Non-Vegetated Parabolic Channels

Pages 14-157 thru 14-161 contain tables for the design of parabolic non-vegetated surface drains. The primary purpose is to provide for surface drainage without interfering with normal cultivation operations that could occur with trapezoidal or "V" ditch construction.

In all cases values are not given where velocities exceed 4 ft/sec.

Design Example

Design and field information indicates that a surface depression exists that does not have a free outlet. It is determined that this area has a contributing drainage area of 100 acres with a "B" drainage discharge of 20 cfs. The landowner wishes to provide an outlet for this area without losing available crop land. Subsurface drainage with a surface inlet was investigated but no outlet was available within a reasonable distance. A channel grade of 0.2% is available. Solution: Install a parabolic nonvegetated channel which may be cropped with the existing cultural practices.

Given: Q = 20 cfs, S = .002, soils - TREATY

1) For Treaty soils, find the maximum permissable velocity from Table 14-2, page 14-26 of the EFM. Treaty is classified as a CL soil. Table 14-2 indicates a maximum velocity of 4.0 ft/sec.

2) From Table IN-14-7, page 14-158 of the EFM, select a parabolic channel that has a capacity of 20 cfs. Selected size is 20' top width, 1.0' depth. The velocity is 2.0 ft/sec, which is less than the 4 ft/sec. allowable.

TABLE IN-14-7
NONVEGETATED PARABOLIC CHANNEL
N VALUE = 0.025

CHANNEL SLOPE = 0.001

DEPTH (FT)	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5
VELOCITY	1.4	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6
TOP WIDTH	CUBIC FEET PER SECOND															
20	19	22	25	29	33	37	41	45	50	54	59	64	69	74	80	85
22	20	24	28	32	36	41	45	50	55	60	65	71	76	82	88	94
24	22	26	30	35	39	44	49	55	60	66	71	77	84	90	97	103
26	24	29	33	38	43	48	54	59	65	71	78	84	91	98	105	112
28	26	31	36	41	46	52	58	64	70	77	84	91	98	106	113	121
30	28	33	38	44	50	56	62	69	75	83	90	97	105	113	122	130
32	30	35	41	47	53	59	66	73	81	88	96	104	112	121	130	139
34	32	38	43	50	56	63	70	78	86	94	102	111	120	129	138	148
36	34	40	46	53	60	67	75	83	91	99	108	117	127	136	146	157
38	36	42	49	56	63	71	79	87	96	105	114	124	134	144	155	166
40	38	44	51	59	66	74	83	92	101	111	120	131	141	152	163	174
42	40	47	54	62	70	78	87	96	106	116	126	137	148	160	171	183
44	42	49	56	65	73	82	91	101	111	122	133	144	155	167	180	192
46	43	51	59	68	76	86	96	106	116	127	139	150	163	175	188	201
48	45	53	62	70	80	90	100	110	121	133	145	157	170	183	196	210
50	47	55	64	73	83	93	104	115	127	138	151	164	177	190	204	219
52	49	58	67	76	87	97	108	120	132	144	157	170	184	198	213	228
54	51	60	69	79	90	101	112	124	137	150	163	177	191	206	221	236
56	53	62	72	82	93	105	117	129	142	155	169	183	198	213	229	245
58	55	64	75	85	97	108	121	134	147	161	175	190	205	221	237	254
60	57	67	77	88	100	112	125	138	152	166	181	197	213	229	246	263

TABLE IN-14-7
NONVEGETATED PARABOLIC CHANNEL
N VALUE = 0.025

CHANNEL SLOPE = 0.002

DEPTH (FT)	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5
VELOCITY	2.0	2.2	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
TOP WIDTH	CUBIC FEET PER SECOND															
20	26	31	36	41	46	52	58	64	71	77	84	91	98	105	113	121
22	29	34	40	45	51	57	64	71	78	85	93	100	108	116	125	133
24	32	37	43	49	56	63	70	77	85	93	101	110	119	127	137	146
26	35	41	47	54	61	68	76	84	92	101	110	119	129	138	149	159
28	37	44	51	58	66	74	82	91	100	109	119	129	139	149	160	171
30	40	47	54	62	70	79	88	97	107	117	127	138	149	160	172	184
32	43	50	58	66	75	84	94	104	114	125	136	147	159	171	184	197
34	45	53	62	71	80	90	100	110	121	133	145	157	169	182	196	209
36	48	56	65	75	85	95	106	117	129	141	153	166	179	193	207	222
38	51	60	69	79	89	100	112	123	136	149	162	176	190	204	219	234
40	54	63	73	83	94	106	118	130	143	157	170	185	200	215	231	247
42	56	66	76	87	99	111	123	137	150	164	179	194	210	226	242	259
44	59	69	80	91	104	116	129	143	158	172	188	204	220	237	254	272
46	62	72	84	96	108	122	135	150	165	180	196	213	230	248	266	284
48	64	76	87	100	113	127	141	156	172	188	205	222	240	259	278	297
50	67	79	91	104	118	132	147	163	179	196	214	232	250	269	289	309
52	70	82	95	108	123	138	153	169	186	204	222	241	260	280	301	322
54	72	85	98	112	127	143	159	176	194	212	231	250	270	291	313	335
56	75	88	102	117	132	148	165	183	201	220	239	260	281	302	324	347
58	78	91	106	121	137	153	171	189	208	228	248	269	291	313	336	360
60	81	95	109	125	142	159	177	196	215	236	257	278	301	324	348	372

TABLE IN-14-7
NONVEGETATED PARABOLIC CHANNEL
N VALUE = 0.025

CHANNEL SLOPE = 0.003

DEPTH (FT)	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
VELOCITY	2.5	2.6	2.8	3.0	3.1	3.3	3.4	3.5	3.7	3.8	3.9
TOP WIDTH	CUBIC FEET PER SECOND										
20	32	38	44	50	57	64	71	79	86	95	103
22	36	42	49	56	63	71	79	87	95	104	114
24	39	46	53	61	69	77	86	95	104	114	124
26	42	50	58	66	75	84	93	103	113	124	135
28	46	54	62	71	80	90	100	111	122	134	145
30	49	58	67	76	86	97	108	119	131	143	156
32	52	61	71	81	92	103	115	127	140	153	167
34	56	65	76	86	98	110	122	135	149	163	177
36	59	69	80	92	104	116	130	143	158	172	188
38	62	73	85	97	110	123	137	151	166	182	198
40	66	77	89	102	115	129	144	159	175	192	209
42	69	81	94	107	121	136	151	167	184	202	219
44	72	85	98	112	127	142	159	175	193	211	230
46	76	89	103	117	133	149	166	184	202	221	241
48	79	93	107	122	139	155	173	192	211	231	251
50	82	96	112	128	144	162	180	200	220	240	262
52	86	100	116	133	150	169	188	208	228	250	272
54	89	104	121	138	156	175	195	216	237	260	282
56	92	108	125	143	162	182	202	224	246	269	293
58	96	112	130	148	168	188	209	232	255	279	304
60	99	116	134	153	173	195	217	240	264	289	314

TABLE IN-14-7
NONVEGETATED PARABOLIC CHANNEL
N VALUE = 0.025

CHANNEL SLOPE = 0.004

DEPTH (FT)	1.0	1.1	1.2	1.3	1.4	1.5	1.6
VELOCITY	2.9	3.1	3.2	3.4	3.6	3.8	3.9
TOP WIDTH	CUBIC FEET PER SECOND						
20	38	44	51	58	66	74	82
22	41	49	56	64	73	82	91
24	45	53	61	70	79	89	99
26	49	58	67	76	86	97	108
28	53	62	72	82	93	104	116
30	57	67	77	88	100	112	124
32	61	71	82	94	106	119	133
34	64	76	87	100	113	127	141
36	68	80	93	106	120	134	150
38	72	85	98	112	127	142	158
40	76	89	103	118	133	149	166
42	80	94	108	124	140	157	175
44	84	98	113	130	147	165	183
46	87	103	119	136	153	172	192
48	91	107	124	141	160	180	200
50	95	111	129	147	167	187	208
52	99	116	134	153	174	195	217
54	103	120	139	159	180	202	225
56	107	125	145	165	187	210	234
58	110	129	150	171	194	217	242
60	114	134	155	177	200	225	250

CHANNEL SLOPE = 0.005

DEPTH (FT)	1.0	1.1	1.2	1.3	1.4
VELOCITY	3.2	3.4	3.6	3.8	4.0
TOP WIDTH	CUBIC FEET PER SECOND				
20	42	49	57	65	74
22	46	54	63	72	81
24	51	59	69	79	89
26	55	64	75	85	96
28	59	69	80	92	104
30	64	75	86	98	111
32	68	80	92	105	119
34	72	85	98	112	126
36	76	90	104	118	134
38	81	95	109	125	142
40	85	100	115	132	149
42	89	105	121	138	157
44	93	110	127	145	164
46	98	115	133	152	172
48	102	120	138	158	179
50	106	125	144	165	187
52	111	130	150	171	194
54	115	135	156	178	202
56	119	140	162	185	209
58	123	145	167	191	217
60	128	150	173	198	224

TABLE IN-14-7
NONVEGETATED PARABOLIC CHANNEL
N VALUE = 0.025

CHANNEL SLOPE = 0.006

DEPTH (FT)	1.0	1.1	1.2
VELOCITY	3.5	3.7	4.0
TOP WIDTH	CUBIC FEET PER SECOND		
20	46	54	63
22	51	60	69
24	56	65	75
26	60	71	82
28	65	76	88
30	70	82	94
32	74	87	101
34	79	93	107
36	84	98	114
38	88	104	120
40	93	109	126
42	98	115	133
44	102	120	139
46	107	126	145
48	112	131	152
50	117	137	158
52	121	142	164
54	126	148	171
56	131	153	177
58	135	159	183
60	140	164	190

CHANNEL SLOPE = 0.007

DEPTH (FT)	1.0	1.1
VELOCITY	3.8	4.0
TOP WIDTH	CUBIC FEET PER SECOND	
20	50	58
22	55	64
24	60	70
26	65	76
28	70	82
30	75	88
32	80	94
34	85	100
36	90	106
38	96	112
40	101	118
42	106	124
44	111	130
46	116	136
48	121	142
50	126	148
52	131	154
54	136	160
56	141	165
58	146	171
60	151	177