Y_2 = general scour of flow depth at the bridge,

D_{50}= the median diameter of the bed material at the bridge.

3.7 Local Scour

Local scour occurs in the bed at embankments due to the actions of vortex systems induced by obstruction of the flow. Local scour occurs in conjunction with, or in the absence of, degradation, aggradation, and general scour. The basic mechanism causing local scour is the vortex of fluid resulting from the pileup of water on the upstream edge and subsequent acceleration of flow around the nose of the embankment. The action of the vortex is to erode bed materials away from the base region. If the transport rate of sediment away from the local region is greater than the transport rate into the region, a scour hole develops. As the depth is increased, strength of the vortex is reduced, transport rate is reduced, equilibrium is re-established, and scouring ceases.

The depth of scour varies with time because sediment transported into the scour hole from upstream varies depending upon the presence or absence of dunes. A mean scour depth between the oscillation or scour depth is referred to as equilibrium scour depth.

3.7.1 Local Scour Around Embankments

Detailed studies of scour around embankments have been performed mostly in laboratories. According to the studies of Liu et al. (1961), the equilibrium scour depth for local scour in sand when the flow is subcritical is determined by the expression

$$\frac{Y_s}{Y_1} = 1.1 \left(\frac{a}{Y_1} \right)^{0.40} Fr_1^{\,0.33} \qquad (3\text{-}7)$$

where, Y_s = the equilibrium scour depth measured from the mean bed level to the bottom of the scour hole, where, Y_1 = the upstream flow depth,

a = the embankment length measured normal to the bank,

Fr_1 = the upstream Froude number.

If the embankment terminates at a vertical wall on the upstream side, then the scour depth in sand nearly doubles. That is,

$$\frac{Y_s}{Y_1} = 2.15 \left(\frac{a}{Y_1} \right)^{0.40} Fr_1^{\,0.33} \qquad (3\text{-}8)$$

Vertical

Field data for scour at embankments for various size rivers is scarce, but data collected at rock dikes on the Mississippi River indicate that

$$\frac{Y_s}{Y_1} = 4\ Fr_1^{\,0.33} \qquad (3\text{-}9)$$

determines the equilibrium scour depth for large a/Y_1.* It is recommended that Equations 3-7 and 3-8 be applied to embankments with $0 < a/Y_1 < 25$ and Equation 3-9 be used for $a/Y_1 > 25$. If $a/Y_1 > 25$, then scour depth is independent of a/Y_1 and depends only on the approach Froude number and depth of flow.

In applying Equations 3-7 and 3-8, the embankment length a is measured from the high waterline at the valley bank perpendicularly to the end of the embankment. A definition of the embankment length for a natural channel with riprap protection is shown in Figure 3-2. It is not uncommon to find depths to be 30 percent greater than equilibrium scour depth. Lateral extent of scour can be determined from the angle of repose of the material and scour depth.

3.7.2 Local Scour Downstream of Hydraulic Structures

The scour downstream of hydraulic structures, such as stilling basins, diversion works, and etc., occurs frequently in engineering application. Figure 3-3 summarizes the possible flow conditions downstream of hydraulic

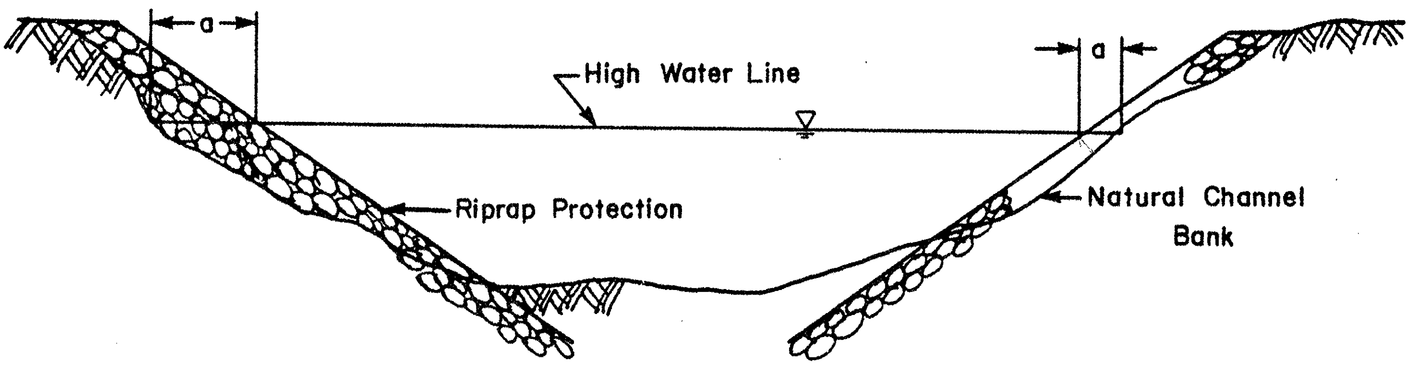

Figure 3-2. The embankment length measured normal to the flow.

Hydrology & Hydraulics -

A small tributary of the Domingo Baca Arroyo just passes thru the NE corner of the subdivision & enters the Domingo Baca just off site. For a short distance, the Domingo Baca flow for Q_{100} is near the northeastern edge of the subdivision. The map which follows this page shows the watershed for the tributary arroyo in question. Actually, the arroyo splits into two small tributaries having their confluence no more than 50-75 ft above their confluence with the Domingo Baca. The split watershed is labeled Areas I & II;

Area I (N. trib.) = 31.9 Ac $L_1 = 4000$ ft, $S_1 = 7\%$
" II (S. trib.) = 27.8 Ac. $L_2 = 4150$ ft, $S_2 = 6\%$
Total 59.7 Ac

In the two watersheds, Units/Acre = 1.56,

& Trmt "D" $= 7\sqrt{(1.56^2)+5(1.56)} = 7\sqrt{2.43+7.80}$
$= 22.4\% \simeq 22\%$ impervious,

& Trmt "B" = 100 − 22 = 78% pervious

For Zone ④, $P_{360} = 2.90$ in. Mass Rainfall distribution is shown on Sheet 3.

$P_{60} = 2.23$

Sheet 2/37

MASS RAINFALL

ZONE = 4

P60 = 2.23
P360 = 2.9
P1440 = 3.65

VALUE OF t	VALUE OF Pt	VALUE OF t	VALUE OF Pt	VALUE OF t	VALUE OF Pt	VALUE OF t	VALUE OF Pt
2	0.0012	92	2.3661	182	2.6174	272	2.7807
4	0.0051	94	2.3735	184	2.6217	274	2.7838
6	0.0151	96	2.3807	186	2.6260	276	2.7868
8	0.0350	98	2.3877	188	2.6302	278	2.7898
10	0.0689	100	2.3947	190	2.6344	280	2.7929
12	0.1210	102	2.4016	192	2.6386	282	2.7958
14	0.1959	104	2.4084	194	2.6427	284	2.7988
16	0.2981	106	2.4151	196	2.6468	286	2.8017
18	0.4324	108	2.4217	198	2.6509	288	2.8047
20	0.6037	110	2.4282	200	2.6549	290	2.8076
22	0.8169	112	2.4346	202	2.6589	292	2.8105
24	1.0771	114	2.4409	204	2.6628	294	2.8133
26	1.3017	116	2.4472	206	2.6668	296	2.8162
28	1.4027	118	2.4534	208	2.6706	298	2.8190
30	1.4883	120	2.4594	210	2.6745	300	2.8219
32	1.5646	122	2.4655	212	2.6783	302	2.8247
34	1.6341	124	2.4714	214	2.6821	304	2.8275
36	1.6983	126	2.4773	216	2.6859	306	2.8302
38	1.7580	128	2.4830	218	2.6896	308	2.8330
40	1.8139	130	2.4888	220	2.6933	310	2.8357
42	1.8664	132	2.4944	222	2.6970	312	2.8385
44	1.9159	134	2.5000	224	2.7007	314	2.8412
46	1.9627	136	2.5055	226	2.7043	316	2.8439
48	2.0070	138	2.5110	228	2.7079	318	2.8465
50	2.0491	140	2.5164	230	2.7114	320	2.8492
52	2.0890	142	2.5217	232	2.7150	322	2.8518
54	2.1269	144	2.5270	234	2.7185	324	2.8545
56	2.1630	146	2.5322	236	2.7220	326	2.8571
58	2.1973	148	2.5374	238	2.7254	328	2.8597
60	2.2306	150	2.5425	240	2.7289	330	2.8623
62	2.2403	152	2.5475	242	2.7323	332	2.8649
64	2.2498	154	2.5525	244	2.7357	334	2.8674
66	2.2592	156	2.5574	246	2.7390	336	2.8700
68	2.2683	158	2.5623	248	2.7424	338	2.8725
70	2.2773	160	2.5672	250	2.7457	340	2.8750
72	2.2861	162	2.5720	252	2.7490	342	2.8776
74	2.2947	164	2.5767	254	2.7523	344	2.8800
76	2.3032	166	2.5814	256	2.7555	346	2.8825
78	2.3116	168	2.5861	258	2.7587	348	2.8850
80	2.3198	170	2.5907	260	2.7619	350	2.8875
82	2.3278	172	2.5952	262	2.7651	352	2.8899
84	2.3357	174	2.5998	264	2.7683	354	2.8923
86	2.3435	176	2.6042	266	2.7714	356	2.8948
88	2.3512	178	2.6087	268	2.7745	358	2.8972
90	2.3587	180	2.6131	270	2.7776	360	2.9000

Basin I:

Pervious Area:

$A_B = 0.78(31.9) = 24.88\,Ac = 0.039\,sq.mi.$

$A_D = 0.22(31.9) = 7.02\,AC = 0.011\,sq.mi$

$IA = 0.32\,in$

$INF = 1.63\,in/hr.$

$$t_c = \frac{4000}{1.5\sqrt{7}} = 1008\,sec = 0.28\,hr.$$

$$t_p = \frac{2}{3}(0.28) = 0.19\,hr.$$

$$k/t_{p30} = 0.836676 + (P_{60} \times 0.02882) \quad \& \quad P_{60} = 2.23$$

$$k/t_{p30} = 0.90$$

$$k/t_{p130} = 1.051878 \times P_{60}^{-.35566} \quad \& \quad P_{60} = 2.23$$

$$k/t_{p130} = 0.79$$

$$k/t_p = k/t_{p30} + \left[\frac{(A-30)(k/t_{p130} - k/t_{p30})}{100}\right] = 0.90 + \left[\frac{(-1.9)(-0.11)}{100}\right]$$

$$k/t_p = 0.90$$

$$k = t_p(0.90) = (0.19)(0.90)$$

$$k = 0.17$$

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JOB Morgan Subdivision
SUBJECT Grading & Drainage
JOB NO.
SHEET 5 OF 37
BY ZG
DATE 4-2-92
CHECKED
DATE

Basin I

Impervious Area

$IA = 0.10$

$INF = 0.04$

$t_p = 0.19$ hr.

$$k/t_{p30} = 0.42063 + (P_{60} \times .00656)$$
$$= 0.44$$

$$k/t_{p130} = 0.667076 \times P_{60}^{-.254788}$$
$$= 0.54$$

$$k/t_p = k/t_{p30} + \left[\frac{(A-30)(k/t_{p130} - k/t_{p30})}{100}\right]$$
$$= 0.44 + \left[\frac{(1.9)(0.54-0.44)}{100}\right]$$
$$= 0.44$$

$$k = 0.44(0.19) = \underline{0.08}$$

BASIN II

Pervious Area 0.78(27.8) = 21.7 Ac = 0.034 sq mi

IA = 0.32 in

INF = 1.63 in/hr

L = 4150 ft, S = 6%

$t_c = \frac{4150}{1.5\sqrt{6}} = 1131 \text{ sec} = 0.31 \text{ hr}$

$t_p = \frac{2}{3} t_c = 0.21 \text{ hr}$

$k/t_{p30} = 0.836676 + (223 \times .028882) = 0.90$

$k = 0.90(0.21) = 0.19$

Impervious area:

$k/t_{p30} = 0.42063 + (P_{20} \times .00656) = 0.44$

$k = (0.44)(0.21) = 0.09$

See following sheets 7 thru 10 for HYMO run for the 2 basins & their combined flows:

$Q_{p1} = 71.4$

$Q_{p2} = 71.1$

$Q_{p(1+2)} = 142 \text{ cfs}$

HYMO PROGRAM (AHYMO490) - AMAFCA VERSION APR.,1990
RUN DATE (MON/DAY/YR) = 03/25/1992
START TIME (HR:MIN:SEC) = 14:38:47

START TIME=0.0

***** COMPUTE HYDROGRAPHS FOR DON MORGAN SUBDIVISION

***** MARCH 25, 1992

***** PERVIOUS AREA OF BASIN I

COMPUTE HYD ID=1 HYD NO=101.1 DT=.03333 HRS DA=.039 SQ MI

IA=-0.32 INF=-1.63 K=-0.280 TP=-0.190 RAIN=

0.0000	0.0012	0.0051	0.0151	0.0350	0.0683	0.1210
0.1959	0.2981	0.4324	0.6037	0.8163	1.0771	1.3017
1.4027	1.4883	1.5646	1.6341	1.6983	1.7580	1.8139
1.8664	1.9159	1.9627	2.0070	2.0491	2.0890	2.1269
2.1630	2.1973	2.2306	2.2403	2.2498	2.2592	2.2683
2.2773	2.2861	2.2947	2.3032	2.3116	2.3198	2.3278
2.3357	2.3435	2.3512	2.3587	2.3661	2.3735	2.3807
2.3877	2.3947	2.4016	2.4084	2.4151	2.4217	2.4282
2.4346	2.4409	2.4472	2.4534	2.4594	2.4655	2.4714
2.4773	2.4830	2.4888	2.4944	2.5000	2.5055	2.5110
2.5164	2.5217	2.5270	2.5322	2.5374	2.5425	2.5475
2.5525	2.5574	2.5623	2.5672	2.5720	2.5767	2.5814
2.5861	2.5907	2.5952	2.5998	2.6042	2.6087	2.6131
2.6174	2.6217	2.6260	2.6302	2.6344	2.6386	2.6427
2.6468	2.6509	2.6549	2.6589	2.6628	2.6668	2.6706
2.6745	2.6783	2.6821	2.6859	2.6896	2.6933	2.6970
2.7007	2.7043	2.7079	2.7114	2.7150	2.7185	2.7220
2.7254	2.7283	2.7323	2.7357	2.7390	2.7424	2.7457
2.7490	2.7523	2.7555	2.7587	2.7619	2.7651	2.7683
2.7714	2.7745	2.7776	2.7807	2.7838	2.7868	2.7898
2.7929	2.7958	2.7988	2.8017	2.8047	2.8076	2.8105
2.8133	2.8162	2.8190	2.8219	2.8247	2.8275	2.8302
2.8330	2.8357	2.8385	2.8412	2.8439	2.8465	2.8492

2.8518 2.8545 2.8571 2.8597 2.8623 2.8649 2.8674

2.8700 2.8725 2.8750 2.8776 2.8800 2.8825 2.8850

2.8875 2.8899 2.8923 2.8948 2.8972 2.9000

K = .280000HR TP = .190000HR SHAPE CONSTANT, N = 2.47992
UNIT PEAK = 48.494 CFS UNIT VOLUME = .9991 B = 236.25

RUNOFF COMPUTED BY INITIAL ABSTRACTION - INFILTRATION METHOD

PRINT HYD ID=1 CODE=1

PARTIAL HYDROGRAPH 101.10

RUNOFF VOLUME = .85082 INCHES = 1.7697 ACRE-FEET
PEAK DISCHARGE RATE = 37.52 CFS AT .567 HOURS

***** IMPERVIOUS AREA OF BASIN I

COMPUTE HYD ID=2 HYD NO=101.2 DT=.03333 HRS DA=0.011 SQ MI

IA=-0.1 INF=-0.04 K=-0.080 TP=-0.190 RAIN=-1

K = .080000HR TP = .190000HR SHAPE CONSTANT, N = 10.00827
UNIT PEAK = 37.611 CFS UNIT VOLUME = .9997 B = 649.65

RUNOFF COMPUTED BY INITIAL ABSTRACTION - INFILTRATION METHOD

PRINT HYD ID=2 CODE=1

PARTIAL HYDROGRAPH 101.20

RUNOFF VOLUME = 2.56749 INCHES = 1.5063 ACRE-FEET
PEAK DISCHARGE RATE = 33.86 CFS AT .567 HOURS

***** COMBINED HYDROGRAPH BASIN I

ADD HYD ID=2 HYD NO=101.3 ID=1 ID=2

PRINT HYD ID=2 CODE=1

PARTIAL HYDROGRAPH 101.30

RUNOFF VOLUME = 1.22848 INCHES = 3.2759 ACRE-FEET
PEAK DISCHARGE RATE = 71.38 CFS AT .567 HOURS

***** PERVIOUS AREA OF BASIN II

COMPUTE HYD ID=3 HYD NO=101.4 DT=.03333 HRS DA=.034 SQ MI

```
    K =   .190000HR    TP =   .210000HR     SHAPE CONSTANT, N =   3.91584
    UNIT PEAK =   56.589    CFS   UNIT VOLUME =    .9999        B =   349.52

    RUNOFF COMPUTED BY INITIAL ABSTRACTION - INFILTRATION METHOD

 PRINT HYD             ID=3 CODE=1


                                       PARTIAL HYDROGRAPH   101.40


    RUNOFF VOLUME =       .85082 INCHES      =        1.5428 ACRE-FEET
     PEAK DISCHARGE RATE =        42.01 CFS     AT       .600 HOURS


 ***** IMPERVIOUS AREA OF BASIN II

 COMPUTE HYD           ID=4 HYD NO=101.5 DT=.03333 HRS DA=.010 SQ MI

                       IA=-0.1 INF=-0.04 K=-0.090 TP=-0.210 RAIN=-1


    K =   .090000HR    TP =   .210000HR     SHAPE CONSTANT, N =   9.76914
    UNIT PEAK =   30.490    CFS   UNIT VOLUME =    .9996        B =   640.30

    RUNOFF COMPUTED BY INITIAL ABSTRACTION - INFILTRATION METHOD

 PRINT HYD             ID=4 CODE=1


                                       PARTIAL HYDROGRAPH   101.50


    RUNOFF VOLUME =      2.56749 INCHES      =        1.3693 ACRE-FEET
     PEAK DISCHARGE RATE =        29.21 CFS     AT       .567 HOURS


 ***** COMBINED HYDROGRAPH BASIN II

 ADD HYD               ID=4 HYD NO=101.6 ID=3 ID=4

 PRINT HYD             ID=4 CODE=1


                                       PARTIAL HYDROGRAPH   101.60


    RUNOFF VOLUME =      1.24097 INCHES      =        2.9121 ACRE-FEET
     PEAK DISCHARGE RATE =        71.09 CFS     AT       .567 HOURS


 ***** COMBINED HYDROGRAPHS FOR BASINS I AND II

 ADD HYD               ID=5 HYD NO=101.7 ID=2 ID=4

 PRINT HYD             ID=5 CODE=1


                                       PARTIAL HYDROGRAPH   101.70
```

RUNOFF VOLUME = 1.23433 INCHES = 6.1881 ACRE-FEET Sh. 10/37
PEAK DISCHARGE RATE = 142.47 CFS AT .567 HOURS

FINISH

END TIME (HR:MIN:SEC) = 14:38:49

UNNAMED ARROYO 2 Basin I

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	THALWEG	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	1.000	88.00	95.77	95.00	.00	.00	.00	64.10	.00
*	2.000	88.00	90.64	90.00	.00	-5.13	.00	15.65	.00
*	3.000	88.00	87.02	86.00	.00	-3.62	.00	28.20	70.00

$Q_p = 71 + \text{bulking} = 88$

UNNAMED ARROYO 1 BASIN II

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	1.000	88.00	93.02	THALWEG 91.90 .00	.00	.00	36.93	.00
*	2.000	88.00	90.70	90.00 .00	-2.32	.00	20.06	.00
*	3.000	88.00	86.90	86.00 .00	-3.80	.00	32.15	60.00

Q_p = 71 + bulking = 88 cfs.

Sh. 15/37

3/26/92 7:30:52 PAGE 4

Basins I & II combined

UNNAMED ARROYO 3

SUMMARY PRINTOUT TABLE 150

THAWEG

	SECNO	Q	CWSEL		DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	1.000	177.00	85.40	84.00	.00	.00	.00	53.17	.00
*	2.000	177.00	80.35	79.70	.00	-5.05	.00	30.74	.00
*	3.000	1470.00	79.04	78.00	.00	-1.31	.00	185.54	130.00

Domingo Baca Arroyo – 50 ft. below confluence

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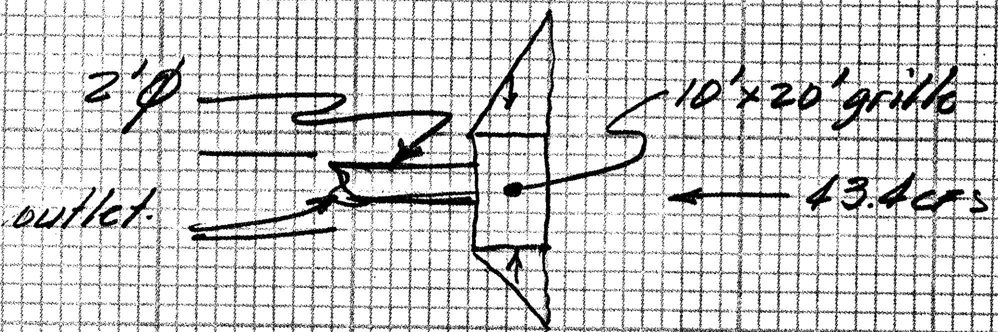
CHECKED
DATE

Offsite Drainage:

Using Holmes & Narver's study, 43.4 cfs (Q_{100}) enters the subdivision along the east boundary. It is proposed to collect this flow in an intake structure and discharge it into the nearest adjacent new street. From there, it can be handled with onsite drainage -



Grille capacity:

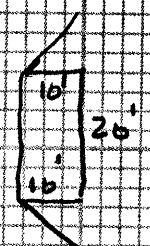
Assume allowable $d = 0.50'$

$P = 2(10) + 20 = 40$ ft

$Q_{CAP} = C_W P d^{1.5}$ (Weir form)

$= 3.0(40)(0.5)^{1.5}$

$= 42.43$ cfs (ok) (d of 0.6' = Q = 56)



Outlet -

Try 24" RCP

Orifice = 2'

$A = \pi r^2 = 3.14$ sf

$Q/A = 43.4/3.14 = 13.82 = V$

$V^2 = 191.04$

$h = \frac{V^2}{C_o^2 2g}$ (orifice eq.) $C_o = 0.63$

$h = 7.42'$ (ok)

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JOB Morgan Subdivision
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BY ZG DATE 4-20-92
CHECKED ______ DATE ______

For conveying flow from the 2' φ outlet to the street,

$S = \Delta h / L = \frac{81.39 - 77.89}{117} = .0299$

Use concrete "U" shape channel –
Try w = 5'0" –
Using Manning's equation & n = 0.015, Q = 43 CFS
d = 0.75 FT, ok.

Onsite Drainage:

Zone 4

TRMT	Q_{P360} (100yr) (CFS/AC)
A	2.26
B	3.05
C	3.94
D	5.74

Area = 13.67 Ac (52 LOTS PROPOSED)

Undeveloped (TRMT A)

$Q_{100} = (13.67)(2.26) = $ **31 CFS.**

Developed:

52 LOTS, $N = \frac{52}{13.67} = 3.80$ units/acre

$\%D = 7\sqrt{N^2+5N} = 7\sqrt{3.8^2+5(3.8)} = 40\%$

TRMT D = 0.40 (13.67) = 5.47 AC

TRMT "B" + "C" = 13.67 − 5.47 = 8.20 AC

TRMT "B" = 0.90 × 8.20 = 7.38 AC

TRMT "C" = 0.10 × 8.20 = 0.82 AC

For purposes of street drainage design, the subdivision is divided into sub-basins I, II, III, IV, V, & VII. (VI was not used.) Sub-basin boundaries are shown on the drawings.

$$Q_{P(100)} = Q_B \cdot A_B + Q_C \cdot A_C + Q_D \cdot A_D$$
$$= 3.05(7.38) + 3.94(0.82) + 5.74(5.47)$$
$$= \boxed{57 \text{ CFS}}$$

PROPORTIONALLY:

Sub-basin	Area (Ac)	% Total	Q_p (100 yr) (6 hr) (Developed)
I	2.58	18.87	10.8
II	1.95	14.26	8.1
III	4.13	30.22	17.3
IV	0.82	6.00	3.4
V	3.01	22.02	12.5
VII	1.18	8.63	4.9
	13.67	100.00	57

Street Hydraulics (DPM II, p.70)

Street C: (All flow in one gutter):
$Q = 10.8$ cfs $S = 1.09\%$ $d = 0.44$ ft ok

Street B: (All flow in one gutter):
$Q = 17.3$ cfs $S = 1.00\%$ $d = 0.53$ ft ok

Street F between B & C St.
$Q = 62.3$ cfs, divided between gutters
(Subbasins I & II + OFFSITE, 10.8 + 8.1 + 43.4)
$S = 2.48$ CFS $Q_{\frac{1}{2}} = 31.2$
$d = 0.54'$ ok

Street Hydraulic's - cont:

Street "F" between A & B Street:

$Q = 62.3 + 17.3 + 3.4 = 83$ CFS, $S = 1.81\%$

$Q_{\frac{1}{2}} = 41.5$ CFS $d = 0.64$ ft ok

Street A

Q increases from 55.4 at one end to 65.4 at the other. $Q_{max} = 65.4$ & $Q_{\frac{1}{2}} = 26.2$, $S = 0.5\%$

$d = 0.73$ ok

All other streets are obviously ok. ($d < 0.87$ ft)

Storm Drain Design:

Originally, it was thought that all on-site flows plus the 43.4 cfs entering from off-site could be gathered at a "sump" along the west edge of the intersection of A Street & F Street, and conveyed through a storm drain to the existing 30" RCP draining the recently constructed "desilting basin" 114 ft right of Sta. 382+00 of the latest Tramway Blvd Project (NMP SP-(M)-4067(200)). However, analysis of the hydraulics of that recently constructed system shows that it will not convey its own design flows, including the 43.4 cfs inflow which currently passes through the Morgan subdivision & enters the "desilting basin" mentioned above. Therefore, it would appear most practical to turn the subdivision flows North to the northern end of A St and convey these flows through a storm drain to the existing dbl. 8'x8' CBC carrying the N. Domingo Baca Arroyo beneath Tramway Blvd. This would be done by enlarging the 30" penetration of the existing storm drain into the CBC from the South as necessary to accomodate the new, larger storm drain.

Where the flow on F Street reaches the A St/F St intersection, Q = 83 cfs, s = 1.81% & d = 0.64 ft, but v = 7.2 fps, &

$d + v^2/2g = 0.64 + 7.2^2/2g$ = 1.44 ft, which is unacceptable, since this indicates flow will cross A St. at that point and run up onto the two lots facing east before the water turns north along A Street. To solve this problem, it is proposed to intercept a sufficient portion of the 83 cfs to reduce the "run-up" to an acceptable amount, (<1.0 ft).

Try $Q_{\frac{1}{2}} = 30$ $(Q_T = 60)$

$d = 0.58,\ v = 5.6,\ \&\ d + \frac{v^2}{2g} = 1.07 > 1$, no good

$Q_{\frac{1}{2}} = 25$

$d = 0.54,\ v = 5.1,\ d + \frac{v^2}{2g} = 0.94 < 1$, ok

$Q_T = 2 \times 25 = 50$

So, must intercept $83 - 50 \approx 33$ cfs

1 - Type "A" DI each side of street,

$d = 0.65',\ s = 0.0181,\ Q_I = 13$ cfs $\times 2 = 26$ cfs

1 - Type "C" DI on N. side of street only

$d = 0.56',\ S = 0.0181,\ \&\ Q_I = 9$ cfs

Total $Q_I = 26 + 9 = 35$ cfs & $Q_R = 83 - 35 = 48$

dmg D. Mark Goodwin & Associates, P.A.

Consulting Engineers and Surveyors

JOB Morgan Subdivision

SUBJECT Grading & Drainage

JOB NO. ____

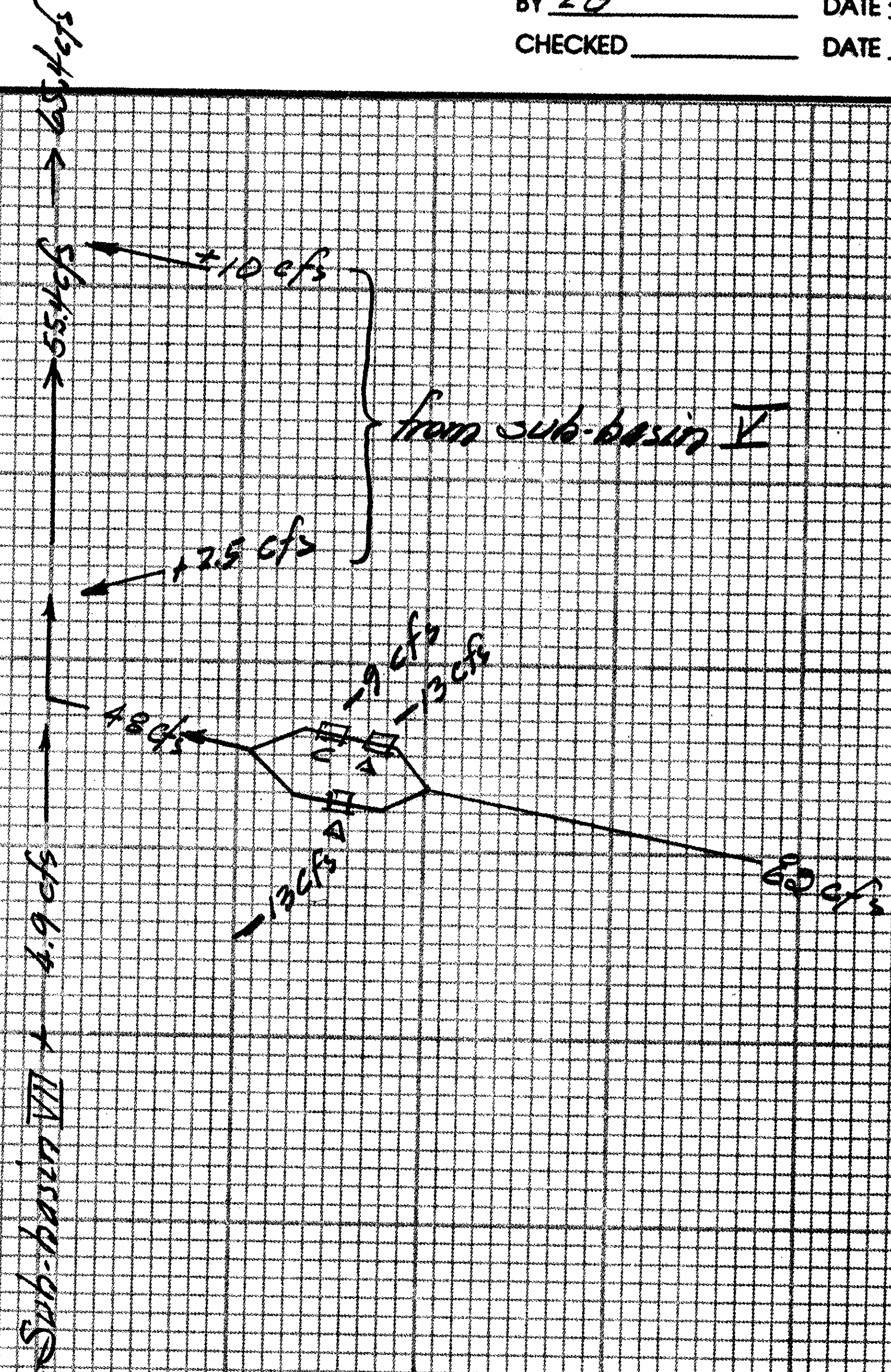
SHEET 22 OF 37

BY ZG

DATE 4-20-97

CHECKED ____

DATE ____



dmg D. Mark Goodwin & Associates, P.A.
Consulting Engineers and Surveyors

JOB Morgan Subdivision
SUBJECT Grading & Drainage
JOB NO. ______ SHEET 23 OF 37
BY ZG DATE 4-20-92
CHECKED ______ DATE ______

Storm Drain Design – cont.

"A St. Sump" @ end of cul-de-sac:

$Q = 65$ cfs, s = sump, $d_{allow} = 0.87'$

try 2-dbl "D" DI in sump.

$P = 2(12.80 + 2.13) = 29.86$ ft

$Q_I = C_w P d^{1.5} = 3.0(29.86)(0.87)^{1.5}$ = 73 cfs ok.

Design Calc's (Printout) follow for Storm Drains:

1. Design assuming 39" d. of flow in dbl. 8x8 CBC conveying N. Domingo Baca arroyo.

2. Same as 1, except with 72" d. of flow in CBC.

HYDRAULIC REPORT FOR

Don Morgan Subdivision

Storm Sewer Design

Diversion North to

N. Br. Domingo Baca

D. Mark Goodwin & Assoc.

Consulting Engineers

Albuquerque, New Mexico

April 20, 1992

Run date: 04-20-1992
File: dm20.ST3

Return Period = 100 Yrs
Rainfall file: Your_County

LINE 1 / Q = 115.0 / HT = 42 / WID = 42 / N = .013 / L = 22 / JLC = 1.25

outfall / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6048.25	39.00	6045.00	12.25	6050.58	19.83	N/A	9.39
UPSTRM	6048.47	39.15	6045.21	12.31	6050.83	21.11	N/A	9.34

Drainage area (ac)	= 0	Slope of invert (%)	= 0.954
Runoff coefficient	= 0	Slope energy grade line (%)	= 1.128
Time of conc (min)	= 5	Critical depth (in)	= 38.99
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 115	Confluence angle (deg)	= 45
Default Q (cfs)	= 115	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 98.3	Line storage (cuft)	= 206

LINE 2 / Q = 115.0 / HT = 48 / WID = 48 / N = .013 / L = 156 / JLC = 1

replacement no. 1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6051.42	48.00	6045.31	9.15	6052.72	0.00	N/A	12.56
UPSTRM	6052.42	48.00	6046.81	9.15	6053.72	0.00	N/A	12.57

Drainage area (ac)	= 0	Slope of invert (%)	= 0.962
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.641
Time of conc (min)	= 4	Critical depth (in)	= 38.05
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 115	Confluence angle (deg)	=-63
Default Q (cfs)	= 115	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 140.9	Line storage (cuft)	= 1960

LINE 3 / Q = 100.0 / HT = 42 / WID = 42 / N = .013 / L = 140 / JLC = 1

line 3 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6053.72	42.00	6047.85	10.40	6055.40	0.00	N/A	9.62
UPSTRM	6055.10	42.00	6050.80	10.39	6056.78	0.00	N/A	9.62

Drainage area (ac)	= 0	Slope of invert (%)	= 2.107
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.988
Time of conc (min)	= 3	Critical depth (in)	= 37.17
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 100	Confluence angle (deg)	=-25
Default Q (cfs)	= 100	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 146.0	Line storage (cuft)	= 1347

LINE 4 / Q = 100.0 / HT = 42 / WID = 42 / N = .013 / L = 170 / JLC = 1

4 / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6056.78	42.00	6051.00	10.40	6058.46	0.00	N/A	9.62
UPSTRM	6058.20	38.37	6055.00	10.85	6060.03	23.60	N/A	9.22

Drainage area (ac)	= 0	Slope of invert (%)	= 2.353
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.923
Time of conc (min)	= 2	Critical depth (in)	= 37.17
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 100	Confluence angle (deg)	=-65
Default Q (cfs)	= 100	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 154.3	Line storage (cuft)	= 1601

LINE 5 / Q = 35.0 / HT = 36 / WID = 36 / N = .013 / L = 343 / JLC = 1.1

line 4 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6060.03	36.00	6056.17	4.95	6060.41	0.00	N/A	7.07
UPSTRM	6060.87	25.57	6058.74	6.52	6061.53	32.66	N/A	5.37

Drainage area (ac)	= 0	Slope of invert (%)	= 0.749
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.328
Time of conc (min)	= 0	Critical depth (in)	= 22.62
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 35	Confluence angle (deg)	=-43
Default Q (cfs)	= 35	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 57.7	Line storage (cuft)	= 2133

LINE 6 / Q = 13.0 / HT = 18 / WID = 18 / N = .013 / L = 56 / JLC = 1

line 5 / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6061.60	18.00	6059.00	7.36	6062.44	0.00	N/A	1.77
UPSTRM	6063.30	18.00	6060.25	7.36	6064.14	0.00	N/A	1.77

Drainage area (ac)	= 0	Slope of invert (%)	= 2.232
Runoff coefficient	= 0	Slope energy grade line (%)	= 3.034
Time of conc (min)	= 0	Critical depth (in)	= 16.47
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 13	Confluence angle (deg)	=-24
Default Q (cfs)	= 13	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 15.7	Line storage (cuft)	= 99

LINE 7 / Q = 22.0 / HT = 24 / WID = 24 / N = .013 / L = 22 / JLC = 1

line 6 / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6061.60	24.00	6059.00	7.00	6062.36	0.00	N/A	3.14
UPSTRM	6061.66	19.95	6060.00	7.88	6062.63	17.98	N/A	2.79

Drainage area (ac) =	0	Slope of invert (%)	= 4.545
Runoff coefficient =	0	Slope energy grade line (%)	= 1.222
Time of conc (min) =	0	Critical depth (in)	= 19.93
Inlet time (min) =	0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr) =	0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A =	0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs) =	22	Confluence angle (deg)	= 0
Default Q (cfs) =	22	Natural ground elev (ft)	= 0
Line capac. (cfs) =	48.2	Line storage (cuft)	= 65

LINE 8 / Q = 13.0 / HT = 18 / WID = 18 / N = .013 / L = 12 / JLC = 1

7 / DNLN = 7

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6062.63	18.00	6060.30	7.36	6063.47	0.00	N/A	1.77
UPSTRM	6063.65	18.00	6061.00	7.36	6064.49	0.00	N/A	1.77

Drainage area (ac) =	0	Slope of invert (%)	= 5.835
Runoff coefficient =	0	Slope energy grade line (%)	= 8.534
Time of conc (min) =	0	Critical depth (in)	= 16.47
Inlet time (min) =	0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr) =	0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A =	0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs) =	13	Confluence angle (deg)	= 0
Default Q (cfs) =	13	Natural ground elev (ft)	= 0
Line capac. (cfs) =	25.4	Line storage (cuft)	= 21

LINE 9 / Q = 15.0 / HT = 30 / WID = 30 / N = .013 / L = 190 / JLC = 1.1

existing 8 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6053.72	30.00	6046.91	3.06	6053.86	0.00	N/A	4.91
UPSTRM	6053.97	30.00	6048.81	3.06	6054.12	0.00	N/A	4.91

Drainage area (ac)	= 0	Slope of invert (%)	= 1.000
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.134
Time of conc (min)	= 1	Critical depth (in)	= 15.53
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 15	Confluence angle (deg)	= 90
Default Q (cfs)	= 15	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 41.0	Line storage (cuft)	= 933

LINE 10 / Q = 9.0 / HT = 24 / WID = 24 / N = .013 / L = 58 / JLC = 1

existing 9 / DNLN = 9

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6054.13	24.00	6049.31	2.87	6054.26	0.00	N/A	3.14
UPSTRM	6054.22	24.00	6051.00	2.86	6054.35	0.00	N/A	3.14

Drainage area (ac)	= 0	Slope of invert (%)	= 2.914
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.158
Time of conc (min)	= 0	Critical depth (in)	= 12.75
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 9	Confluence angle (deg)	= 0
Default Q (cfs)	= 9	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 38.6	Line storage (cuft)	= 182

LINE 11 / Q = 6.0 / HT = 18 / WID = 18 / N = .013 / L = 68 / JLC = 1

existing 10 / DNLN = 10

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6054.35	18.00	6051.50	3.40	6054.53	0.00	N/A	1.77
UPSTRM	6054.75	18.00	6052.25	3.40	6054.93	0.00	N/A	1.77

Drainage area (ac)	= 0	Slope of invert (%)	= 1.103
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.327
Time of conc (min)	= 0	Critical depth (in)	= 11.22
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 6	Confluence angle (deg)	= 0
Default Q (cfs)	= 6	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 11.0	Line storage (cuft)	= 120

31/37

HYDRAULIC REPORT FOR

Don Morgan Subdivision

Storm Sewer System

High Water in Culvert

N. Br. Domingo Baca

D. Mark Goodwin & Assoc.

Consulting Engineers

Albuquerque, New Mexico

April 20, 1992

32/37

Run date: 04-20-1992
File: dm21.ST3

Return Period = 100 Yrs
Rainfall file: Your_County

LINE 1 / Q = 115.0 / HT = 42 / WID = 42 / N = .013 / L = 22 / JLC = 1.25

outfall / Outfall

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6051.00	42.00	6045.00	11.96	6053.22	0.00	N/A	9.62
UPSTRM	6051.29	42.00	6045.21	11.95	6053.51	0.00	N/A	9.62

Drainage area (ac)	= 0	Slope of invert (%)	= 0.954
Runoff coefficient	= 0	Slope energy grade line (%)	= 1.308
Time of conc (min)	= 5	Critical depth (in)	= 38.99
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 115	Confluence angle (deg)	= 45
Default Q (cfs)	= 115	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 98.3	Line storage (cuft)	= 212

LINE 2 / Q = 115.0 / HT = 48 / WID = 48 / N = .013 / L = 156 / JLC = 1

replacement no. 1 / DNLN = 1

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6054.06	48.00	6045.31	9.15	6055.36	0.00	N/A	12.56
UPSTRM	6055.06	48.00	6046.81	9.15	6056.36	0.00	N/A	12.57

Drainage area (ac)	= 0	Slope of invert (%)	= 0.962
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.641
Time of conc (min)	= 4	Critical depth (in)	= 38.05
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 115	Confluence angle (deg)	=-63
Default Q (cfs)	= 115	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 140.9	Line storage (cuft)	= 1960

LINE 3 / Q = 100.0 / HT = 42 / WID = 42 / N = .013 / L = 140 / JLC = 1

line 3 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6056.36	42.00	6047.85	10.40	6058.04	0.00	N/A	9.62
UPSTRM	6057.75	42.00	6050.80	10.39	6059.42	0.00	N/A	9.62

Drainage area (ac)	= 0	Slope of invert (%)	= 2.107
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.988
Time of conc (min)	= 3	Critical depth (in)	= 37.17
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 100	Confluence angle (deg)	=-25
Default Q (cfs)	= 100	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 146.0	Line storage (cuft)	= 1347

LINE 4 / Q = 100.0 / HT = 42 / WID = 42 / N = .013 / L = 170 / JLC = 1

line 4 / DNLN = 3

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6059.42	42.00	6051.00	10.40	6061.10	0.00	N/A	9.62
UPSTRM	6061.10	42.00	6055.00	10.39	6062.78	0.00	N/A	9.62

Drainage area (ac)	= 0	Slope of invert (%)	= 2.353
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.988
Time of conc (min)	= 2	Critical depth (in)	= 37.17
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 100	Confluence angle (deg)	=-65
Default Q (cfs)	= 100	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 154.3	Line storage (cuft)	= 1635

LINE 5 / Q = 35.0 / HT = 36 / WID = 36 / N = .013 / L = 343 / JLC = 1.1

line 5 / DNLN = 4

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6062.78	36.00	6056.17	4.95	6063.16	0.00	N/A	7.07
UPSTRM	6063.73	36.00	6058.74	4.95	6064.11	0.00	N/A	7.07

Drainage area (ac)	= 0	Slope of invert (%)	= 0.749
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.275
Time of conc (min)	= 0	Critical depth (in)	= 22.62
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 35	Confluence angle (deg)	=-43
Default Q (cfs)	= 35	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 57.7	Line storage (cuft)	= 2424

LINE 6 / Q = 13.0 / HT = 18 / WID = 18 / N = .013 / L = 56 / JLC = 1

line 6 / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6064.15	18.00	6059.00	7.36	6064.99	0.00	N/A	1.77
UPSTRM	6065.85	18.00	6060.25	7.36	6066.69	0.00	N/A	1.77

Drainage area (ac)	= 0	Slope of invert (%)	= 2.232
Runoff coefficient	= 0	Slope energy grade line (%)	= 3.034
Time of conc (min)	= 0	Critical depth (in)	= 16.47
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 13	Confluence angle (deg)	= 0
Default Q (cfs)	= 13	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 15.7	Line storage (cuft)	= 99

LINE 7 / Q = 22.0 / HT = 24 / WID = 24 / N = .013 / L = 22 / JLC = 1

line 7 / DNLN = 5

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6064.15	24.00	6059.00	7.00	6064.91	0.00	N/A	3.14
UPSTRM	6064.35	24.00	6060.00	7.00	6065.12	0.00	N/A	3.14

Drainage area (ac)	= 0	Slope of invert (%)	= 4.545
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.946
Time of conc (min)	= 0	Critical depth (in)	= 19.93
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 22	Confluence angle (deg)	= 0
Default Q (cfs)	= 22	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 48.2	Line storage (cuft)	= 69

LINE 8 / Q = 13.0 / HT = 18 / WID = 18 / N = .013 / L = 12 / JLC = 1

line 8 / DNLN = 7

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6065.12	18.00	6060.30	7.36	6065.96	0.00	N/A	1.77
UPSTRM	6066.14	18.00	6061.00	7.36	6066.98	0.00	N/A	1.77

Drainage area (ac)	= 0	Slope of invert (%)	= 5.835
Runoff coefficient	= 0	Slope energy grade line (%)	= 8.534
Time of conc (min)	= 0	Critical depth (in)	= 16.47
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 13	Confluence angle (deg)	= 0
Default Q (cfs)	= 13	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 25.4	Line storage (cuft)	= 21

LINE 9 / Q = 15.0 / HT = 30 / WID = 30 / N = .013 / L = 190 / JLC = 1.1

existing 9 / DNLN = 2

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6056.36	30.00	6046.91	3.06	6056.51	0.00	N/A	4.91
UPSTRM	6056.62	30.00	6048.81	3.06	6056.76	0.00	N/A	4.91

Drainage area (ac)	= 0	Slope of invert (%)	= 1.000
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.134
Time of conc (min)	= 1	Critical depth (in)	= 15.53
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 15	Confluence angle (deg)	= 90
Default Q (cfs)	= 15	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 41.0	Line storage (cuft)	= 933

LINE 10 / Q = 9.0 / HT = 24 / WID = 24 / N = .013 / L = 58 / JLC = 1

existing 10 / DNLN = 9

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6056.78	24.00	6049.31	2.87	6056.90	0.00	N/A	3.14
UPSTRM	6056.87	24.00	6051.00	2.86	6057.00	0.00	N/A	3.14

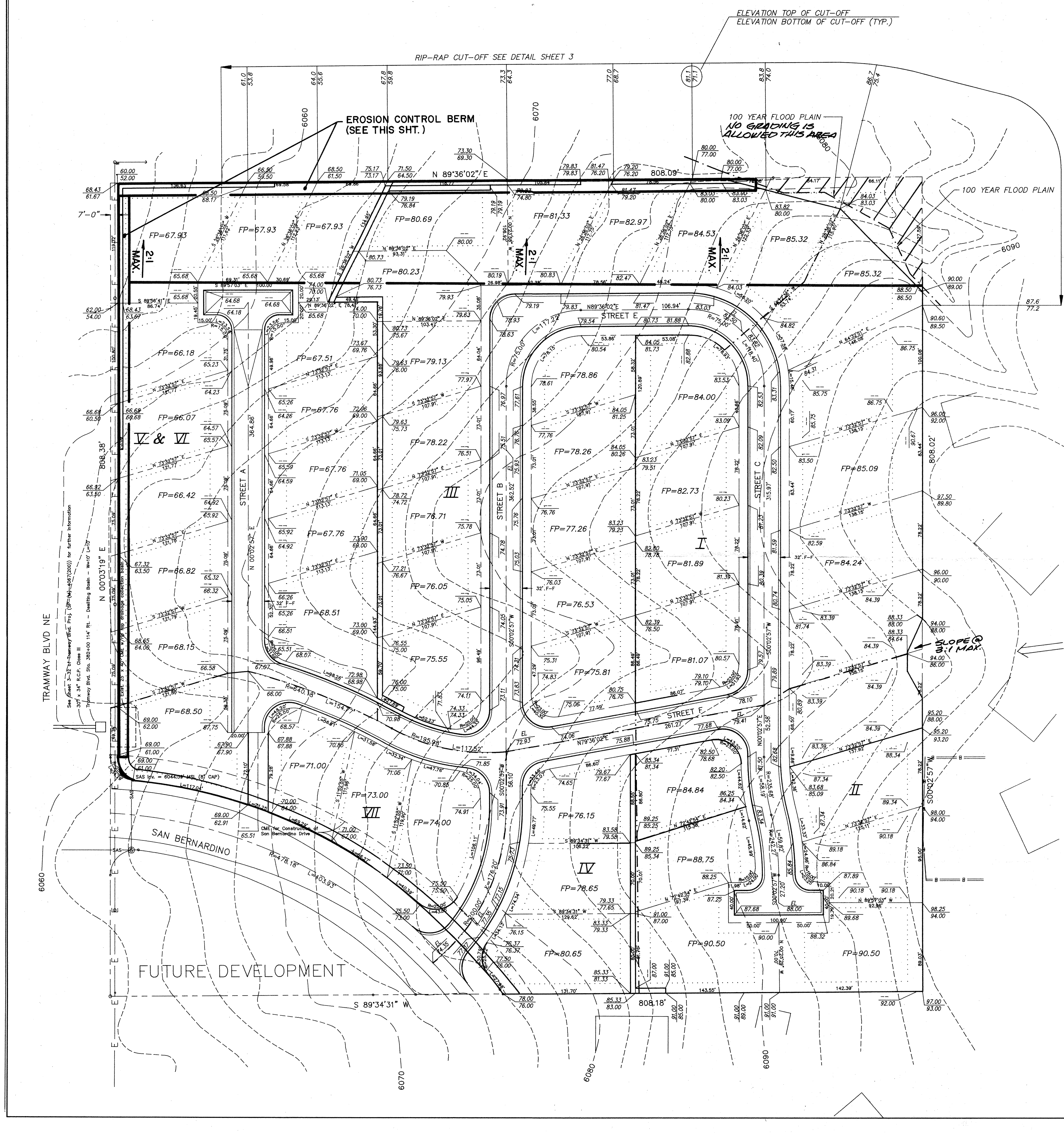
Drainage area (ac)	= 0	Slope of invert (%)	= 2.914
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.158
Time of conc (min)	= 0	Critical depth (in)	= 12.75
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 9	Confluence angle (deg)	= 0
Default Q (cfs)	= 9	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 38.6	Line storage (cuft)	= 182

LINE 11 / Q = 6.0 / HT = 18 / WID = 18 / N = .013 / L = 68 / JLC = 1

existing 11 / DNLN = 10

	HGL	DEPTH	INVERT	VEL	EGL	T WID	COVER	AREA
DNSTRM	6057.00	18.00	6051.50	3.40	6057.17	0.00	N/A	1.77
UPSTRM	6057.40	18.00	6052.25	3.40	6057.58	0.00	N/A	1.77

Drainage area (ac)	= 0	Slope of invert (%)	= 1.103
Runoff coefficient	= 0	Slope energy grade line (%)	= 0.327
Time of conc (min)	= 0	Critical depth (in)	= 11.22
Inlet time (min)	= 0	Req'd length curb inlet (ft)	= 0.0
Intensity (in/hr)	= 0.00	Req'd grate area (sf)	= 0.0
Cumulative C*A	= 0.0	Depth at inlet opening (in)	= 0
Flow contrib (cfs)	= 6	Confluence angle (deg)	= 0
Default Q (cfs)	= 6	Natural ground elev (ft)	= 0
Line capac. (cfs)	= 11.0	Line storage (cuft)	= 120



GENERAL NOTES

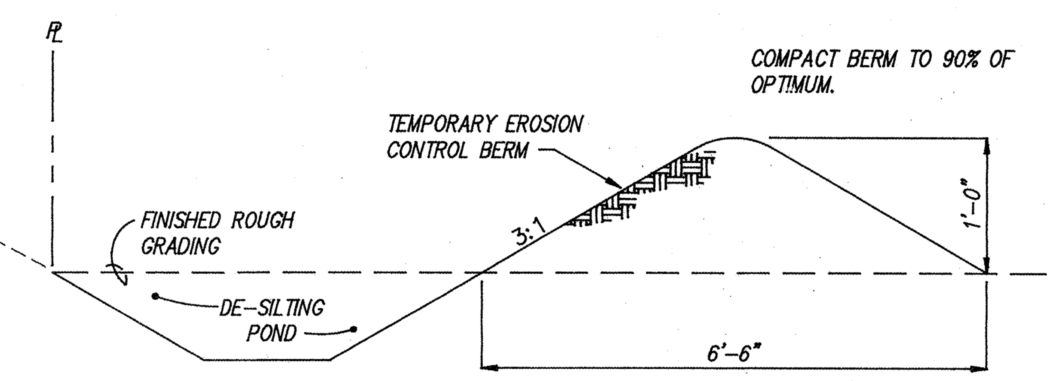
1. CONTRACTOR MUST OBTAIN A TOPSOIL DISTURBANCE PERMIT FROM THE ENVIRONMENTAL HEALTH DIVISION PRIOR TO CONSTRUCTION.

2. CITY OF ALBUQUERQUE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST EDITION SHALL GOVERN ALL WORK.

3. THE CONTRACTOR SHALL CONFORM TO ALL CITY, COUNTY, STATE AND FEDERAL DUST CONTROL MEASURES AND REQUIREMENTS AND WILL BE RESPONSIBLE FOR PREPARING AND OBTAINING ALL NECESSARY APPLICATIONS AND APPROVALS.

4. THE CONTRACTOR SHALL ENSURE THAT NO SOIL ERODES FROM THE LOTS INTO PUBLIC RIGHT-OF-WAY. THIS CAN BE ACHIEVED BY CONSTRUCTING TEMPORARY BERMS AS PER DTL. THIS SHT. AND WETTING THE SOIL TO KEEP IT FROM BLOWING.

5. FAR N.E. CORNER SITE IS IN A FLOOD HAZARD ZONE. NO GRADING WILL BE ALLOWED IN THIS AREA.



SECTION

EROSION CONTROL BERM DETAIL

N.T.S.

APPROVED FOR ROUGH GRADING ±1'	
10/13/92	
AMAFCA	DATE

APPROVED FOR ROUGH GRADING ±1'	
10/15/92	
BERNALILLO COUNTY PUBLIC WORKS DEPT.	DATE

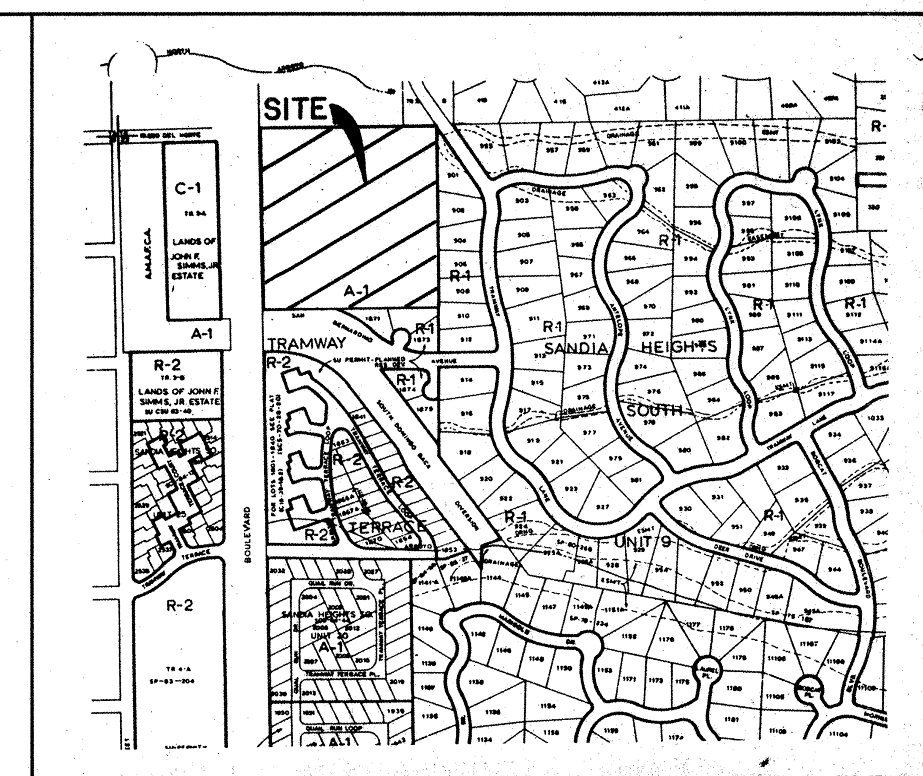
APPROVED FOR ROUGH GRADING ±1'	
10-15-92	
CITY/COUNTY FLOOD PLAIN ADMINISTRATION	DATE

APPROVED FOR ROUGH GRADING ±1'	
APPROVED FOR ROUGH GRADING ±1'	DATE

REGISTERED PROFESSIONAL ENGINEER AND LAND SURVEYOR
NO. 2745
NEW MEXICO
Z. M. GOODWIN

8-14-92
10-5-92
10-13-92

MSD\MORGANG



VICINITY MAP — ZONE ATLAS D-23-Z — SCALE: NONE

ACS BENCHMARK

THE STATION MARK IS A STANDARD ACS ALUMINUM CAP STAMPED "2-C21 1985" SET ON A 2 1/2" ALUMINUM TUBE WITH THE CAP PROJECTING 0.1 FEET ABOVE THE GROUND.
TO REACH THE STATION FROM THE INTERSECTION OF I-40 AND PASEO DEL NORTE, GO EAST ON PASEO DEL NORTE 3.8 MILES TO BROWINING ST. AND THE STATION IS ON THE LEFT.
X = 420,720.10 Y = 1,518,901.78 Z = 5834.10

LEGEND

— — —	PROPERTY LINE
— — E — —	EXISTING UTILITY LINE
~69~	EXISTING CONTOUR
95.20 (TOP OF WALL) / 91.20 (FLOWLINE ELEV.)	NEW SPOT ELEVATION
———	RETAINING WALL
═══	NEW CURB AND GUTTER
—··—··—	DRAINAGE AREA

GENERAL NOTES

1. All construction for this grading and drainage plan shall conform to City of Albuquerque Standard Specifications for Public Works Construction, issue in effect at time of construction.

2. All elevations are finished elevations.

3. All pads are to be compacted to 95% ASTM D 1557.

4. All new storm drain manholes are to be 8'-0" diameter, Type 'E.'

5. All storm drain pipe shall be Class III RCP.

6. Off-site flows of 39 cfs (Q100) enter the site as shown.

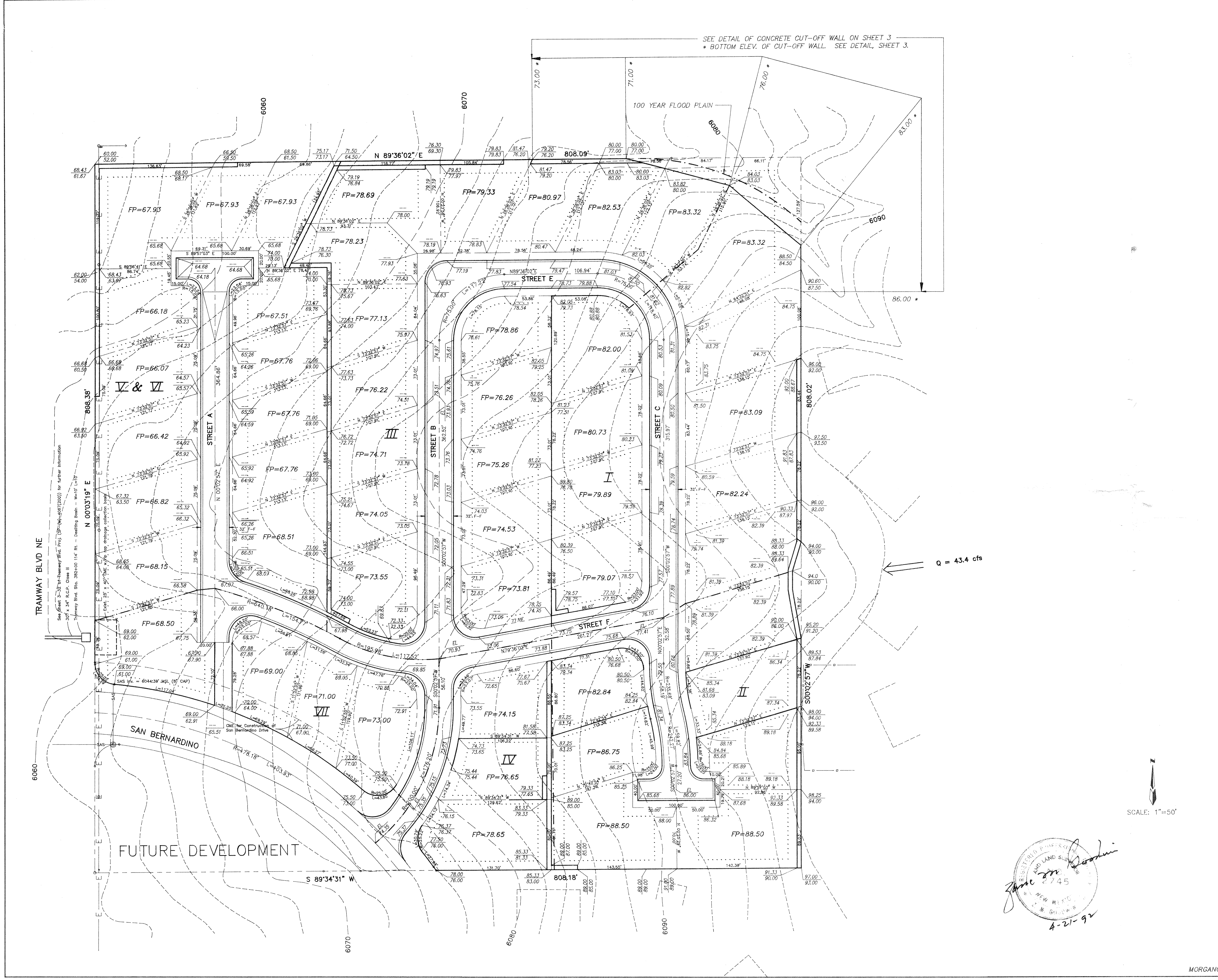
7. Rip-Rap cut-off wall to be constructed at northeast corner of subdivision as shown, and will extend westerly along the northern boundary until it intersects existing elevation of 6058.00.

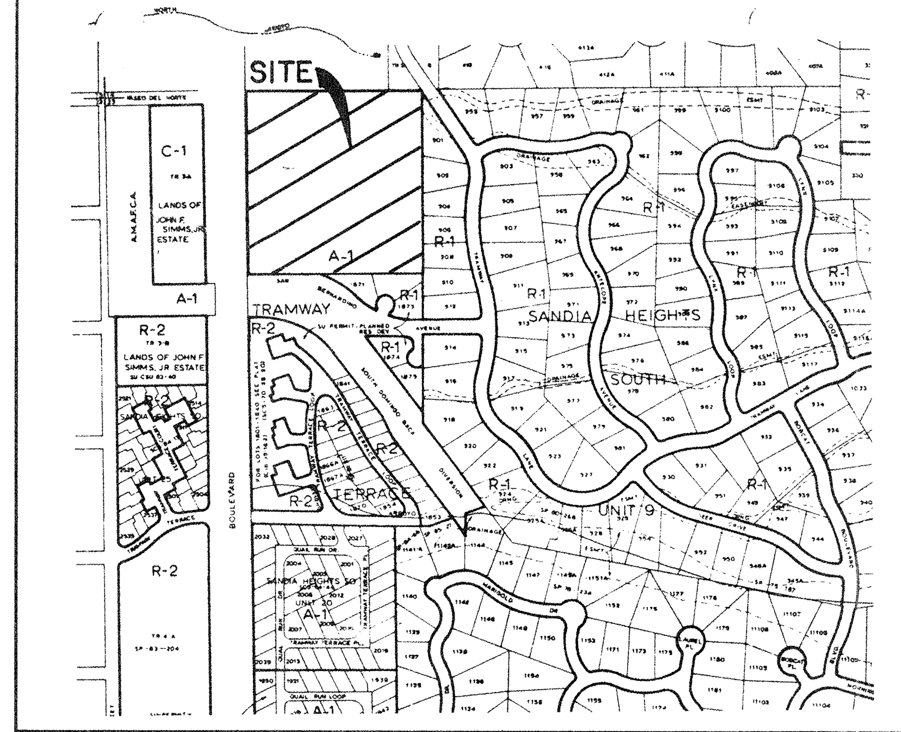
MORGAN SUBDIVISION

INTERIM GRADING PLAN

D. MARK GOODWIN & ASSOCIATES, P.A.
CONSULTING ENGINEERS & SURVEYORS
P.O. BOX 90606
ALBUQUERQUE, NEW MEXICO 87199
(505) 828-2200

Designed: ZMG	Drawn: STAFF	Checked: ZMG	Sheet 1 of 1
Scale: 1"=50'	Date: 8/92	Job: 9224	





VICINITY MAP

ZONE ATLAS D-23-Z

SCALE: NONE

ACS BENCHMARK

THE STATION MARK IS A STANDARD ACS ALUMINUM CAP STAMPED "2-C21 1985" SET ON A 2 1/2" ALUMINUM TUBE WITH THE CAP PROJECTING 0.1 FEET ABOVE THE GROUND.
TO REACH THE STATION FROM THE INTERSECTION OF I-40 AND PASEO DEL NORTE, GO EAST ON PASEO DEL NORTE 3.8 MILES TO BROWINING ST. AND THE STATION IS ON THE LEFT.
X = 420,720.10 Y = 1,518,901.78 Z = 5834.10

LEGEND

- PROPERTY LINE
- EXISTING UTILITY LINE
- EXISTING CONTOUR
- NEW SPOT ELEVATION (95.20 / 91.20)
- RETAINING WALL
- NEW CURB AND GUTTER
- DRAINAGE AREA

GENERAL NOTES

1. All construction for this grading and drainage plan shall conform to City of Albuquerque Standard Specifications for Public Works Construction, issue in effect at time of construction.
2. All elevations are finished elevations.
3. All pads are to be compacted to 95% ASTM D 1557.
4. All new storm drain manholes are to be 8'-0" diameter, Type 'E.'
5. All storm drain pipe shall be Class III RCP.
6. Off-site flows of 43.4 cfs (Q100) enter the site as shown.
7. Concrete cut-off wall to be constructed at northeast corner of subdivision will extend westerly along the northern boundary until the setback line from the Domingo Baca Arroyo clears the property line. Field survey will be needed to determine this location.

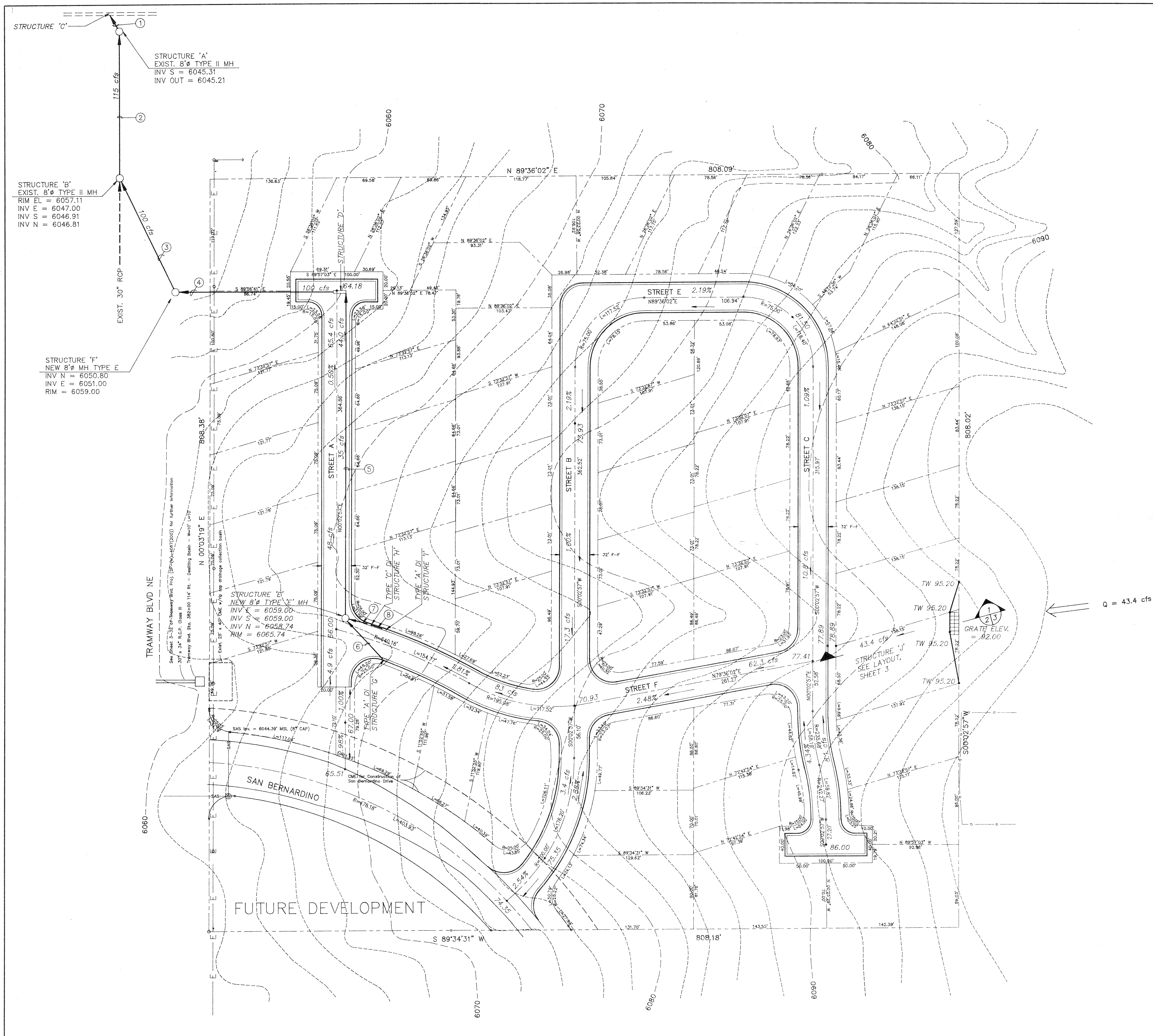
MORGAN SUBDIVISION

GRADING PLAN

D. MARK GOODWIN & ASSOCIATES, P.A.
CONSULTING ENGINEERS & SURVEYORS
P.O. BOX 90606
ALBUQUERQUE, NEW MEXICO 87199
(505) 828-2200

Designed: ZMG	Drawn: STAFF	Checked: ZMG	Sheet 1 of 3
Scale: 1"=50'	Date: 4/92	Job: 9224	

MORGANG



STORM DRAIN PIPE SCHEDULE

1. NEW 42"ø RCP, CLASS III, 22 LF (APPROX.). INV UP = 6045.21 INV DN = 6045.00
REMOVE EXISTING 30" RCP.
2. NEW 48"ø RCP, CLASS III, 156 LF (APPROX.). INV UP = 6046.81 INV DN = 6045.31
REMOVE EXISTING 30" RCP.
3. NEW 42"ø RCP, CLASS III, 140 LF (APPROX.). INV UP = 6050.80 INV DN = 6047.85
4. NEW 42"ø RCP, CLASS III, 170 LF (APPROX.). INV UP = 6055.00 INV DN = 6051.00
5. NEW 36"ø RCP, CLASS III, 343 LF (APPROX.). INV UP = 6058.74 INV DN = 6056.17
6. NEW 18"ø RCP, CLASS III, 56 LF (APPROX.). INV UP = 6060.25 INV DN = 6059.00
7. NEW 24"ø RCP, CLASS III, 22 LF (APPROX.). INV UP = 6060.00 INV DN = 6059.00
8. NEW 18"ø RCP, CLASS III, 12 LF (APPROX.). INV UP = 6061.00 INV DN = 6060.30

STRUCTURE SCHEDULE

A	EXISTING 8'ø SD MH	INCREASE O/L PIPE SIZE FROM 30" TO 42" INCREASE I/L PIPE SIZE FROM 30" TO 48"
B	EXISTING 8'ø SD MH	INCREASE O/L PIPE SIZE FROM 30" TO 48" ADD NEW I/L EAST, 42"ø, INV = 6047.85
C	EXISTING 30" PIPE PENETRATION IN EXISTING BOX CULVERT, INCREASE TO 42".	
D	2 – DBL 'D' DROP INLETS, 12'-10" X 2'-2" OVERALL GRATE ELEV = 6064.18 IN ELEV = 6054.80 I/L ELEV = 6056.17 O/L ELEV = 6055.00	
E	NEW 8'ø TYPE 'E' MH INV = 6058.74 RIM = 6065.74	
F	NEW 8'ø TYPE 'E' MH INV N = 6050.80 INV E = 6051.00 RIM = 6059.00	
G	NEW TYPE 'A' D.I. (SGL). GR. ELEV = 6066.68 INV ELEV = 6060.25	
H	NEW TYPE 'C' D.I. (SGL). GR. ELEV = 6066.22 INV ELEV = 6060.00	
I	NEW TYPE 'A' D.I. (SGL). GR. ELEV = 6066.49 INV ELEV = 6061.00	
J	NEW CONCRETE AND RCP INTAKE STRUCTURE	

8-21-92

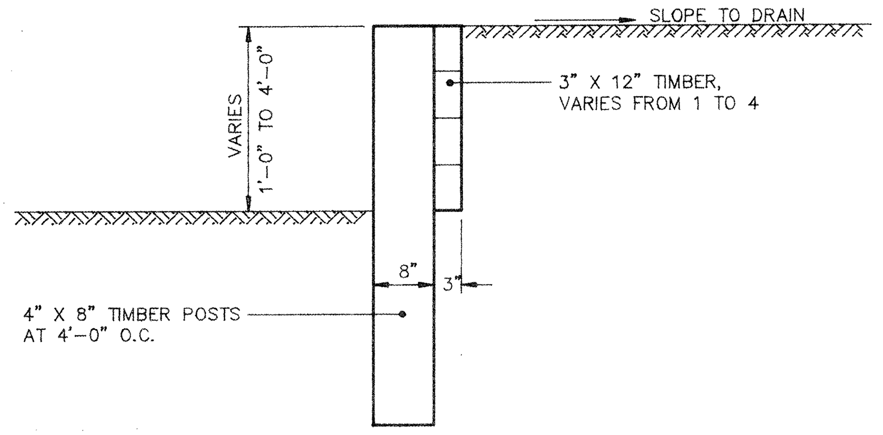
MORGAN SUBDIVISION

DRAINAGE PLAN

D. MARK GOODWIN & ASSOCIATES, P.A.
CONSULTING ENGINEERS & SURVEYORS
P.O. BOX 90606
ALBUQUERQUE, NEW MEXICO 87199
(505) 828-2200

Designed: ZMG	Drawn: STAFF	Checked: ZMG	Sheet 2 of 3
Scale: 1"=50'	Date: 4/92	Job: 9224	

MORGAND

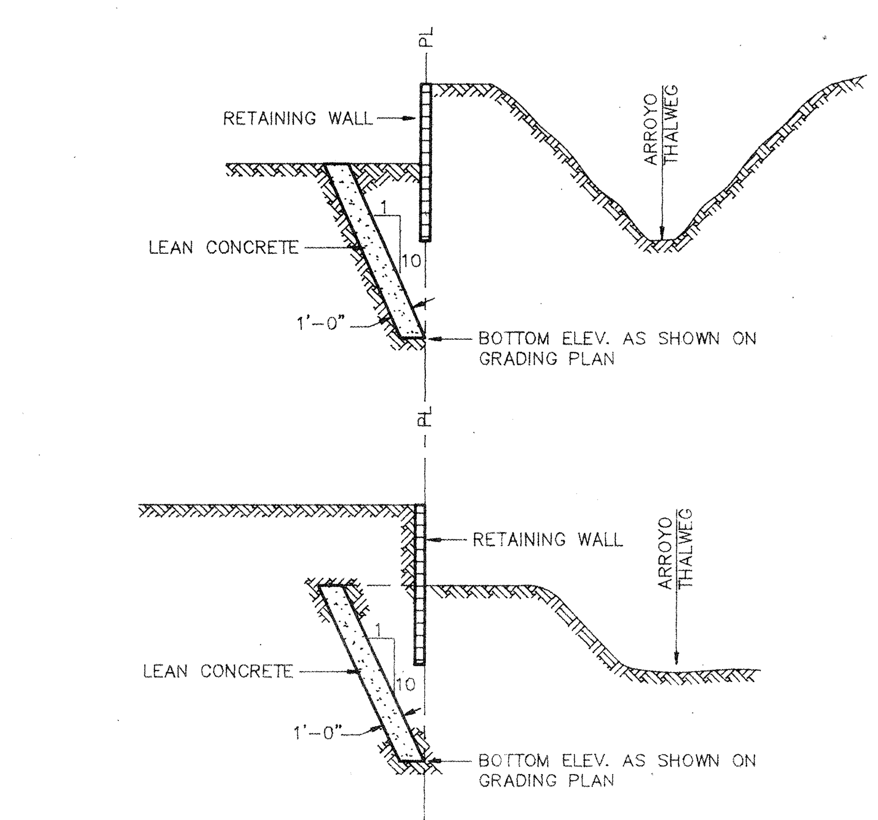


GENERAL NOTES:

1. TO BE USED WHERE EVER RETAINING WALL HEIGHT IS 4'-0" OR LESS.
2. ALL TIMBERS SHALL BE TREATED IN ACCORDANCE WITH SEC. 146, CITY OF ALBUQUERQUE STANDARD SPECIFICATIONS.
3. MINIMUM COMPACTION AROUND VERTICAL TIMBER POSTS IS TO BE 95% PER ASTM D 1557 FOR A DISTANCE OF 18" SURROUNDING THE POST.

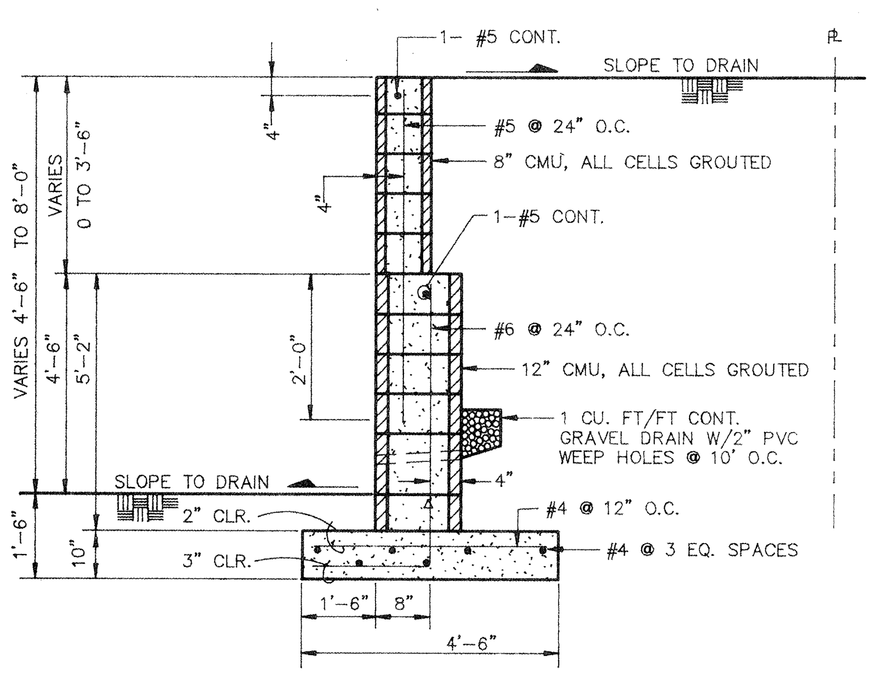
TIMBER RETAINING WALL DETAIL

SCALE: NONE



CUT — OFF WALL DETAILS

SCALE: NONE

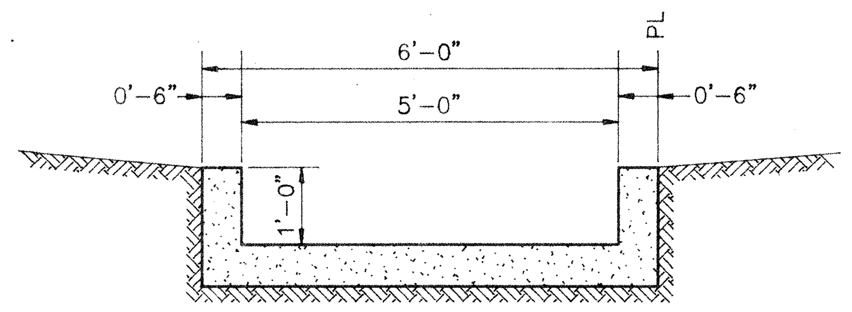


GENERAL NOTES:

1. TO BE USED WHERE-EVER RETAINING WALL HEIGHT EXCEEDS 4'-0".
2. ALL CONCRETE IS TO BE 3000 PSI AT 28 DAYS.
3. MINIMUM COMPACTION UNDER FOOTINGS IS TO BE 95% PER ASTM D 1557 FOR A DEPTH OF 12". MOISTURE CONTENT IS TO BE ±2.0%
4. BACKFILL AGAINST WALLS IS TO BE HAND-PLACED AND COMPACTED.
5. ALL BARS ARE TO BE GRADE 60, ASTM 615.
6. TRUSS TYPE DUR-O-WALL EVERY OTHER COURSE.

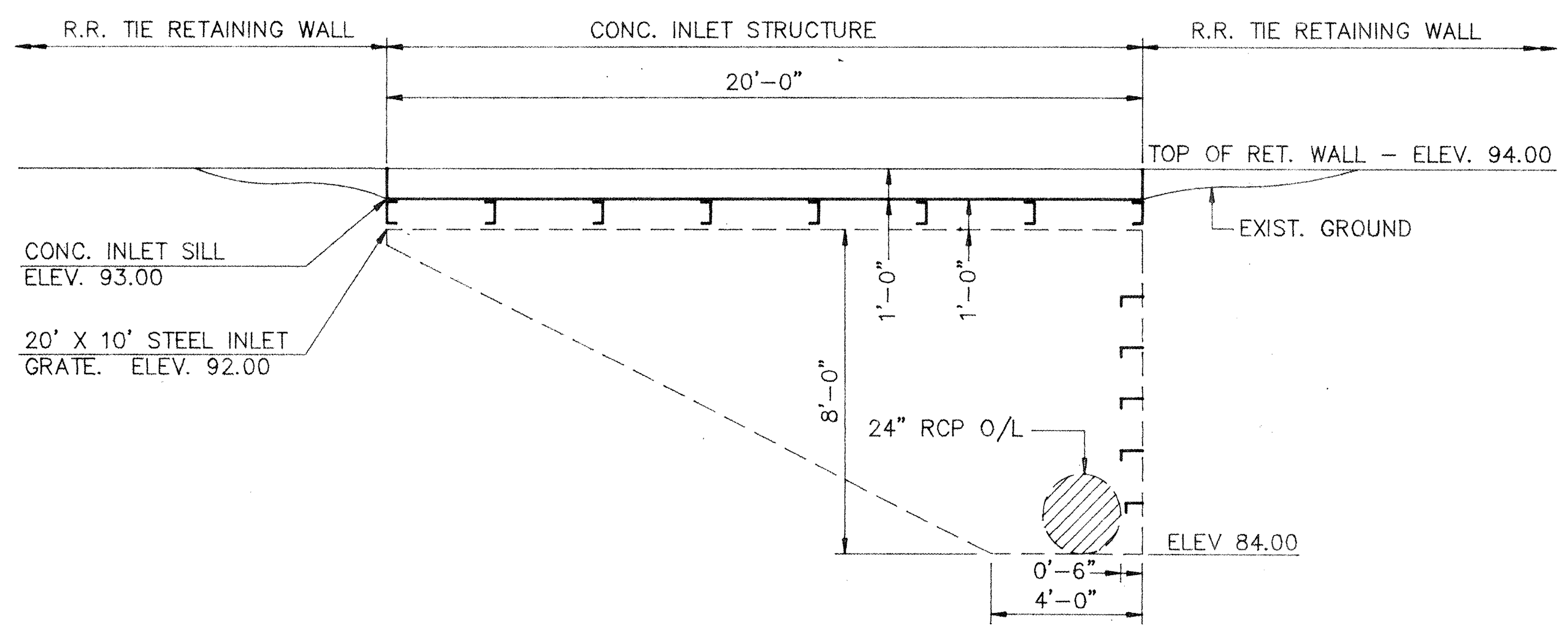
CMU RETAINING WALL DETAIL

SCALE: NONE



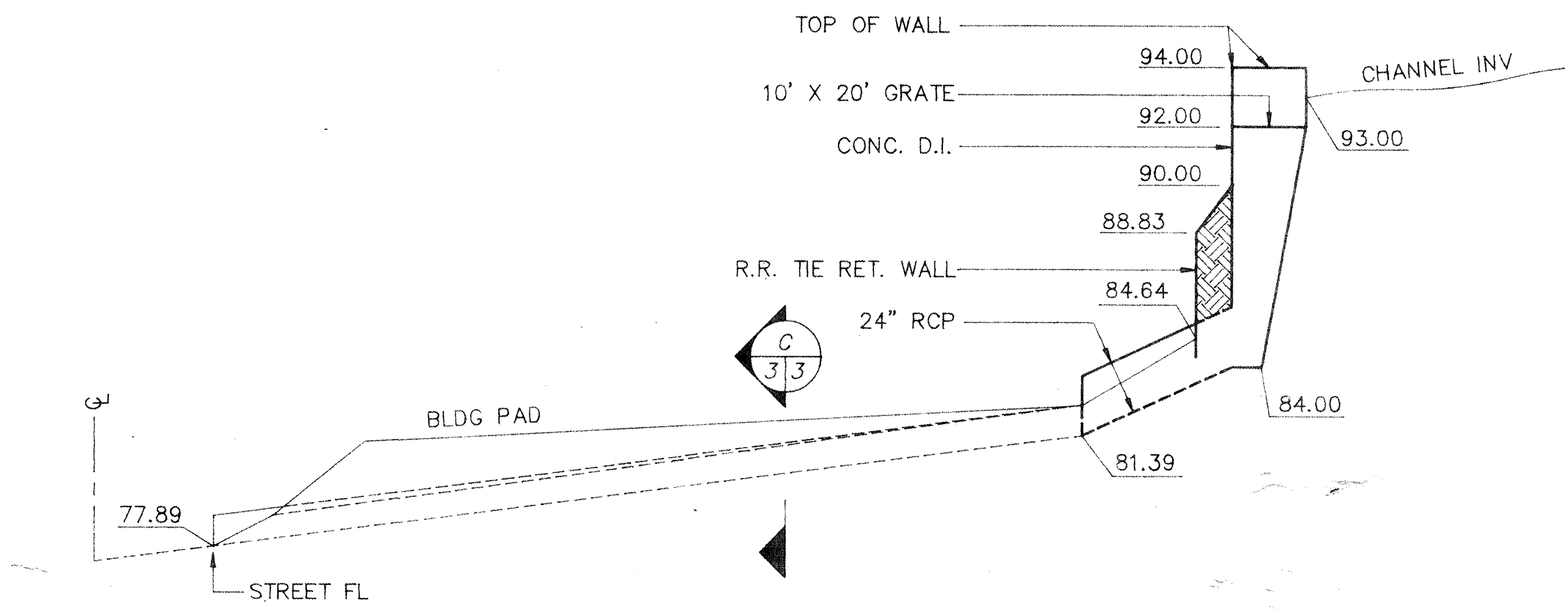
SECTION C 3/3

SCALE: 1" = 2'-0"



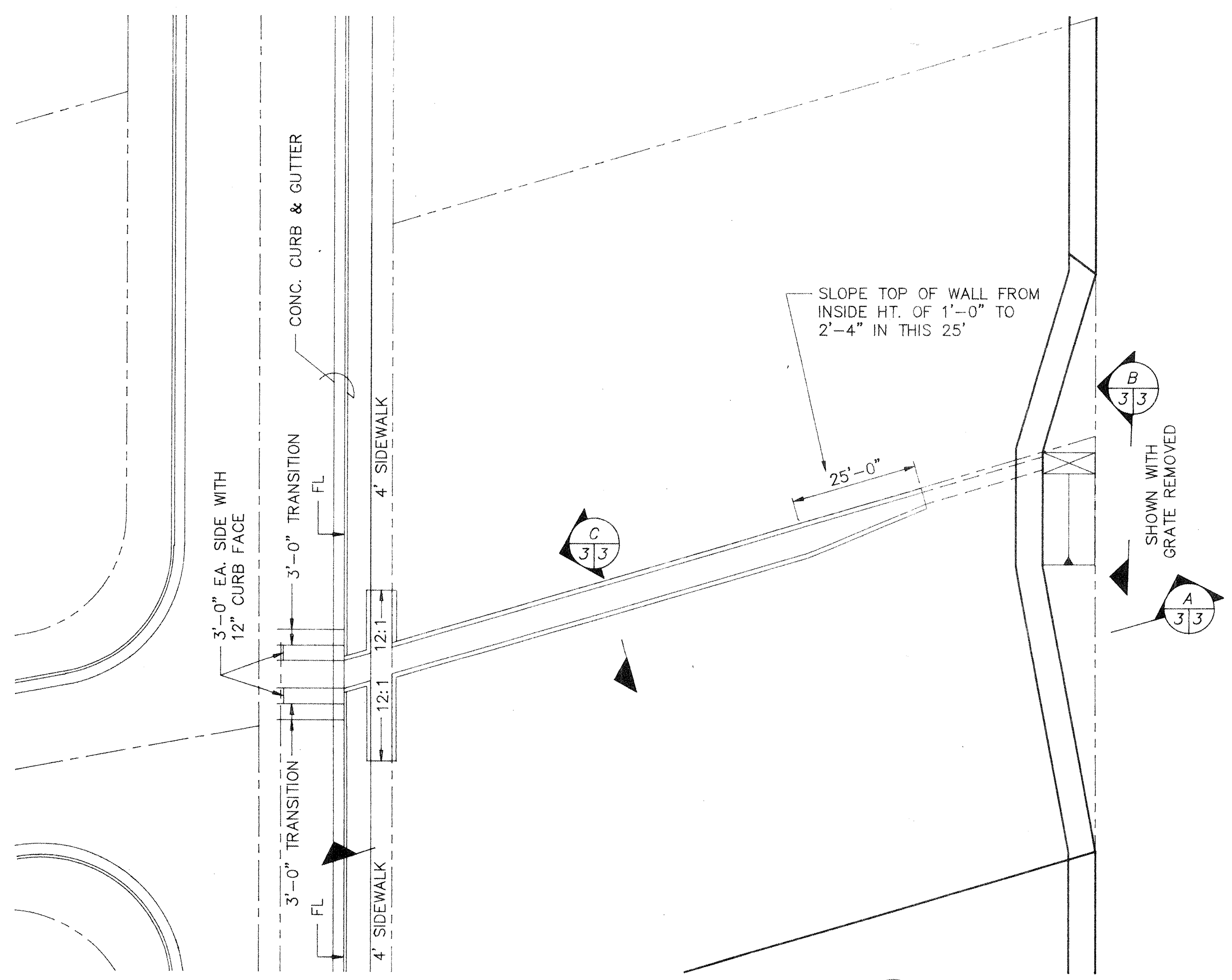
SECTION B 3/3

SCALE: 1" = 4'-0"



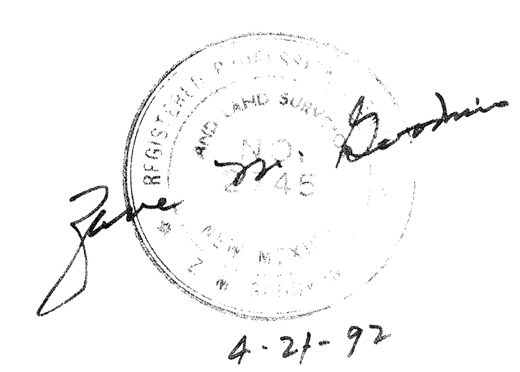
SECTION A 3/3

HOR. SCALE: 1" = 20' VER. SCALE: 1" = 5'



LAYOUT — INTAKE STRUCTURE 'J' 1/2 3

SCALE: 1" = 20'



4-21-92

DETAILS

MORGAN SUBDIVISION

DETAILS

dmg D. MARK GOODWIN & ASSOCIATES, P.A.
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Designed: ZMG	Drawn: STAFF	Checked: ZMG	Sheet 3 of 3
Scale: AS SHOWN	Date: 4/92	Job: 9224	