030	0.0200		0.22	8.7
116+15	115+60	55	70	0.09	0.94	5	6.7	0.57	1.01	1.58	0.0080	0.0150		0.21	10.1
115+60	114+70	90	varies	0.14	0.94	5	6.7	0.88	1.58	2.46	0.0080	0.0050		0.19	24.0
114+70	114+23	47	varies	0.07	0.94	5	6.7	0.44	0.00	0.44					

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-T2	114+70	Type 5	0.19	2.46	0.00
	to	with			
	115+60	90' Slotted Drain			

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVillie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed V
STA 117+16 TO 116+15

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0030
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.010
T	Width of Spread (ft)	8.67

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.561
d	Depth at Curb (ft)	0.22
V	Average Velocity (ft/sec)	1.27

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed V
STA 116+15 TO 115+60

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0150
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.580
T	Width of Spread (ft)	10.10

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.522
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	1.93

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed V
STA 115+60 TO 114+70

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0050
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.460
T	Width of Spread (ft)	23.95

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.297
d	Depth at Curb (ft)	0.19
V	Average Velocity (ft/sec)	1.63

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed V
STA 115+60 TO 114+70

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0080
SX	Pavement Cross Slope	(ft/ft)	0.0050
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.460
T	Width of Spread (ft)		23.95

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.297
d	Depth at Curb (ft)		0.19
V	Average Velocity	(ft/sec)	1.63

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	29.40	90.00	1.00	2.460	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	2.460	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: W

WATERSHED AREA (A): 1.19 acres

LENGTH OF WATERCOURSE (Lc): 647. ft

LENGTH TO CENTER OF GRAVITY (Lca): 324. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

647. 3.7

MEAN SLOPE (Sc): .0057 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	6.99	6.92	6.90	6.87	6.85	6.84
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	4.74	6.40	7.51	8.94	10.24	11.53

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed W

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
114+79	112+70	209	varies	0.34	0.94	5	6.7	2.14	0.31	2.45	0.0080	0.0087		0.21	16.9
112+70	112+00	70	varies	0.13	0.94	5	6.7	0.82	0.00	0.82	0.0080	0.0400		0.18	4.5
112+00	110+50	150	80	0.28	0.94	5	6.7	1.76	0.82	2.58	0.0050	0.0400		0.31	7.6
110+50	109+80	70	80	0.13	0.94	5	6.7	0.82	0.00	0.82	0.0080	0.0400		0.18	4.5
109+80	108+32	148	varies	0.31	0.94	5	6.7	1.95	0.82	2.77	0.0011	0.0320		0.40	11.8
107+50	108+32	82	75	0.14	0.94	5	6.7	0.88	0.98	1.86	0.0013	0.0320		0.34	9.8

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
CB-U1	112+70	Type 5, w/ 150' Slotted Drain	0.21	2.45	0.00
CB-V1	110+50	Type 5, w/ 150' Slotted Drain	0.18	2.58	0.00
CB-W2	108+32	Type 5, w/ 150' Slotted Drain	0.40	2.77	0.00
	108+21	11' Slotted Drain	0.34	1.86	0.00
	to				
	108+32				

Computed by: SP Checked by: _____ Date: 9/30/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 114+79 TO 112+70

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0087
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.450
T	Width of Spread (ft)	16.92

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.366
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	1.87

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 112+70 TO 112+00

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0400
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.820
T	Width of Spread (ft)	4.49

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.796
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	2.01

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 112+00 TO 110+50

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
SX	Pavement Cross Slope (ft/ft)	0.0400
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.580
T	Width of Spread (ft)	7.58

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.561
d	Depth at Curb (ft)	0.31
V	Average Velocity (ft/sec)	2.24

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 110+50 TO 109+80

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0400
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.820
T	Width of Spread (ft)	4.49

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.796
d	Depth at Curb (ft)	0.18
V	Average Velocity (ft/sec)	2.01

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 109+80 TO 108+32

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0011
SX	Pavement Cross Slope (ft/ft)	0.0320
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	2.770
T	Width of Spread (ft)	11.83

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.401
d	Depth at Curb (ft)	0.40
V	Average Velocity (ft/sec)	1.23

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 112+70

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0080
SX	Pavement Cross Slope	(ft/ft)	0.0087
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.450
T	Width of Spread (ft)		16.92

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.366
d	Depth at Curb (ft)		0.21
V	Average Velocity	(ft/sec)	1.87

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	25.02	150.00	1.00	2.450	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	2.450	0.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 110+50

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0050
SX	Pavement Cross Slope	(ft/ft)	0.0400
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.580
T	Width of Spread (ft)		7.58

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.561
d	Depth at Curb (ft)		0.31
V	Average Velocity	(ft/sec)	2.24

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	14.78	150.00	1.00	2.580	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	2.580	0.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 108+32

Slotted Drain and Grate Inlet

Roadway and Discharge Data

			Composite
	Cross Slope		
S	Longitudinal Slope	(ft/ft)	0.0011
SX	Pavement Cross Slope	(ft/ft)	0.0320
n	Manning's Coefficient		0.016
Q	Discharge (cfs)		2.770
T	Width of Spread (ft)		11.83

Gutter Flow

W	Gutter Width (ft)		2.00
SW	Gutter Cross Slope	(ft/ft)	0.0420
a	Gutter Depression	(inch)	0.00
Eo	Gutter Flow Ratio		0.401
d	Depth at Curb (ft)		0.40
V	Average Velocity	(ft/sec)	1.23

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	10.47	150.00	1.00	2.770	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	2.770	0.000

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 107+50 TO 108+32

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0013
SX	Pavement Cross Slope (ft/ft)	0.0320
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.860
T	Width of Spread (ft)	9.84

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.469
d	Depth at Curb (ft)	0.34
V	Average Velocity (ft/sec)	1.18

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 09/30/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed W
STA 108+21 TO 108+32

Slotted Drain Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0013
SX	Pavement Cross Slope (ft/ft)	0.0320
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.860
T	Width of Spread (ft)	9.84

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.469
d	Depth at Curb (ft)	0.34
V	Average Velocity (ft/sec)	1.18

Inlet Interception

	Inlet Type	Slotted Drain
LT	Length for 100% Inteception (ft)	9.21
L	Slotted Drain Length (ft)	11.00
e	Inlet Efficiency	1.000
Qi	Intercepted Flow (cfs)	1.860
Qb	By-pass Flow (cfs)	0.000

PROJECT NAME AND LOCATION: CORTARO FARMS ROAD

DRAINAGE CONCENTRATION POINT: X

WATERSHED AREA (A): .69 acres

LENGTH OF WATERCOURSE (Lc): 591. ft

LENGTH TO CENTER OF GRAVITY (Lca): 296. ft

INCREMENTAL CHANGE IN LENGTH (Li) - ft INCREMENTAL CHANGE IN ELEV (Hi) - ft

591. 4.7

MEAN SLOPE (Sc): .0080 ft BASIN FACTOR (Nb): .0180

WATERSHED TYPE(S): PAVEMENT

RAINFALL VALUES

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
P 1	1.25	1.65	1.92	2.26	2.57	2.88
P 2	1.38	1.84	2.14	2.53	2.88	3.23
P 3	1.47	1.96	2.29	2.71	3.09	3.47
P 6	1.64	2.20	2.57	3.05	3.48	3.91
P24	2.01	2.70	3.17	3.76	4.31	4.84

SOIL GROUPS

100. % C, CN= 88, COVER TYPE= DESERT BRUSH , COVER DENSITY= 20 %

IMPERVIOUS COVER= 100. %

RAINFALL/RUNOFF AND PEAK DISCHARGE DATA

	EVENT					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
RUNOFF SUPPLY RATE (q/i):	.909	.930	.939	.948	.954	.959
Tc (FUNCTION OF i) :	5.79	5.73	5.71	5.69	5.67	5.66
SOLUTION OF Tc (MINUTES):	5	5	5	5	5	5
RAINFL INT. @ Tc (IN/HR):	4.348	5.739	6.669	7.862	8.948	10.018
RUNOFF RATE @ Tc (IN/HR):	3.953	5.338	6.265	7.456	8.540	9.608
PEAK DISCHARGE (CFS) :	2.75	3.71	4.36	5.19	5.94	6.68

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed X (East of Sump)

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
114+23	113+75	48	varies	0.06	0.94	5	6.7	0.38	0.44	0.82	0.0080	0.0050		0.15	14.8
113+75	112+70	105	varies	0.12	0.94	5	6.7	0.76	0.82	1.58	0.0080	0.0170		0.21	9.4
112+70	110+50	220	varies	0.23	0.94	5	6.7	1.45	1.58	3.03	0.0080	0.0200		0.27	11.1
110+50	109+50	100	44	0.10	0.94	5	6.7	0.63	3.03	3.66	0.0080	0.0200		0.28	11.9
109+50	108+44	106	varies	0.10	0.94	5	6.7	0.63	3.66	4.29	0.0044	0.0200		0.33	14.3

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
	109+50	106' Slotted Drain			
	to	with			
CB-W1	108+44	Type 5	0.33	4.29	0.00

Computed by: SP Checked by: _____ Date: 4/29/2002

MMLA
McGovern MacVillie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed X (East of Sump)
STA 114+23 TO 113+75

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0050
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	0.820
T	Width of Spread (ft)	14.83

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.498
d	Depth at Curb (ft)	0.15
V	Average Velocity (ft/sec)	1.31

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed X (East of Sump)
STA 113+75 TO 112+70

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0170
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.580
T	Width of Spread (ft)	9.38

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.542
d	Depth at Curb (ft)	0.21
V	Average Velocity (ft/sec)	1.98

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed X (East of Sump)
STA 112+70 TO 110+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.030
T	Width of Spread (ft)	11.07

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.456
d	Depth at Curb (ft)	0.27
V	Average Velocity (ft/sec)	2.39

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed X (East of Sump)
STA 110+50 TO 109+50

Gutter Flow Parameters

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0080
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	3.660
T	Width of Spread (ft)	11.93

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.427
d	Depth at Curb (ft)	0.28
V	Average Velocity (ft/sec)	2.50

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/28/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed X (East of Sump)
STA 109+50 TO 108+44

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0044
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.290
T	Width of Spread (ft)	14.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.362
d	Depth at Curb (ft)	0.33
V	Average Velocity (ft/sec)	2.06

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 04/28/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description
Watershed X (East of Sump)
STA 109+50 TO 108+44

Slotted Drain and Grate Inlet

Roadway and Discharge Data

	Cross Slope	Composite
S	Longitudinal Slope (ft/ft)	0.0044
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	4.290
T	Width of Spread (ft)	14.26

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.362
d	Depth at Curb (ft)	0.33
V	Average Velocity (ft/sec)	2.06

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Slotted drain	22.20	106.00	1.00	4.290	0.000
Reticuline	1.97	3.33	0.00	0.000	0.000
Combination			1.00	4.290	0.000

PAVEMENT DRAINAGE WORKSHEET

LOCATION DATA

Highway: Cortaro Farms Road

Location: Watershed X (West of Sump)

Project No.: 99067-01

DESIGN DATA

Frequency: 10 years

P_6 = 2.57 in P_{24} = 3.17 P_1 = 1.92 in

n = 0.016

From Station	To Station	L (ft)	W (ft)	D.A. (ac)	C	T_c (min)	I in/hr	Q (cfs)	Q_c (cfs)	Q_T (cfs)	So (ft/ft)	Sx (ft/ft)	z/n	D (ft)	T (ft)
107+50	108+32	82	varies	0.08	0.94	5	6.7	0.50	1.13	1.63	0.0029	0.0200		0.26	10.6

INLET CALCULATIONS

Inlet ID	Station	Inlet Type	D (ft)	Q_i (cfs)	$Q_c = Q_T - Q_i$ (cfs)
SC-7	108+32	4' Scupper	0.42	1.63	0.00

Computed by: SP Checked by: _____ Date: 5/1/2002

MMLA
McGovern MacVittie Lodge & Associates, Inc.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 03/14/2002

Project No. :99067-01
Project Name.:CORTARO FARMS ROAD
Computed by :SP

Project Description

Watershed X (West of Sump)
STA 107+50 TO 108+32

Gutter Flow Parameters

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0029
SX	Pavement Cross Slope (ft/ft)	0.0200
n	Manning's Coefficient	0.016
Q	Discharge (cfs)	1.630
T	Width of Spread (ft)	10.59

Gutter Flow

W	Gutter Width (ft)	2.00
SW	Gutter Cross Slope (ft/ft)	0.0420
a	Gutter Depression (inch)	0.00
Eo	Gutter Flow Ratio	0.474
d	Depth at Curb (ft)	0.26
V	Average Velocity (ft/sec)	1.40

10-YEAR CARRYOVER DISCHARGE SUMMARY

CORTARO FARMS ROAD
Q10 CARRYOVER TO ADJACENT WATERSHEDS

	Destination Watershed											
Origin	A	B	C	E1	Q3	S	S1	W	X (E)	X (W)	16	31b
A												
B												
C												
D												
E												
E1												
F												
G												
H												
I											0.44	
J												
K												
L												
M												
N												
O												
P												
Q												
Q1												
Q2												2.02
Q3												
R												
S												
S1												
S2												
T												
U								0.31				
V									0.44			
W												
X (East)												
X (West)												
OS-1	0.26											
OS-2		0.09										
OS-3								0.98				
OS-4										1.13		
1												
2												
3												
4												
5												
6												
7			4.0									
8												
8a				4.45								
9												
10												
11												
12												
13												
14												
15												

SAG INLET CALCULATIONS

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Cortaro Farms Road
Project Number: 99067-01 Made by SP Date 10/24/02
Reference: P.C. Rdwy Des. Man. Checked By _____ Date _____

ROADWAY SAG INLET DESIGN

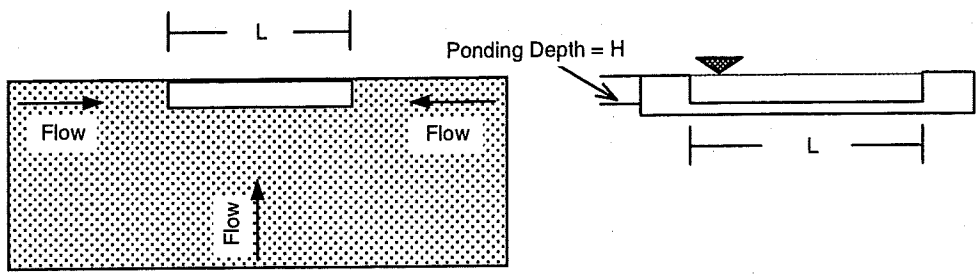
General Equation

Weir

$$Q = C_s L H^{3/2} (0.5)$$

where

L	=	Length of Opening (ft)
C_D	=	Weir Coefficient
H	=	Height of Opening (ft)
Q	=	100-year Peak Discharge (cfs)
0.5	=	Clogging Factor



Location	Q_{10} (cfs)	L_{min} (ft) @ H_{max} = 0.5'	Proposed Inlet	L_{actual} (ft)	H_{actual} (ft)	Q_{100}* (cfs)	H_{100} (ft)
Watershed A (217+80)	6.31	11.9	12' Depressed Curb	12	0.50	12	0.76
Watershed A (217+95)	5.46	10.3	11' Depressed Curb	11	0.48	12	0.81
Watershed C (215+25)	2.52	4.8	5' Depressed Curb	5	0.48	4	0.66
Watershed C (214+90)	2.57	4.8	5' Depressed Curb	5	0.49	4	0.66
Watershed E1 (212+25)	5.02	9.5	Type 4, 2 EF-1 Grates	15.2	0.36	7.65	0.48
Watershed L (181+60)	2.12	4.0	4' Scupper	4	0.50	3.23	0.66
Watershed Q (133+39)	1.76	3.3	Type 5	5.94	0.34	2.68	0.45
Watershed Q3 (49+00)	5.65	10.7	Type 5, 68' Slot. Drain	73.94	0.14	8.61	0.18
Watershed R (133+39)	3.15 [a]	5.9	Type 5	5.94	0.50	4.80	0.66
Watershed S (121+88)	4.07	7.7	Type 5, 10' Slot. Drain	15.94	0.31	6.20	0.41
Watershed S1 (119+20)	4.25	8.0	Type 3, 8' Wing	11	0.40	6.48	0.54
Watershed T (121+88)	2.45	4.6	Type 5, 10' Slot. Drain	15.94	0.22	3.73	0.29
Watershed X (108+32)	1.63	3.1	4' Scupper	4	0.42	2.48	0.56

[a] Interception Capacity (all calculated flows intercepted by adjacent slotted drains)

*** Determination of Q_{100} (except for Watershed A and C inlets - Q_{100} from existing Watersheds 5 and 7, respectively):**

D.A. = $Q_{10} / (C_{10} \times i_{10})$ with $C_{10} = 0.94$, $i_{10} = 6.7$ in/hr

D.A. = $Q_{10}/6.298$

For 100-year event, $C_{100} = 0.96$, $i_{100} = 10.0$ in/hr

$Q_{100} = 0.96 * 10.0$ in/hr * (Q_{10}/6.298)

OFF-ROADWAY INLET CALCULATIONS

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Cortaro Farms Road
Project Number : 99067-01 Made by SP Date 10/24/02
Reference: COT SMDDFM Checked By _____ Date _____

GRATE INLET DESIGN - CB X1 @ Hartman/ Red Rock Ridge (C.P. 31b)

General Equations

Weir

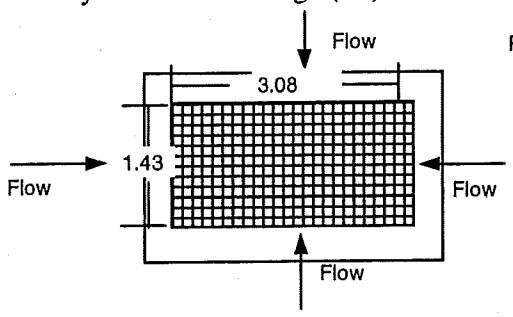
$$Q = C_s L H^{3/2}$$

where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)



For Pedestrian Safe Grates (Pima County Std. Detail 311)
Bar Spacing = 2 in
No. Bars = 8 laterals and 13 longitudinal
Effective Area = 4.66 ft^2/Grate
Effective Horizontal Opening = 3.08 f
Effective Vertical Opening = 1.43 f

Perimeter of 1 Grate = 3.08(2) + 1.43(2) = 9.0 feet

Solution

Weir
- Q = 8.52 cfs
- C_D = 3
- H = 0.6 ft
- **L = 6 ft**

One grate provides 9 feet of opening
To account for clogging use **1 grate**

Orifice
- Q = 8.52
- C_D = 5.35
- H = 0.6
- A = 2.0559

One grate provides 4.66 ft^2 of opening
To account for clogging use **1 grate**

Weir Controls - Use 1 Grate

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Cortaro Farms Road
Project Number: 99067-01 Made by SP Date 10/24/02
Reference: COT SMDDFM Checked By _____ Date _____

GRATE INLET DESIGN for CB X2 @ Hartman Lane (C.P. 31c)

General Equations

Weir

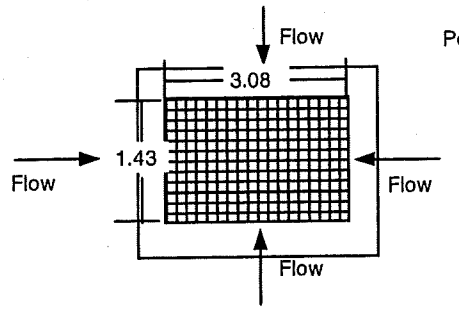
$$Q = C_s L H^{3/2}$$

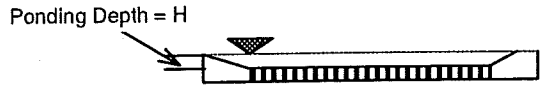
where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)





For Pedestrian Safe Grates (Pima County Std. Detail 311)
Bar Spacing = 2 in
No. Bars = 8 laterals and 13 longitudinal
Effective Area = 4.66 ft^2/Grate
Effective Horizontal Opening = 3.08 f
Effective Vertical Opening = 1.43 f

Perimeter of 1 Grate = 3.08(2) + 1.43(2) = 9.0 feet

Solution

Weir
- Q = 1.1 cfs
- C_D = 3
- H = 0.5 ft
- **L = 1 ft**

One grate provides 9 feet of opening
To account for clogging use **1 grate**

Orifice
- Q = 1.1
- C_D = 5.35
- H = 0.5
- **A** = 0.2908

One grate provides 4.66 ft of opening
To account for clogging use **1 grate**

Weir Controls - Use 1 Grate

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Cortaro Farms Road
Project Number: 99067-01 Made by SP Date 10/23/02
Reference: COT SMDDFM Checked By _____ Date _____

GRATE INLET DESIGN - CB X5 @ NE Corner Hartman / Cortaro Farms (C.P. 27)

General Equations

Weir

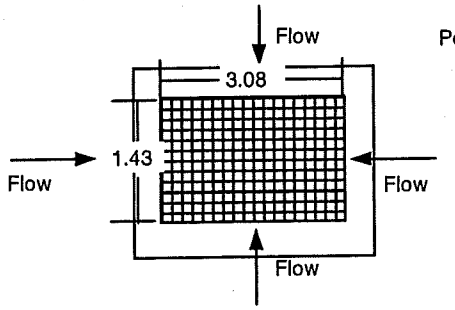
$$Q = C_s L H^{3/2}$$

where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)



For Pedestrian Safe Grates (Pima County Std. Detail 311)
Bar Spacing = 2 in
No. Bars = 8 laterals and 13 longitudinal
Effective Area = 4.66 ft^2/Grate
Effective Horizontal Opening = 3.08 f
Effective Vertical Opening = 1.43 f

Perimeter of 4 Grates = 3.08(8) + 1.43(2) = 27.5 feet

Solution

Weir
- Q = 117 cfs
- C_D = 3
- H = 1 ft
- **L = 39 ft**

Four grates provides 28 feet of opening
To account for clogging use **8 grates**

Orifice
- Q = 117
- C_D = 5.35
- H = 1
- A = 21.869

Four grates provides 18.64 ft^2 of opening
To account for clogging use **8 grates**

Weir Controls - Use 8 Grates

MMLA
McGovern MacVittie Lodge & Associates, Inc.

Project Name: Cortaro Farms Road
Project Number # : 99067-01 Made by SP Date 10/22/02
Reference: COT SMDDFM Checked By Date

Rating Curve Calculations - CB Y1 & Y2 @ Ex. Cortaro Ranch Drainage Channel

General Equations

Weir

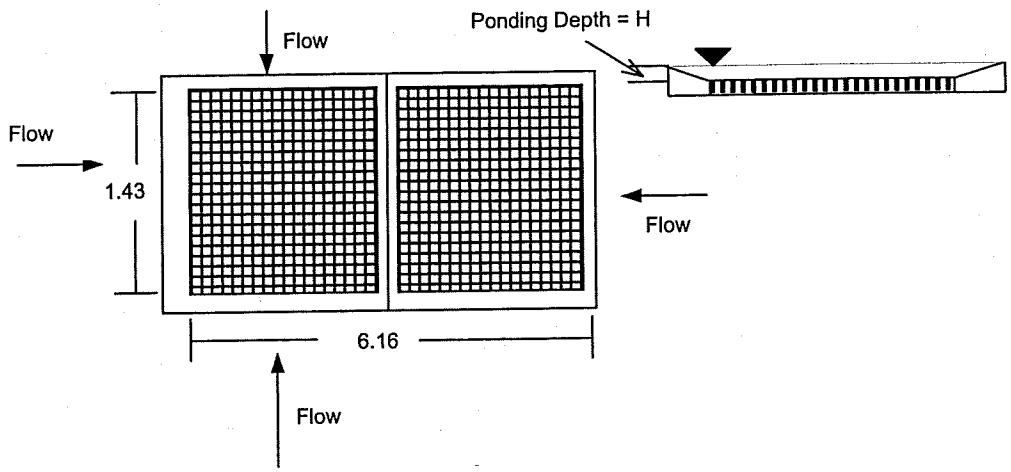
$$Q = C_s L H^{3/2}$$

where
- L = Length of Opening (ft)
- C_D = Weir Coefficient
- H = Height of Opening (ft)
- Q = 100-year Peak Discharge (cfs)

Orifice

$$Q = C_s A H^{1/2}$$

where
- A = Effective Area
- Cs = Orifice Coefficient
- H = Depth of ponding
- Q = 100-year Peak Discharge (cfs)



For PCDOT EF-1 Type Grates
Bar Spacing = 1.625 in
No. Bars = 13
Total Openings = 13

Effective Area = 9.32 ft^2/ Double Grate
Effective Length Opening = 6.16 ft
Effective Width Opening = 1.43 ft

To account for clogging, use 1 grate
Perimeter = 1.43(2) + 3.08(2) = **9.0** ft
Area = 1 (4.66) = **4.7** sq. ft

Solution

Depth (ft)	Perimeter (ft)	Area (ft^2)	C_{weir}	$C_{orifice}$	Q_{weir} (cfs)	$Q_{orifice}$ (cfs)	Q_{govern} (cfs)	
0	9.0	4.7	3	5.35	0.0	0.0	0	
0.25	9.0	4.7	3	5.35	3.4	12.5	3	
0.5	9.0	4.7	3	5.35	9.6	17.6	10	
0.75	9.0	4.7	3	5.35	17.6	21.6	18	
1	9.0	4.7	3	5.35	27.1	24.9	25	
1.25	9.0	4.7	3	5.35	37.8	27.9	28	
1.5	9.0	4.7	3	5.35	49.7	30.5	31	
1.75	9.0	4.7	3	5.35	62.6	33.0	33	Qmax = 36 cfs
2	9.0	4.7	3	5.35	76.5	35.3	35	←
2.25	9.0	4.7	3	5.35	91.3	37.4	37	

STORM DRAIN ANALYSIS

STARTING WATER SURFACE ELEVATION CALCULATIONS

STORM DRAIN ANALYSIS - STARTING WATER SURFACE ELEVATIONS

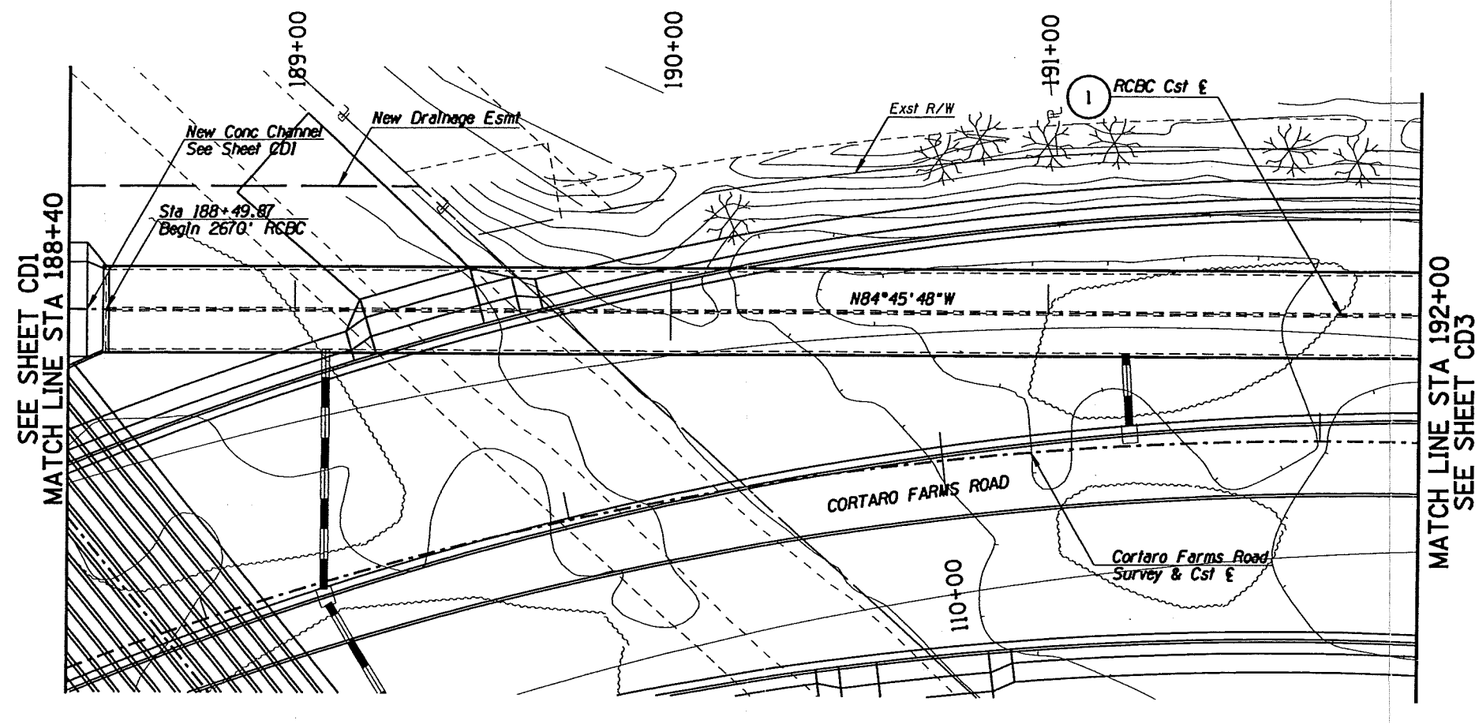
C.P.	CULVERT	Q10 (cfs)	10-YR HEADWATER ELEVATION	10-YR TAILWATER ELEVATION	STORM DRAIN OUTFALL	CRITICAL DEPTH AT OUTFALL	CONTROL HW	CONTROL TW	CONTROL CRIT. DEPTH
2	2 - 12' X 5' RCBC	256	2345.17	2342.77	A-North	2344.68	X		
					A-South	2343.69			X
3	2 - 36" RCP	35	2343.04	2339.83	B	2342.78	X		
8	8' X 4' RCBC	86	2333.59	2332.03	C-North	2332.08	X		
					C-North2	2332.00	X		
					C-South	2331.98		X	
11	2 - 36" RCP	63	2321.27	2318.58	D-North	2319.22	X		
					D-South	2317.56		X	
12	30" RCP	16	2315.65	2314.08	E1	2314.29	X		
					E2	2313.61		X	
					E4	2313.50		X	
13	48" RCP	16	2313.02	2311.09	E3	2312.90	X		
16	2 - 36" RCP	10	2306.17	2303.41	F	2306.23			X
18	3 - 8' X 4' RCBC	163	2290.56	2286.72	G	2290.30	X		
19	36" RCP	5	2290.84	2286.04	H	2287.00			X
20	36" RCP	8	2277.24	2275.20	I	2276.99	X		
21	36" RCP	13	2267.55	2258.12	J	2266.92	X		
24	2 - 10' X 5' RCBC	197	2236.20	2228.80	K	2235.33	X		
25	2 - 8' X 5' RCBC	218	2209.45	2207.05	L	2209.38	X		
26	36" RCP	9	2195.17	2190.46	M	2195.26			X

** All other storm drains discharge into 2670' 2- 10' x 4' RCBC (see attached sheets)**

HYDRAULIC GRADE CALCULATIONS

NOTE:

Matchline of plan view extends beyond matchline of profile view to show the location of the concrete channel



For working days before you dig CALL FOR THE BLUE STAKES 1-800-STAKE-IT BLUE STAKE CENTER CALL COLLECT

VIEW NAME: M:\99067-01\Sheets\Drainage\drn_ppch2.dgn
10/24/2002 09:13:29 AM

SCALES: HORIZ. 1"=20' VERT. 1"=4'

SHEET CD2 OF 23

SHEET 139 OF 381

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

		DATE
DESIGNED	KKH	7-02
DRAWN	ODL	7-02
CHECKED	BAB	9-02
PROJ. ENGR.	BAB	9-02

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
RCBC PLAN AND PROFILE
STA 188+50.00 - 192+00.00

PIMA COUNTY W.O. 4TCF17

800 East Ninth Street, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

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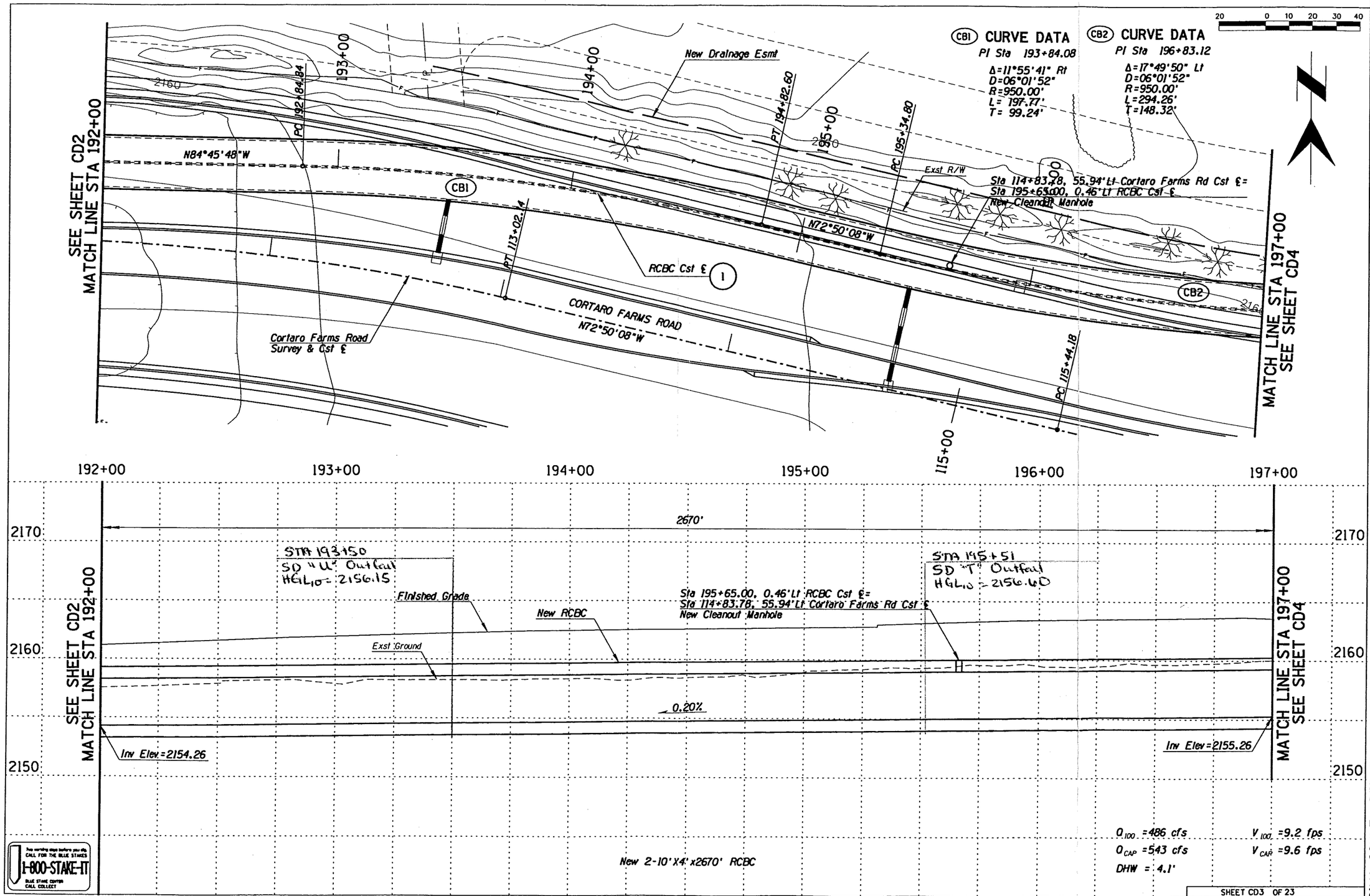

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10/24/2002 09:14:56 AM

SCALES	
HORIZ.	1"=20'
VERT.	1"=4'

SHEET CD3 OF 23

SHEET 140 OF 381

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

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Tucson, Arizona 85705
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ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
RCBC PLAN AND PROFILE
STA 192+00.00 - 197+00.00

KURT WEINRICH, P.E., DIRECTOR

		DATE
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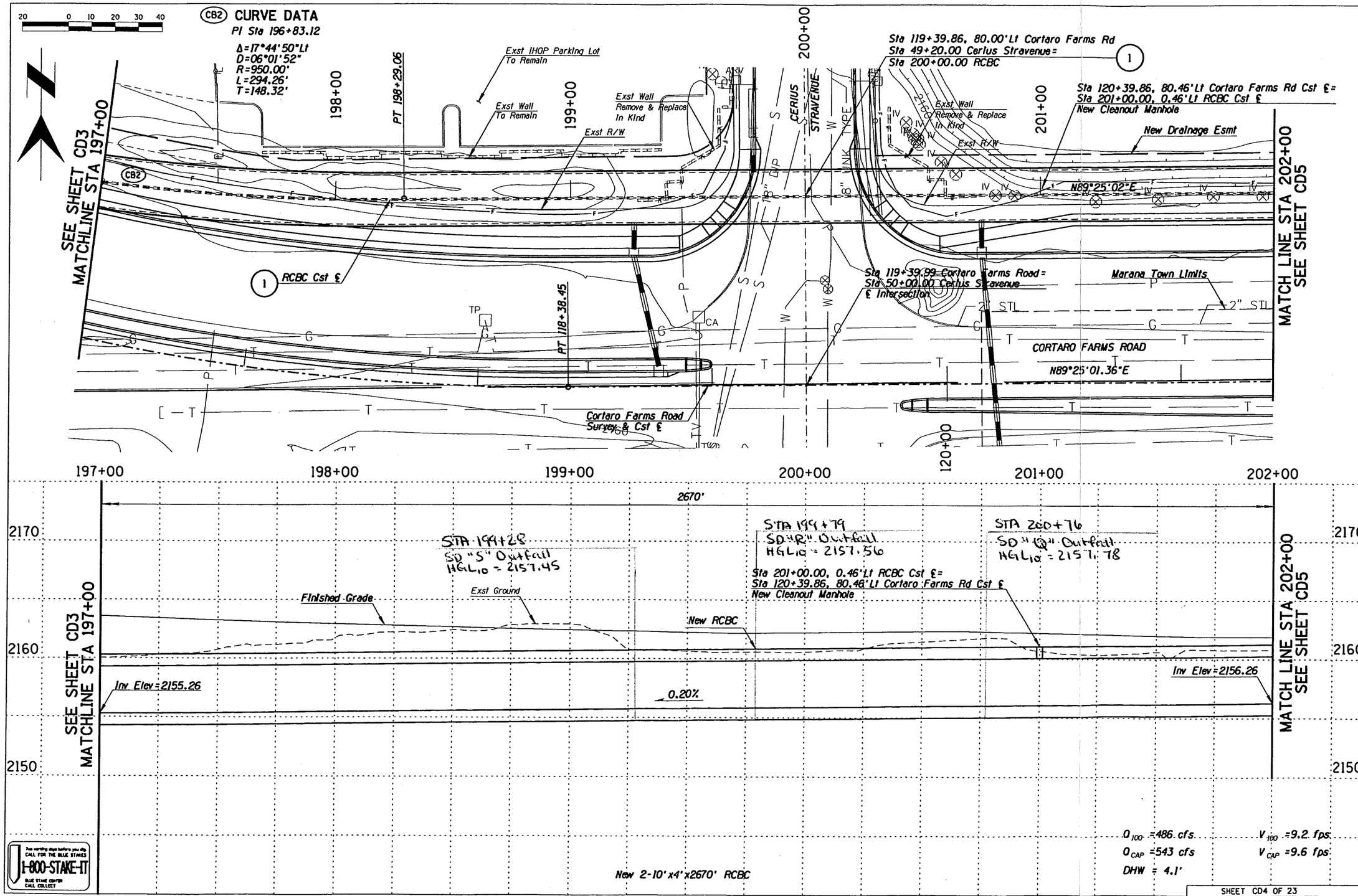

SCALES HORIZ. 1"=20' VERT. 1"=4'

SHEET CD4 OF 23

SHEET 141 OF 381

VIEW NAME: M:\99867-01\Sheets\Drainage\drn_ppch4.dgn
10/24/2002 8:11:31 AM

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

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ROADWAY IMPROVEMENT PLANS FOR CORTARO FARMS ROAD

RCBC PLAN AND PROFILE

STA 197+00.00 - 202+00.00

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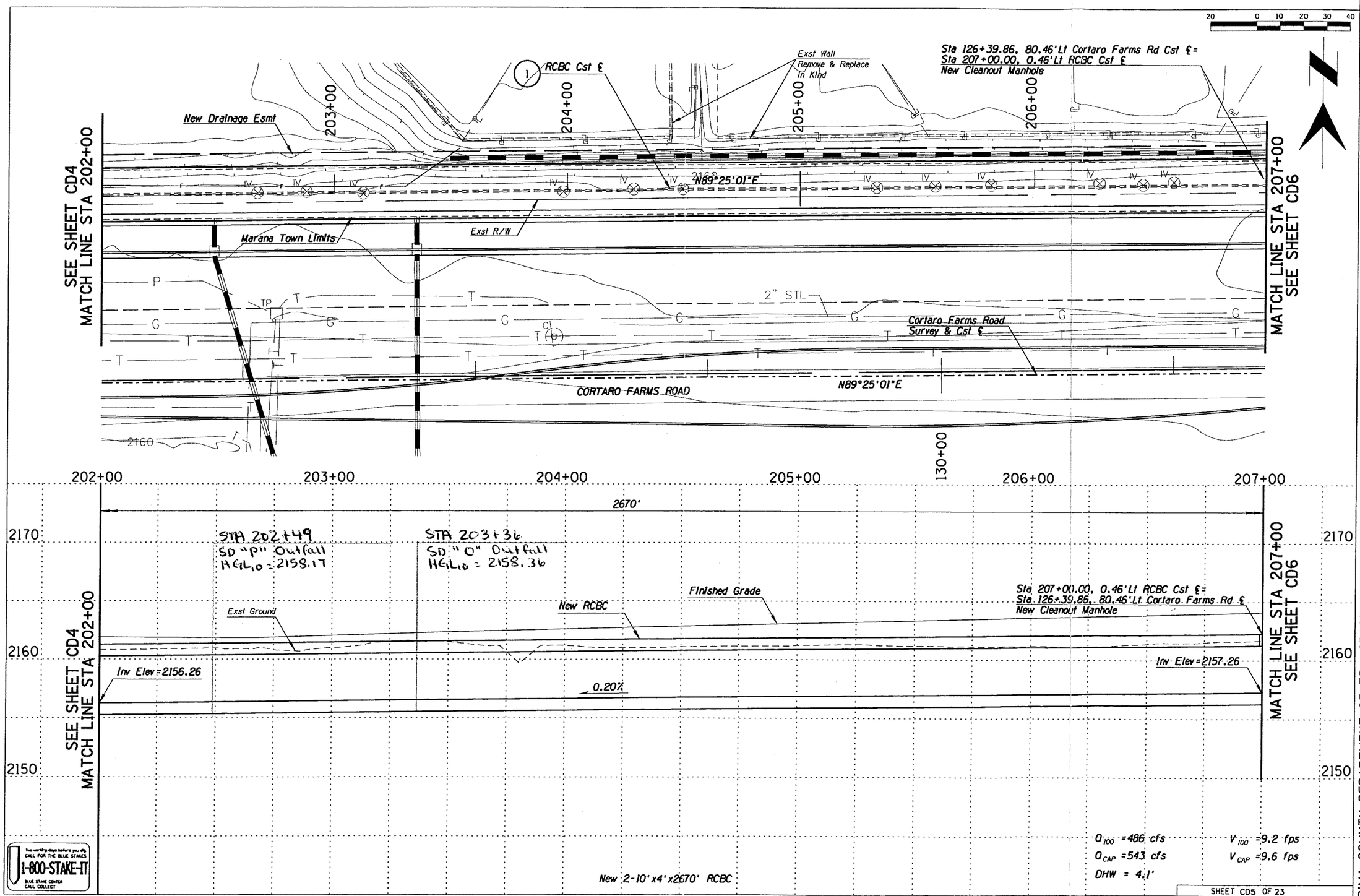

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10/24/2002 09:16:14 AM

SCALES	
HORIZ.	1"=20'
VERT.	1"=4'

SHEET CD5 OF 23

SHEET 142 OF 381

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

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PROJ. ENGR.	BAB	9-02

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
RCBC PLAN AND PROFILE
STA 202+00.00 - 207+00.00

PIMA COUNTY W.O. 4TCFIT

800 East Ninth Road, Suite 110
Tucson, Arizona 85719
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Fax (520) 292-1290

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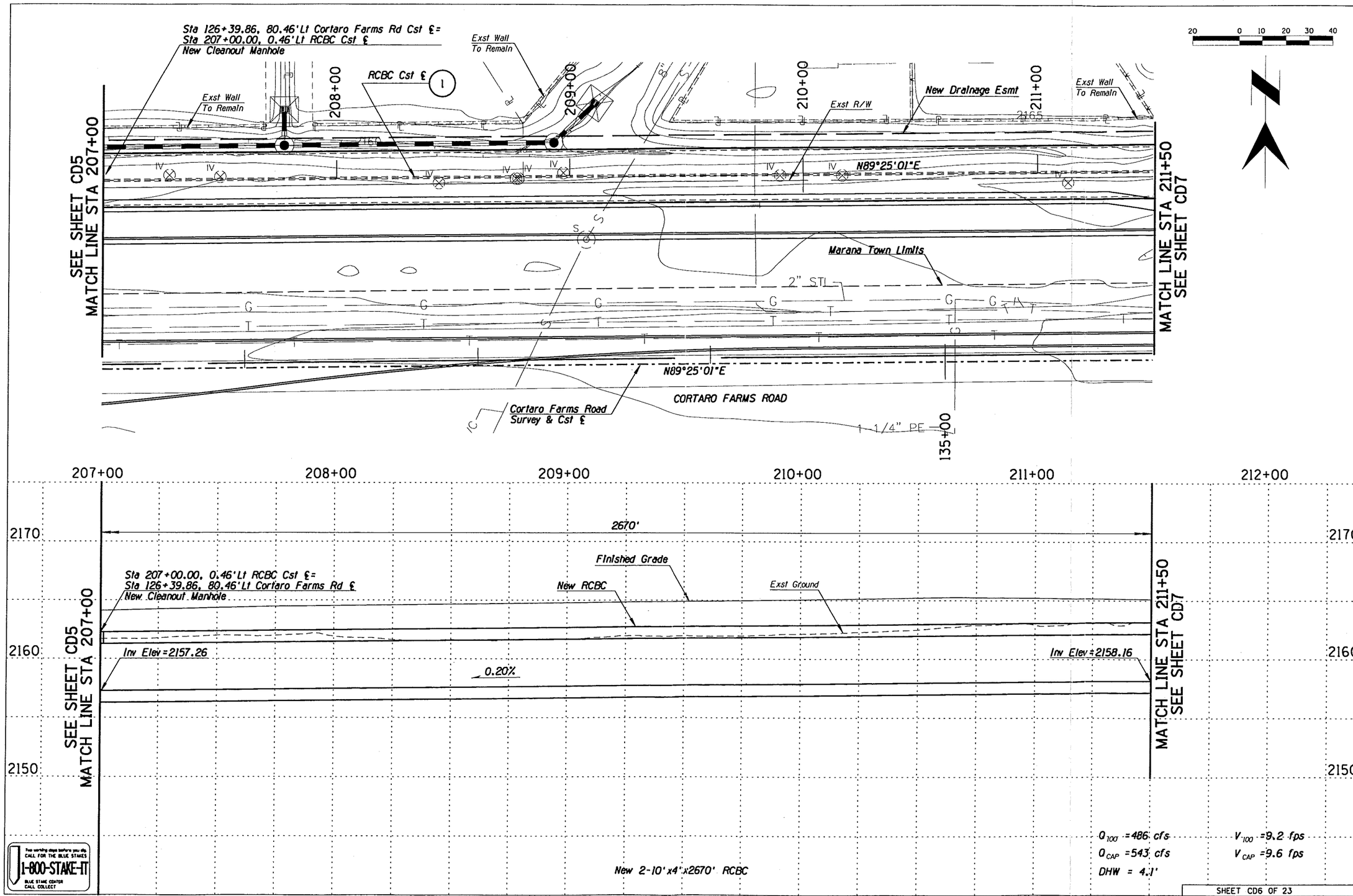

VIEW NAME: W:\99867-01\Sheets\Drainage\drn.ppch6.dgn
10/24/2002 09:17:01 AM

SCALES		
HORIZ.	1"=20'	
VERT.	1"=4'	

SHEET CD6 OF 23

SHEET 143 OF 381

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

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Morris Martinez & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Westmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

KURT WEINRICH, P.E., DIRECTOR

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DRAWN	GDL	7-02
CHECKED	BAB	9-02
PROJ. ENGR.	BAB	9-02

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
RCBC PLAN AND PROFILE
STA 207+00.00 - 211+50.00

SEE SHEET CD6
MATCH LINE STA 211+50

Sta 131+14.84, 80.46'Lt Cortaro Farms Rd Cst ℄=
Sta 211+75.00, 0.46'Lt RCBC Cst ℄
New Cleanout Manhole

PC 211+79.17

New 2-10' x4' x2670'
RCBC Cst ℄

PT 212+73.88

PC 213+87.08

New R/W

Exst R/W

Cortaro Farms Road
Survey & Cst ℄

Hartman Lane
Survey & Cst ℄

N00°03'38W

N00°34'59W

HARTMAN LANE

Marana Town Limits

CORTARO FARMS ROAD

Sta 132+12.58 Cortaro Farms Road=
Sta 50+00.00 Hartman Lane

Sta 46+42.28, 37.89'Lt Hartman Ln=
Sta 215+20.00 RCBC

PT 215+03.33

N60°30'37"E

Gunite Bank Protection
(See Note 2)

New Channel
See Sheet CD8

Angle Point
Sta 45+70.06, 47' Lt Hartman Ln=
Sta 215+98.77 Channel

Inlet Headwall & Wings
ADOT Std B-04.70
30° Skew (See Note 1)

Sta 46+19.72, 52.71'Lt Hartman Ln=
Sta 215+10.78 Channel

MATCH LINE STA 216+00
SEE SHEET CD8

CB3 CURVE DATA

PI Sta 212+38.63

Δ=89°28'40" Lt
D=95°29'35"
R= 60.00'
L= 93.70'
T= 59.46

CB4 CURVE DATA

PI Sta 214+51.29

Δ=60°34'15" Rt
D=52°05'13"
R=110.00'
L=116.29'
T= 64.24'

NOTES:

1. Wingwalls must match existing ground and channel walls
2. 6" thick Gunite bank protection. 1:1 slope from bottom of drop inlet to match existing ground

211+00 | 212+00 | 213+00 | 214+00 | 215+00 | 216+00

STA 211+61
SD "N2" Outfall
HGL10 = 2160.21

STA 212+14
SD "N" Outfall
HGL10 = 2160.35

STA 212+30
SD "X5" Outfall
HGL10 = 2160.69

STA 212+54
SD "X3" Outfall
HGL10 = 2160.70

Sta 211+75.00, 0.46'Lt RCBC Cst ℄=
Sta 131+14.84, 80.46'Lt Cortaro Farms Rd ℄
New Cleanout Manhole

STA 212+63
SD "X4" Outfall
HGL10 = 2160.70

STA 214+62
SD "X1 & X2" Outfall
HGL10 = 2162.83

Sta 215+48.78 Channel=
Sta 46+19.72, 52.71'Lt Hartman Ln
Begin Channel
Elev=2163.47

Sta 215+39.03 CBC=
Sta 46+28.92, 49.66'Lt Hartman Ln
End Drop Inlet
Inv Elev=2158.94

Hartman Ln
Finished Grade

Exst Ground

New RCBC

Inv Elev=2158.16

0.20%

0.20%

1.81%

6"

Sta 215+20.00=
Sta 46+42.28, 37.89' Lt Hartman Ln
Inv Elev=2158.90

2670'

2170 | 2160 | 2150

SEE SHEET CD6
MATCH LINE STA 211+50

MATCH LINE STA 216+00
SEE SHEET CD8

New 2-10'x4'x2670' RCBC

Q_{100} =486 cfs
Q_{CAP} =543 cfs
DHW = 4.1'

V_{100} =9.2 fps
V_{CAP} =9.6 fps

CALL FOR THE BLUE STAKES
1-800-STAKE-IT
BLUE STAKE CENTER
CALL COLLECT

VIEW NAME: W:\99867-01\Sheets\Drainage\drn_ppch7.dgn
10/24/2002 09:17:43 AM

SCALES | HORIZ. 1"=20' | VERT. 1"=4'

SHEET CD7 OF 23

SHEET 144 OF 381

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

		DATE
DESIGNED	KKH	9-02
DRAWN	ODL	9-02
CHECKED	BAB	9-02
PROJ. ENGR.	BAB	9-02

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
RCBC PLAN AND PROFILE
STA 211+50.00 - STA 216+00.00

PIMA COUNTY W.O. 4TCFIT

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MMLA
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Engineering · Planning · Environmental · Surveying · Water Resources
800 East Ironwood Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	1	101.0	48 x 120 b	2380.2	2153.56	2158.32	0.200	2155.03	2160.37	0.32	End
2	2	75.00	48 x 120 b	290.0	2158.32	2158.90	0.200	2160.69	2160.77	0.25	1

Project File: cfarms_hrtmn10.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	48 120 b	101.0	2153.56	2155.03	1.47	14.69	6.88	0.74	2155.76	0.306	2380	2158.32	2160.37	2.05	20.49	4.93	0.38	2160.75	0.113	0.209	4.981	0.85	0.32
2	48 120 b	75.00	2158.32	2160.69	2.37	23.70	3.16	0.16	2160.85	0.041	290	2158.90	2160.77	1.87	18.70	4.01	0.25	2161.02	0.082	0.061	0.177	1.00	0.25

Project File: cfarms_hrtmn10.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 2 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2155.029 (ft) , * Critical depth assumed., ** Critical depth assumed.

C.P. 2: 2 – 12' X 5' RCBC @ STA 224+56 (Q_{10})

```
                    SOLUTION
========================================

 2  Cells X  5  High X  12  Wide
Discharge   256.00CFS
Length (Ft)  156    Slope    1.09%
Manning's 'n' 0.012
Entrance Type:
 SQR. TOP EDGE, 30-75DEG. WW FLAIR
Inlet Control HW/D  0.47
Inlet Control HW = 2.34
Ke 0.40
H  0.12
Critical Depth  1.53
Dc+D/2  3.26
Tailwater  1.53
H0  3.26
L*S0  1.70
Outlet HW  1.68
INLET Control Governs  HW= 2.34
Outlet Velocity 10.87fps
Normal Depth  0.98
```

C.P. 3: 2 – 36" RCP @ STA 222+00 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is  35.00 cfs
 2  X  36 " RCP X  158  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.65
Inlet Control HW     1.94
Ke       0.50
H         0.24
Critical Depth  1.34
Dc+D/2          2.17
Tailwater       1.34
H0              2.17
L*S0            2.61
Outlet HW   -0.20

INLET CONTROL  GOVERNS   HW=  1.94
Outlet Velocity 10.08 fps
```

C.P. 11: 2 – 36" RCP @ STA 202+65 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SOCKET HEADWALL (RCP)
Discharge is  63.00 cfs
 2  X  36 " RCP X  192  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.88
Inlet Control HW     2.64
Ke       0.20
H         0.73
Critical Depth  1.82
Dc+D/2          2.41
Tailwater       1.82
H0              2.41
L*S0            3.17
Outlet HW   -0.02

INLET CONTROL  GOVERNS   HW=  2.64
Outlet Velocity 11.87 fps
```

C.P. 12: 30" RCP @ STA 198+40 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is  16.00 cfs
 1  X  30 " RCP X  131  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.81
Inlet Control HW     2.02
Ke       0.50
H         0.42
Critical Depth  1.35
Dc+D/2          1.93
Tailwater       1.35
H0              1.93
L*S0            0.90
Outlet HW    1.44

INLET CONTROL  GOVERNS   HW=  2.02
Outlet Velocity  7.25 fps
```

C.P. 13: 48" RCP @ STA 196+00 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is  16.00 cfs
 1  X  48 " RCP X  146  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.39
Inlet Control HW     1.54
Ke      0.50
H        0.05
Critical Depth  1.17
Dc+D/2          2.59
Tailwater       1.17
H0              2.59
L*S0            1.56
Outlet HW    1.08

INLET CONTROL  GOVERNS   HW=  1.54
Outlet Velocity  8.18 fps
```

C.P. 16: 2 – 36" RCP @ STA 189+38 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is  10.00 cfs
 2  X  36 " RCP X  130  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.29
Inlet Control HW     0.87
Ke       0.50
H         0.02
Critical Depth  0.70
Dc+D/2          1.85
Tailwater       0.70
H0              1.85
L*S0            2.59
Outlet HW   -0.72

INLET CONTROL  GOVERNS   HW=  0.87
Outlet Velocity  7.47 fps
```

C.P. 19: 36" RCP @ STA 179+38 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is   5.00 cfs
 1  X  36 " RCP X  121  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.29
Inlet Control HW     0.87
Ke       0.50
H         0.02
Critical Depth  0.70
Dc+D/2          1.85
Tailwater       0.70
H0              1.85
L*S0            4.63
Outlet HW   -2.77

INLET CONTROL  GOVERNS   HW=  0.87
Outlet Velocity  9.15 fps
```

C.P. 21: 36" RCP @ STA 168+82 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is  13.00 cfs
 1  X  36 " RCP X  210  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.54
Inlet Control HW     1.61
Ke      0.50
H        0.15
Critical Depth  1.15
Dc+D/2          2.07
Tailwater       1.15
H0              2.07
L*S0            8.97
Outlet HW   -6.75

INLET CONTROL  GOVERNS   HW=  1.61
Outlet Velocity 12.98 fps
```

C.P. 24: 2 – 10' X 5' RCBC @ STA 158+88 (Q_{10})

```
                    SOLUTION
========================================

 2  Cells X  5  High X  10  Wide
Discharge   197.00CFS
Length (Ft)  298    Slope    2.13%
Manning's 'n' 0.012
Entrance Type:
 SQR. TOP EDGE, NORMAL HDWL TO 45 SK
Inlet Control HW/D  0.50
Inlet Control HW = 2.48
Ke 0.20
H  0.11
Critical Depth  1.45
Dc+D/2  3.22
Tailwater  1.45
H0  3.22
L*S0  6.35
Outlet HW -3.01
INLET Control Governs  HW= 2.48
Outlet Velocity 12.75fps
Normal Depth  0.77
```

C.P. 25: 2 – 8' X 5' RCBC @ STA 149+39 (Q_{10})

SOLUTION

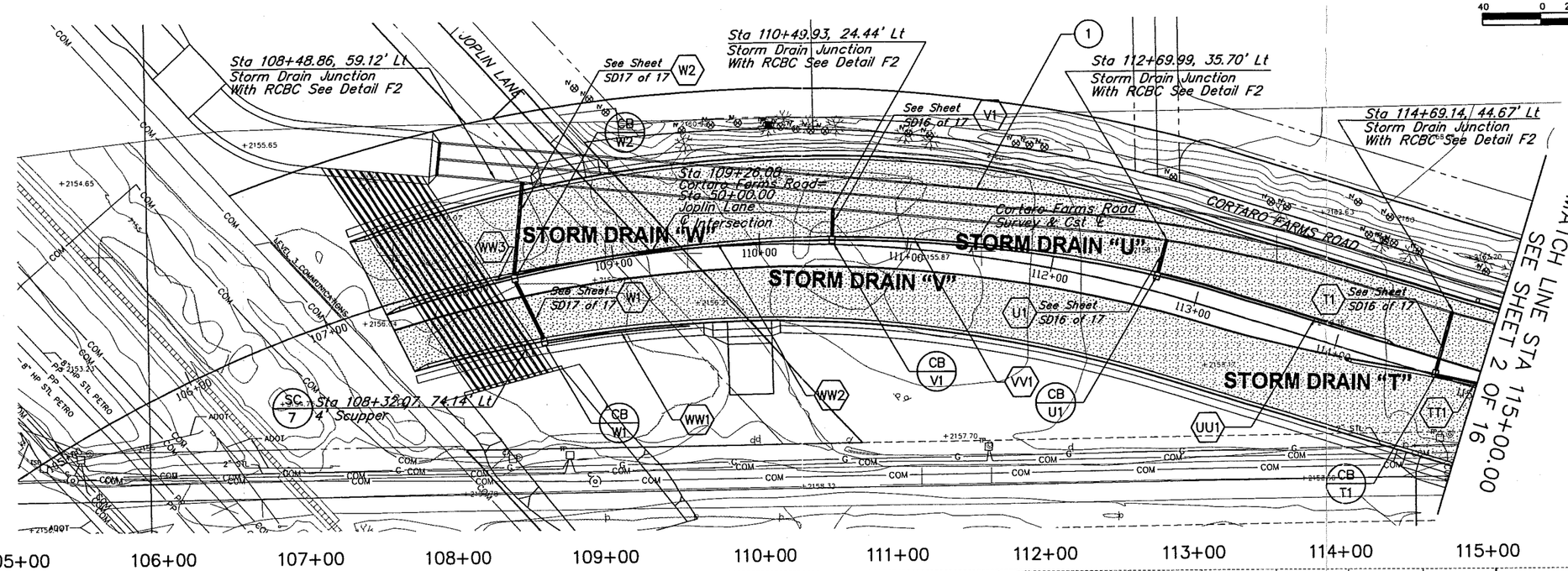
==========

```
 2  Cells X  5  High X  8  Wide
Discharge   218.00CFS
Length (Ft)  144    Slope    1.00%
Manning's 'n' 0.012
Entrance Type:
 SQR. TOP EDGE, 30-75DEG. WW FLAIR
Inlet Control HW/D  0.55
Inlet Control HW = 2.76
Ke 0.40
H  0.20
Critical Depth  1.80
Dc+D/2  3.40
Tailwater  1.80
H0  3.40
L*S0  1.44
Outlet HW  2.16
INLET Control Governs  HW= 2.76
Outlet Velocity 11.63fps
Normal Depth  1.17
```

C.P. 26: 36" RCP @ STA 144+62 (Q_{10})

```
                    RESULTS
=========================================
Entrance Type: SQUARE HEADWALL (RCP)
Discharge is   9.00 cfs
 1  X  36 " RCP X  126  FT. LONG
Manning's  'n' 0.012
Inlet  Control HW/D   0.42
Inlet Control HW     1.27
Ke      0.50
H        0.06
Critical Depth  0.95
Dc+D/2          1.97
Tailwater       0.95
H0              1.97
L*S0            4.38
Outlet HW   -2.35

INLET CONTROL  GOVERNS   HW=  1.27
Outlet Velocity 10.83 fps
```



Two working days before you dig
CALL FOR THE BLUE STAKES
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Blue Stake Center
CALL COLLECT

SCALES HORIZ. 1"=40' VERT. 1"=4'

SHEET SD1 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS
FOR
CORTARO FARMS ROAD
STA 105+00 - 215+00

NO.	REVISION DESCRIPTION	DIV. \ SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

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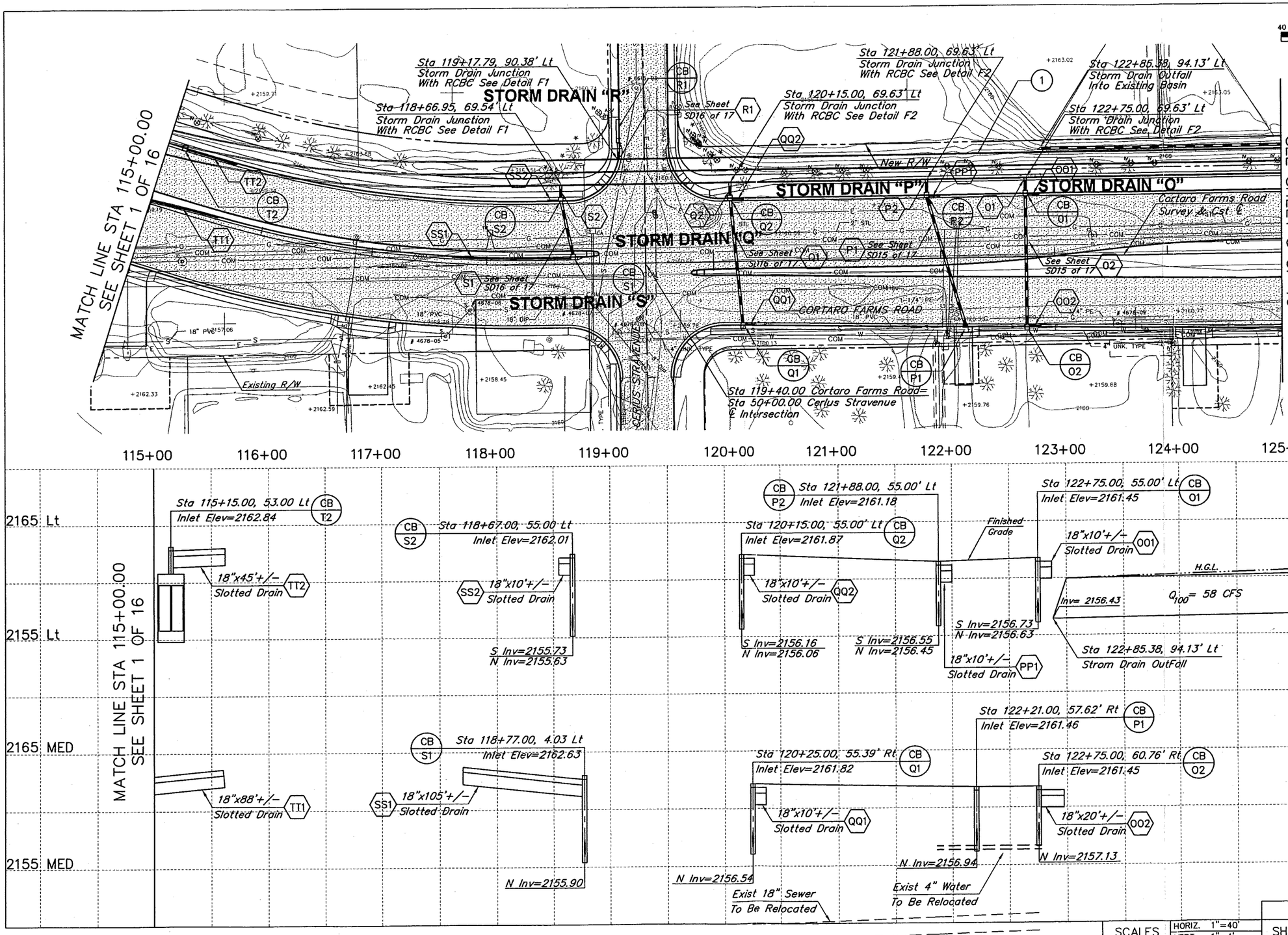

Two working days before you dig
CALL FOR THE BLUE STAKES
1-800-STAKE-IT
Blue Stake Center
CALL COLLECT

KURT WEINRICH, P.E., DIRECTOR

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 115+00 - 125+00

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

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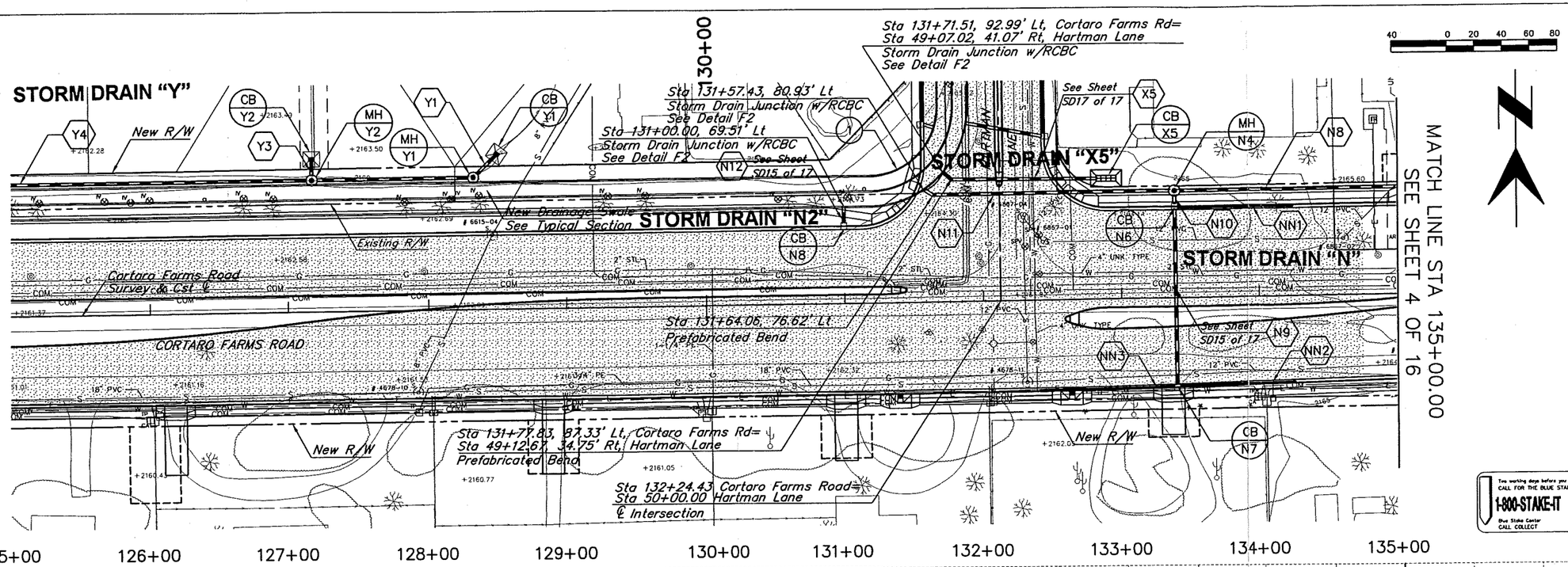
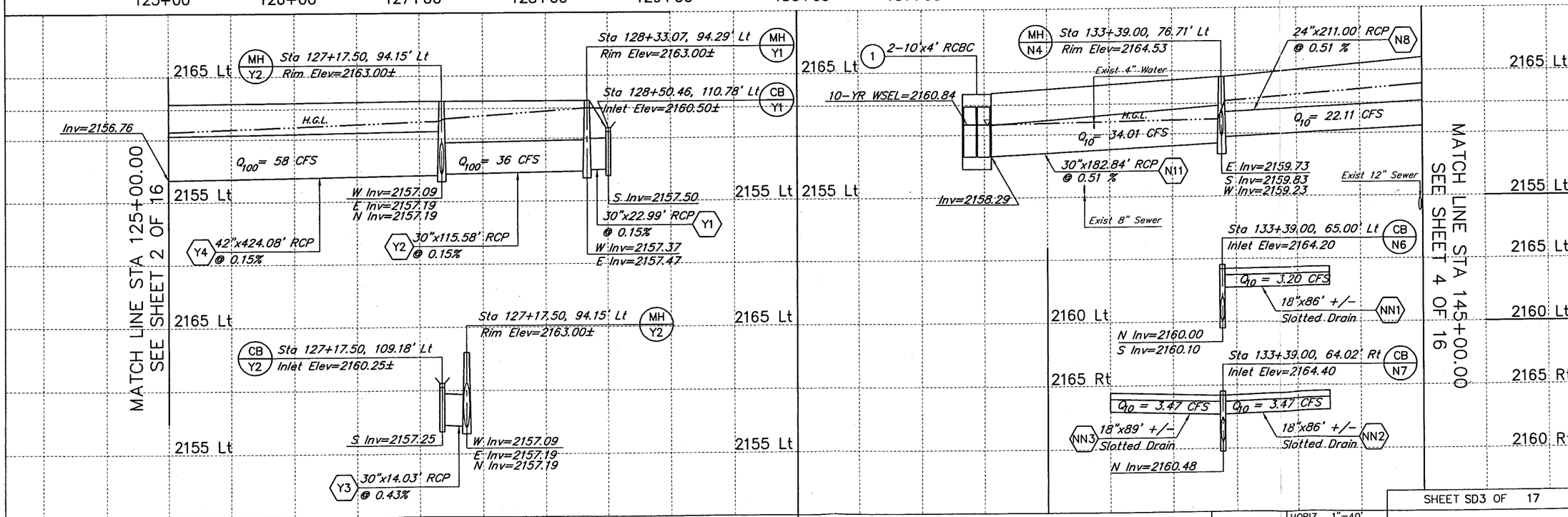
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Weldmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2200
Fax (520) 292-1290

JOB NO.: 99067-01





SCALES: HORIZ. 1"=40' / VERT. 1"=4'

SHEET SD3 OF 17

SHEET OF

Two working days before you dig, CALL FOR THE BLUE STAKES
1-800-STAKE-IT
Blue Stake Center CALL COLLECT

KURT WEINRICH, P.E., DIRECTOR

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD
STA 125+00 - 135+00

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

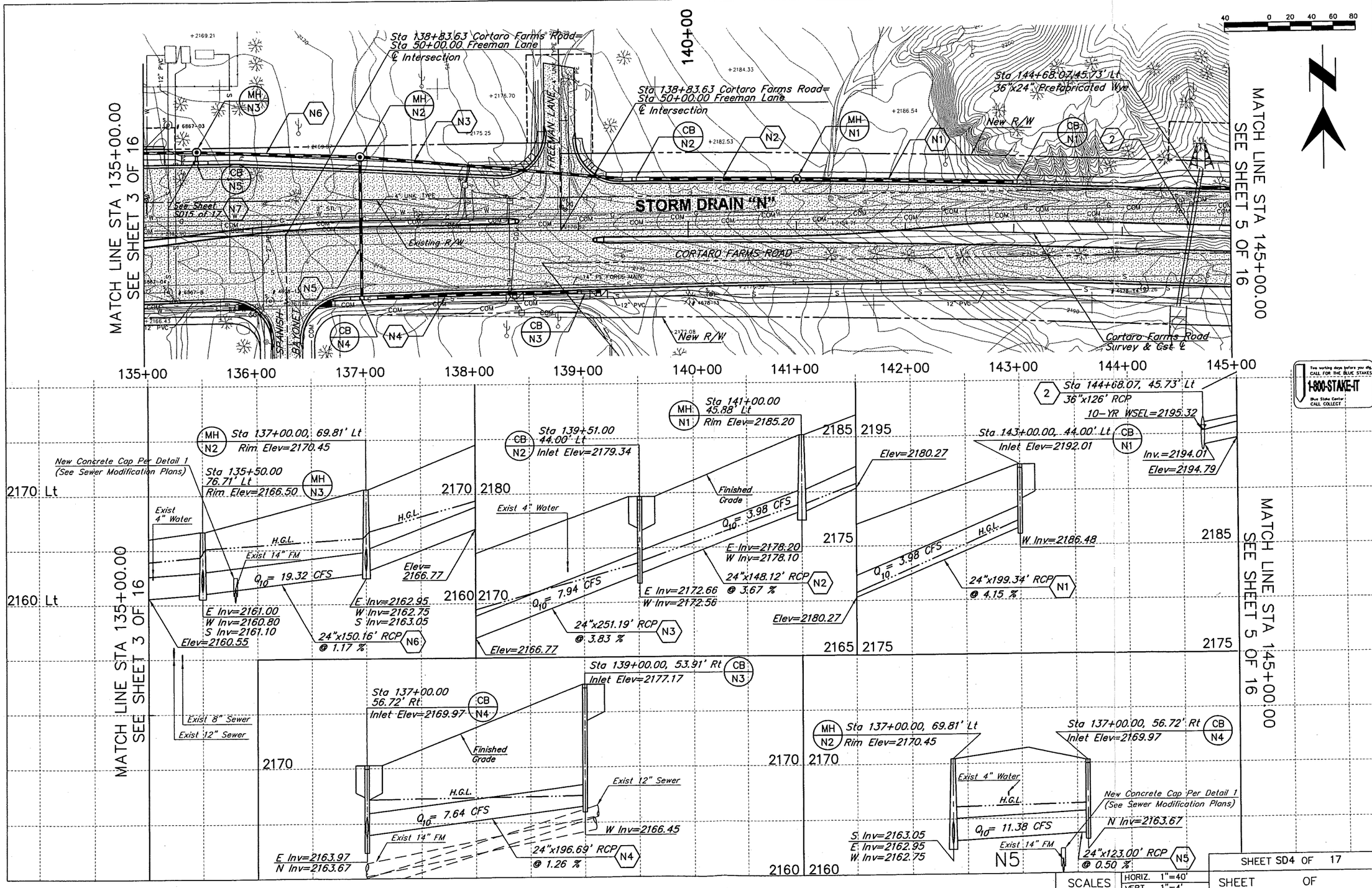
PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

800 East Waterworx Road, Suite 110
Tucson, AZ 85705
Telephone (520) 292-2300
Fax (520) 292-1280

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
Bickerstaff Heffernan Lodge & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

JOB NO.: 99067-01



Two working days before you dig
CALL FOR THE BLUE STAKES
1-800-STAKE-IT
Blue Stake Center
CALL COLLECT

DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

KURT WEINRICH, P.E., DIRECTOR

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 135+00 - 145+00

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

800 East Weinrich Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-1200
Fax (520) 292-1290

SCHEMATIC NOT FOR CONSTRUCTION

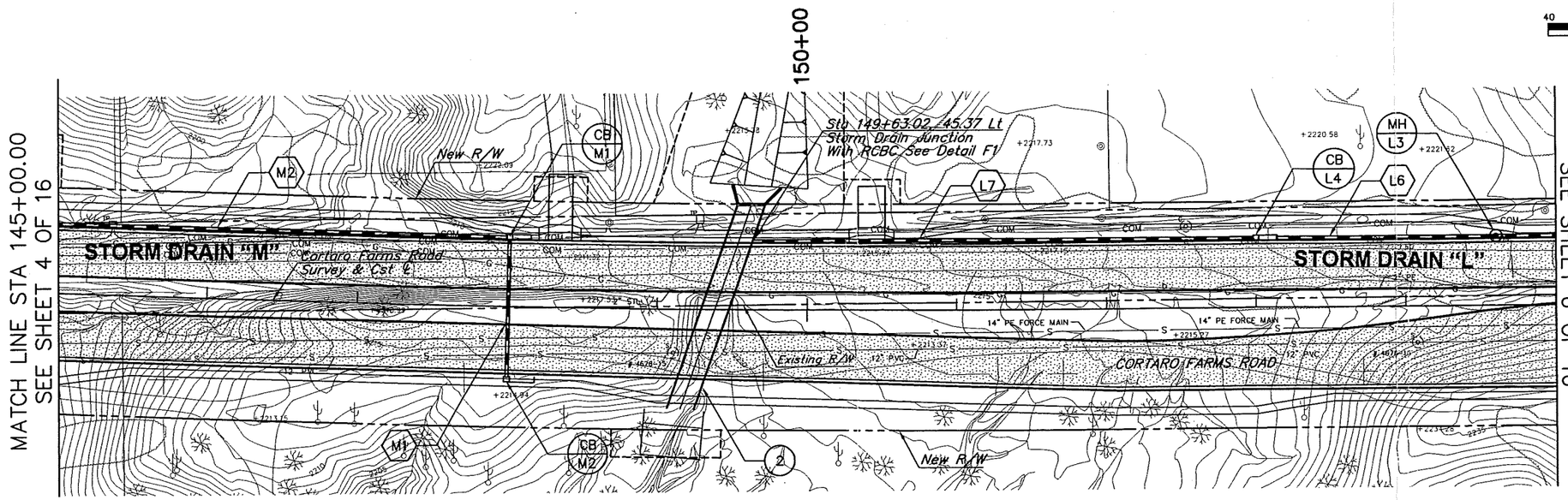
MMLA
McGann McClitis Lodge & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

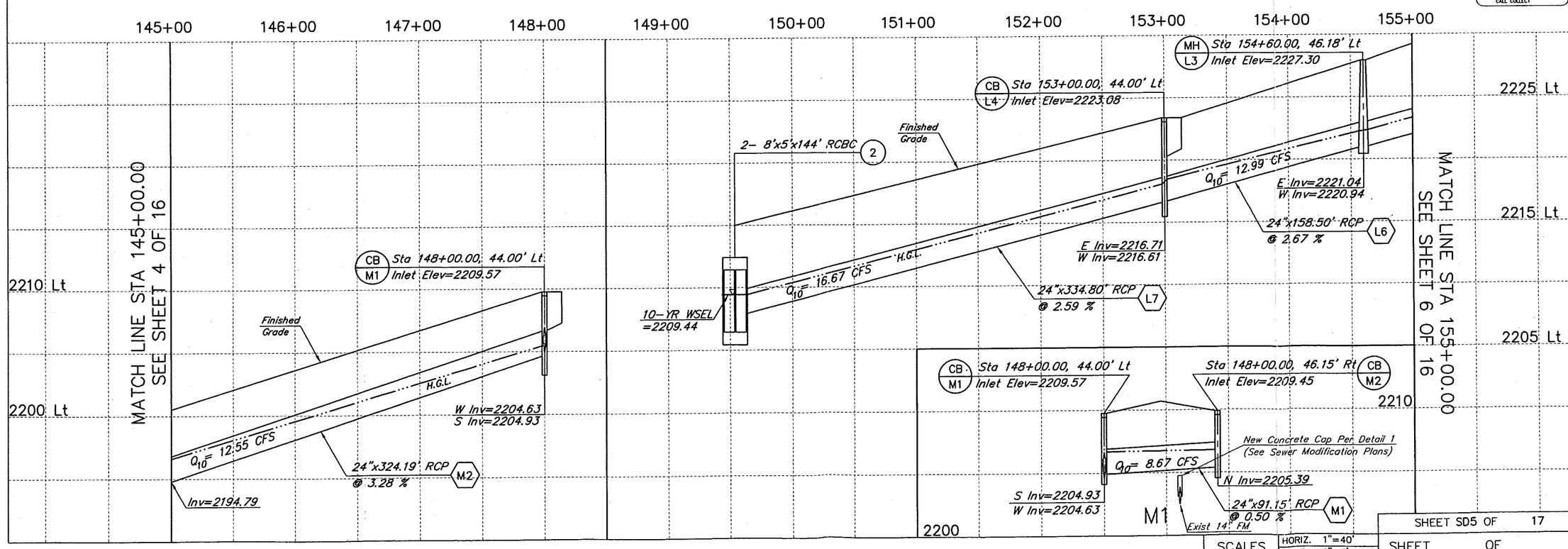
SCALES	
HORIZ.	1"=40'
VERT.	1"=4'

SHEET SD4 OF 17

SHEET OF

JOB NO.: 99067-01





Two working days before you dig
CALL FOR THE BLUE STAKES
1-800-STAKE-IT
Blue Stake Center
CALL COLLECT

SCALES	
HORIZ.	1"=40'
VERT.	1"=4'

SHEET SD5 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS
FOR
CORTARO FARMS ROAD
STA 145+00 - 155+00

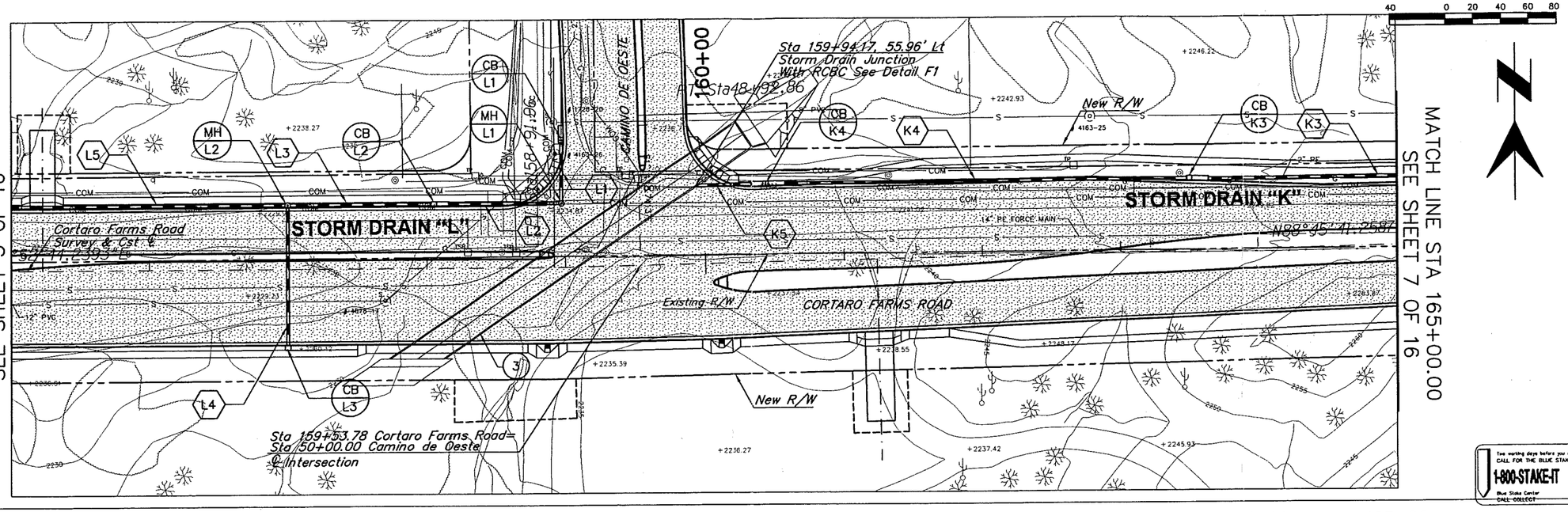
PIMA COUNTY W.O. 4TCFIT

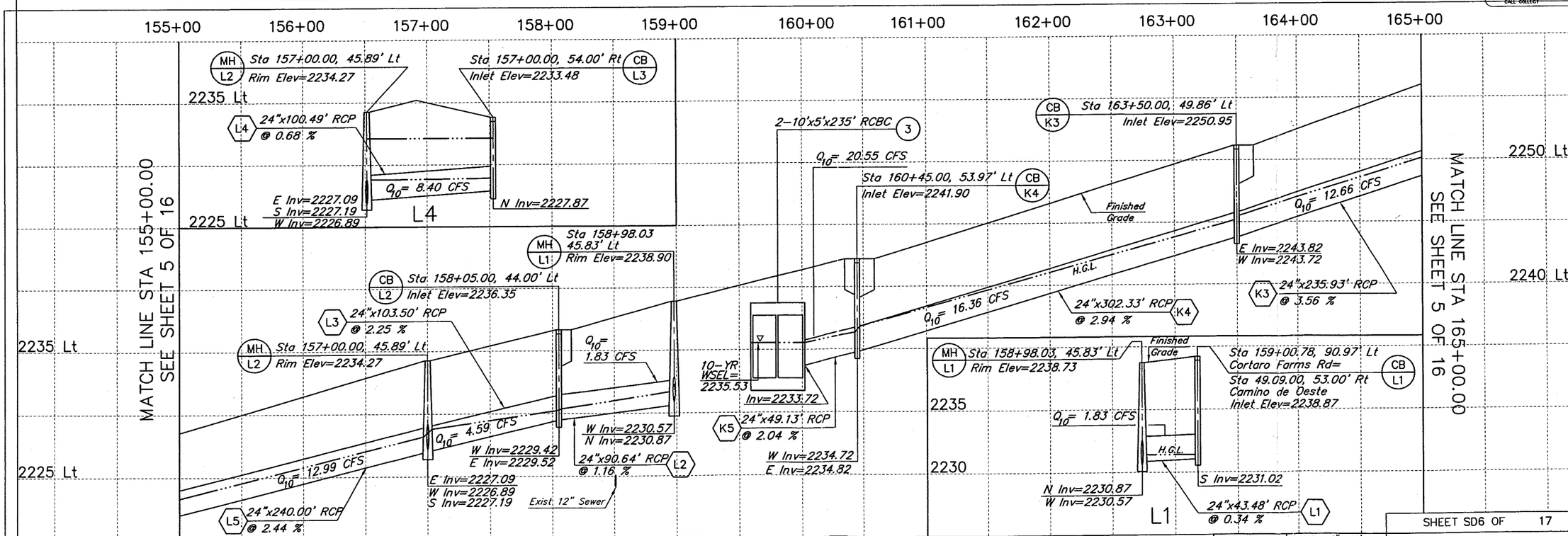
800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

SCHEMATIC
NOT FOR
CONSTRUCTION

MMLA
McGann McGann Lage & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

JOB NO.: 99067-01





SCALES		
	HORIZ.	1"=40'
	VERT.	1"=4'

SHEET SD6 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 155+00 - 165+00

NO.	REVISION DESCRIPTION	DIV. SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

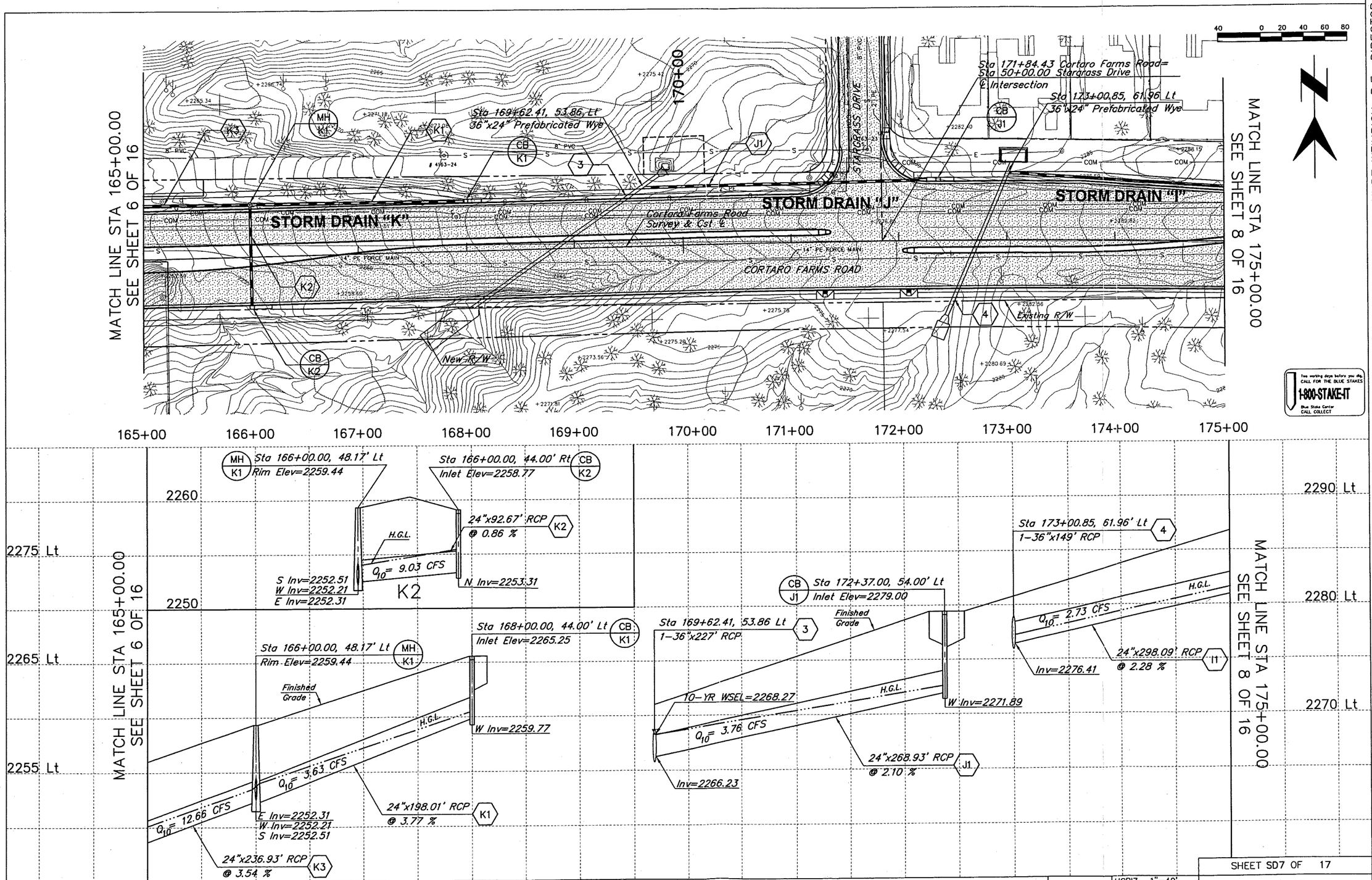
Two working days before you dig, CALL FOR THE BLUE STAKES 1-800-STAKE-IT Blue Stake Center CALL COLLECT

SCHEMATIC NOT FOR CONSTRUCTION

800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1259

MMLA
McGann Machlis Lodge & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

JOB NO.: 99067-01



SCALES: HORIZ. 1"=40' VERT. 1"=4'

SHEET SD7 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 165+00 - 175+00

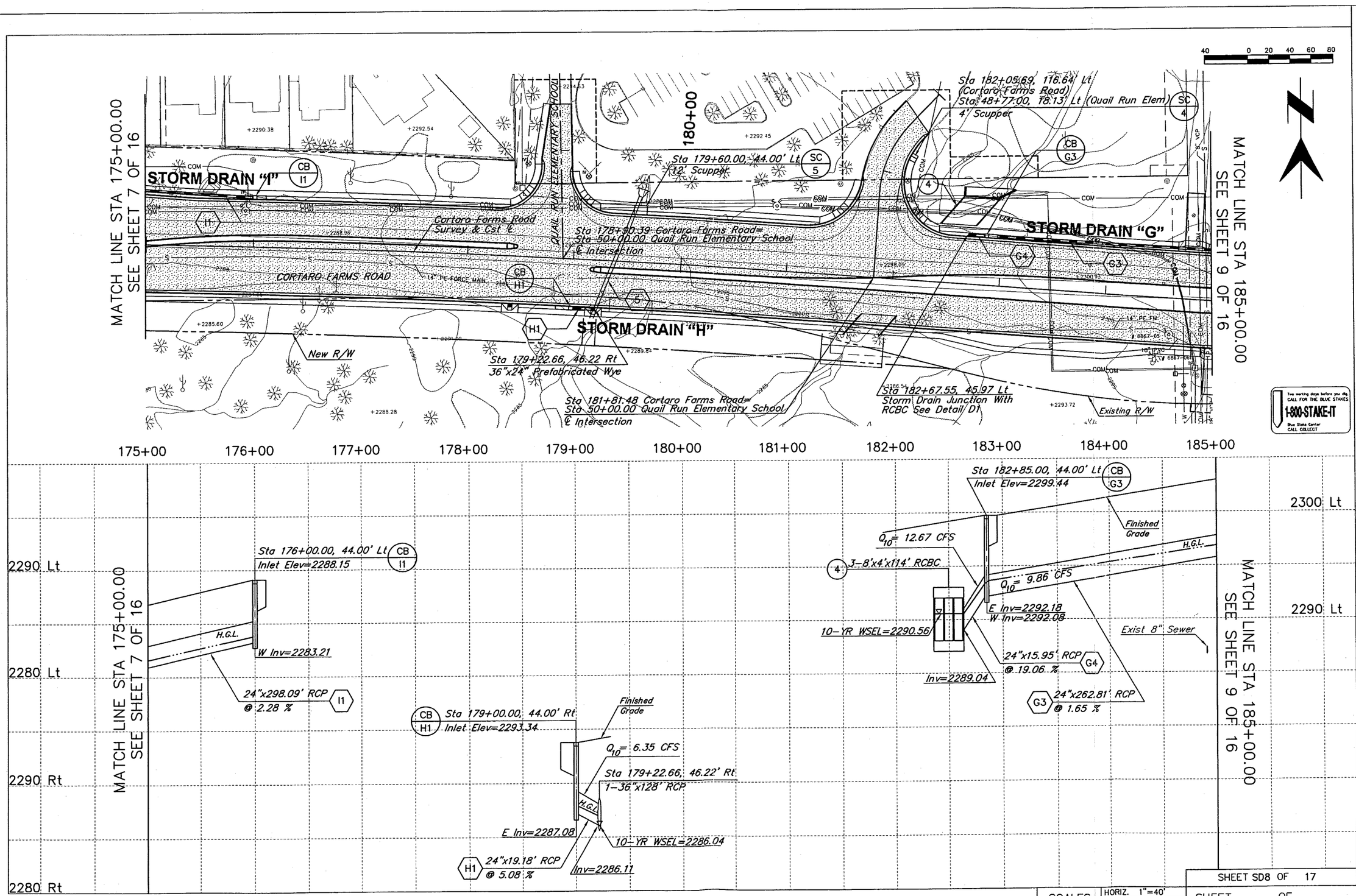
PIMA COUNTY W.O. 4TCFIT

800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1250

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McGann McGann Lopez & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

JOB NO.: 99067-01



SCALES: HORIZ. 1"=40'; VERT. 1"=4'

SHEET SD8 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 175+00 - 185+00

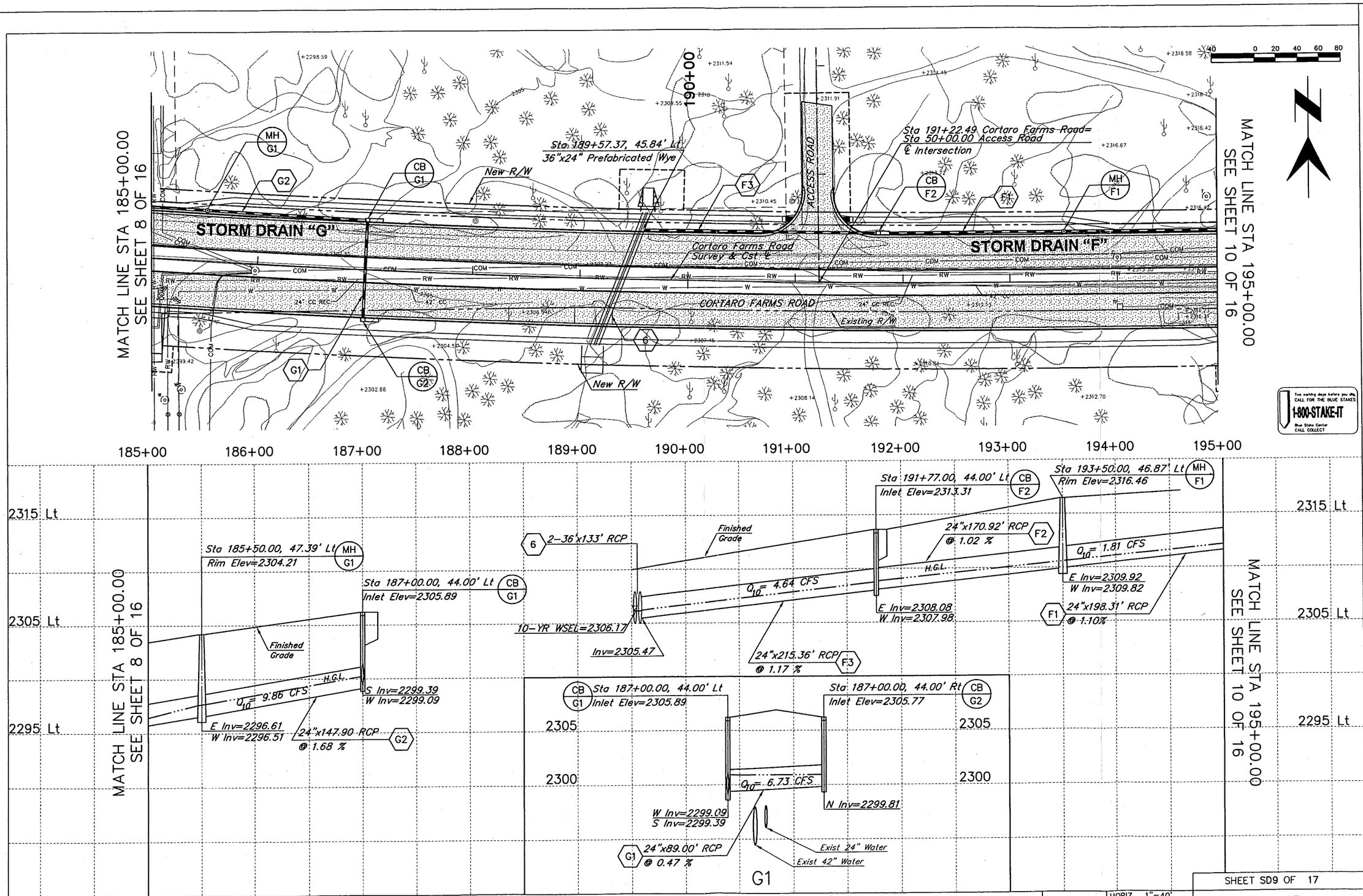
NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McGoven Mechlins Lodge & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Wetmore Road, Suite 110
Tucson, Arizona 85705
Telephone (520) 292-2300
Fax (520) 292-1289

JOB NO.: 99067-01



SCALES HORIZ. 1"=40' VERT. 1"=4'

SHEET SD9 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 185+00 - 195+00

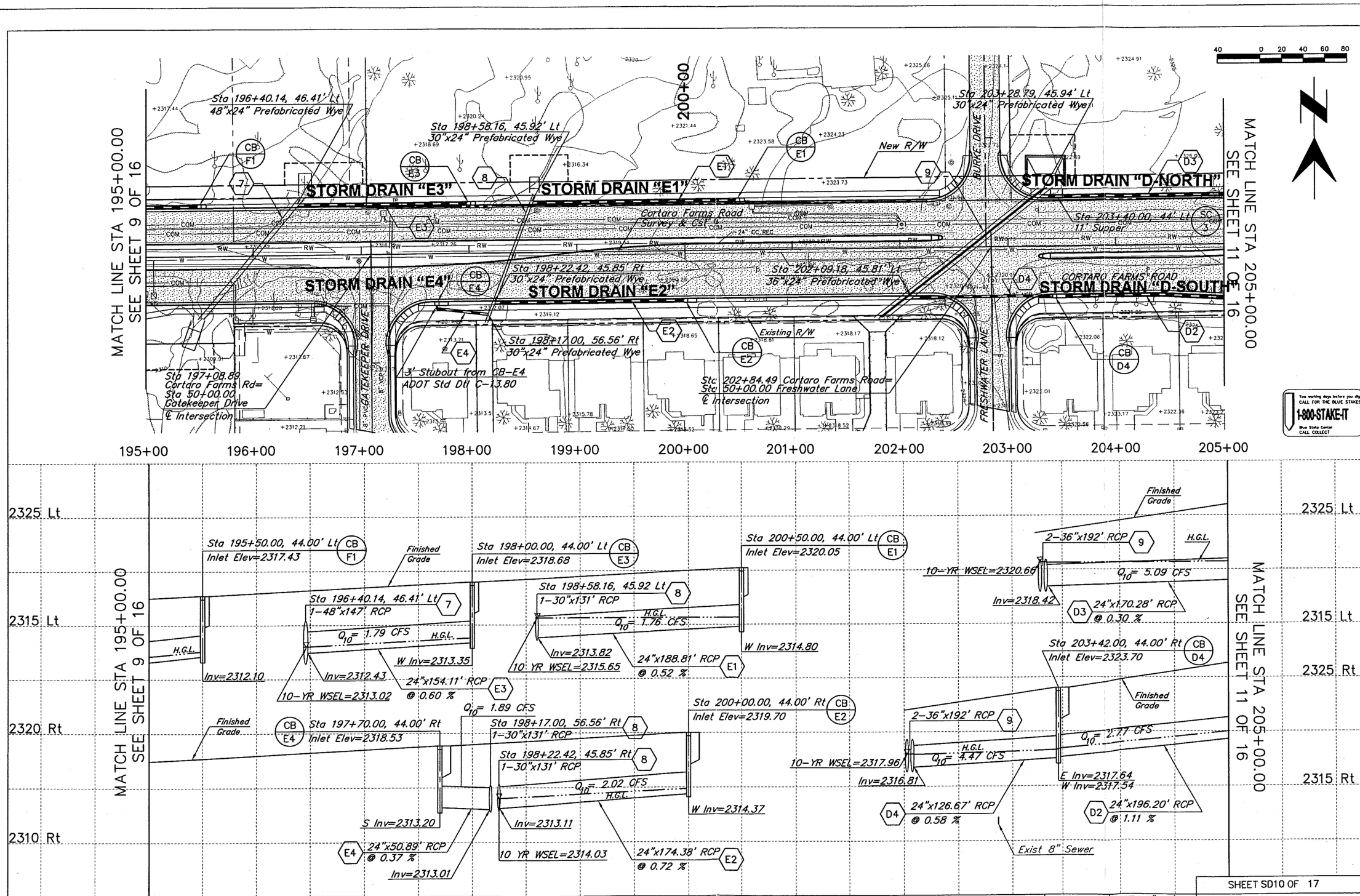
NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McGann & Martin Lodge & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Wetmore Road, Suite 110
Tucson, Arizona 85705
Telephone: (520) 292-2300
Fax: (520) 292-1260

JOB NO.: 99067-01



SCALES HORIZ. 1"=40' VERT. 1"=4'

SHEET SD10 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 195+00 - 205+00

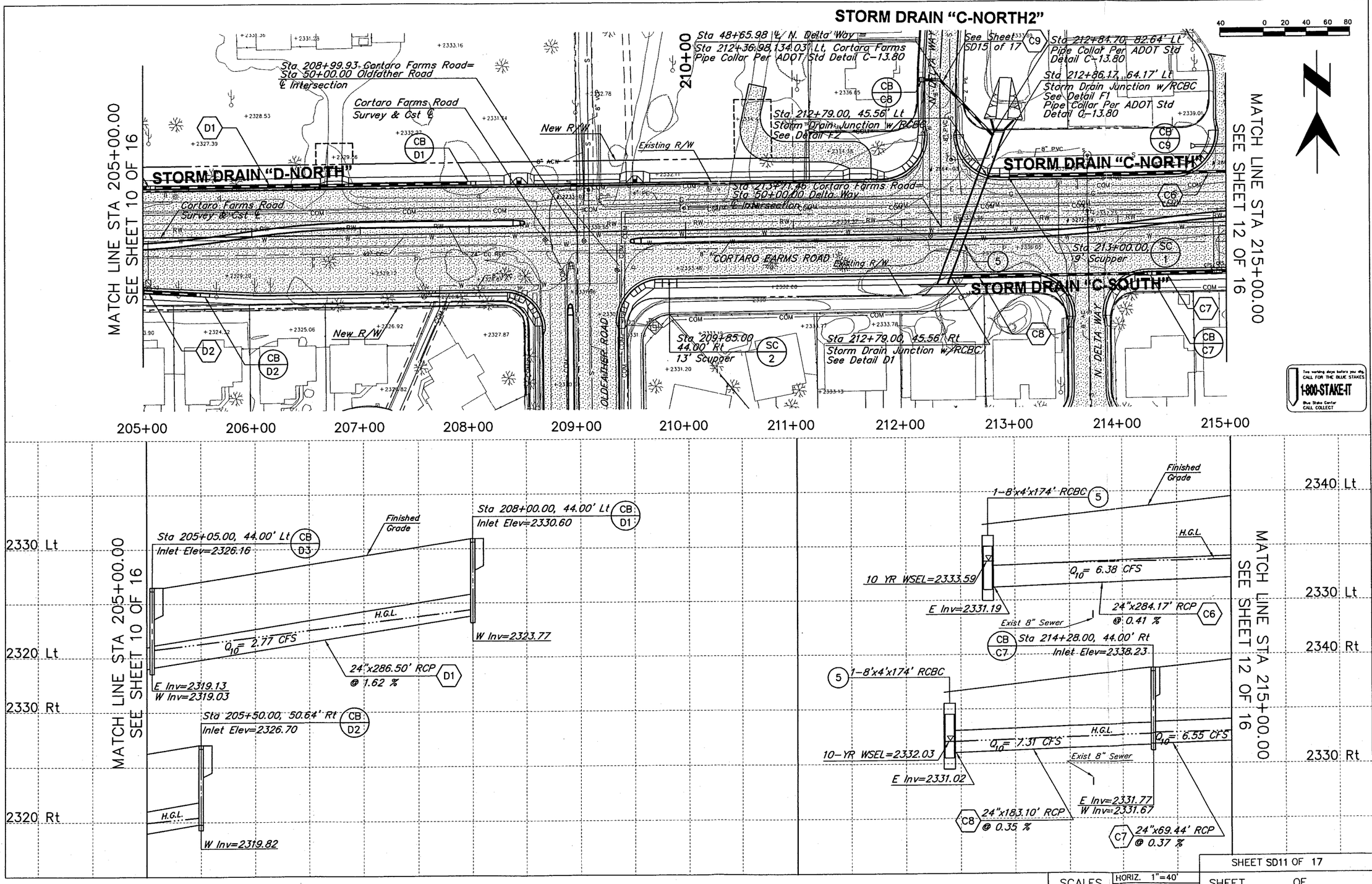
NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA

JOB NO.: 99067-01



SCALES HORIZ. 1"=40' VERT. 1"=4'

SHEET SD11 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

STA 205+00 - 215+00

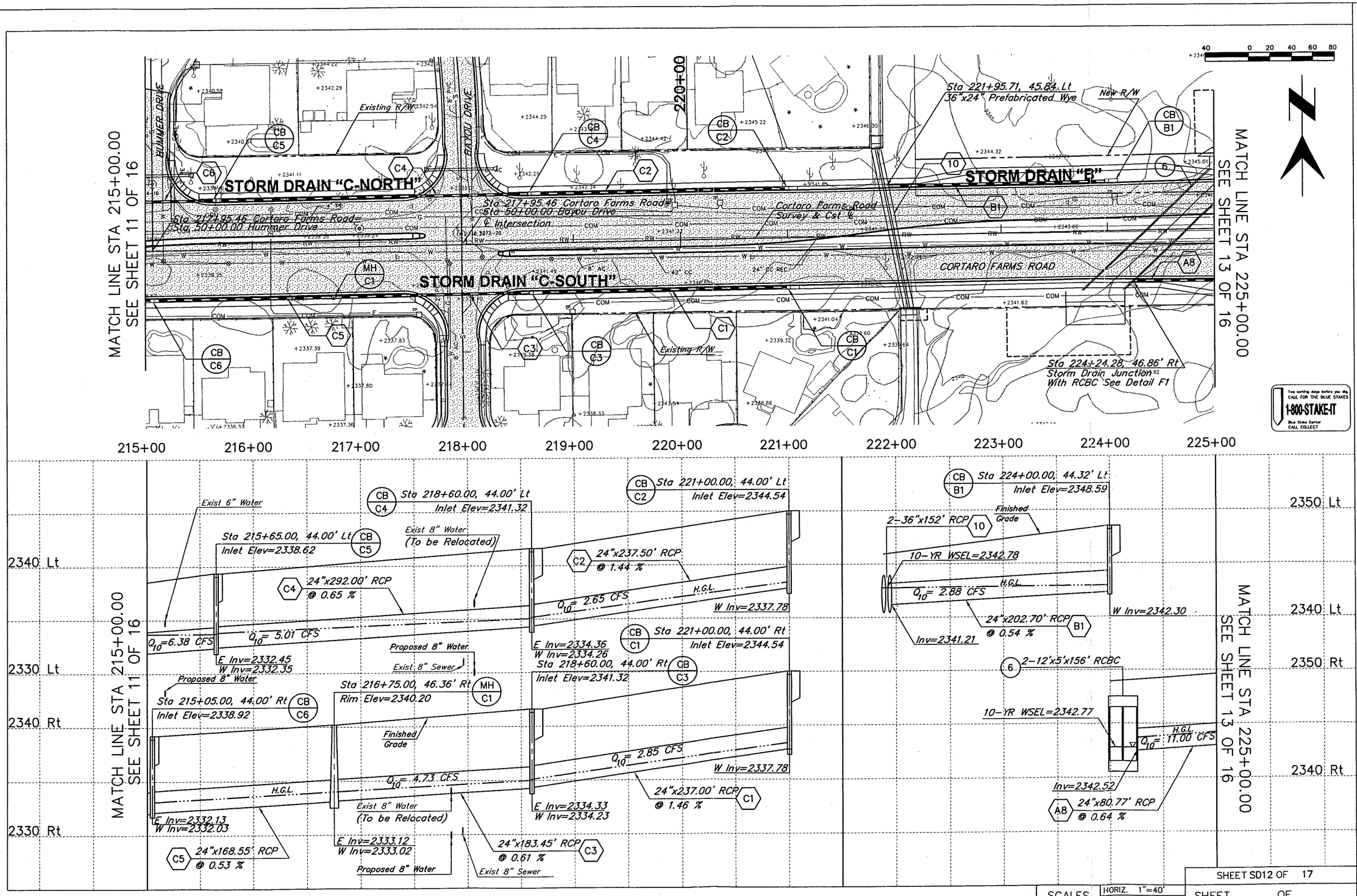
NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McCorkle McCrea Lodge & Associates, Inc.
Engineering • Planning • Landscape Architecture • Surveying • Water Resources
800 East Walmart Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

JOB NO.: 99067-01



SCALES HORIZ. 1"=40' VERT. 1"=4'

SHEET SD12 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

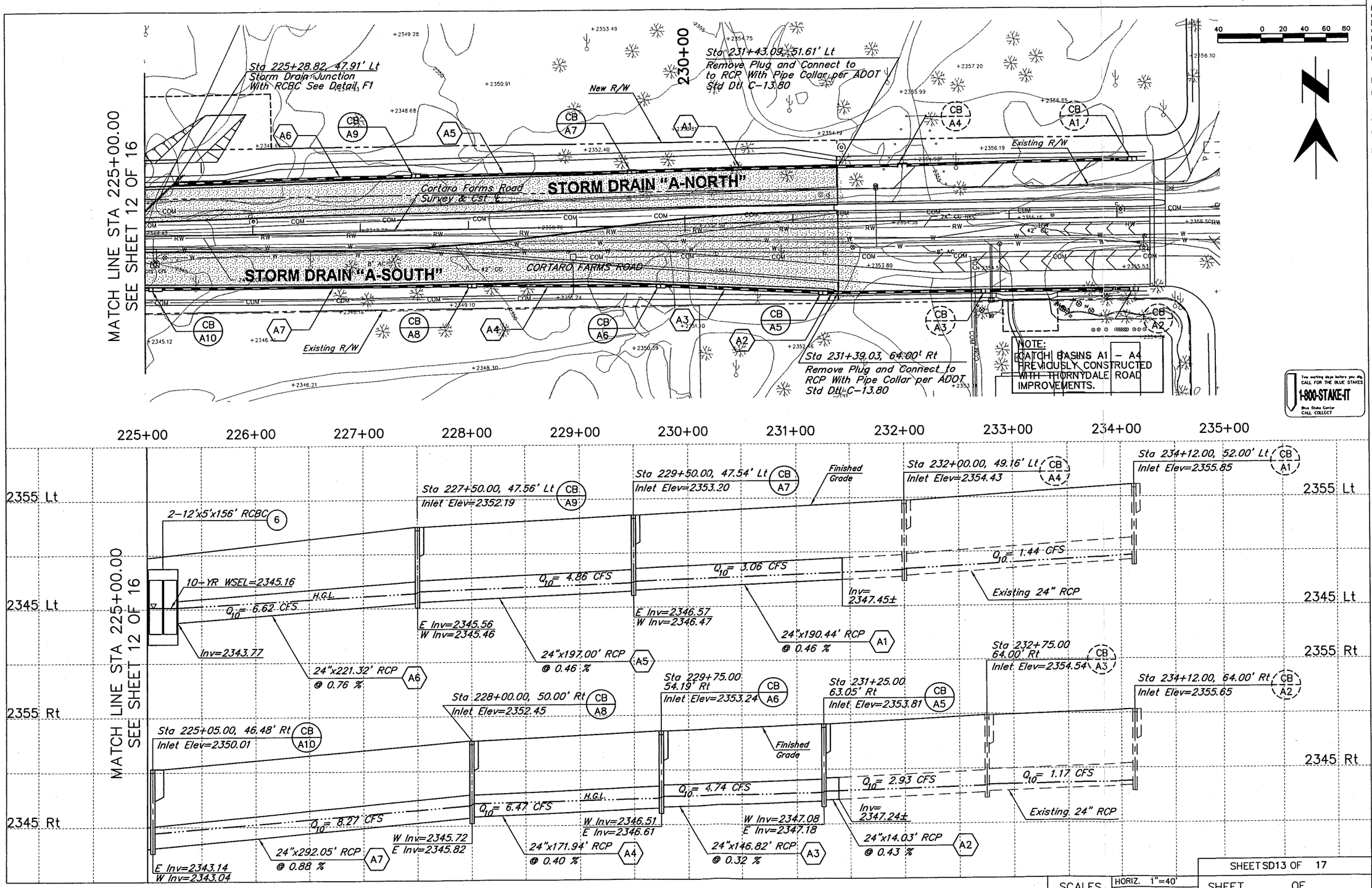
STA 215.00 - 225+00

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McGann McMillan Light & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1250

JOB NO.: 99067-01



SCALES	
HORIZ.	1"=40'
VERT.	1"=4'

SHEET SD13 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR
CORTARO FARMS ROAD
STA 225+00 - 235+00

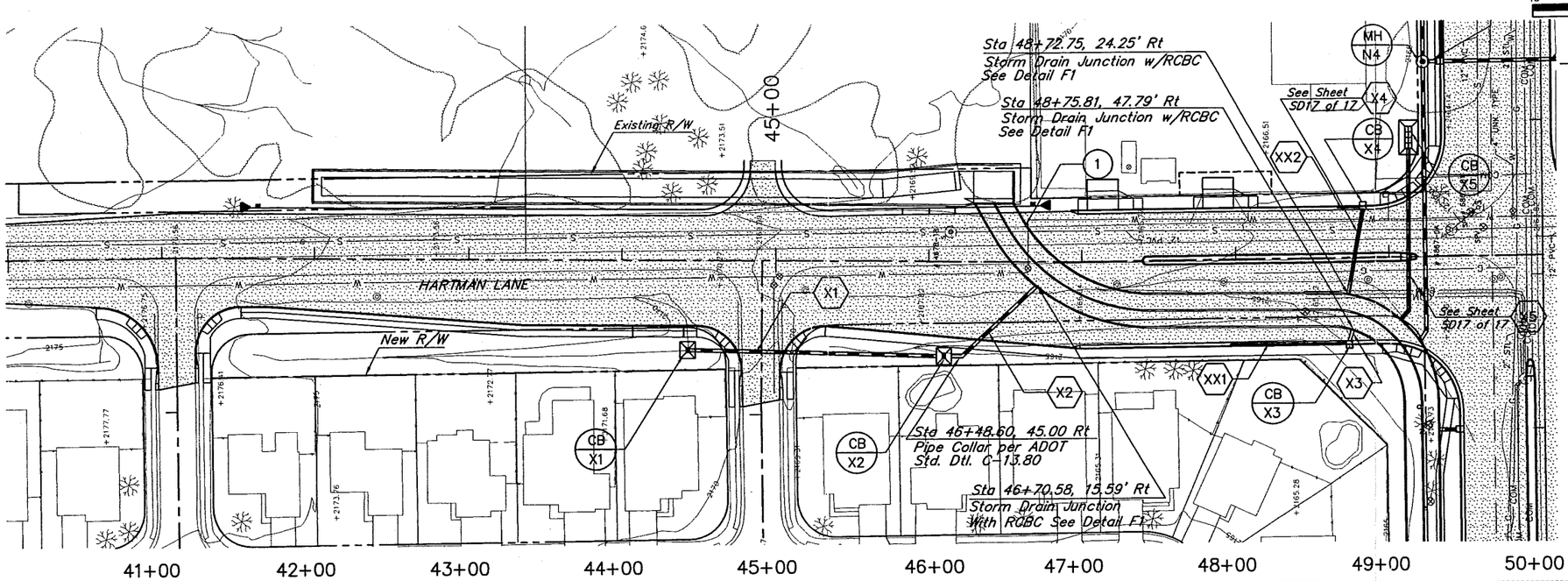
PIMA COUNTY W.O. 4TCFIT

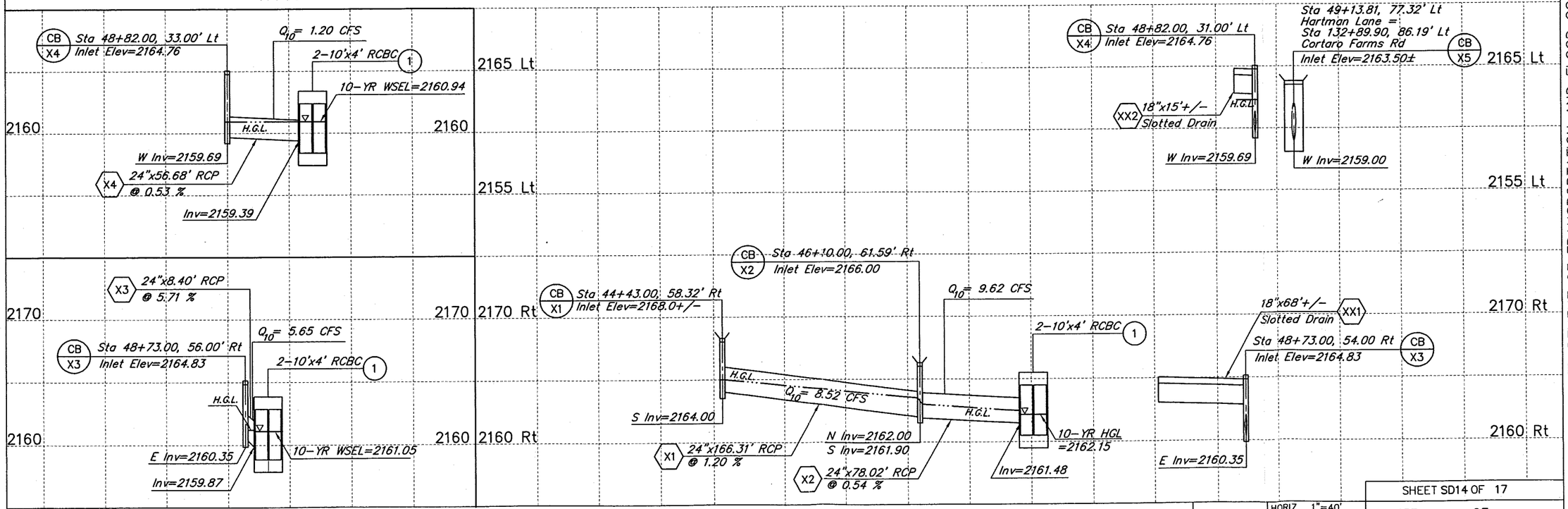
SCHEMATIC NOT FOR CONSTRUCTION

800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1280

MMLA
McGann McGann Lage & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

JOB NO.: 99067-01





SCALES	
HORIZ.	1"=40'
VERT.	1"=4'

SHEET SD14 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

		DATE
DESIGNED	MED	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

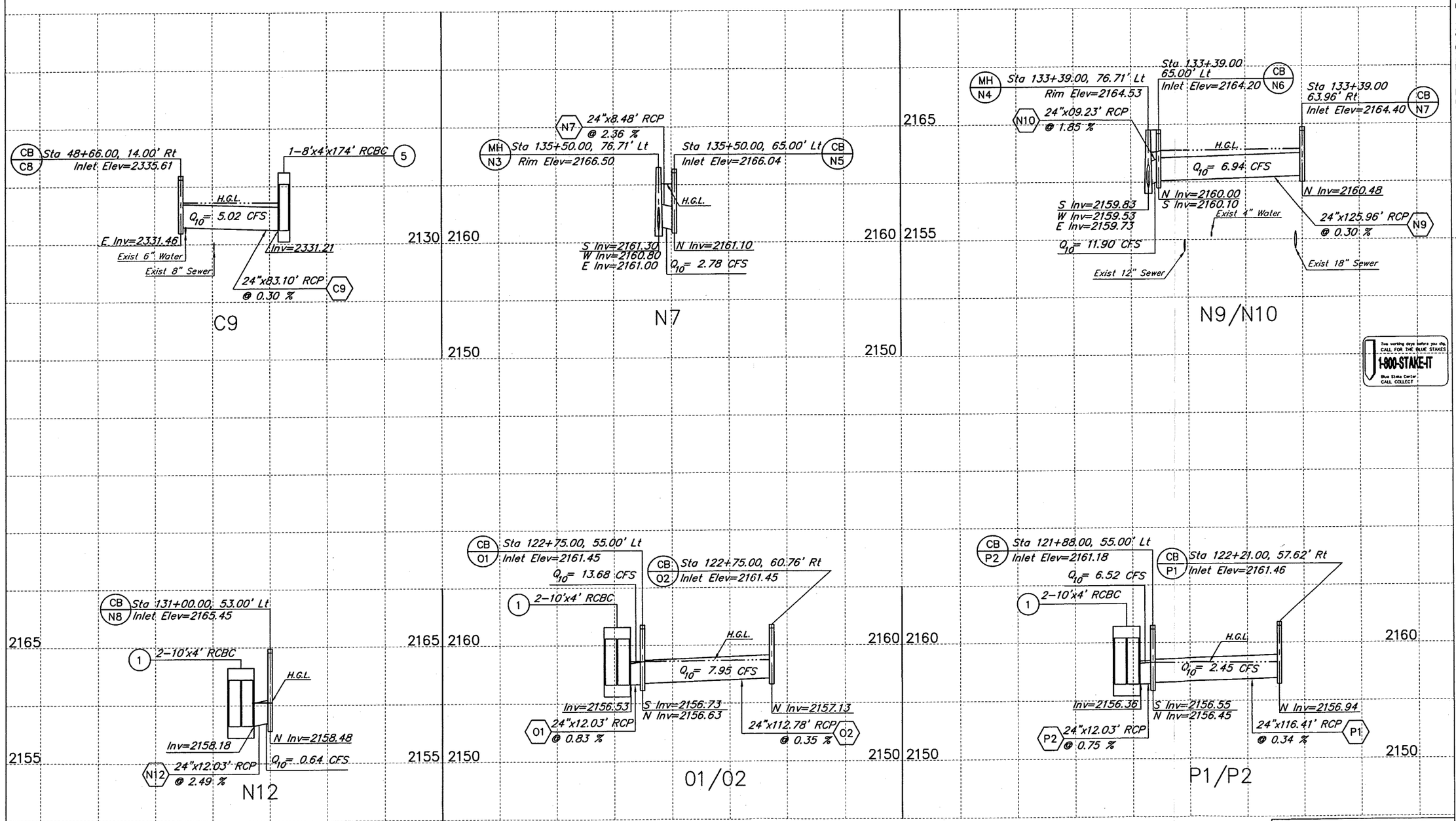
HARTMAN LANE STA 40+00 - 50+00

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
Michael Mathews Lodge Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

JOB NO.: 99057-01



Two working days before you dig CALL FOR THE BLUE STAKES 1-800-STAKE-IT Blue Stake Center CALL COLLECT

SCALES	
HORIZ.	1"=40'
VERT.	1"=4'

SHEET SD15 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

		DATE
DESIGNED	MED/SKP	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

LATERAL PROFILES

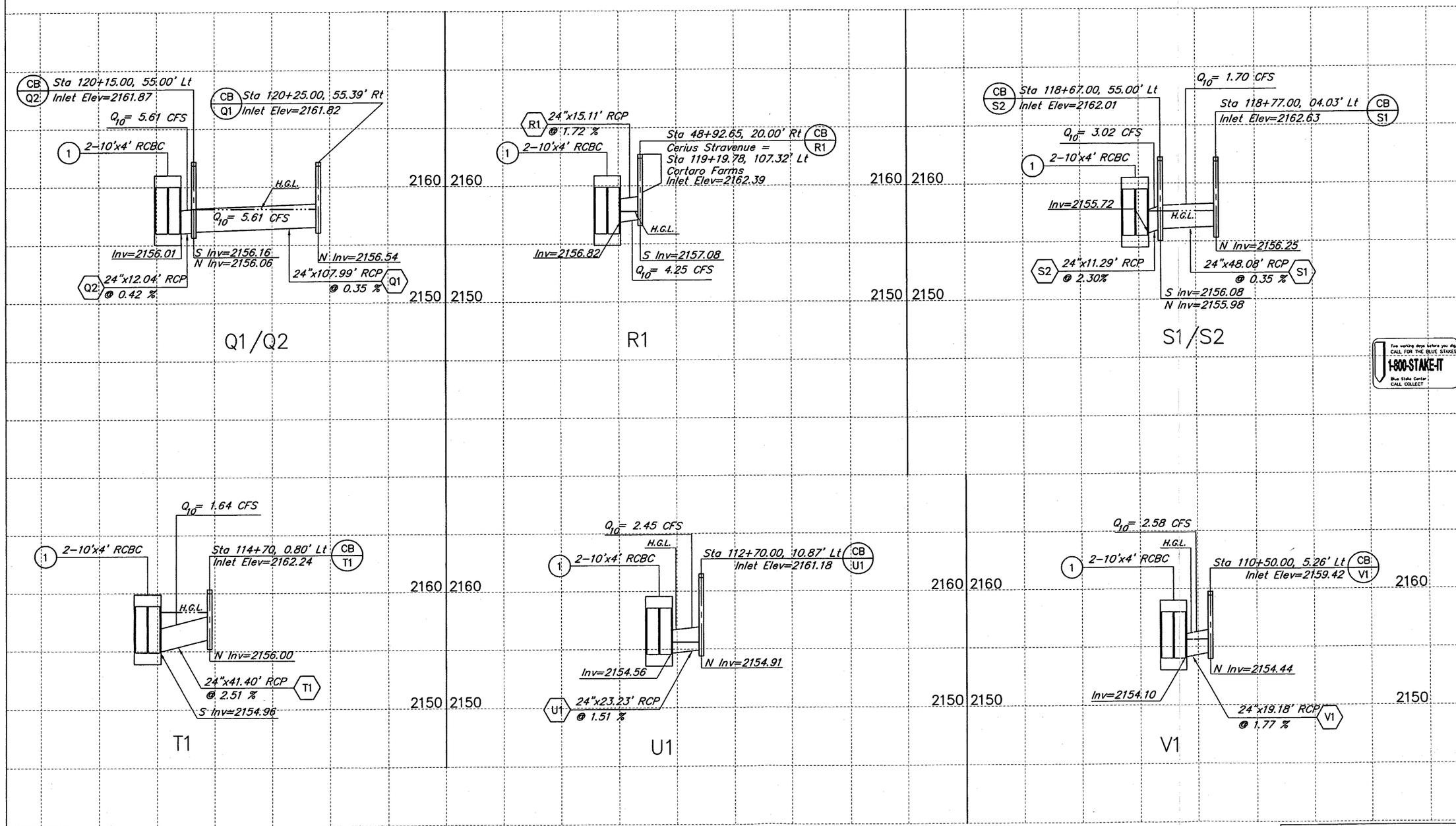
NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA Mattson Architects & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Weinrich Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

JOB NO.: 99067-01



SCALES HORIZ. 1"=40' VERT. 1"=4'

SHEET SD16 OF 17

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

		DATE
DESIGNED	MED/SKP	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

LATERAL PROFILES

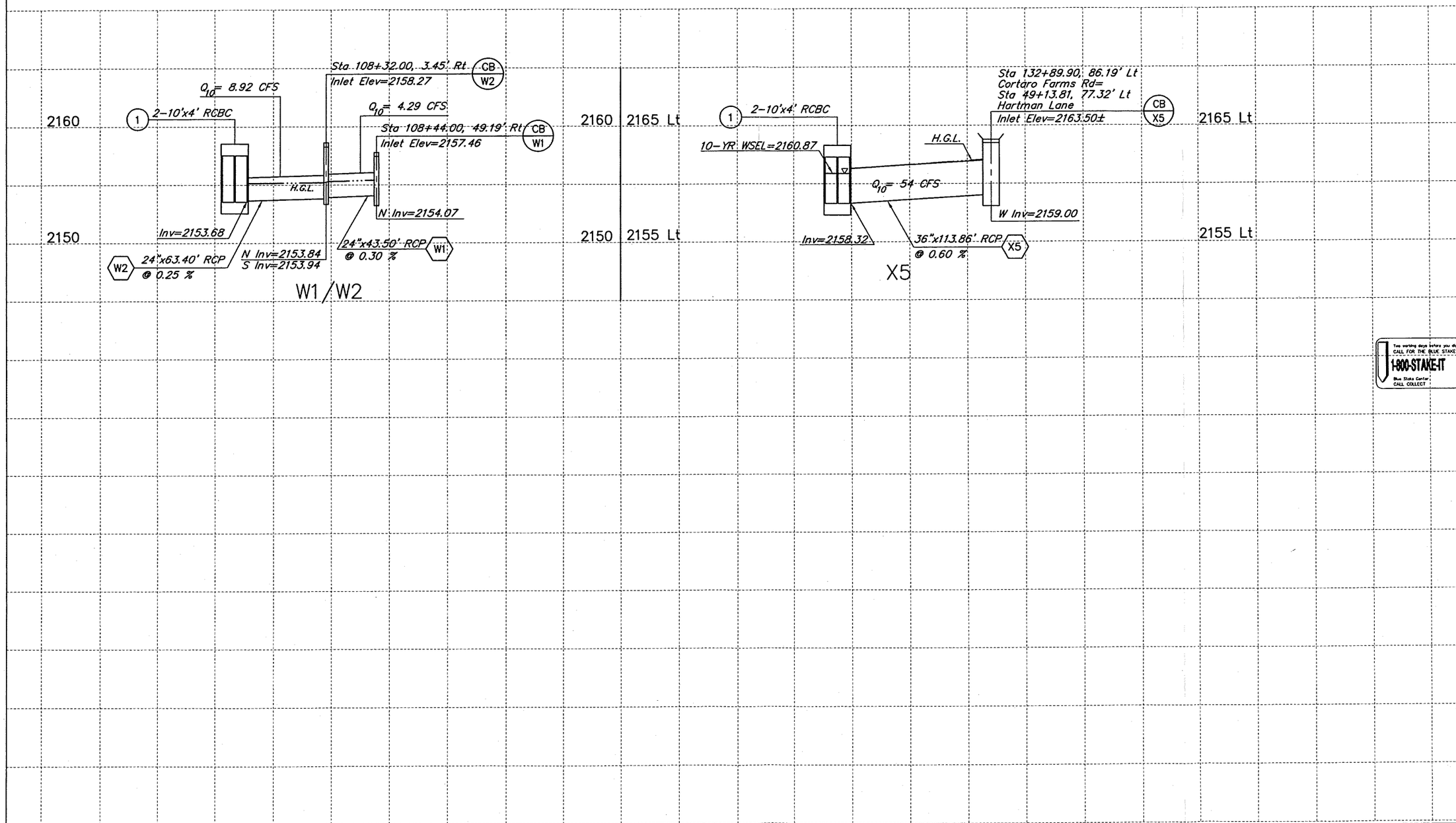
PIMA COUNTY W.O. 4TCFIT

800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McGann McClelland Lindsey & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources

JOB NO.: 99067-01



Two working days before you dig CALL FOR THE BLUE STAKES
1-800-STAKE-IT
Blue Stake Center CALL COLLECT

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

KURT WEINRICH, P.E., DIRECTOR

		DATE
DESIGNED	MED/SKP	4/02
DRAWN	TJF	4/02
CHECKED		4/02
PROJ. ENGR.	BAB	4/02

STORM DRAIN PLANS FOR CORTARO FARMS ROAD

LATERAL PROFILES

NO.	REVISION DESCRIPTION	DIV.\SECT. ENGR.	DATE

PIMA COUNTY W.O. 4TCFIT

SCHEMATIC NOT FOR CONSTRUCTION

MMLA
McGann Martin Lidge & Associates, Inc.
Engineering • Planning • Environmental • Surveying • Water Resources
800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1289

SHEET SD17 OF 17

SHEET OF

SCALES		
	HORIZ.	1"=40'
	VERT.	1"=4'

JOB NO.: 99067-01

Hydraflow Plan View

Project file: cfarms_anorth.stm	IDF file: SAMPLE.IDF	No. Lines: 4	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	A6	6.62	24 c	221.3	2343.77	2345.46	0.764	2345.17	2346.37	0.18	End
2	A5	4.86	24 c	197.0	2345.56	2346.47	0.462	2346.55	2347.25	0.14	1
3	A1+ (Exist.)	3.06	24 c	247.4	2346.57	2347.70	0.457	2347.39	2348.32	0.11	2
4	(Exist.)	1.44	24 c	209.1	2347.80	2349.17	0.655	2348.43	2349.59	0.14	3

Project File: cfarms_anorth.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 4	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

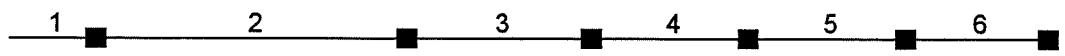
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	6.62	2343.77	2345.17	1.40	2.35	2.82	0.12	2345.29	0.104	221	2345.46	2346.37	0.91**	1.39	4.75	0.35	2346.72	0.403	0.253	N/A	0.50	0.18
2	24	4.86	2345.56	2346.55	0.99	1.54	3.15	0.15	2346.70	0.165	197	2346.47	2347.25	0.78**	1.14	4.28	0.28	2347.54	0.379	0.272	N/A	0.50	0.14
3	24	3.06	2346.57	2347.39	0.82	1.22	2.51	0.10	2347.49	0.124	247	2347.70	2348.32	0.62**	0.83	3.69	0.21	2348.53	0.359	0.242	N/A	0.50	0.11
4	24	1.44	2347.80	2348.43	0.63	0.84	1.71	0.05	2348.47	0.077	209	2349.17	2349.59	0.43**	0.49	2.95	0.14	2349.73	0.353	0.215	N/A	1.00	0.14

Project File: cfarms_anorth.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 4	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2345.17 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_asouth.stm	IDF file: SAMPLE.IDF	No. Lines: 6	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	A8	11.00	24 c	80.8	2342.52	2343.04	0.644	2343.69	2344.21	0.26	End
2	A7	8.27	24 c	292.0	2343.14	2345.82	0.918	2344.47	2346.84	0.21	1
3	A4	6.47	24 c	172.9	2345.82	2346.51	0.399	2347.04	2347.41	0.17	2
4	A3	4.74	24 c	146.8	2346.61	2347.08	0.320	2347.58	2347.86	0.14	3
5	A2+(Exist.)	2.93	24 c	147.1	2347.18	2347.81	0.428	2347.99	2348.42	0.10	4
6	(Exist.)	1.17	24 c	134.0	2347.91	2348.36	0.336	2348.52	2348.75	0.12	5

Project File: cfarms_asouth.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 6	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

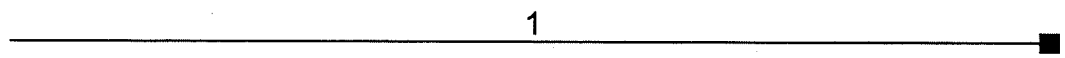
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	11.00	2342.52	2343.69	1.17	1.92	5.73	0.51	2344.21	0.477	80.8	2343.04	2344.21	1.17**	1.92	5.73	0.51	2344.73	0.477	0.477	N/A	0.50	0.26
2	24	8.27	2343.14	2344.47	1.33	2.22	3.73	0.22	2344.69	0.186	292	2345.82	2346.84	1.02**	1.61	5.14	0.41	2347.25	0.428	0.307	N/A	0.50	0.21
3	24	6.47	2345.82	2347.04	1.22	2.02	3.21	0.16	2347.20	0.145	173	2346.51	2347.41	0.90**	1.37	4.71	0.35	2347.76	0.400	0.273	N/A	0.50	0.17
4	24	4.74	2346.61	2347.58	0.97	1.52	3.12	0.15	2347.74	0.164	147	2347.08	2347.86	0.78	1.13	4.21	0.28	2348.13	0.369	0.266	0.391	0.50	0.14
5	24	2.93	2347.18	2347.99	0.81	1.20	2.44	0.09	2348.09	0.118	147	2347.81	2348.42	0.61**	0.80	3.64	0.21	2348.62	0.358	0.238	N/A	0.50	0.10
6	24	1.17	2347.91	2348.52	0.61	0.81	1.44	0.03	2348.55	0.056	134	2348.36	2348.75	0.39	0.43	2.74	0.12	2348.86	0.340	0.198	0.265	1.00	0.12

Project File: cfarms_asouth.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 6	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2343.695 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_b.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	B1	2.88	24 c	202.7	2341.21	2342.30	0.538	2343.04	2343.10	0.09	End

Project File: cfarms_b.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

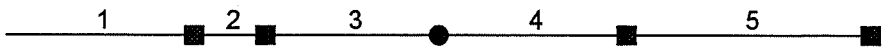
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	2.88	2341.21	2343.04	1.83	3.01	0.96	0.01	2343.05	0.012	203	2342.30	2343.10	0.80	1.17	2.47	0.09	2343.19	0.124	0.068	0.138	1.00	0.09

Project File: cfarms_b.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2343.04 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_csouth.stm	IDF file: SAMPLE.IDF	No. Lines: 5	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	C8	7.31	24 c	183.1	2331.02	2331.67	0.355	2332.03	2332.66	0.17	End
2	C7	6.55	24 c	69.4	2331.77	2332.03	0.375	2332.83	2332.94	0.17	1
3	C5	4.73	24 c	168.6	2332.13	2333.02	0.528	2333.11	2333.79	0.04	2
4	C3	4.73	24 c	183.4	2332.12	2333.23	0.605	2333.83	2334.01	0.14	3
5	C1	2.85	24 c	237.0	2334.33	2337.78	1.456	2334.93	2338.38	0.20	4

Project File: cfarms_csouth.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 5	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	7.31	2331.02	2332.03	1.01	1.59	4.60	0.33	2332.36	0.344	183	2331.67	2332.66	0.99	1.56	4.70	0.34	2333.01	0.365	0.355	0.649	0.50	0.17
2	24	6.55	2331.77	2332.83	1.06	1.70	3.85	0.23	2333.07	0.232	69.4	2332.03	2332.94	0.91	1.39	4.70	0.34	2333.28	0.394	0.313	0.217	0.50	0.17
3	24	4.73	2332.13	2333.11	0.98	1.54	3.08	0.15	2333.26	0.158	169	2333.02	2333.79	0.77**	1.12	4.24	0.28	2334.07	0.377	0.268	N/A	0.15	0.04
4	24	4.73	2332.12	2333.83	1.71	2.86	1.65	0.04	2333.87	0.035	183	2333.23	2334.01	0.78	1.12	4.20	0.27	2334.28	0.369	0.202	0.370	0.50	0.14
5	24	2.85	2334.33	2334.93	0.60*	0.79	3.61	0.20	2335.13	0.358	237	2337.78	2338.38	0.60**	0.79	3.61	0.20	2338.58	0.358	0.358	N/A	1.00	0.20

Project File: cfarms_csouth.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 5 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2332.03 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View

Project file: cfarms_dnorth.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	D3	5.09	24 c	170.3	2318.42	2318.93	0.299	2321.27*	2321.34*	0.02	End
2	D1	2.77	24 c	286.5	2319.03	2323.77	1.654	2321.36	2324.36	0.20	1

Project File: cfarms_dnorth.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

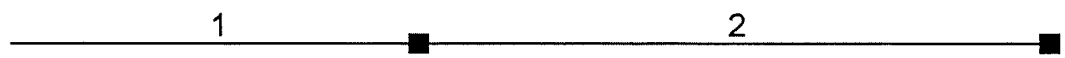
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	5.09	2318.42	2321.27	2.00	3.14	1.62	0.04	2321.31	0.043	170	2318.93	2321.34	2.00	3.14	1.62	0.04	2321.38	0.043	0.043	0.074	0.50	0.02
2	24	2.77	2319.03	2321.36	2.00	3.14	0.88	0.01	2321.38	0.013	287	2323.77	2324.36	0.59**	0.77	3.58	0.20	2324.56	0.357	0.185	N/A	1.00	0.20

Project File: cfarms_dnorth.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 2 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2321.27 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_dsouth.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	D4	4.47	24 c	126.7	2316.81	2317.54	0.576	2318.58	2318.60	0.05	End
2	D2	2.77	24 c	196.2	2317.64	2319.82	1.111	2318.65	2320.41	0.20	1

Project File: cfarms_dsouth.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

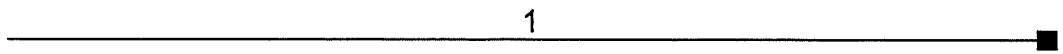
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	4.47	2316.81	2318.58	1.77	2.94	1.52	0.04	2318.62	0.030	127	2317.54	2318.60	1.06	1.68	2.66	0.11	2318.71	0.111	0.070	0.089	0.50	0.05
2	24	2.77	2317.64	2318.65	1.01	1.59	1.74	0.05	2318.70	0.049	196	2319.82	2320.41	0.59**	0.77	3.58	0.20	2320.61	0.357	0.203	N/A	1.00	0.20

Project File: cfarms_dsouth.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 2 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2318.58 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_e2.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	E2	2.02	24 c	174.4	2313.11	2314.37	0.722	2314.08	2314.87	0.17	End

Project File: cfarms_e2.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

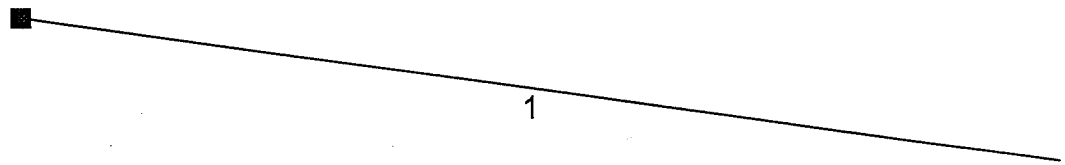
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	2.02	2313.11	2314.08	0.97	1.51	1.34	0.03	2314.11	0.030	174	2314.37	2314.87	0.50**	0.62	3.26	0.17	2315.04	0.353	0.191	N/A	1.00	0.17

Project File: cfarms_e2.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2314.08 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_e4.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	E4	1.89	24 c	50.9	2313.01	2313.20	0.373	2314.08	2314.08	0.03	End

Project File: cfarms_e4.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

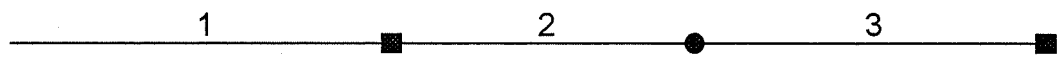
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	1.89	2313.01	2314.08	1.07	1.71	1.10	0.02	2314.10	0.019	50.9	2313.20	2314.08	0.88	1.33	1.42	0.03	2314.11	0.037	0.028	0.014	1.00	0.03

Project File: cfarms_e4.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2314.08 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_f.stm	IDF file: SAMPLE.IDF	No. Lines: 3	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	F3	4.64	24 c	215.4	2305.47	2307.98	1.165	2306.23	2308.74	0.14	End
2	F2	1.81	24 c	170.9	2308.08	2309.82	1.018	2308.88	2310.30	0.02	1
3	F1	1.81	24 c	198.3	2309.92	2312.10	1.099	2310.40	2312.58	0.15	2

Project File: cfarms_f.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 3	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

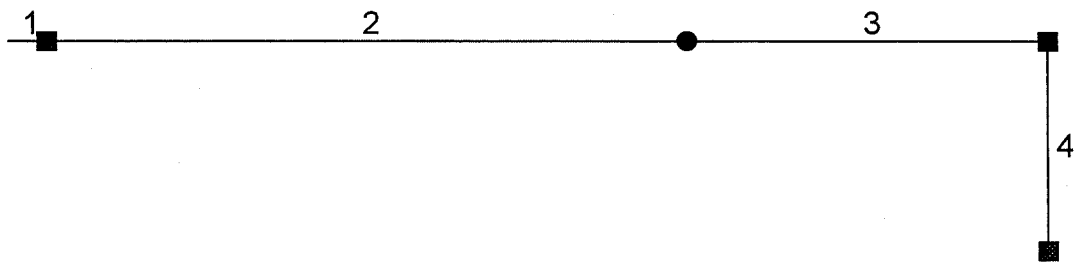
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	4.64	2305.47	2306.23	0.76	1.10	4.21	0.28	2306.51	0.376	215	2307.98	2308.74	0.76**	1.10	4.21	0.28	2309.02	0.376	0.376	N/A	0.50	0.14
2	24	1.81	2308.08	2308.88	0.80	1.18	1.54	0.04	2308.92	0.048	171	2309.82	2310.30	0.48**	0.57	3.15	0.15	2310.45	0.352	0.200	N/A	0.15	0.02
3	24	1.81	2309.92	2310.40	0.48*	0.57	3.15	0.15	2310.55	0.352	198	2312.10	2312.58	0.48**	0.57	3.15	0.15	2312.73	0.352	0.352	N/A	1.00	0.15

Project File: cfarms_f.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 3 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2306.233 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_g.stm	IDF file: SAMPLE.IDF	No. Lines: 4	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	G4	12.67	24 c	15.9	2289.04	2292.08	19.060	2290.56	2293.34	0.29	End
2	G3	9.86	24 c	262.8	2292.18	2296.51	1.648	2293.63	2297.62	0.07	1
3	G2	9.86	24 c	147.9	2296.61	2299.09	1.677	2297.72	2300.20	0.70	2
4	G1	6.73	24 c	89.0	2299.39	2299.81	0.472	2300.91	2300.93	0.22	3

Project File: cfarms_g.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 4	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

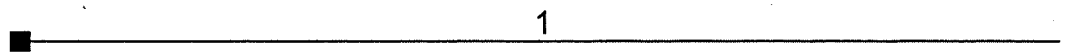
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	12.67	2289.04	2290.56	1.52	2.56	4.95	0.38	2290.94	0.312	15.9	2292.08	2293.34	1.26**	2.09	6.07	0.57	2293.91	0.511	0.411	N/A	0.50	0.29
2	24	9.86	2292.18	2293.63	1.45	2.43	4.05	0.25	2293.88	0.212	263	2296.51	2297.62	1.11**	1.79	5.49	0.47	2298.09	0.456	0.334	N/A	0.15	0.07
3	24	9.86	2296.61	2297.72	1.11*	1.79	5.49	0.47	2298.19	0.456	148	2299.09	2300.20	1.11**	1.79	5.49	0.47	2300.67	0.456	0.456	N/A	1.50	0.70
4	24	6.73	2299.39	2300.91	1.52	2.56	2.63	0.11	2301.01	0.089	89.0	2299.81	2300.93	1.12	1.81	3.72	0.22	2301.14	0.208	0.148	0.132	1.00	0.22

Project File: cfarms_g.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 4	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2290.56 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_h.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	H1	6.35	24 c	19.2	2286.11	2287.08	5.052	2287.00	2287.97	0.34	End

Project File: cfarms_h.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

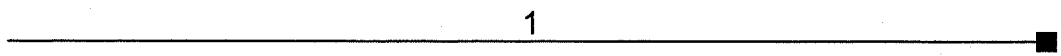
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	6.35	2286.11	2287.00	0.89	1.36	4.68	0.34	2287.34	0.399	19.2	2287.08	2287.97	0.89**	1.36	4.68	0.34	2288.31	0.399	0.399	N/A	1.00	0.34

Project File: cfarms_h.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2287.003 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_i.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	l1	2.73	24 c	298.1	2276.41	2283.21	2.281	2277.24	2283.80	0.20	End

Project File: cfarms_i.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

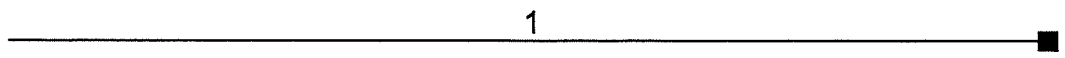
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	2.73	2276.41	2277.24	0.83	1.23	2.21	0.08	2277.32	0.096	298	2283.21	2283.80	0.59**	0.77	3.57	0.20	2283.99	0.357	0.226	N/A	1.00	0.20

Project File: cfarms_i.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2277.24 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_j.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	J1	3.76	24 c	268.9	2266.23	2271.89	2.105	2267.55	2272.58	0.24	End

Project File: cfarms_j.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

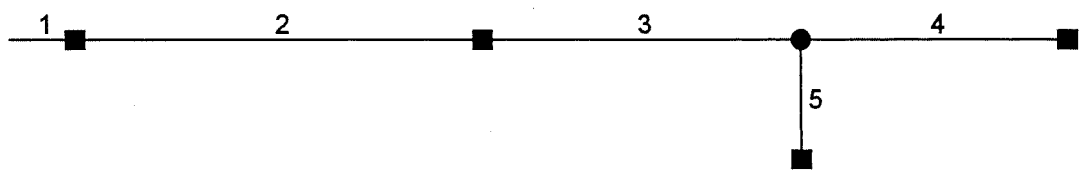
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	3.76	2266.23	2267.55	1.32	2.20	1.71	0.05	2267.60	0.039	269	2271.89	2272.58	0.69**	0.95	3.94	0.24	2272.82	0.366	0.203	N/A	1.00	0.24

Project File: cfarms_j.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2267.55 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_k.stm	IDF file: SAMPLE.IDF	No. Lines: 5	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	K5	20.55	24 c	49.1	2233.72	2234.72	2.037	2236.20	2236.33	0.45	End
2	K4	16.36	24 c	302.3	2234.82	2243.72	2.944	2236.78	2245.15	0.36	1
3	K3	12.66	24 c	235.9	2243.82	2252.21	3.556	2245.51	2253.47	0.57	2
4	K1	3.63	24 c	198.0	2252.31	2259.77	3.768	2254.04	2260.44	0.24	3
5	K2	9.03	24 c	92.7	2252.51	2253.31	0.863	2254.04	2254.37	0.44	3

Project File: cfarms_k.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 5	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * indicates surcharge condition.

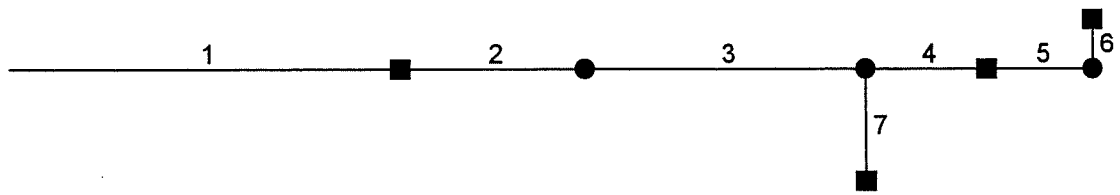
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	20.55	2233.72	2236.20	2.00	3.14	6.54	0.67	2236.87	0.704	49.1	2234.72	2236.33	1.61	2.71	7.58	0.89	2237.22	0.728	0.716	0.351	0.50	0.45
2	24	16.36	2234.82	2236.78	1.96	3.12	5.24	0.43	2237.20	0.398	302	2243.72	2245.15	1.43**	2.41	6.79	0.72	2245.87	0.599	0.499	N/A	0.50	0.36
3	24	12.66	2243.82	2245.51	1.69	2.83	4.47	0.31	2245.82	0.253	236	2252.21	2253.47	1.26**	2.09	6.07	0.57	2254.04	0.511	0.382	N/A	1.00	0.57
4	24	3.63	2252.31	2254.04	1.73	2.89	1.26	0.02	2254.07	0.020	198	2259.77	2260.44	0.67**	0.93	3.89	0.24	2260.68	0.365	0.192	N/A	1.00	0.24
5	24	9.03	2252.51	2254.04	1.53	2.58	3.49	0.19	2254.23	0.155	92.7	2253.31	2254.37	1.06**	1.70	5.31	0.44	2254.81	0.441	0.298	N/A	1.00	0.44

Project File: cfarms_k.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 5	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2236.2 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_l.stm	IDF file: SAMPLE.IDF	No. Lines: 7	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	L7	16.67	24 c	334.8	2207.93	2216.61	2.593	2209.45	2218.06	0.37	End
2	L6	12.99	24 c	158.5	2216.71	2220.94	2.669	2218.42	2222.22	0.09	1
3	L5	12.99	24 c	240.0	2221.04	2226.89	2.437	2222.32	2228.17	0.59	2
4	L3	4.59	24 c	103.5	2227.09	2229.42	2.251	2228.75	2230.18	0.14	3
5	L2	1.83	24 c	90.6	2229.52	2230.57	1.158	2230.32	2231.05	0.16	4
6	L1	1.83	24 c	43.5	2230.87	2231.02	0.345	2231.35	2231.50	0.15	5
7	L4	8.40	24 c	100.5	2227.19	2227.87	0.677	2228.75	2228.90	0.42	3

Project File: cfarms_I.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 7	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

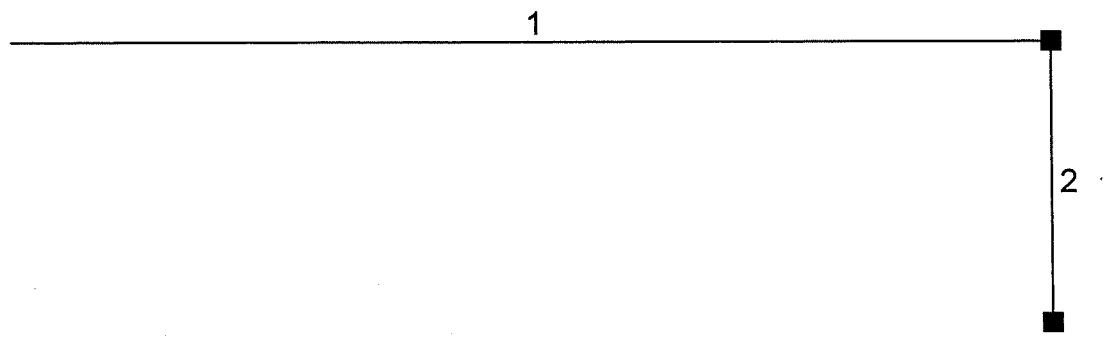
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	16.67	2207.93	2209.45	1.52	2.56	6.51	0.66	2210.11	0.540	335	2216.61	2218.06	1.45**	2.43	6.85	0.73	2218.79	0.608	0.574	N/A	0.50	0.37
2	24	12.99	2216.71	2218.42	1.71	2.86	4.54	0.32	2218.74	0.262	159	2220.94	2222.22	1.28**	2.12	6.14	0.59	2222.80	0.518	0.390	N/A	0.15	0.09
3	24	12.99	2221.04	2222.32	1.28*	2.12	6.14	0.59	2222.90	0.518	240	2226.89	2228.17	1.28**	2.12	6.14	0.59	2228.75	0.518	0.518	N/A	1.00	0.59
4	24	4.59	2227.09	2228.75	1.66	2.79	1.65	0.04	2228.79	0.034	104	2229.42	2230.18	0.76**	1.09	4.20	0.27	2230.45	0.375	0.205	N/A	0.50	0.14
5	24	1.83	2229.52	2230.32	0.80	1.16	1.57	0.04	2230.35	0.050	90.6	2230.57	2231.05	0.48**	0.58	3.16	0.16	2231.21	0.352	0.201	N/A	1.00	0.16
6	24	1.83	2230.87	2231.35	0.48*	0.58	3.16	0.16	2231.50	0.352	43.5	2231.02	2231.50	0.48	0.59	3.13	0.15	2231.66	0.340	0.346	0.150	1.00	0.15
7	24	8.40	2227.19	2228.75	1.56	2.63	3.19	0.16	2228.91	0.129	101	2227.87	2228.90	1.03**	1.62	5.17	0.42	2229.31	0.430	0.280	N/A	1.00	0.42

Project File: cfarms_I.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 7 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2209.45 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_m.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	M2	12.55	24 c	324.2	2194.01	2204.63	3.276	2195.26	2205.88	0.85	End
2	M1	8.67	24 c	91.2	2204.93	2205.39	0.504	2206.74	2206.79	0.21	1

Project File: cfarms_m.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

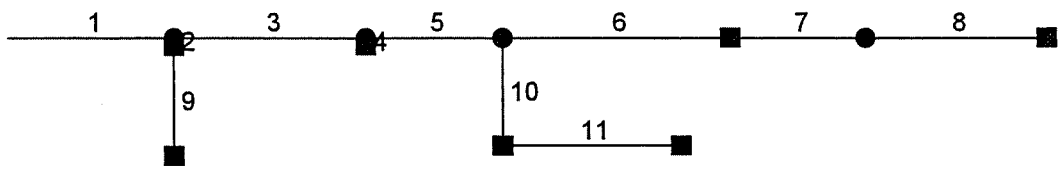
Hydraflow Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	24	12.55	2194.01	2195.26	1.25	2.07	6.05	0.57	2195.83	0.508	324	2204.63	2205.88	1.25**	2.07	6.05	0.57	2206.45	0.508	0.508	N/A	1.50	0.85
2	24	8.67	2204.93	2206.74	1.81	2.99	2.90	0.13	2206.87	0.110	91.2	2205.39	2206.79	1.40	2.34	3.70	0.21	2207.00	0.180	0.145	0.132	1.00	0.21

Project File: cfarms_m.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 2 | Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2195.265 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_n.stm	IDF file: SAMPLE.IDF	No. Lines: 11	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	N11	34.01	30 c	182.8	2158.29	2159.23	0.514	2160.35	2161.48	0.83	End
2	N10	11.90	24 c	9.2	2159.83	2160.00	1.847	2162.31*	2162.33*	0.11	1
3	N8	22.11	24 c	211.0	2159.73	2160.80	0.507	2162.31*	2164.03*	0.77	1
4	N7	2.78	24 c	8.5	2161.10	2161.30	2.352	2164.80*	2164.80*	0.01	3
5	N6	19.32	24 c	150.2	2161.00	2162.75	1.165	2164.80*	2165.74*	0.59	3
6	N3	7.94	24 c	251.2	2162.95	2172.56	3.826	2166.32	2173.56	0.20	5
7	N2	3.98	24 c	148.1	2172.66	2178.10	3.673	2173.76	2178.81	0.04	6
8	N1	3.98	24 c	199.3	2178.20	2186.48	4.154	2178.91	2187.19	0.25	7
9	N9	6.94	24 c	126.0	2160.10	2160.48	0.301	2162.45*	2162.56*	0.08	2
10	N5	11.38	24 c	123.0	2163.05	2163.67	0.504	2166.32*	2166.59*	0.31	5
11	N4	7.64	24 c	196.7	2163.97	2166.45	1.261	2166.89	2167.43	0.39	10

Project File: cfarms_n.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 11	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

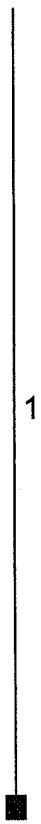
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	30	34.01	2158.29	2160.35	2.06	4.33	7.86	0.96	2161.31	0.580	183	2159.23	2161.48	2.25	4.66	7.30	0.83	2162.31	0.515	0.548	1.001	1.00	0.83
2	24	11.90	2159.83	2162.31	2.00	3.14	3.79	0.22	2162.54	0.236	9.2	2160.00	2162.33	2.00	3.14	3.79	0.22	2162.56	0.236	0.236	0.022	0.50	0.11
3	24	22.11	2159.73	2162.31	2.00	3.14	7.04	0.77	2163.08	0.815	211	2160.80	2164.03	2.00	3.14	7.04	0.77	2164.80	0.814	0.814	1.718	1.00	0.77
4	24	2.78	2161.10	2164.80	2.00	3.14	0.89	0.01	2164.81	0.013	8.5	2161.30	2164.80	2.00	3.14	0.88	0.01	2164.81	0.013	0.013	0.001	1.00	0.01
5	24	19.32	2161.00	2164.80	2.00	3.14	6.15	0.59	2165.39	0.622	150	2162.75	2165.74	2.00	3.14	6.15	0.59	2166.32	0.622	0.622	0.934	1.00	0.59
6	24	7.94	2162.95	2166.32	2.00	3.14	2.53	0.10	2166.42	0.105	251	2172.56	2173.56	1.00**	1.57	5.07	0.40	2173.96	0.423	0.264	N/A	0.50	0.20
7	24	3.98	2172.66	2173.76	1.10	1.77	2.25	0.08	2173.84	0.077	148	2178.10	2178.81	0.71**	0.99	4.01	0.25	2179.06	0.368	0.223	N/A	0.15	0.04
8	24	3.98	2178.20	2178.91	0.71*	0.99	4.01	0.25	2179.16	0.369	199	2186.48	2187.19	0.71**	0.99	4.01	0.25	2187.44	0.368	0.369	N/A	1.00	0.25
9	24	6.94	2160.10	2162.45	2.00	3.14	2.21	0.08	2162.52	0.094	126	2160.48	2162.56	2.00	3.14	2.21	0.08	2162.64	0.094	0.094	0.119	1.00	0.08
10	24	11.38	2163.05	2166.32	2.00	3.14	3.62	0.20	2166.53	0.216	123	2163.67	2166.59	2.00	3.14	3.62	0.20	2166.79	0.216	0.216	0.265	1.50	0.31
11	24	7.64	2163.97	2166.89	2.00	3.14	2.43	0.09	2166.99	0.097	197	2166.45	2167.43	0.98**	1.53	5.00	0.39	2167.82	0.418	0.258	N/A	1.00	0.39

Project File: cfarms_n.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 11	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2160.35 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_n2.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	N12	0.64	24 c	12.0	2158.18	2158.48	2.500	2160.21	2160.21	0.00	End

Project File: cfarms_n2.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

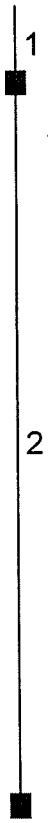
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	0.64	2158.18	2160.21	2.00	3.14	0.20	0.00	2160.21	0.001	12.0	2158.48	2160.21	1.73	2.89	0.22	0.00	2160.21	0.001	0.001	0.000	1.00	0.00

Project File: cfarms_n2.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2160.21 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_o.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	O1	13.68	24 c	12.0	2156.53	2156.63	0.832	2158.36	2158.37	0.17	End
2	O2	7.95	24 c	112.8	2156.73	2157.13	0.355	2158.54	2158.62	0.16	1

Project File: cfarms_o.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

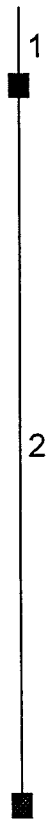
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	13.68	2156.53	2158.36	1.83	3.01	4.54	0.32	2158.68	0.271	12.0	2156.63	2158.37	1.74	2.90	4.72	0.35	2158.71	0.285	0.278	0.033	0.50	0.17
2	24	7.95	2156.73	2158.54	1.81	2.99	2.66	0.11	2158.65	0.092	113	2157.13	2158.62	1.49	2.51	3.16	0.16	2158.78	0.128	0.110	0.124	1.00	0.16

Project File: cfarms_o.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2158.36 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_p.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	P2	6.52	24 c	12.0	2156.36	2156.45	0.749	2158.17	2158.17	0.04	End
2	P1	2.45	24 c	111.0	2156.55	2156.94	0.351	2158.21	2158.22	0.02	1

Project File: cfarms_p.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	6.52	2156.36	2158.17	1.81	2.99	2.18	0.07	2158.24	0.062	12.0	2156.45	2158.17	1.72	2.87	2.27	0.08	2158.25	0.066	0.064	0.008	0.50	0.04
2	24	2.45	2156.55	2158.21	1.66	2.79	0.88	0.01	2158.22	0.010	111	2156.94	2158.22	1.28	2.12	1.15	0.02	2158.24	0.018	0.014	0.016	1.00	0.02

Project File: cfarms_p.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2158.17 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View

Project file: cfarms_q.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	Q2	5.61	24 c	12.0	2156.01	2156.06	0.417	2157.78	2157.78	0.03	End
2	Q1	0.44	24 c	108.0	2156.16	2156.54	0.352	2157.81	2157.82	0.00	1

Project File: cfarms_q.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

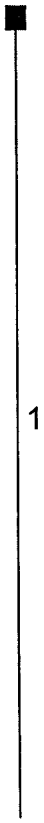
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	5.61	2156.01	2157.78	1.77	2.94	1.91	0.06	2157.84	0.047	12.0	2156.06	2157.78	1.72	2.88	1.95	0.06	2157.84	0.048	0.048	0.006	0.50	0.03
2	24	0.44	2156.16	2157.81	1.65	2.78	0.16	0.00	2157.81	0.000	108	2156.54	2157.82	1.28	2.11	0.21	0.00	2157.82	0.001	0.000	0.000	1.00	0.00

Project File: cfarms_q.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2157.78 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_r.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	R1	4.25	24 c	15.1	2156.82	2157.08	1.721	2157.56	2157.81	0.26	End

Project File: cfarms_r.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	4.25	2156.82	2157.56	0.74	1.06	4.02	0.25	2157.81	0.353	15.1	2157.08	2157.81	0.73**	1.04	4.10	0.26	2158.07	0.371	0.362	N/A	1.00	0.26

Project File: cfarms_r.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2157.56 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View

Project file: cfarms_s.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	S2	3.02	24 c	11.3	2155.72	2155.98	2.303	2157.45	2157.45	0.01	End
2	S1	1.70	24 c	48.1	2156.08	2156.25	0.353	2157.46	2157.46	0.01	1

Project File: cfarms_s.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

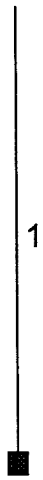
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	3.02	2155.72	2157.45	1.73	2.89	1.05	0.02	2157.47	0.014	11.3	2155.98	2157.45	1.47	2.47	1.22	0.02	2157.47	0.019	0.017	0.002	0.50	0.01
2	24	1.70	2156.08	2157.46	1.38	2.31	0.74	0.01	2157.47	0.007	48.1	2156.25	2157.46	1.21	1.99	0.86	0.01	2157.47	0.010	0.009	0.004	1.00	0.01

Project File: cfarms_s.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2157.45 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_t.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	T1	1.64	24 c	41.4	2154.96	2156.00	2.512	2156.60	2156.56	0.08	End

Project File: cfarms_t.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

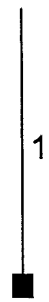
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	1.64	2154.96	2156.60	1.64	2.76	0.59	0.01	2156.61	0.004	41.4	2156.00	2156.56	0.56	0.72	2.29	0.08	2156.64	0.155	0.080	0.033	1.00	0.08

Project File: cfarms_t.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2156.6 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_u.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	U1	2.45	24 c	23.2	2154.56	2154.91	1.506	2156.15	2156.15	0.01	End

Project File: cfarms_u.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

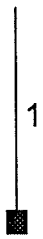
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	2.45	2154.56	2156.15	1.59	2.68	0.91	0.01	2156.16	0.011	23.2	2154.91	2156.15	1.24	2.04	1.20	0.02	2156.17	0.020	0.015	0.004	0.50	0.01

Project File: cfarms_u.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2156.15 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_v.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	V1	2.58	24 c	19.2	2154.10	2154.44	1.770	2155.64	2155.63	0.01	End

Project File: cfarms_v.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	2.58	2154.10	2155.64	1.54	2.60	0.99	0.02	2155.66	0.013	19.2	2154.44	2155.63	1.19	1.95	1.32	0.03	2155.66	0.025	0.019	0.004	0.50	0.01

Project File: cfarms_v.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2155.64 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View

Project file: cfarms_w.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-02-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	W2	8.92	24 c	63.4	2153.68	2153.84	0.253	2155.16	2155.25	0.11	End
2	W1	4.29	24 c	43.5	2153.94	2154.07	0.299	2155.36	2155.37	0.06	1

Project File: cfarms_w.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-02-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

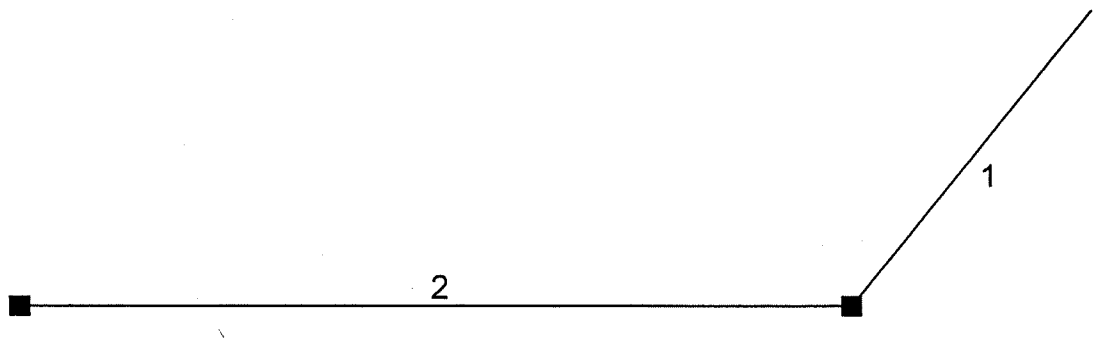
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	8.92	2153.68	2155.16	1.48	2.49	3.58	0.20	2155.36	0.164	63.4	2153.84	2155.25	1.41	2.37	3.77	0.22	2155.47	0.185	0.175	0.111	0.50	0.11
2	24	4.29	2153.94	2155.36	1.42	2.39	1.80	0.05	2155.41	0.042	43.5	2154.07	2155.37	1.30	2.16	1.98	0.06	2155.43	0.054	0.048	0.021	1.00	0.06

Project File: cfarms_w.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2155.16 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_x1&x2.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-21-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	X2	9.62	24 c	78.0	2161.48	2161.90	0.538	2162.83	2163.00	0.51	End
2	X1	8.52	24 c	166.3	2162.00	2164.00	1.203	2163.51	2165.03	0.42	1

Project File: cfarms_x1&x2.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-24-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

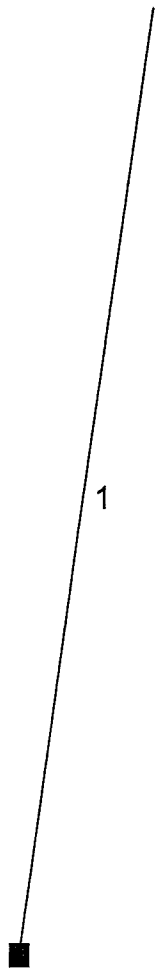
Hydraflow Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	24	9.62	2161.48	2162.83	1.35	2.26	4.26	0.28	2163.11	0.242	78.0	2161.90	2163.00	1.10**	1.77	5.44	0.46	2163.46	0.451	0.347	N/A	1.10	0.51
2	24	8.52	2162.00	2163.51	1.51	2.54	3.36	0.18	2163.68	0.144	166	2164.00	2165.03	1.03**	1.64	5.20	0.42	2165.45	0.432	0.288	N/A	1.00	0.42

Project File: cfarms_x1&x2.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-24-2002

NOTES: Initial tailwater elevation = 2162.83 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_x3.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-21-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	X3	5.65	24 c	8.4	2159.87	2160.35	5.714	2161.05	2161.19	0.16	End

Project File: cfarms_x3.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-21-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

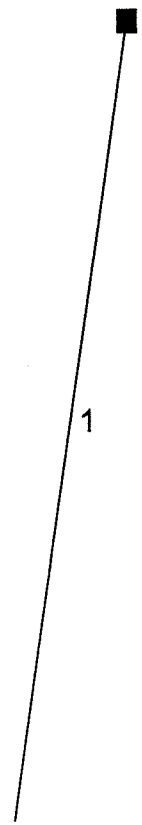
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	5.65	2159.87	2161.05	1.18	1.93	2.93	0.13	2161.18	0.124	8.4	2160.35	2161.19	0.84**	1.26	4.50	0.31	2161.51	0.389	0.257	N/A	0.50	0.16

Project File: cfarms_x3.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-21-2002

NOTES: Initial tailwater elevation = 2161.05 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_x4.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-21-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	X4	2.21	24 c	56.7	2159.39	2159.69	0.529	2160.94	2160.94	0.01	End

Project File: cfarms_x4.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-21-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

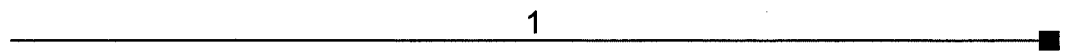
Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	2.21	2159.39	2160.94	1.55	2.61	0.85	0.01	2160.95	0.009	56.7	2159.69	2160.94	1.25	2.06	1.07	0.02	2160.96	0.016	0.013	0.007	0.50	0.01

Project File: cfarms_x4.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 1	Run Date: 10-21-2002

NOTES: Initial tailwater elevation = 2160.94 (ft) , * Critical depth assumed., ** Critical depth assumed.

Hydraflow Plan View



Project file: cfarms_x5.stm	IDF file: SAMPLE.IDF	No. Lines: 1	10-21-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	1	54.00	36 c	113.9	2158.32	2159.00	0.597	2161.32*	2162.07*	0.91	End

Project File: cfarms_x5.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 1	Run Date: 10-21-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	36	54.00	2158.32	2161.32	3.00	7.07	7.64	0.91	2162.23	0.656	114	2159.00	2162.07	3.00	7.07	7.64	0.91	2162.97	0.656	0.656	0.747	1.00	0.91

Project File: cfarms_x5.stm | I-D-F File: SAMPLE.IDF | Total number of lines: 1 | Run Date: 10-21-2002

NOTES: Initial tailwater elevation = 2161.32 (ft) , * Crown depth assumed., ** Critical depth assumed.

Hydraflow Plan View

Project file: cfarms_y.stm	IDF file: SAMPLE.IDF	No. Lines: 2	10-21-2002

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	1	58.00	42 c	424.1	2156.50	2157.14	0.151	2160.00*	2161.41*	0.08	End
2	2	36.00	30 c	115.6	2157.24	2157.41	0.147	2161.49*	2162.39*	0.84	1

Project File: cfarms_y.stm	I-D-F File: SAMPLE.IDF	Total No. Lines: 2	Run Date: 10-21-2002

NOTES: c = circular; e = elliptical; b = box; Return period = 100 Yrs.; * Indicates surcharge condition.

Hydraflow Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	42	58.00	2156.50	2160.00	3.50	9.62	6.03	0.57	2160.57	0.332	424	2157.14	2161.41	3.50	9.62	6.03	0.57	2161.98	0.332	0.332	1.410	0.15	0.08
2	30	36.00	2157.24	2161.49	2.50	4.91	7.34	0.84	2162.33	0.771	116	2157.41	2162.39	2.50	4.91	7.33	0.84	2163.22	0.771	0.771	0.891	1.00	0.84

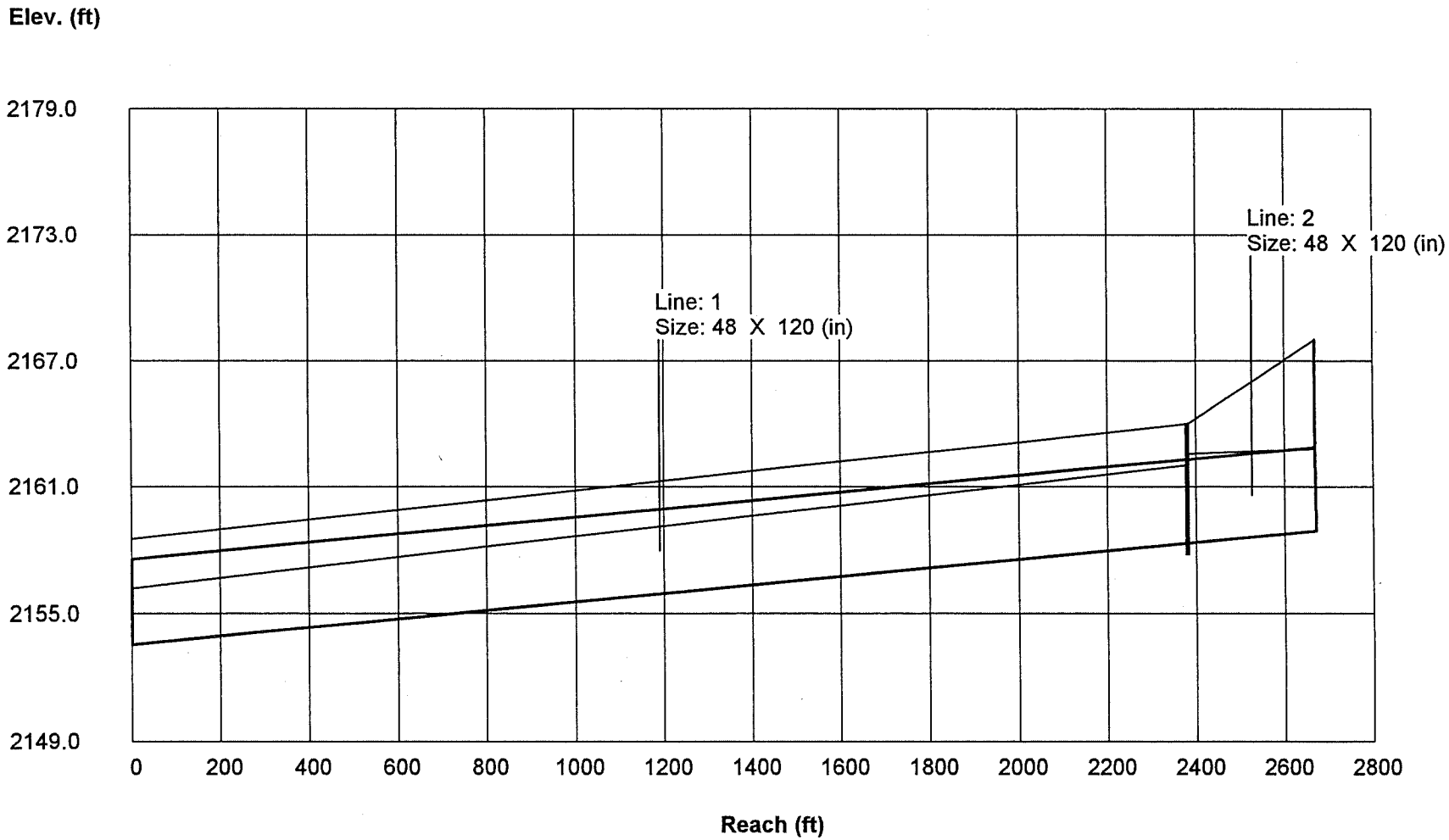
Project File: cfarms_y.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-21-2002

NOTES: Initial tailwater elevation = 2160 (ft) , * Crown depth assumed., ** Critical depth assumed.

2,670' 2 – 10' X 4' RCBC
HYDRAULIC GRADE LINE ANALYSIS
(100-YEAR)

Storm Sewer Profile

Proj. file: cfarms_hrtmn.stm



Hydraflow Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	48 120 b	243.0	2153.56	2156.20	2.64	26.35	9.22	1.32	2157.52	0.314	2380	2158.32	2162.02	3.70	36.96	6.58	0.67	2162.69	0.121	0.218	5.180	0.85	0.57
2	48 120 b	190.0	2158.32	2162.59	4.00	40.00	4.75	0.35	2162.94	0.107	290	2158.90	2162.83	3.93	39.27	4.84	0.36	2163.19	0.063	0.085	0.246	1.00	0.36

Project File: cfarms_hrtmn.stm	I-D-F File: SAMPLE.IDF	Total number of lines: 2	Run Date: 10-02-2002

NOTES: Initial tailwater elevation = 2156.196 (ft) , * Critical depth assumed., ** Critical depth assumed.