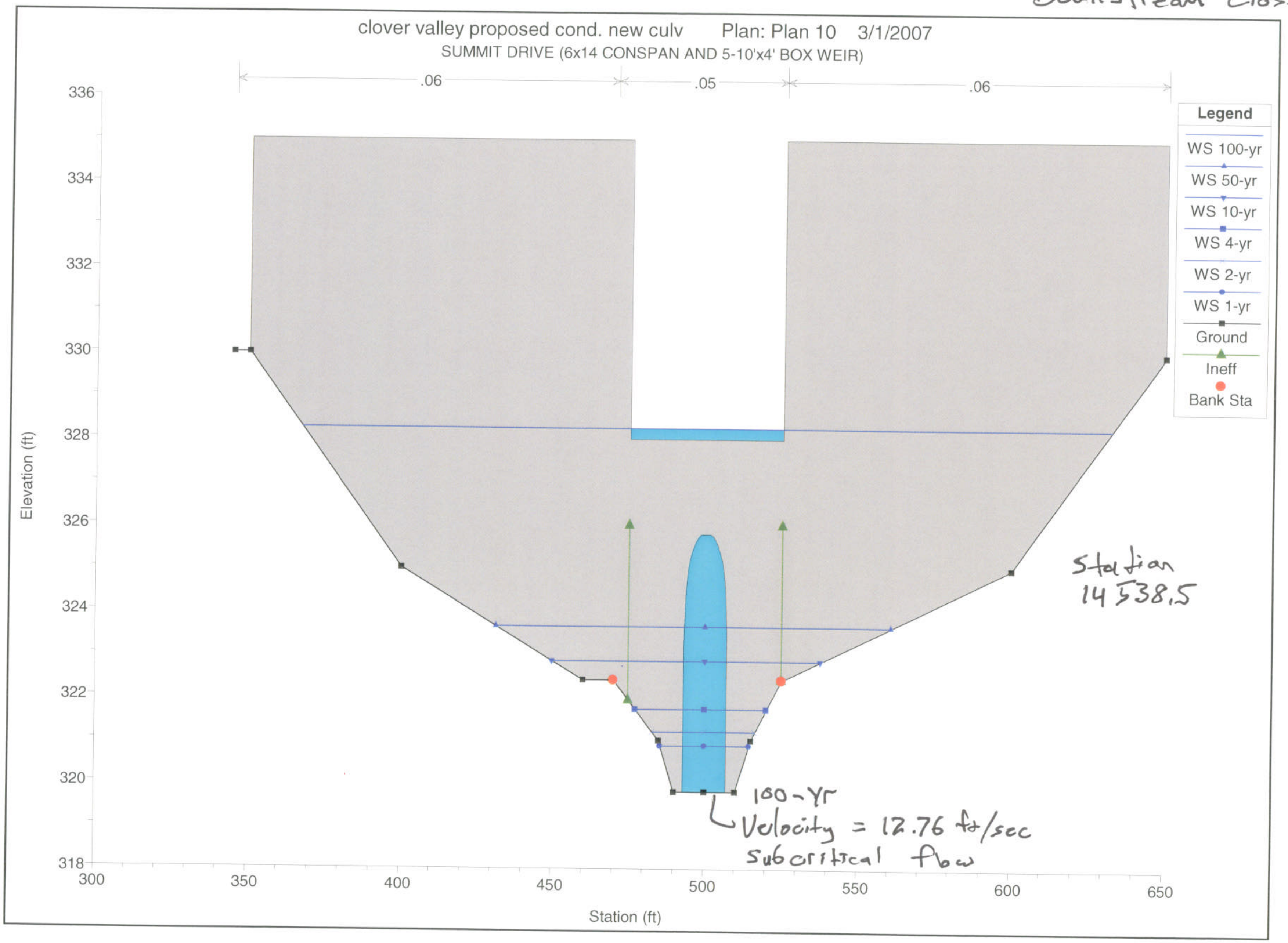
Proposed Project

Upstream Crossing

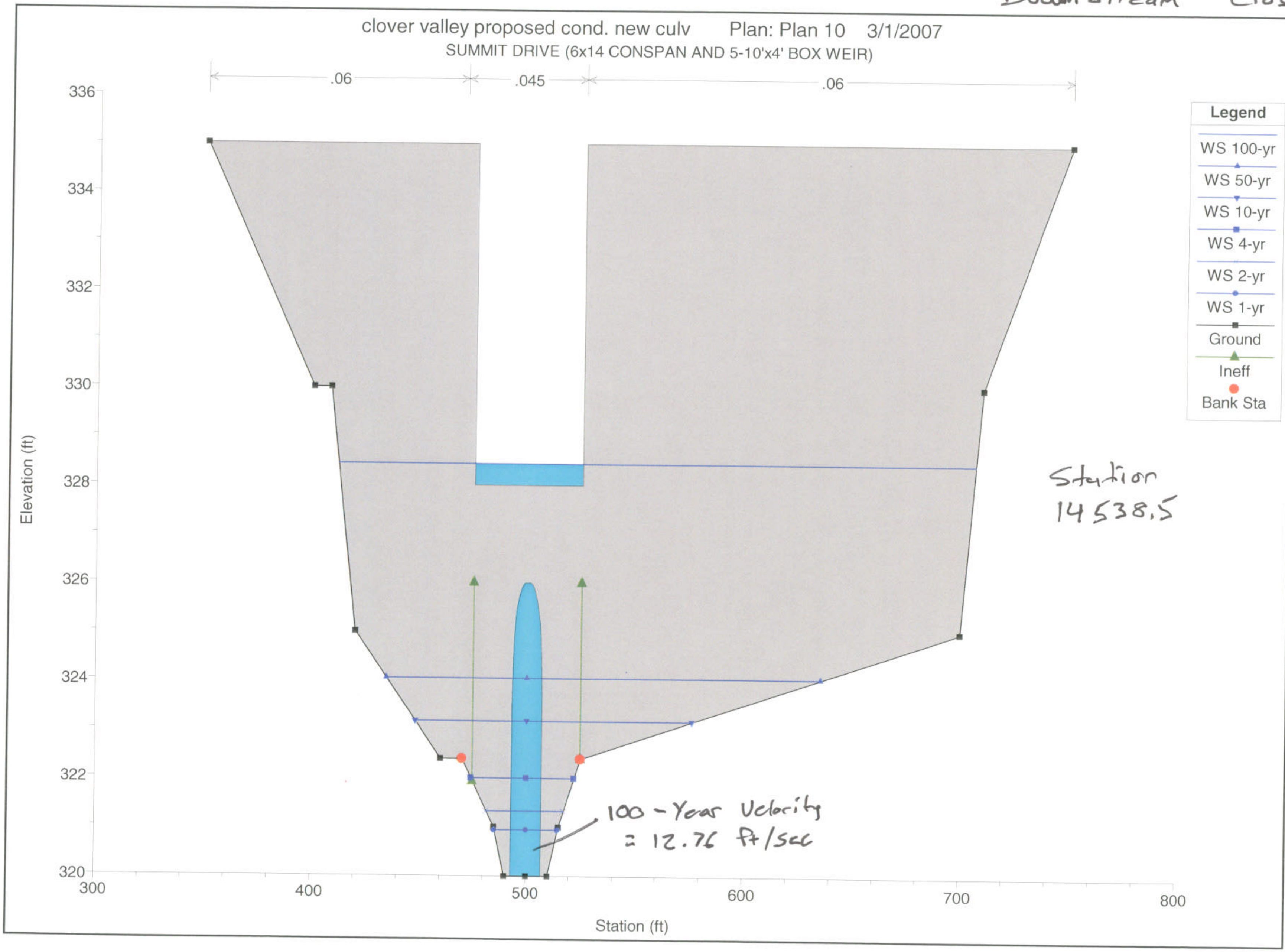
Plan: DET 1_01 CLOVER VALLEY CR CLOVER VALLEY LK RS: 17303.5 Culv Group: Pipe2 Profile: 100-yr

Q Culv Group (cfs)	846.17	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	12.84
Q Barrel (cfs)	846.17	Culv Vel DS (ft/s)	17.18
E.G. US. (ft)	353.84	Culv Inv El Up (ft)	343.50
W.S. US. (ft)	353.83	Culv Inv El Dn (ft)	343.00
E.G. DS (ft)	347.33	Culv Frctn Ls (ft)	0.85
W.S. DS (ft)	346.68	Culv Exit Loss (ft)	4.38
Delta EG (ft)	6.51	Culv Entr Loss (ft)	1.28
Delta WS (ft)	7.15	Q Weir (cfs)	13.83
E.G. IC (ft)	353.84	Weir Sta Lft (ft)	486.00
E.G. OC (ft)	353.26	Weir Sta Rgt (ft)	514.00
Culvert Control	Inlet	Weir Submerg	0.00
Culv WS Inlet (ft)	349.50	Weir Max Depth (ft)	0.33
Culv WS Outlet (ft)	347.12	Weir Avg Depth (ft)	0.33
Culv Nml Depth (ft)	5.08	Weir Flow Area (sq ft)	9.25
Culv Crt Depth (ft)	5.11	Min El Weir Flow (ft)	353.51

Proposed Project
Downstream Crossing



Proposed Project
Downstream Crossing



Station 14538.5

Plan: DET 1_01 CLOVER VALLEY CR CLOVER VALLEY LK RS: 14538.5 Culv Group: LOWFLOW Profile: 100-yr

Q Culv Group (cfs)	822.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	12.76
Q Barrel (cfs)	822.00	Culv Vel DS (ft/s)	12.76
E.G. US. (ft)	328.44	Culv Inv El Up (ft)	320.00
W.S. US. (ft)	328.43	Culv Inv El Dn (ft)	319.80
E.G. DS (ft)	323.48	Culv Frctn Ls (ft)	0.20
W.S. DS (ft)	322.74	Culv Exit Loss (ft)	3.50
Delta EG (ft)	4.96	Culv Entr Loss (ft)	1.26
Delta WS (ft)	5.69	Q Weir (cfs)	38.00
E.G. IC (ft)	327.34	Weir Sta Lft (ft)	475.00
E.G. OC (ft)	328.44	Weir Sta Rgt (ft)	525.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	324.65	Weir Max Depth (ft)	0.44
Culv WS Outlet (ft)	324.45	Weir Avg Depth (ft)	0.44
Culv Nml Depth (ft)	6.00	Weir Flow Area (sq ft)	22.02
Culv Crt Depth (ft)	4.65	Min El Weir Flow (ft)	328.50

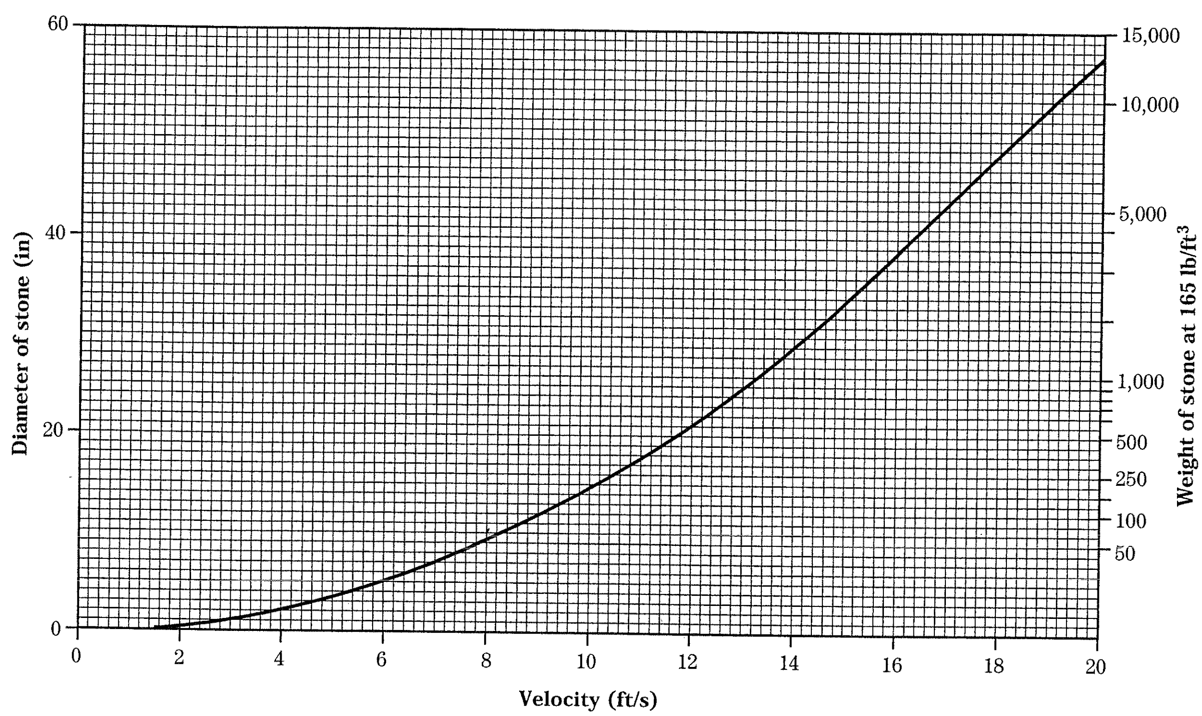
Proposed Project
Downstream Crossing

Appendix 16A Size Determination for Rock Riprap

Isbash Curve

The Isbash Curve, because of its widespread acceptance and ease of use, is a direct reprint from the previous chapter 16, Engineering Field Manual. The curve was developed from empirical data to determine a rock size for a given velocity. See figure 16A–1. The user can read the D_{100} rock size (100 percent of riprap ≤ this size) directly from the graph in terms of weight (pounds) or dimension (inches). Less experienced users should use this method for quick estimates or comparison with other methods before determining a final design.

Figure 16A–1 Rock size based on Isbash Curve



Based on Isbash Curve

Procedure
1. Determine the design velocity.
2. Use velocity and fig. 16A-1 (Isbash Curve) to determine basic rock size.
3. Basic rock size is the D_{100} size.

Figure 16A–2 Rock size based on Far West States (FWS)-Lane method

$D_s = \frac{3.5}{CK} w D S$ $D_s = D_{75}$ size rock in inches

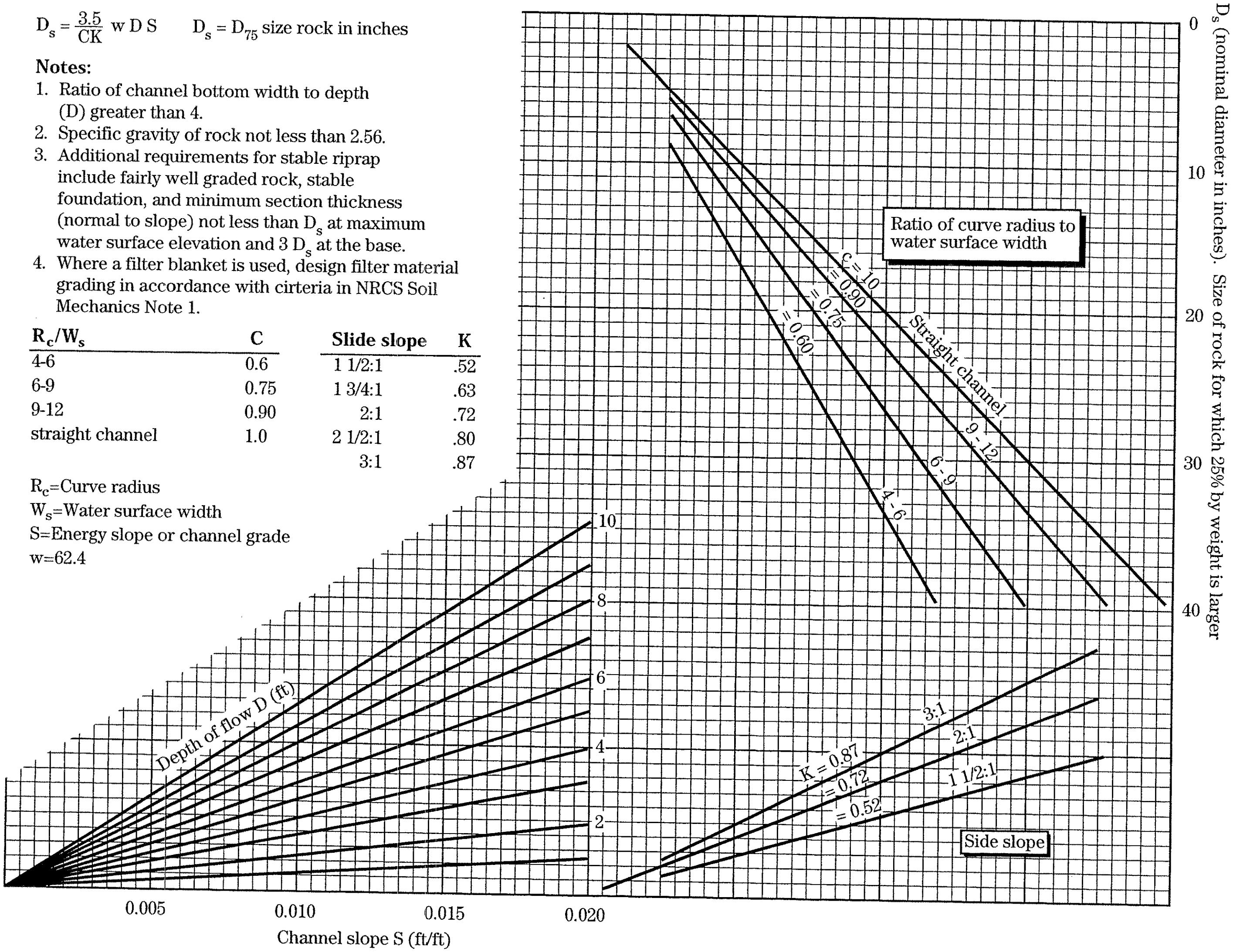
Notes:

1. Ratio of channel bottom width to depth (D) greater than 4.
2. Specific gravity of rock not less than 2.56.
3. Additional requirements for stable riprap include fairly well graded rock, stable foundation, and minimum section thickness (normal to slope) not less than D_s at maximum water surface elevation and 3 D_s at the base.
4. Where a filter blanket is used, design filter material grading in accordance with cirteria in NRCS Soil Mechanics Note 1.

R_c/W_s	C
4-6	0.6
6-9	0.75
9-12	0.90
straight channel	1.0

Slide slope	K
1 1/2:1	.52
1 3/4:1	.63
2:1	.72
2 1/2:1	.80
3:1	.87

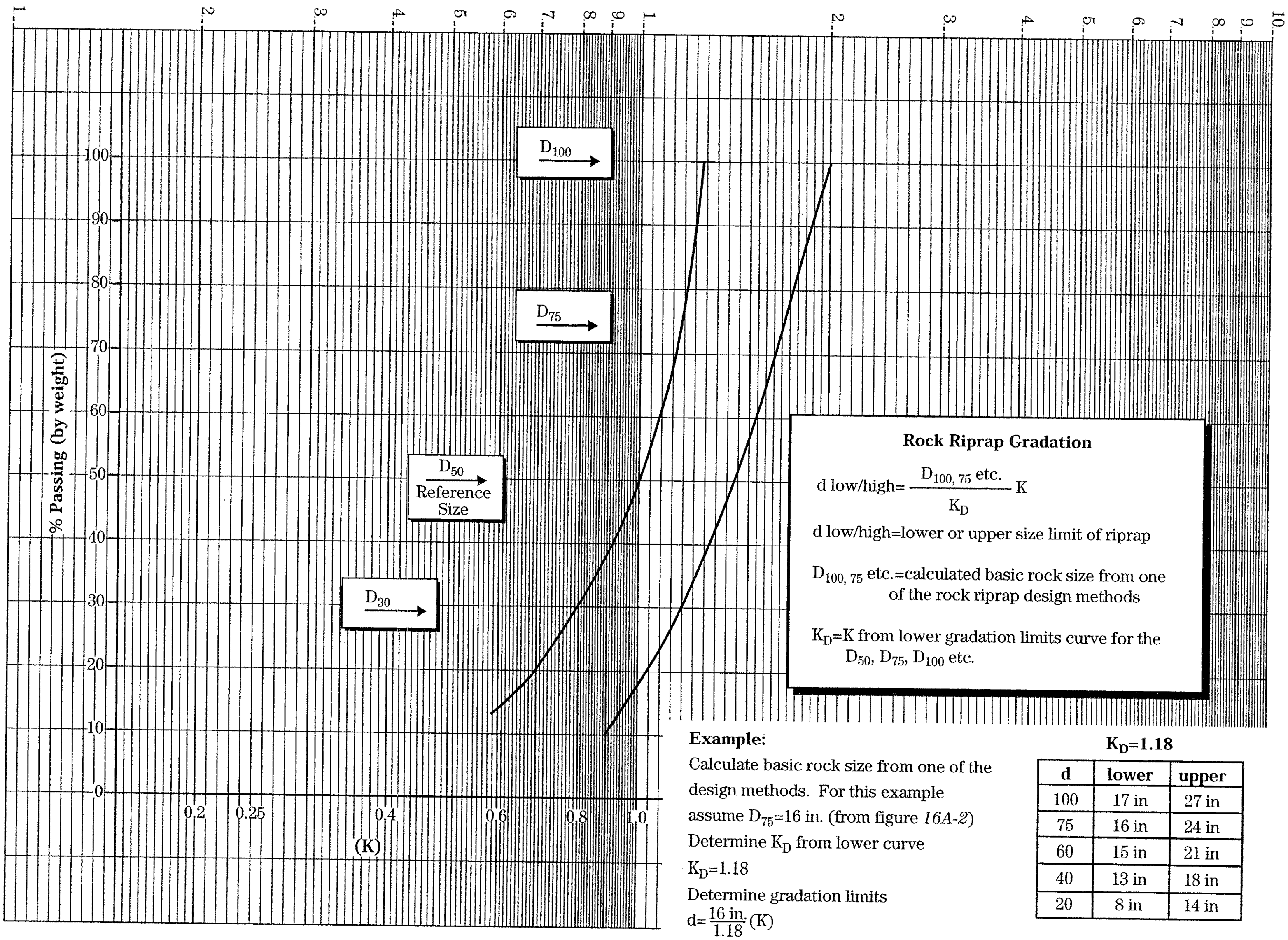
R_c=Curve radius
W_s=Water surface width
S=Energy slope or channel grade
w=62.4



Procedure

1. Determine the average channel grade or energy slope.
2. Enter fig. 16A-2 with energy slope, flow depth, and site physical characteristics to determine basic rock size.
3. Basic rock size is the D_{75} size.

Figure 16A–3 Gradation limits curve for determining suitable rock gradation



Example:

Calculate basic rock size from one of the design methods. For this example assume D_{75}=16 in. (from figure *16A-2*)

Determine K_D from lower curve

K_D=1.18

Determine gradation limits

$d=\frac{16\text{ in.}}{1.18}(K)$

K_D=1.18

d	lower	upper
100	17 in	27 in
75	16 in	24 in
60	15 in	21 in
40	13 in	18 in
20	8 in	14 in