STANDARD AND SPECIFICATIONS FOR DIVERSION

Definition

A drainage way of parabolic or trapezoidal cross-section with a supporting ridge on the lower side that is constructed across the slope.

Purpose

The purpose of a diversion is to intercept and convey runoff to stable outlets at non-erosive velocities.

Conditions Where Practice Applies

Diversions are used where:

1. Runoff from higher areas has potential for damaging properties, causing erosion, or interfering with, or preventing the establishment of, vegetation on lower areas.

2. Surface and/or shallow subsurface flow is damaging sloping upland.

3. The length of slopes needs to be reduced so that soil loss will be kept to a minimum.

Diversions are only applicable below stabilized or protected areas. Avoid establishment on slopes greater than fifteen percent. Diversions should be used with caution on soils subject to slippage. Construction of diversions shall be in compliance with state drainage and water laws.

Design Criteria

Location

Diversion location shall be determined by considering outlet conditions, topography, land use, soil type, length of slope, seep planes (when seepage is a problem), and the development layout.

Capacity

Peak rates of runoff values used in determining the capacity requirements shall be computed by TR-55, Urban Hydrology for Small Watersheds, or other appropriate methods.

The constructed diversion shall have capacity to carry, as a minimum, the peak discharge from a ten-year frequency rainfall event with freeboard of not less than 0.3 feet.

Diversions designed to protect homes, schools, industrial buildings, roads, parking lots, and comparable high-risk areas, and those designed to function in connection with other structures, shall have sufficient capacity to carry peak runoff expected from a storm frequency consistent with the hazard involved.

Cross Section

The diversion channel shall be parabolic or trapezoidal in shape. Parabolic Diversion design charts are provided in Figures 5B.2 through 5B.7 on pages 5B.4 to 5B.9**.** The diversion shall be designed to have stable side slopes. The side slopes shall not be steeper than 2:1 and shall be flat enough to ensure ease of maintenance of the diversion and its protective vegetative cover.

The ridge shall have a minimum width of four feet at the design water elevation; a minimum of 0.3 feet freeboard and a reasonable settlement factor shall be provided.

Velocity and Grade

The permissible velocity for the specified method of stabilization will determine the maximum grade. Maximum permissible velocities of flow for the stated conditions of stabilization shall be as shown in Table 5B.1 on page 5B.2 of this standard.

Diversions are not usually applicable below high sediment producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with, or before, the diversions.

Outlets

Each diversion must have an adequate outlet. The outlet may be a grassed waterway, vegetated or paved area, grade stabilization structure, stable watercourse, or subsurface drain outlet. In all cases, the outlet must convey runoff to a point where outflow will not cause damage. Vegetated outlets shall be installed before diversion construction, if needed, to ensure establishment of vegetative cover in the outlet channel.

The design elevation of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Stabilization

Diversions shall be stabilized in accordance with the following tables.

Construction Specifications

See Figure 5B.1 on page 5B.3 for details.

Table 5B.1 Diversion Maximum Permissible Design Velocities

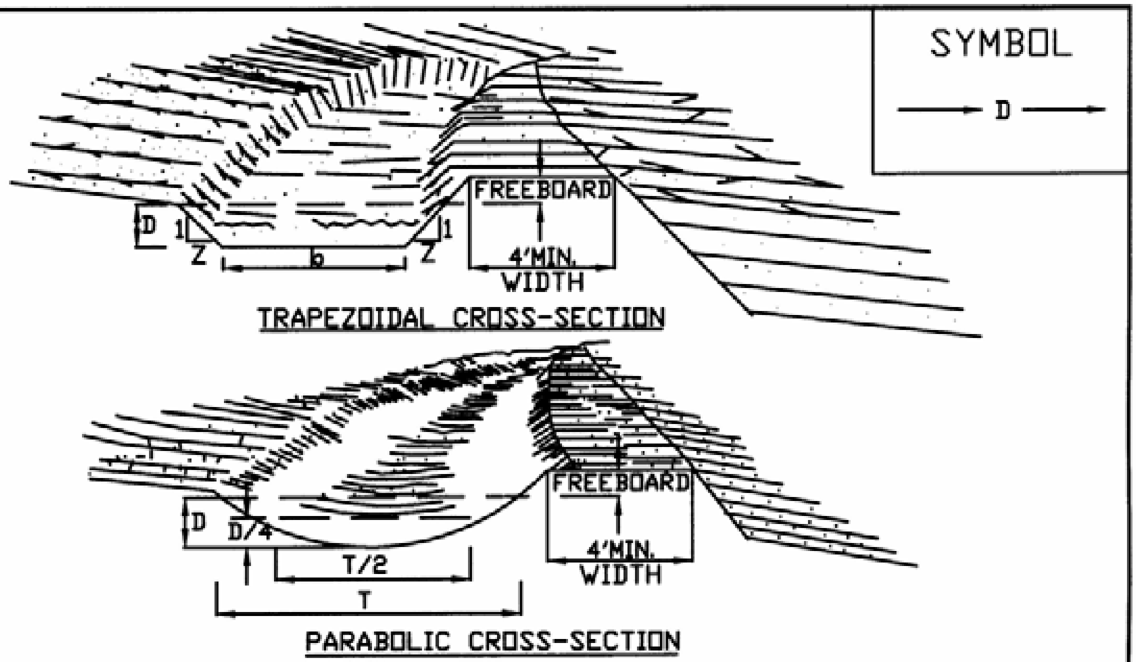
Soil Texture	**Retardance and Cover**	Permissible Velocity (ft / second) for Selected **Channel Vegetation**
Sand, Silt, Sandy loam, silty loam, loamy sand (ML, SM, SP, SW)	C-Kentucky 31 tall fescue and Kentucky bluegrass	3.0
	D-Annuals[1] Small grain (rye, oats, barley, millet) Ryegrass	2.5
Silty clay loam, Sandy clay loam (ML-CL, SC)	C-Kentucky 31 tall fescue and Kentucky bluegrass	4.0
	D-Annuals[1] Small grain (rye, oats, barley, millet) Ryegrass	3.5
Clay (CL)	C-Kentucky 31 tall fescue and Kentucky bluegrass	5.0
	D-Annuals[1] Small grain (rye, oats, barley, millet) Ryegrass	4.0

[1] Annuals—Use only as temporary protection until permanent vegetation is established.

Table 5B.2—Retardance Factors for Various Grasses and Legumes

Retardance	**Cover**	**Condition**
A	Reed canarygrass………………………………………………...	Excellent stand, tall (average 36 inches)
B	Smooth bromegrass……………………………………………	Good stand, mowed (average 12 to 15 inches)
	Tall fescue…………………………………………………..	Good stand, unmowed (average 18 inches)
	Grass-legume mixture—Timothy, smooth bromegrass, or Orchard grass with birdsfoot trefoil…………………………	Good stand, uncut (average 20 inches)
	Reed canarygrass……………………………………………….	Good stand, mowed (average 12 to 15 inches)
	Tall fescue, with birdsfoot trefoil or ladino clover……………..	Good stand, uncut (average 18 inches)
C	Redtop……………………………………………………	Good stand, headed (15 to 20 inches)
	Grass-legume mixture—summer (Orchard grass, redtop, Annual ryegrass, and ladino or white clover)…………………………	Good stand, uncut (6 to 8 inches)
	Kentucky bluegrass…………………………………………….	Good stand, headed (6 to 12 inches)
D	Red fescue……………………………………………………	Good stand, headed (12 to 18 inches)
	Grass-legume mixture—fall, spring (Orchard grass, redtop, Annual ryegrass, and white or ladino clover)……………….	Good stand, uncut (4 to 5 inches)

Figure 5B.1
Diversion



CONSTRUCTION SPECIFICATIONS

1. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE DIVERSION.
2. THE DIVERSION SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN, AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
3. FILLS SHALL BE COMPACTED AS NEEDED TO PREVENT UNEQUAL SETTLEMENT THAT WOULD CAUSE DAMAGE IN THE COMPLETE DIVERSION.
4. ALL EARTH REMOVED AND NOT NEEDED IN CONSTRUCTION SHALL BE SPREAD OR DISPOSED OF SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE DIVERSION.
5. STABILIZATION SHALL BE DONE ACCORDING TO THE APPROPRIATE STANDARD AND SPECIFICATIONS FOR VEGETATIVE PRACTICES.
   A. FOR DESIGN VELOCITIES OF LESS THAN 3.5 FT. PER. SEC., SEEDING AND MULCHING MAY BE USED FOR THE ESTABLISHMENT OF THE VEGETATION. IT IS RECOMMENDED THAT, WHEN CONDITIONS PERMIT, TEMPORARY DIVERSIONS OR OTHER MEANS SHOULD BE USED TO PREVENT WATER FROM ENTERING THE DIVERSION DURING THE ESTABLISHMENT OF THE VEGETATION.
   B. FOR DESIGN VELOCITIES OF MORE THAN 3.5 FT. PER. SEC., THE DIVERSION SHALL BE STABILIZED WITH SOD, WITH SEEDING PROTECTED BY JUTE OR EXCELSIOR MATTING OR WITH SEEDING AND MULCHING INCLUDING TEMPORARY DIVERSION OF THE WATER UNTIL THE VEGETATION IS ESTABLISHED.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	DIVERSION

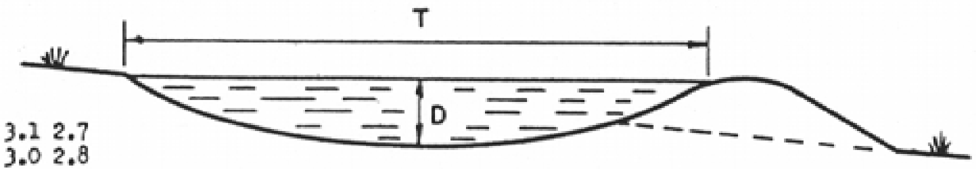
Figure 5B.2
Parabolic Diversion Design, Without Freeboard-1 (USDA - NRCS)

PARABOLIC DIVERSION DESIGN, WITHOUT FREEBOARD

RETARDANCE - D & C
GRADE, % - 0.25

V_1 Based on Permissible Velocity of the Soil With Retardance "D"
Top Width, Depth & V_2 Based on Retardance "C"

Q	V_1 = 2.0			V_1 = 2.5			V_1 = 3.0			V_1 = 3.5			V_1 = 4.0			V_1 = 4.5			V_1 = 5.0			V_1 = 5.5			V_1 = 6.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15																											
20																											
25	10	2.4	1.6																								
30	11	2.3	1.7																								
35	13	2.3	1.7																								
40	15	2.3	1.8	10	2.7	2.1																					
45	17	2.2	1.8	12	2.6	2.2																					
50	19	2.2	1.8	13	2.6	2.2																					
55	20	2.2	1.8	14	2.6	2.3																					
60	22	2.2	1.8	15	2.5	2.3																					
65	24	2.2	1.8	17	2.5	2.3																					
70	26	2.2	1.9	18	2.5	2.3	13	3.1	2.7																		
75	28	2.2	1.9	19	2.5	2.4	13	3.0	2.8																		
80	29	2.2	1.9	20	2.5	2.4	14	3.0	2.8																		
90	33	2.2	1.9	23	2.5	2.4	16	3.0	2.8																		
100	37	2.2	1.9	25	2.5	2.4	18	3.0	2.9																		
110	40	2.2	1.9	28	2.5	2.4	19	2.9	2.9																		
120	44	2.2	1.9	30	2.5	2.4	21	2.9	2.9	15	3.6	3.3															
130	48	2.2	1.9	33	2.5	2.4	23	2.9	2.9	16	3.6	3.3															
140	51	2.2	1.9	35	2.5	2.4	25	2.9	2.9	18	3.5	3.4															
150	55	2.2	1.9	37	2.5	2.4	26	2.9	2.9	19	3.5	3.4															
160	58	2.2	1.9	40	2.5	2.4	28	2.9	3.0	20	3.5	3.4															
170	62	2.2	1.9	42	2.5	2.4	30	2.9	3.0	21	3.5	3.4	17	4.0	3.8												
180	66	2.2	1.9	45	2.5	2.4	31	2.9	3.0	22	3.5	3.5	18	4.0	3.8												
190	69	2.2	1.9	47	2.5	2.4	33	2.9	3.0	24	3.5	3.5	19	4.0	3.9												
200	73	2.2	1.9	50	2.5	2.4	35	2.9	3.0	25	3.4	3.5	19	3.9	3.9												
220	80	2.2	1.9	55	2.5	2.4	38	2.9	3.0	27	3.4	3.5	21	3.9	3.9												
240	87	2.2	1.9	60	2.5	2.5	42	2.9	3.0	30	3.4	3.6	23	3.9	4.0												
260	95	2.2	1.9	65	2.5	2.4	45	2.9	3.0	32	3.4	3.5	25	3.9	4.0	20	4.6	4.3									
280				69	2.5	2.5	49	2.9	3.0	35	3.4	3.6	27	3.9	4.0	21	4.6	4.3									
300				74	2.5	2.5	52	2.9	3.0	37	3.4	3.6	29	3.8	4.1	22	4.5	4.4									



T = Top width, Retardance "C"
D = Flow depth, Retardance "C"
V_1 = Permissible velocity, Retardance "D"
V_2 = Velocity, Retardance "C"

T and D are the dimensions required to carry the design flow. Add freeboard and allowance for settlement as necessary.

Figure 5B.3
Parabolic Diversion Design, Without Freeboard-2 (USDA - NRCS)

PARABOLIC DIVERSION DESIGN, WITHOUT FREEBOARD

RETARDANCE - D & C
GRADE, % - 0.50

V_1 Based on Permissible Velocity of the Soil With Retardance "D"
Top Width, Depth & V_2 Based on Retardance "C"

Q	V_1 = 2.0			V_1 = 2.5			V_1 = 3.0			V_1 = 3.5			V_1 = 4.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15	9	1.6	1.6												
20	11	1.6	1.7												
25	14	1.6	1.7	9	1.9	2.1									
30	17	1.6	1.7	11	1.9	2.2	8	2.2	2.5						
35	20	1.6	1.7	12	1.9	2.3	9	2.1	2.6						
40	22	1.6	1.7	14	1.8	2.3	11	2.1	2.7						
45	25	1.5	1.7	16	1.8	2.3	12	2.0	2.8						
50	28	1.5	1.7	18	1.8	2.4	13	2.0	2.8	10	2.4	3.2			
55	31	1.5	1.7	19	1.8	2.4	15	2.0	2.8	11	2.4	3.3			
60	33	1.5	1.7	21	1.8	2.4	16	2.0	2.8	11	2.4	3.3			
65	36	1.5	1.8	23	1.8	2.4	17	2.0	2.9	12	2.4	3.3			
70	39	1.5	1.7	24	1.8	2.4	18	2.0	2.9	13	2.3	3.4			
75	42	1.5	1.8	26	1.8	2.4	19	2.0	2.9	14	2.3	3.4	11	2.7	3.7
80	44	1.5	1.8	28	1.8	2.4	21	2.0	2.9	15	2.3	3.4	12	2.7	3.8
90	50	1.5	1.8	31	1.8	2.4	24	2.0	2.9	17	2.3	3.4	13	2.7	3.8
100	55	1.5	1.8	35	1.8	2.4	26	2.0	2.9	19	2.3	3.5	15	2.6	3.9
110	61	1.5	1.8	38	1.8	2.4	29	2.0	2.9	21	2.3	3.5	16	2.6	3.9
120	66	1.5	1.8	42	1.8	2.4	31	2.0	2.9	22	2.3	3.5	18	2.6	3.9
130	72	1.5	1.8	45	1.8	2.4	34	2.0	2.9	24	2.3	3.5	19	2.6	4.0
140	77	1.5	1.8	48	1.8	2.4	36	2.0	2.9	26	2.3	3.5	20	2.6	4.0
150	83	1.5	1.8	52	1.8	2.4	39	2.0	2.9	28	2.3	3.5	22	2.6	4.0
160	88	1.5	1.8	55	1.8	2.4	41	2.0	2.9	30	2.3	3.5	23	2.6	4.0
170	93	1.5	1.8	59	1.8	2.4	44	2.0	2.9	32	2.3	3.6	25	2.6	4.0
180	99	1.5	1.8	62	1.8	2.4	47	2.0	2.9	33	2.3	3.6	26	2.6	4.0
190				65	1.8	2.4	49	2.0	2.9	35	2.3	3.6	28	2.6	4.0
200				69	1.8	2.4	52	2.0	2.9	37	2.3	3.6	29	2.6	4.0
220				76	1.8	2.4	57	2.0	2.9	41	2.3	3.6	32	2.6	4.0
240				82	1.8	2.5	62	2.0	2.9	44	2.3	3.6	45	2.5	4.1
260				89	1.8	2.5	67	2.0	2.9	48	2.3	3.6	38	2.6	4.1
280				96	1.8	2.5	72	2.0	3.0	52	2.3	3.6	40	2.5	4.1
300							77	2.0	3.0	55	2.3	3.6	43	2.5	4.1

Q	V_1 = 4.5			V_1 = 5.0			V_1 = 5.5			V_1 = 6.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
100	12	3.0	4.1									
110	13	3.0	4.2									
120	14	2.9	4.3									
130	15	2.9	4.4									
140	16	2.9	4.3									
150	18	2.9	4.4	14	3.3	4.8						
160	19	2.9	4.4	15	3.3	4.8						
170	20	2.9	4.4	16	3.3	4.9						
180	21	2.9	4.5	17	3.3	4.9						
190	22	2.9	4.5	18	3.3	5.0						
200	23	2.9	4.5	18	3.3	5.0	15	3.7	5.2			
220	25	2.9	4.5	20	3.2	5.0	17	3.7	5.4			
240	28	2.9	4.5	22	3.2	5.0	18	3.7	5.4			
260	30	2.9	4.5	24	3.2	5.1	20	3.5	5.4			
280	32	2.8	4.6	26	3.2	5.1	21	3.6	5.5	18	4.1	5.8
300	35	2.8	4.6	27	3.2	5.2	23	3.6	5.5	19	4.1	5.8

Figure 5B.4
Parabolic Diversion Design, Without Freeboard-3 (USDA - NRCS)

PARABOLIC DIVERSION DESIGN, WITHOUT FREEBOARD

RETARDANCE - D & C
GRADE, % - 0.75

V_1 Based on Permissible Velocity of the Soil With Retardance "D"
Top Width, Depth & V_2 Based on Retardance "C"

Q	V_1 = 2.0			V_1 = 2.5			V_1 = 3.0			V_1 = 3.5			V_1 = 4.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15	12	1.3	1.5	7	1.6	2.0									
20	16	1.3	1.5	9	1.5	2.2									
25	19	1.3	1.5	11	1.5	2.2	8	1.7	2.6						
30	23	1.3	1.5	13	1.5	2.2	10	1.7	2.7	8	1.9	3.0			
35	27	1.3	1.5	15	1.5	2.3	11	1.7	2.7	9	1.9	3.1			
40	31	1.3	1.5	18	1.5	2.3	13	1.7	2.8	10	1.9	3.2			
45	35	1.3	1.6	20	1.5	2.3	14	1.7	2.8	11	1.8	3.2			
50	38	1.3	1.6	22	1.5	2.3	16	1.6	2.9	13	1.8	3.3	9	2.2	3.7
55	42	1.3	1.6	24	1.5	2.3	18	1.6	2.9	14	1.8	3.3	10	2.1	3.8
60	46	1.3	1.6	26	1.5	2.3	19	1.6	2.8	15	1.8	3.3	11	2.1	3.9
65	50	1.3	1.6	28	1.5	2.3	21	1.6	2.9	16	1.8	3.3	12	2.1	3.8
70	53	1.3	1.6	30	1.5	2.3	22	1.6	2.9	17	1.8	3.3	13	2.1	3.8
75	57	1.3	1.6	33	1.5	2.3	24	1.6	2.9	19	1.8	3.3	14	2.1	4.0
80	61	1.3	1.6	35	1.5	2.3	25	1.6	2.9	20	1.8	3.4	15	2.1	4.0
90	68	1.3	1.6	39	1.5	2.3	28	1.6	2.9	22	1.8	3.4	16	2.1	4.0
100	76	1.3	1.6	43	1.5	2.3	32	1.6	2.9	25	1.8	3.4	18	2.1	4.0
110	83	1.3	1.6	48	1.5	2.3	35	1.6	2.9	27	1.8	3.4	20	2.0	4.0
120	91	1.3	1.6	52	1.5	2.3	38	1.6	2.9	30	1.8	3.4	22	2.1	4.0
130	98	1.3	1.6	56	1.5	2.4	41	1.6	2.9	32	1.8	3.4	23	2.1	4.0
140				60	1.5	2.4	44	1.6	2.9	34	1.8	3.4	25	2.0	4.1
150				65	1.5	2.4	47	1.6	2.9	37	1.8	3.4	27	2.0	4.1
160				69	1.5	2.4	50	1.6	2.9	39	1.8	3.4	29	2.0	4.1
170				73	1.5	2.4	53	1.6	2.9	42	1.8	3.4	30	2.0	4.1
180				77	1.5	2.4	56	1.6	2.9	44	1.8	3.4	32	2.0	4.1
190				82	1.5	2.4	60	1.6	2.9	47	1.8	3.4	34	2.0	4.1
200				85	1.5	2.4	63	1.6	3.0	49	1.8	3.4	36	2.0	4.1
220				94	1.5	2.4	69	1.6	3.0	54	1.8	3.4	39	2.0	4.1
240							75	1.6	3.0	59	1.8	3.4	43	2.0	4.1
260							81	1.6	3.0	64	1.8	3.4	46	2.0	4.1
280							87	1.6	3.0	68	1.8	3.4	50	2.0	4.1
300							93	1.6	3.0	73	1.8	3.5	53	2.0	4.1

Q	V_1 = 4.5			V_1 = 5.0			V_1 = 5.5			V_1 = 6.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15												
20												
25												
30												
35												
40												
45												
50												
55												
60												
65	10	2.4	4.1									
70	11	2.4	4.2									
75	11	2.3	4.2									
80	12	2.3	4.3									
90	13	2.3	4.4	11	2.6	4.6						
100	15	2.3	4.4	12	2.6	4.8						
110	16	2.3	4.5	13	2.6	4.8						
120	18	2.3	4.4	15	2.5	4.8	12	2.9	5.2			
130	19	2.2	4.5	15	2.5	4.9	13	2.8	5.3			
140	21	2.3	4.5	17	2.5	4.9	14	2.8	5.3			
150	22	2.2	4.5	18	2.5	4.9	15	2.8	5.3			
160	24	2.2	4.5	19	2.5	4.9	16	2.8	5.4	13	3.1	5.8
170	25	2.2	4.5	20	2.5	5.0	17	2.8	5.4	14	3.1	5.8
180	27	2.2	4.5	22	2.5	5.0	18	2.8	5.5	15	3.1	5.9
190	28	2.2	4.6	23	2.5	5.0	19	2.8	5.5	16	3.1	5.9
200	29	2.2	4.5	24	2.5	5.0	20	2.7	5.5	16	3.1	5.9
220	32	2.2	4.6	26	2.5	5.1	22	2.7	5.5	18	3.1	5.9
240	35	2.2	4.6	29	2.5	5.0	24	2.7	5.6	19	3.1	6.0
260	38	2.2	4.6	31	2.5	5.1	26	2.7	5.6	21	3.1	6.1
280	41	2.2	4.6	33	2.5	5.1	27	2.7	5.7	23	3.0	6.1
300	44	2.2	4.6	35	2.5	5.1	29	2.7	5.6	24	3.0	6.1

Figure 5B.5
Parabolic Diversion Design, Without Freeboard-4 (USDA - NRCS)

PARABOLIC DIVERSION DESIGN, WITHOUT FREEBOARD

RETARDANCE - D & C
GRADE, % - 1.0

V_1 based on Permissible Velocity of the Soil With Retardance "D"
Top Width, Depth & V_2 Based on Retardance "C"

Q	V_1 = 2.0			V_1 = 2.5			V_1 = 3.0			V_1 = 3.5		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15	13	1.1	1.5	8	1.3	2.0						
20	18	1.1	1.5	11	1.3	2.1	8	1.5	2.6			
25	22	1.1	1.5	14	1.3	2.1	9	1.5	2.6	8	1.6	3.0
30	27	1.1	1.5	17	1.3	2.1	11	1.5	2.7	9	1.6	3.0
35	31	1.1	1.5	19	1.3	2.2	13	1.5	2.8	11	1.6	3.1
40	35	1.1	1.5	22	1.3	2.1	15	1.4	2.8	12	1.6	3.1
45	40	1.1	1.5	25	1.3	2.2	17	1.5	2.8	13	1.6	3.2
50	44	1.1	1.5	28	1.3	2.2	19	1.4	2.8	15	1.6	3.2
55	48	1.1	1.5	30	1.3	2.2	20	1.4	2.8	16	1.5	3.3
60	53	1.1	1.5	33	1.3	2.2	22	1.4	2.8	18	1.5	3.3
65	57	1.1	1.5	36	1.3	2.2	24	1.4	2.8	19	1.5	3.3
70	61	1.1	1.5	38	1.3	2.2	26	1.4	2.8	21	1.5	3.3
75	66	1.1	1.5	41	1.3	2.2	28	1.4	2.9	22	1.5	3.3
80	70	1.1	1.5	44	1.3	2.2	29	1.4	2.9	24	1.5	3.3
90	79	1.1	1.5	49	1.3	2.2	33	1.4	2.9	27	1.5	3.3
100	87	1.1	1.5	55	1.3	2.2	37	1.4	2.9	29	1.5	3.3
110	96	1.1	1.5	60	1.3	2.2	40	1.4	2.9	32	1.5	3.3
120				65	1.3	2.2	44	1.4	2.9	35	1.5	3.3
130				71	1.3	2.2	47	1.4	2.9	38	1.5	3.3
140				76	1.3	2.2	51	1.4	2.9	41	1.5	3.3
150				81	1.3	2.2	55	1.4	2.9	44	1.5	3.3
160				87	1.3	2.2	58	1.4	2.9	47	1.5	3.3
170				92	1.3	2.2	62	1.4	2.9	50	1.5	3.3
180				97	1.3	2.2	65	1.4	2.9	53	1.5	3.4
190							69	1.4	2.9	55	1.5	3.4
200							72	1.4	2.9	58	1.5	3.4
220							80	1.4	2.9	64	1.5	3.4
240							87	1.4	2.9	70	1.5	3.4
260							94	1.4	2.9	76	1.5	3.4
280										81	1.5	3.4
300										87	1.5	3.4

Q	V_1 = 4.0			V_1 = 4.5			V_1 = 5.0			V_1 = 5.5			V_1 = 6.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15															
20															
25															
30															
35	8	1.8	3.6												
40	9	1.8	3.7												
45	10	1.8	3.7												
50	11	1.8	3.7	9	2.0	4.2									
55	12	1.8	3.8	10	2.0	4.3									
60	14	1.7	3.8	10	2.0	4.3									
65	15	1.7	3.8	11	2.0	4.3	9	2.2	4.7						
70	16	1.7	3.9	12	2.0	4.4	10	2.2	4.7						
75	17	1.7	3.9	13	2.0	4.5	11	2.2	4.7						
80	18	1.7	3.9	14	2.0	4.4	11	2.2	4.9						
90	20	1.7	3.9	15	1.9	4.5	13	2.2	4.9	11	2.4	5.2			
100	22	1.7	3.9	17	1.9	4.5	14	2.2	4.9	12	2.4	5.3			
110	24	1.7	3.9	19	1.9	4.5	15	2.1	5.0	13	2.4	5.3	11	2.6	5.7
120	27	1.7	4.0	20	1.9	4.6	17	2.1	5.0	14	2.4	5.4	12	2.6	5.7
130	29	1.7	4.0	22	1.9	4.6	18	2.1	5.0	15	2.4	5.4	13	2.6	5.8
140	31	1.7	4.0	24	1.9	4.6	20	2.1	5.0	16	2.3	5.5	14	2.6	5.8
150	33	1.7	4.0	25	1.9	4.6	21	2.1	5.1	17	2.4	5.5	15	2.6	5.8
160	35	1.7	4.0	27	1.9	4.6	22	2.1	5.1	19	2.3	5.5	16	2.5	6.0
170	38	1.7	4.0	29	1.9	4.6	24	2.1	5.1	20	2.3	5.7	17	2.5	5.9
180	40	1.7	4.0	30	1.9	4.6	25	2.1	5.1	21	2.3	5.6	18	2.5	5.9
190	42	1.7	4.0	32	1.9	4.6	26	2.1	5.1	22	2.3	5.6	19	2.5	6.0
200	44	1.7	4.0	34	1.9	4.7	28	2.1	5.1	23	2.3	5.6	20	2.5	6.0
220	48	1.7	4.0	37	1.9	4.6	31	2.1	5.1	25	2.3	5.6	22	2.5	6.1
240	53	1.7	4.0	40	1.9	4.7	33	2.1	5.1	28	2.3	5.7	24	2.5	6.1
260	57	1.7	4.0	44	1.9	4.7	36	2.1	5.1	30	2.3	5.4	26	2.5	6.1
280	61	1.7	4.0	47	1.9	4.7	39	2.1	5.1	32	2.3	5.6	28	2.5	6.2
300	66	1.7	4.0	50	1.9	4.7	42	2.1	5.1	34	2.3	5.7	30	2.5	6.1

Figure 5B.6
Parabolic Diversion Design, Without Freeboard-5 (USDA - NRCS)

PARABOLIC DIVERSION DESIGN, WITHOUT FREEBOARD

RETARDANCE - D & C
GRADE, % - 1.5

V_1 Based on Permissible Velocity of the Soil With Retardance "D"
Top Width, Depth & V_2 Based on Retardance "C"

Q	V_1 = 2.0			V_1 = 2.5			V_1 = 3.0			V_1 = 3.5			V_1 = 4.0			V_1 = 4.5			V_1 = 5.0			V_1 = 5.5			V_1 = 6.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15	17	0.9	1.4	11	1.1	1.9	8	1.2	2.4																		
20	23	0.9	1.4	15	1.0	1.9	10	1.2	2.5	7	1.4	3.0	6	1.5	3.4												
25	28	0.9	1.4	19	1.0	1.9	12	1.2	2.6	8	1.4	3.2	7	1.5	3.6												
30	34	0.9	1.4	22	1.0	1.9	15	1.2	2.6	10	1.3	3.2	8	1.5	3.6	7	1.6	4.0									
35	40	0.9	1.4	26	1.0	2.0	17	1.1	2.6	12	1.3	3.3	10	1.4	3.7	8	1.6	4.1									
40	45	0.9	1.4	30	1.0	1.9	20	1.2	2.6	14	1.3	3.3	11	1.4	3.7	9	1.6	4.2	7	1.8	4.6						
45	51	0.9	1.4	33	1.0	2.0	22	1.1	2.5	15	1.3	3.4	12	1.4	3.8	10	1.5	4.3	8	1.8	4.6						
50	56	0.9	1.4	37	1.0	2.0	25	1.1	2.7	17	1.3	3.4	14	1.4	3.9	11	1.5	4.3	9	1.8	4.8						
55	62	0.9	1.5	41	1.0	2.0	27	1.1	2.6	19	1.3	3.4	15	1.4	3.9	12	1.5	4.3	10	1.7	4.9	8	1.9	5.1			
60	67	0.9	1.5	44	1.0	2.0	30	1.1	2.7	20	1.3	3.4	16	1.4	3.9	14	1.5	4.4	11	1.7	4.9	9	1.9	5.2			
65	73	0.9	1.5	48	1.0	2.0	32	1.1	2.7	22	1.3	3.4	18	1.4	3.9	15	1.5	4.4	11	1.7	5.0	10	1.9	5.3			
70	78	0.9	1.5	51	1.0	2.0	34	1.1	2.7	24	1.3	3.4	19	1.4	3.9	16	1.5	4.4	12	1.7	4.9	10	1.9	5.4	9	2.1	5.6
75	83	0.9	1.5	55	1.0	2.0	37	1.1	2.7	25	1.3	3.4	21	1.4	3.9	17	1.5	4.4	13	1.7	5.0	11	1.9	5.4	9	2.1	5.6
80	89	0.9	1.5	59	1.0	2.0	39	1.1	2.7	27	1.3	3.4	22	1.4	3.9	18	1.5	4.4	14	1.7	5.0	12	1.9	5.5	10	2.1	5.8
90	100	0.9	1.5	66	1.0	2.0	44	1.1	2.7	30	1.3	3.5	25	1.4	3.9	20	1.5	4.4	16	1.7	5.0	13	1.9	5.4	11	2.0	5.9
100				73	1.0	2.0	49	1.1	2.7	33	1.3	3.5	27	1.4	3.9	22	1.5	4.5	17	1.7	5.1	15	1.9	5.5	12	2.0	6.0
110				80	1.0	2.0	54	1.1	2.7	37	1.3	3.5	30	1.4	3.9	25	1.5	4.5	19	1.7	5.1	16	1.8	5.6	14	2.0	6.0
120				87	1.0	2.0	58	1.1	2.7	40	1.3	3.5	33	1.4	4.0	27	1.5	4.5	21	1.7	5.1	18	1.9	5.5	15	2.0	6.0
130				95	1.0	2.0	63	1.1	2.7	43	1.3	3.5	35	1.4	3.9	29	1.5	4.5	22	1.7	5.1	19	1.8	5.5	16	2.0	6.1
140							68	1.1	2.7	47	1.3	3.5	38	1.4	4.0	31	1.5	4.5	24	1.7	5.2	20	1.8	5.5	17	2.0	6.1
150							73	1.1	2.7	50	1.3	3.5	41	1.4	4.0	33	1.5	4.5	26	1.7	5.2	22	1.8	5.6	18	2.0	6.1
160							78	1.1	2.7	53	1.3	3.5	43	1.4	4.0	36	1.5	4.5	27	1.7	5.2	23	1.8	5.6	20	2.0	6.1
170							82	1.1	2.7	56	1.3	3.5	46	1.4	4.0	38	1.5	4.5	29	1.7	5.2	25	1.8	5.6	21	2.0	6.1
180							87	1.1	2.7	60	1.3	3.5	49	1.4	4.0	40	1.5	4.5	31	1.7	5.2	26	1.8	5.7	22	2.0	6.1
190							92	1.1	2.7	63	1.3	3.5	51	1.4	4.0	42	1.5	4.5	33	1.7	5.2	27	1.8	5.7	23	2.0	6.2
200							97	1.1	2.7	66	1.3	3.5	54	1.4	4.0	44	1.5	4.5	34	1.7	5.2	29	1.8	5.6	24	2.0	6.2
220										73	1.3	3.5	59	1.4	4.0	49	1.5	4.5	38	1.7	5.2	32	1.8	5.7	27	2.0	6.2
240										79	1.3	3.5	65	1.4	4.0	53	1.5	4.5	41	1.7	5.2	35	1.8	5.7	29	2.0	6.2
260										86	1.3	3.5	70	1.4	4.0	57	1.5	4.5	44	1.7	5.2	37	1.8	5.7	32	2.0	6.2
280										92	1.3	3.5	75	1.4	4.0	62	1.5	4.5	48	1.7	5.2	40	1.8	5.7	34	2.0	6.2
300										99	1.3	3.5	81	1.4	4.0	66	1.5	4.5	51	1.7	5.2	43	1.8	5.7	36	2.0	6.2

Figure 5B.7
Parabolic Diversion Design, Without Freeboard-6 (USDA - NRCS)

PARABOLIC DIVERSION DESIGN, WITHOUT FREEBOARD

RETARDANCE - D & C
GRADE, % - 2.0

V_1 Based on Permissible Velocity of the Soil With Retardance "D"
Top Width, Depth & V_2 Based on Retardance "C"

Q	V_1 = 2.0			V_1 = 2.5			V_1 = 3.0			V_1 = 3.5			V_1 = 4.0			V_1 = 4.5			V_1 = 5.0			V_1 = 5.5			V_1 = 6.0		
cfs	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2	T	D	V_2
15	21	0.8	1.3	13	0.9	1.9	9	1.0	2.4	7	1.2	2.9															
20	28	0.8	1.3	17	0.9	1.9	12	1.0	2.4	9	1.1	3.0	7	1.3	3.5	5	1.4	3.8									
25	35	0.8	1.3	21	0.9	1.9	15	1.0	2.4	11	1.1	3.0	8	1.3	3.7	7	1.4	4.0									
30	41	0.8	1.3	26	0.9	1.9	18	1.0	2.5	13	1.1	3.0	10	1.2	3.7	8	1.3	4.2	7	1.5	4.5						
35	48	0.8	1.4	30	0.9	1.9	22	1.0	2.4	15	1.1	3.1	11	1.2	3.8	9	1.3	4.2	8	1.5	4.7						
40	55	0.8	1.3	34	0.9	1.9	25	1.0	2.5	18	1.1	3.1	13	1.2	3.8	11	1.3	4.3	9	1.5	4.7	7	1.7	5.0			
45	62	0.8	1.4	38	0.9	1.9	28	1.0	2.5	20	1.1	3.1	14	1.2	3.8	12	1.3	4.3	10	1.4	4.8	8	1.6	5.2			
50	68	0.8	1.4	42	0.9	1.9	31	1.0	2.5	22	1.1	3.1	16	1.2	3.9	13	1.3	4.3	11	1.4	4.8	9	1.6	5.3	8	1.7	5.6
55	75	0.8	1.4	46	0.9	1.9	34	1.0	2.5	24	1.1	3.1	17	1.2	3.8	14	1.3	4.3	12	1.4	4.9	10	1.6	5.3	8	1.7	5.8
60	82	0.8	1.4	51	0.9	1.9	37	1.0	2.5	26	1.1	3.1	19	1.2	3.9	16	1.3	4.4	13	1.4	4.8	11	1.6	5.3	9	1.7	5.7
65	88	0.8	1.4	55	0.9	1.9	40	1.0	2.5	28	1.1	3.1	21	1.2	3.9	17	1.3	4.4	14	1.4	4.9	11	1.6	5.4	10	1.7	5.7
70	95	0.8	1.4	59	0.9	1.9	43	1.0	2.5	30	1.1	3.1	22	1.2	3.9	18	1.3	4.4	15	1.4	4.9	12	1.6	5.4	10	1.7	5.8
75				63	0.9	1.9	46	1.0	2.5	32	1.1	3.2	24	1.2	3.9	20	1.3	4.4	16	1.4	5.0	13	1.6	5.5	11	1.7	5.9
80				67	0.9	2.0	48	1.0	2.5	35	1.1	3.1	25	1.2	3.9	21	1.3	4.4	17	1.4	4.9	14	1.6	5.4	12	1.7	6.0
90				75	0.9	2.0	54	1.0	2.5	39	1.1	3.2	28	1.2	3.9	23	1.3	4.4	19	1.4	4.9	16	1.6	5.5	13	1.7	5.9
100				83	0.9	2.0	60	1.0	2.5	43	1.1	3.2	31	1.2	3.9	26	1.3	4.4	21	1.4	5.0	17	1.6	5.5	15	1.7	6.0
110				92	0.9	2.0	66	1.0	2.5	47	1.1	3.2	34	1.2	3.9	28	1.3	4.4	23	1.4	5.0	19	1.5	5.6	16	1.7	6.0
120				100	0.9	2.0	72	1.0	2.5	52	1.1	3.2	38	1.2	3.9	31	1.3	4.4	26	1.4	5.0	21	1.5	5.6	18	1.7	6.1
130							78	1.0	2.5	56	1.1	3.2	41	1.2	3.9	34	1.3	4.5	28	1.4	5.0	23	1.5	5.6	19	1.7	6.0
140							84	1.0	2.5	60	1.1	3.2	44	1.2	4.0	36	1.3	4.5	30	1.4	5.0	24	1.5	5.6	21	1.7	6.1
150							90	1.0	2.5	64	1.1	3.2	47	1.2	4.0	39	1.3	4.5	32	1.4	5.0	26	1.5	5.6	22	1.7	6.1
160							96	1.0	2.5	69	1.1	3.2	50	1.2	4.0	41	1.3	4.5	34	1.4	5.1	28	1.5	5.6	23	1.7	6.1
170										73	1.1	3.2	53	1.2	4.0	44	1.3	4.5	36	1.4	5.1	29	1.5	5.7	25	1.7	6.1
180										77	1.1	3.2	56	1.2	4.0	46	1.3	4.5	38	1.4	5.0	31	1.5	5.7	25	1.7	6.1
190										81	1.1	3.2	59	1.2	4.0	49	1.3	4.5	40	1.4	5.0	33	1.5	5.7	28	1.7	6.1
200										85	1.1	3.2	62	1.2	4.0	51	1.3	4.5	42	1.4	5.0	34	1.5	5.7	29	1.7	6.2
220										94	1.1	3.2	68	1.2	4.0	56	1.3	4.5	46	1.4	5.1	38	1.5	5.7	32	1.7	6.2
240													74	1.2	4.0	61	1.3	4.5	51	1.4	5.1	41	1.5	5.7	35	1.7	6.2
260													80	1.2	4.0	66	1.3	4.5	55	1.4	5.1	45	1.5	5.7	38	1.7	6.2
280													86	1.2	4.0	71	1.3	4.5	59	1.4	5.1	48	1.5	5.7	41	1.7	6.2
300													92	1.2	4.0	76	1.3	4.5	63	1.4	5.1	51	1.5	5.7	44	1.7	6.2