Table 7-24 Summary of Division Ditch Calculations (Cont)

Ditch	Bottom Width (Ft)	Top Width (Ft)	Depth (Ft)	Type Side Slope H:V	Measured Slope %	Contributing Watershed	REQ'D Av. Rip-Rap Size (In.)
D-17U	0	2	0.67	1.5:1	13 Av.	AU-1[a]	Bedrock
D-18U	0	2	0.67	1.5:1	5 Min	AU-1	Soil
D-19U	0	2	0.67	1.5:1	6 Av.	AU-2B	Soil
D-20U	0	1.33	0.67	1:1	16 Av.	AU-42	Soil
D-21U	0	2	1.0	1:1	13 Av.	AU-43	D_{50}=3"
D-22U	0	3	1.0	1.5:1	11 Av.	AU-19, AU-25	D_{50}=6"
D-23U	0	1.16	0.58	1:1	19 Av.	AU-36	Soil
D-24U	0	~~1.16~~ 1.00	~~0.58~~ 0.50	1:1	14 Av.	AU-35 ,AD-17, C-28U	Soil
D-25U	0	1	0.5	1:1	16 Av.	AD-17	Soil
D-26U	0	1	0.5	1:1	24 Av.	AU-32	Soil
D-27U	0.50	2	0.5	1.5:1	13 Min, 30 Max	AU-31, AU-22, AU-27, AU-28, AU-29, AU-29A	Soil
D-28U	0	1	0.5	1:1	14 Av.	AU-33	Soil
D-29U	0	1.33	0.67	1:1	8 Av.	AU-34	Soil
D-30U	0	1.16	0.58	1:1	13 Av.	AU-25	Soil
D-31U	0	3	1.0	1.5:1	12 Av.	AU-20, AU-26 AU-21, AU-30, AU-22	Bedrock
D-32U	0	1	0.5	1:1	17 Av.	AU-30	Soil
D-33U	0	1.16	0.58	1:1	18 Av.	AU-29	Soil
D-34U	1	2.74	0.58	1.5:1	11 Av.	AU-24, AU-23, AU-28A	Soil
D-35U	0	~~2.0~~ 1.125	~~1.0~~ 0.75	~~1:1~~ 1.5:1	10 Av.	AU-29, AU-27	Soil
D-36U	0	1.0	0.5	1:1	8 Av.	AU-27	Soil
D-37U	0	~~1.0~~ 1.5	~~0.5~~ 1.0	~~1:1~~ 1.5:1	8 Av.	AU-26, AU-21,AU-22	Soil
D-38U	0	~~1.33~~ 1.5	~~0.67~~ 1.0	~~1:1~~ 1.5:1	12 Min, 20 Max	AU-21, AU-22	D_{50}=3"
D-39U	0	~~1.0~~ 0.75	0.5	~~1:1~~ 1.5:1	10 Av.	AU-28	Soil

FILE IN: Expandable 07202006

Refer to Record No. 0037
in C0150085, 2006, INCOMING
for additional information

Table 7-25 Culvert Characteristics

Culvert	Diameter (in.)	Type	Contributing Watersheds	Slope (ft/ft)	Outlet Condition
C-21U	36	CMP	Right Fork Drainage	0.06	Bedrock
C-22U	20	CMP	AU-19, AU-25	0.06	Soil
C-23U	36	CMP	AU-36, AU-35~~, AU-34, AU-20, AU-26~~, C-24U , AU-39, C-28U, AD-17	0.06	11" rip-rap
C-24U	32	CMP	AU-40, ~~C-25U~~, C-28U	0.06	10" rip-rap
~~C-25U~~	~~30~~	~~CMP~~	~~AD-17, C-26U~~	~~0.06~~	~~8" rip-rap~~
C-26U	30	CMP	AU-39, AU-32, AU-33, ~~C-30U~~, C-34U, AU-23, AU-28U, AU-22	0.06	8" rip-rap
C-27U	15	CMP	AU-22, AU-28, AU29A, AU-31, AU-27, AU-29	0.06	4" rip-rap
C-28U	15	CMP	~~AU-43~~, C-29U, AU-34	0.06	4" rip-rap
C-29U	15	CMP	AU-20, AU-25, AU-26, AU-21, AU-30	0.06	3" rip-rap
C-30U	15	CMP	~~AU-21, AU-27, AU-30~~ Abandoned In Place	0.06	Soil
C-31U	12	CMP	AU-29, AU-27	0.06	Soil
C-32U	15	CMP	AU-22, AU-28, AU-29A, AU-22	0.06	3" rip-rap
C-33U	24	CMP	AU-24, AU-28A, AU-37 ,AU-23	0.06	8" rip-rap
C-34U	24	CMP	AD-19, AU-31, AU-37, AU-38, C-31U, C-32U ,AU-23, AU-28A	0.06	8" rip-rap
C-35U	84	CMP	Bear Creek	0.06	48" rip-rap
C-36U	15	CMP	~~AU-27, AU-21~~ Abandoned In Place	0.11	3" rip-rap
C-37U	15	CMP	Abandoned In Place		
C-38U	15	CMP	AU-28, AU-22	0.08	Soil
C-39U	15~~12~~	CMP	AU-22, AU-32A, C-40U AU-22	0.18~~0.06~~	6" rip-rap Soil
~~C-40U~~	~~12~~	~~CMP~~	~~AU-23~~	~~0.001~~	~~Soil~~

Culvert	Dia (in.)	Type	Contributing Watersheds	Peak Q(cfs)	Slope (ft/ft)	Outlet Condition
C-21U	36	CMP	Right Fork Drainage	43.09	0.06	12" rip-rap
C-22U	20	CMP	AU-19, AU-25	4.33	0.06	4"rip-rap
C-23U	36	CMP	AU-36, AU-35,AU-34, ~~AU-20, AU-26~~, C-24U ,C-28U, AD-17	~~38.80~~ 46.08	0.06	11" rip-rap
C-24U	32	CMP	AU-40, ~~C-25U~~ C-26U, C-28U	~~35.81~~ 41.38	0.06	10" rip-rap
~~C-25U~~	~~30~~	~~CMP~~	~~AD-17, C-26U~~	~~19.85~~	~~0.06~~	~~8" rip-rap~~
C-26U	30	CMP	AU-39, AU-32, AU-33~~, C-30U~~, C-34U , AU-22 ,AU-23, AU-28U	~~19.69~~ 21.40	0.06	8" rip-rap
C-27U	15	CMP	AU-22, AU-28, AU-29A, AU-31, AU-27, AU-29	~~2.68~~ 2.28	0.06	4" rip-rap
C-28U	15	CMP	AU-34, C-29U	~~3.04~~ 4.02	0.06	4" rip-rap
C-29U	15	CMP	AU-20, ~~AU-25~~, AU-26, AU-21, AU-30	~~2.77~~ 3.75	0.06	3: rip-rap
C-30U	15	CMP	~~AU-21, AU-21, AU-30~~ Abandoned In Place	~~1.26~~	~~0.06~~	~~Soil~~
C-31U	12	CMP	AU-29, AU-27	~~0.29~~ 0.23	0.06	soil
C-32U	15	CMP	AU-22, AU-28, AU-29A	~~2.36~~ 1.73	0.06	3" rip-rap
C-33U	24	CMP	AU-23, AU-37, AU-28A, AU-24	~~14.42~~ 16.33	0.06	8" rip-rap
C-34U	24	CMP	AD-19, AU-31, AU-37, AU-38, C-31U, C-32U, AU-23, AU-28A	~~17.86~~ 18.23	0.06	8" rip-rap
C-35U	84	CMP	BEAR CREEK	412.70	0.06	48" rip-rap
C-36U	15	CMP	~~AU-27, AU-21~~ Abandoned In Place	~~1.18~~	~~0.11~~	~~3" rip-rap~~
C-37U	15	CMP	Abandoned In Place			
C-38U	15	CMP	AU-28, AU-22	~~0.09~~ 1.67	0.08	soil
C-39U	~~15~~12	CMP	AU-22~~,AU23A,C40U~~	~~2.27~~1.56	~~0.18~~0.06	~~6"rip-rap~~ Soil
~~C-40U~~	~~12~~	~~CMP~~	~~AU-23~~	~~0.64~~	~~0.001~~	~~soil~~

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-23U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	36 in
Discharge	46.08 cfs

Results	
Depth	1.54 ft
Flow Area	3.6 ft²
Wetted Perimeter	4.79 ft
Top Width	3.00 ft
Critical Depth	2.21 ft
Percent Full	51.2 %
Critical Slope	0.020379 ft/ft
Velocity	12.65 ft/s
Velocity Head	2.49 ft
Specific Energy	4.02 ft
Froude Number	2.02
Maximum Discharge	95.19 cfs
Discharge Full	88.49 cfs
Slope Full	0.016270 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 11" m.d. riprap at outlet

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-24U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.060000	ft/ft
Diameter	32	in
Discharge	41.38	cfs

Results		
Depth	1.55	ft
Flow Area	3.4	ft²
Wetted Perimeter	4.63	ft
Top Width	2.63	ft
Critical Depth	1.98	ft
Percent Full	58.2	%
Critical Slope	0.025365	ft/ft
Velocity	12.28	ft/s
Velocity Head	2.34	ft
Specific Energy	3.89	ft
Froude Number	1.91	
Maximum Discharge	69.53	cfs
Discharge Full	64.64	cfs
Slope Full	0.024589	ft/ft
Flow Type	Supercritical	

Minimum required riprap conditions = 10" m.d. riprap at outlet

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-26U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.060000 ft/ft
Diameter	30 in
Discharge	21.40 cfs

Results	
Depth	1.09 ft
Flow Area	2.1 ft²
Wetted Perimeter	3.60 ft
Top Width	2.48 ft
Critical Depth	1.57 ft
Percent Full	43.6 %
Critical Slope	0.017837 ft/ft
Velocity	10.42 ft/s
Velocity Head	1.69 ft
Specific Energy	2.78 ft
Froude Number	2.02
Maximum Discharge	58.54 cfs
Discharge Full	54.42 cfs
Slope Full	0.009279 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 8" m.d. riprap at outlet

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-33U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.024
Slope	0.024000 ft/ft
Diameter	30 in
Discharge	16.33 cfs

Results	
Depth	0.94 ft
Flow Area	1.7 ft²
Wetted Perimeter	3.30 ft
Top Width	2.42 ft
Critical Depth	1.37 ft
Percent Full	37.6 %
Critical Slope	0.016104 ft/ft
Velocity	9.69 ft/s
Velocity Head	1.47 ft
Specific Energy	2.40 ft
Froude Number	2.05
Maximum Discharge	37.02 cfs
Discharge Full	34.42 cfs
Slope Full	0.005403 ft/ft
Flow Type	Supercritical

Minimum required riprap conditions = 8" m.d. riprap at outlet

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-34U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.060000	ft/ft
Diameter	30	in
Discharge	18.23	cfs

Results		
Depth	1.00	ft
Flow Area	1.8	ft²
Wetted Perimeter	3.42	ft
Top Width	2.45	ft
Critical Depth	1.45	ft
Percent Full	39.4	%
Critical Slope	0.016697	ft/ft
Velocity	9.99	ft/s
Velocity Head	1.55	ft
Specific Energy	2.55	ft
Froude Number	2.04	
Maximum Discharge	58.54	cfs
Discharge Full	54.42	cfs
Slope Full	0.006733	ft/ft
Flow Type	Supercritical	

Minimum required riprap conditions = 8" m.d. riprap at outlet

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	C-38U
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.080000	ft/ft
Diameter	15	in
Discharge	1.67	cfs

Results		
Depth	0.35	ft
Flow Area	0.3	ft²
Wetted Perimeter	1.39	ft
Top Width	1.12	ft
Critical Depth	0.57	ft
Percent Full	27.8	%
Critical Slope	0.018292	ft/ft
Velocity	6.00	ft/s
Velocity Head	0.56	ft
Specific Energy	0.92	ft
Froude Number	2.12	
Maximum Discharge	10.65	cfs
Discharge Full	9.90	cfs
Slope Full	0.002278	ft/ft
Flow Type	Supercritical	

DITCH	CHANNEL SLOPE %	CONTRIBUTING WATERSHED	PEAK Q (cfs)	BANK AND BOTTOM DESC.	MANNING'S $\eta^{(a)}$
D-23U	19 Av	AU-36	.12	soil	0.03
D-24U	14 Av	AU-35, AD-17,C-28U	~~.13~~ 4.31	soil	0.03
D-25U	16 Av	AD-17	.16	soil	0.03
D-26U	24 Av	AU-32	.28	soil	0.03
D-27U	13 Min, 30 Max	AU-31, AU-22, AU-27, AU-28, AU-29, AU-29A	~~.32~~ 2.28	~~Soil~~ bedrock	0.03
D-28U	14 Av	AU-33	.11	soil	0.03
D-29U	8 Av	AU-34	.27	soil	0.03
D-30U	13 Av	AU-25	.30	soil	0.03
D-31U	12 Av	AU-20, AU-26, AU-21, AU-26, AU-30, AU-22	~~2.47~~ 5.32	bedrock	0.03
D-32U	17 Av	AU-30	.08	soil	0.03
D-33U	18 Av	AU-29	.20	soil	0.03
D-34U	11 Av	AU-24 , AU-23, AU-28A	~~1.66~~ ~~2.69~~	soil	0.03
D-35U	10 Av	AU-29, AU-27	~~0.29~~ 0.23	soil	0.03
D-36U	8 Av	AU-27	0.03	soil	0.03
D-37U	8 Av	AU-21, AU-26, AU-22	~~1.25~~ 3.76	soil	0.03
D-38U	12 Min, 20 Max	AU-21, AU-22	~~1.15~~ 2.68	D_{50} = 3", soil	0.03
D-39U	10 Av	AU-28	~~0.09~~ 0.11	soil	0.03
D-40U	9 Av	AU-28A~~, AU-39U~~	~~2.41~~ 0.12	~~D_{50} = 3"~~ soil	0.03
~~D-41U~~	~~15 Av~~	~~AU-22, AU-23[a], AU-40U~~	~~2.27~~	~~D_{50} = 4"~~	~~0.03~~
D-42U	36 Av, 63 Max	~~AU-23A~~ AU-22	~~0.04~~ 12.13	soil	0.03
D-43U	20 Min, 45 Max	AU-23	~~0.64~~ 5.56	D_{50} = 5", soil	0.03

(a) Based on tables from Barfield et al (1981) and the equation $\eta = .0395(D_{50})^{1/6}$;(D in ft)
(b) Peak Q for misc. road drainage assumed to be 1.0 cfs based on similar disturbed areas.
(c) See table 7.2-10 for summary of diversion ditch calculation

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-24U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.140000	ft/ft
Left Side Slope	1.00	V : H
Right Side Slope	1.00	V : H
Bottom Width	0.00	ft
Discharge	0.29/4.31	cfs

Results		
Depth	0.27/0.75	ft
Flow Area	0.1/0.6	ft²
Wetted Perimeter	0.77/2.12	ft
Top Width	0.55/1.50	ft
Critical Depth	0.35/1.03	ft
Critical Slope	0.037231/0.025979	ft/ft
Velocity	3.90/7.65	ft/s
Velocity Head	0.24//0.41	ft
Specific Energy	0.51/1.66	ft
Froude Number	1.86/2.20	
Flow Type	Supercritical	

Use Minimum Depth = 0.5/1.0 ft Velocity < 5/7.65 fps	Minimum Freeboard = 0.23/0.25 ft No riprap required /3" riprap below confluence with C-28U

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-31U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.120000	ft/ft
Left Side Slope	0.67	V : H
Right Side Slope	0.67	V : H
Bottom Width	0.00	ft
Discharge	5.32	cfs

Results		
Depth	0.69	ft
Flow Area	0.7	ft²
Wetted Perimeter	2.48	ft
Top Width	2.06	ft
Critical Depth	0.95	ft
Critical Slope	0.021493	ft/ft
Velocity	7.47	ft/s
Velocity Head	0.87	ft
Specific Energy	1.56	ft
Froude Number	2.24	
Flow Type	Supercritical	

Notes: Use Min. Depth = 1.0 ft: Minimum Freeboard = 0.31 ft.
Velocity = 7.47 fps: Use channel bottom is bedrock

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	D-34U
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Slope	0.110000	ft/ft
Left Side Slope	0.67	V : H
Right Side Slope	0.67	V : H
Bottom Width	1.00	ft
Discharge	2.69	cfs

Results		
Depth	0.31	ft
Flow Area	0.50	ft²
Wetted Perimeter	2.12	ft
Top Width	1.93	ft
Critical Depth	0.48	ft
Critical Slope	0.021912	ft/ft
Velocity	5.13	ft/s
Velocity Head	0.54	ft
Specific Energy	0.85	ft
Froude Number	2.14	
Flow Type	Supercritical	

Notes: Use Min. Depth = 0.58 ft: Minimum Freeboard = 0.27 ft.
Velocity = 5 fps: No riprap required

BTCA Area K - Outslope of Fill Area Around C-15U

This area is approx 0.32 acres, and includes the fill outslope of the lower Tank Seam Access Road around culvert C-15U (Plate 7-1E). The estimated volume of runoff from this area is 0.04 acre-ft, with a maximum slope length of 90 ft. Erosion and runoff will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water from crossing or saturating the fill slope, a berm will be maintained along the outer edge of the road, and the road will be sloped to drain water away from the slope.

BTCA Area L – Outslope of Lower WHR Tank Seam Access Road

This includes two areas along the lower ~~portion of the~~ WHR Tank Seam Access Road. This first one is just below the first switchback and is approximately ~~0.05~~ 0.26 acres. The second one is 200 feet past the first switchback and is approximately ~~0.02~~ 0.11. The estimated volume of runoff form these areas in less then ~~0.01~~ 0.02 acre-ft, with a maximum slope length of ~~40~~ 60 feet. Erosion and runoff will be controlled by the placement of erosion control matting of the slope, which will be maintained. The area will also be seeded and revegetated after construction and natural vegetation will be used for soil and erosion control during port-mining use. These areas are shown on ~~Plate 3-2G and~~ Plate 7-1G.

BTCA Area M - Outslope of Fill Area Around C-16U

This area is approx 0.091 acres, and includes the fill outslope of the lower Tank Seam Access Road around culvert C-16U (Plate 7-1E). The estimated volume of runoff from this area is 0.011 acre-ft, with a maximum slope length of 50 ft. Erosion will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water from crossing or saturating into the slope, a berm will be maintained along the outer edge of the road above the slope and the road will be sloped to drain water away from the fill slope.

BTCA Area N – Outslope of Fill Area Along WHR Tank Seam Access Road

This ~~consist~~ area consists of approximately 0.232 acres located below the second switchback on the WHR Tank Seam Access Road and ~~0.269~~ 0.141 acres located on the slope just below the hunting cabin turn-off (Plate 7-1 G). The estimated volume of runoff from the first area is 0.029 acre-ft, with a maximum slope length of 76 feet. The estimated volume of runoff form the second area is ~~0.034~~ 0.010 acre-ft, with a maximum slope length of ~~78~~ 56 feet. Erosion will be controlled by the placement of erosion control matting on the slope, which will be maintained. To prevent excess water form crossing or saturating into the slope, a berm will be maintained along the outer edge of the road above the slope and the road will be sloped to drain water away form the fill slope.