PFO 0004

CYPRUS
Plateau Mining

Cyprus Plateau Mining Corporation
P.O. Drawer PMC
Price, Utah 84501
(801) 637-2875

This submittal was "NOT APPROVED" But a later one was.

~~November 16,~~ 1995

Keith H. Sieber
Vice President and General Manager

INCORPORATED
EFFECTIVE:
NOV 27 1995
UTAH DIVISION OIL, GAS AND MINING
PRICE FIELD OFFICE

95B

Mr. William J. Malencik
Reclamation Specialist
Division of Oil, Gas and Mining
451 East 400 North, Rm 115
Price, Utah 84501

95B

Re: Application ~~for Permit Change,~~ Surface Water and Sedimentation Control Facilities, Star Point Mines, ACT/007/006, Carbon County

#2 file

Dear Mr. Malencik:

Cyprus Plateau Mining Corporation (CPMC) is herewith submitting revised text and drawings to update its MRP. These updates are an outgrowth of a Division courtesy inspection, midterm review, and the incorporation of various environmental control measures installed as a result of prior regulatory infractions. While the infractions required an abatement plan, most did not require CPMC to update its MRP text and drawings.

Revisions to the text have been shaded to aid the review. All diversions with the exception of culvert UT16A are located on CPMC's land. UT16A, which is an existing 19 foot culvert, is located on U.S.A. land under Right-of-Way U-52409. CPMC is proposing to extend culvert UT16A by approximately 30 feet, so that the existing road ditch can be eliminated.

Bonding for these runoff conveyance structures is covered under the existing reclamation costs. This structures will be removed during the earthwork operation of the area as identified in the MRP (Area 1 and 14); therefore, no further reclamation costs are warranted.

As a matter of courtesy, CPMC is hereby notifying the Division that it may install some half-round culvert in a section of diversion ditch 20, which is already identified as a lined ditch, in an attempt to minimize the infiltration of runoff above the road slide area. Once the decision is made, the appropriate size of the half-round will be determine and installed.

CPMC appreciates the Division's assistance with this permit amendment. If you have any questions or need additional information, please do not hesitate to contact me.

Sincerely,

Johnny Pappas
Environmental Engineer

Enclosures

cc: J. Borla

INCORPORATED
EFFECTIVE:
NOV 27 1995
95B
UTAH DIVISION OIL, GAS AND MINING
PRICE FIELD OFFICE

File: Env 2.5.2.1.1.2
Chrono: JP951101.ltr

Form DOGM - C1 (Last Revised 6/93) File Folder # 3

APPLICATION FOR PERMIT CHANGE

Title of Change: Surface Water and Sedimentation Control Facilities

Permit Number: ACT/007/006

Mine: STAR POINT MINE

Permittee: CYPRUS PLATEAU MINING

Description, include reason for change and timing required to implement: To update Star Point's MRP's surface water and sedimentation control facilities pursuant to the Division's courtesy inspection and midterm review.

☐ Yes	X No	1. Change in the size of the Permit Area? _____ acres ☐ increase ☐ decrease.
☐ Yes	X No	2. Change in the size of the Disturbed Area? _____ acres ☐ increase ☐ decrease.
☐ Yes	X No	3. Will permit change include operations outside the Cumulative Hydrologic Impact Area?
☐ Yes	X No	4. Will permit change include operations in hydrologic basins other than currently approved?
☐ Yes	X No	5. Does permit change result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes	X No	6. Does permit change require or include public notice publication?
☐ Yes	X No	7. Permit change as a result of a Violation? Violation #
☐ Yes	X No	8. Permit change as a result of a Division Order? D.O.#
☐ Yes	X No	9. Permit change as a result of other laws or regulations? Explain:
☐ Yes	X No	10. Does permit change require or include ownership, control, right-of-entry, or compliance information?
☐ Yes	X No	11. Does the permit change affect the surface landowner or change the post mining land use?
☐ Yes	X No	12. Does permit change require or include collection and reporting of any baseline information?
☐ Yes	X No	13. Could the permit change have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes	X No	14. Does permit change require or include soil removal, storage or placement?
☐ Yes	X No	15. Does permit change require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	X No	16. Does permit change require or include construction, modification, or removal of surface facilities?
X Yes	☐ No	17. Does permit change require or include water monitoring, sediment or drainage control measures?
X Yes	☐ No	18. Does permit change require or include certified designs, maps, or calculations?
☐ Yes	X No	19. Does permit change require or include underground design or mine sequence and timing?
☐ Yes	X No	20. Does permit change require or include subsidence control or monitoring?
☐ Yes	X No	21. Have reclamation costs for bonding been provided or revised for any change in the reclamation plan?
☐ Yes	X No	22. Is permit change within 100 feet of a public road or perennial stream or 500 feet of an occupied dwelling?
☐ Yes	X No	23. Is this permit change coal exploration activity ☐ inside ☐ outside of the permit area?

☐ **Attach 3 complete copies of proposed permit change as it would be incorporated into the Mining and Reclamation Plan.**

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

Johnny Pappas Envir. Engineer Nov. 10, 1995
Signed - Name - Position - Date

Subscribed and sworn to before me this 10 day of Nov, 19 95.
John C. Pappas
Notary Public
My Commission Expires: 3-7, 19 98
Attest: STATE OF UTAH
COUNTY OF CARBON

JOHN C. PAPPAS
NOTARY PUBLIC • STATE of UTAH
1046 EAST CASTLE CIRCLE
PRICE, UTAH 84501
COMM. EXP. 3-7-98

Received by Oil, Gas & Mining

ASSIGNED PERMIT CHANGE NUMBER

INCORPORATED
EFFECTIVE:
NOV 27 1995
UTAH DIVISION OIL, GAS AND MINING
MAIN OFFICE

95B

Application for Permit Change
Detailed Schedule of Changes to the Permit

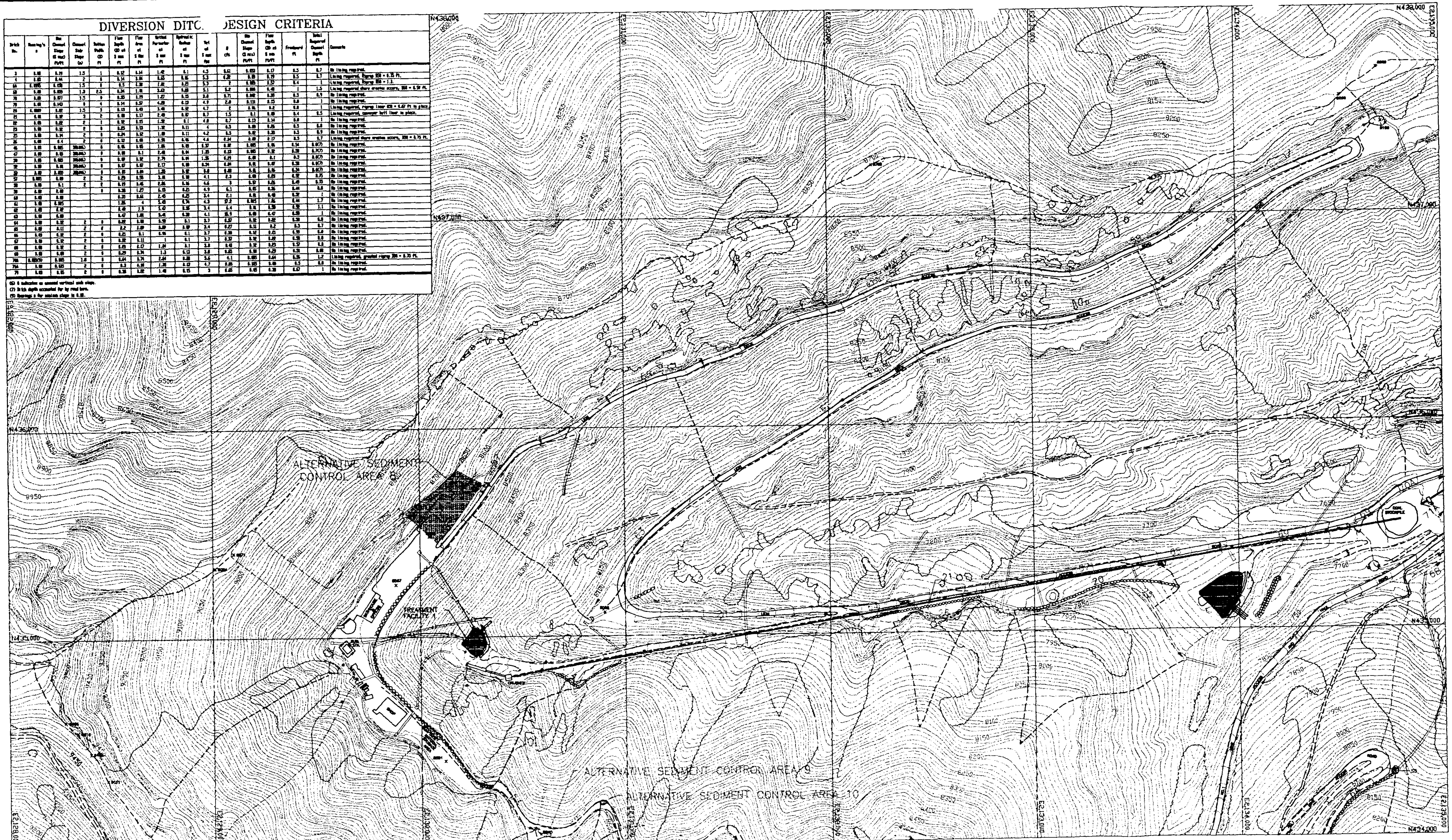
Title of Change: Surface Water and Sedimentation Control Facilities	Permit Number:ACT /007 /006
	Mine:STAR POINT MINE
	Permittee:CYPRUS PLATEAU MINING

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit change. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the exiting mining and reclamation plan. Include page, section and drawing numbers as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	X REPLACE	☐ REMOVE	Maps 731.720 a, b and e
☐ ADD	X REPLACE	☐ REMOVE	Pages 700-171 through 700-171.1
☐ ADD	X REPLACE	☐ REMOVE	Pages 700-119 through 700-126.1
☐ ADD	X REPLACE	☐ REMOVE	Pages 700-128 through 700-135.1
X ADD	REPLACE	☐ REMOVE	Addendum to Exhibit 732.300 B
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	

INCORPORATED
EFFECTIVE:
NOV 27 1995
958
UTAH DIVISION OIL, GAS AND MINING
PRICE FIELD OFFICE

Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?



DIVERSION DITCH DESIGN CRITERIA

Ditch No.	Manning's n	Max Channel Slope (S max) ft/ft	Channel Side Slope (z)	Bottom Width (B) ft	Flow Depth (D) at S max ft	Flow Area at S max ft	Wetted Perimeter at S max ft	Hydraulic Radius at S max ft	Vel at S max fps	Q cfs	Min Channel Slope (S min) ft/ft	Flow Depth (D) at S min ft/ft	Freeboard ft	Total Required Channel Depth ft	Comments
3	[illegible]	0.19	1.5	1	0.12	0.14	1.42	0.1	4.5	0.61	[illegible]	0.17	0.5	0.7	No lining required.
4	[illegible]	0.44	2	[illegible]	0.14	[illegible]	[illegible]	[illegible]	5.3	[illegible]	[illegible]	0.19	0.5	0.7	Lining required, Riprap D50 = 0.75 ft.
6A	[illegible]	[illegible]	1.5	[illegible]	0.5	[illegible]	[illegible]	[illegible]	5.3	[illegible]	[illegible]	[illegible]	0.4	1	Lining required, Riprap D50 = 1.1.
6B	[illegible]	[illegible]	1.3	2.5	0.34	[illegible]	[illegible]	[illegible]	5.1	5.2	[illegible]	[illegible]	1	1.5	Lining required where erosion occurs, D50 = [illegible] ft.
7A	[illegible]	[illegible]	1.5	[illegible]	[illegible]	1.19	1.27	0.15	[illegible]	0.71	[illegible]	[illegible]	0.5	0.9	No lining required.
7B	[illegible]	0.143	[illegible]	4	0.14	0.57	[illegible]	[illegible]	4.9	[illegible]	0.111	0.13	[illegible]	1	No lining required.
20	[illegible]	[illegible]	1.5	3	0.13	[illegible]	[illegible]	[illegible]	4.7	[illegible]	[illegible]	0.2	[illegible]	1	Lining required, riprap liner D50 = [illegible] ft in place.
21	[illegible]	0.12	3	2	[illegible]	0.17	[illegible]	[illegible]	[illegible]	1.5	0.1	[illegible]	0.4	[illegible]	Lining required, conveyor belt liner in place.
22	[illegible]	[illegible]	2	1	0.12	0.15	1.52	0.1	4.8	[illegible]	0.13	0.14	[illegible]	1	No lining required.
23	[illegible]	0.12	2	[illegible]	[illegible]	0.13	1.32	0.11	4	0.5	[illegible]	[illegible]	0.5	[illegible]	No lining required.
25	[illegible]	0.14	2	[illegible]	0.24	0.12	[illegible]	0.11	4.2	0.5	[illegible]	[illegible]	0.5	0.9	No lining required.
26	[illegible]	0.4	2	[illegible]	0.12	[illegible]	[illegible]	[illegible]	4.6	[illegible]	[illegible]	0.17	0.5	0.7	Lining required where erosion occurs, D50 = 0.75 ft.
46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.54	[illegible]	No lining required.
47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1	0.5	[illegible]	No lining required.
52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
53	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
57	[illegible]	[illegible]	2	2	[illegible]	[illegible]	[illegible]	[illegible]	4.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
58	[illegible]	0.1	2	2	0.19	[illegible]	[illegible]	[illegible]	4.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
59	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
60	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.1	[illegible]	[illegible]	[illegible]	1	No lining required.
61	[illegible]	[illegible]			[illegible]	4	[illegible]	[illegible]	4.3	[illegible]	[illegible]	[illegible]	[illegible]	1.7	No lining required.
62	[illegible]	[illegible]			[illegible]	1.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.1	No lining required.
63	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	4.1	[illegible]	[illegible]	[illegible]	[illegible]	1	No lining required.
64	[illegible]	0.12	2	[illegible]	[illegible]	[illegible]	[illegible]	0.1	[illegible]	[illegible]	0.12	[illegible]	[illegible]	[illegible]	No lining required.
65	[illegible]	0.11	2	[illegible]	0.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.11	0.2	0.5	0.7	No lining required.
66	[illegible]	0.12	2	[illegible]	[illegible]	0.1	[illegible]	0.1	[illegible]	[illegible]	0.12	[illegible]	[illegible]	[illegible]	No lining required.
67	[illegible]	0.12	2	[illegible]	[illegible]	0.11	1	0.1	[illegible]	[illegible]	0.12	[illegible]	[illegible]	[illegible]	No lining required.
68	[illegible]	0.12	2	[illegible]	[illegible]	[illegible]	[illegible]	0.1	[illegible]	[illegible]	0.12	[illegible]	[illegible]	[illegible]	No lining required.
69	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	No lining required.
70A	[illegible]	[illegible]	1.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.6	4.1	[illegible]	[illegible]	[illegible]	1.2	Lining required, grouted riprap D50 = 0.75 ft.
71A	[illegible]	[illegible]	2	[illegible]	0.3	[illegible]	[illegible]	[illegible]	4.7	[illegible]	[illegible]	[illegible]	0.5	[illegible]	No lining required.
73	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	1.4	0.15	3	[illegible]	[illegible]	[illegible]	[illegible]	1	No lining required.

(6) [illegible] vertical side slope.
(7) Ditch depth accounted for by road berm.
(9) Manning's n for minimum slope is [illegible].

LEGEND

PRIMARY ROAD
SECONDARY ROAD
TRAIL
BRIDGE, CULVERT
RAILROAD
BUILDINGS, STRUCTURES
LAKE, POND
RIVER, STREAM
FENCE
CONTOURS
TREE LINES
TRAVERSE STATION
HORIZONTAL CONTROL
VERTICAL CONTROL
PHOTO CENTER
DRILL HOLE
SPOT ELEVATION
WATER SPOT
NEW LOCAL COORDINATE GRID TICK
SECTION CORNER
SWAMP
MINE PORTAL
DOWN SPOUT
CATCH BASIN
LIGHT POLE
POWER POLE
UNLINED DITCH SECTION AND DITCH NUMBER
LINED DITCH SECTION AND DITCH NUMBER
DITCH DRAINAGE BASIN DIVIDE
SEDIMENT POND DRAINAGE BASIN DIVIDE
SEDIMENT TRAP
CULVERT
SILT FENCE

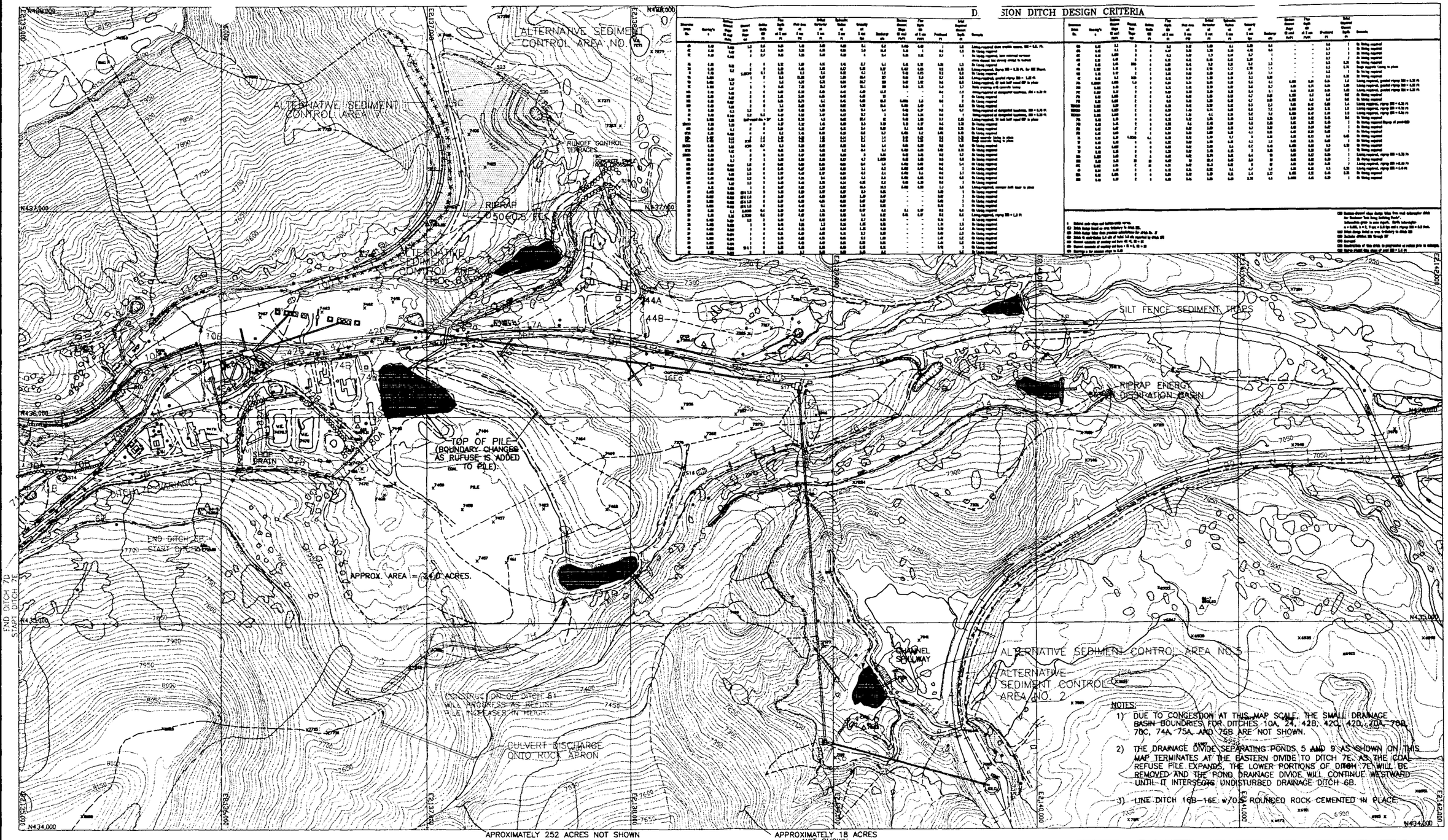
NORTH

SURFACE WATER & SEDIMENTATION CONTROL FACILITIES MAP A

CYPRUS Plateau Mining

E-12

MAP 731.720a



NOTES:

1) DUE TO CONGESTION AT THIS MAP SCALE, THE SMALL DRAINAGE BASIN BOUNDRIES FOR DITCHES 10A, 24, 42B, 42C, 42D, 70A, 70B, 70C, 74A, 75A, AND 76B ARE NOT SHOWN.

2) THE DRAINAGE DIVIDE SEPARATING PONDS 5 AND 9 AS SHOWN ON THIS MAP TERMINATES AT THE EASTERN DIVIDE TO DITCH 7E. AS THE COAL REFUSE PILE EXPANDS, THE LOWER PORTIONS OF DITCH 7E WILL BE REMOVED AND THE POND DRAINAGE DIVIDE WILL CONTINUE WESTWARD UNTIL IT INTERSECTS UNDISTURBED DRAINAGE DITCH 6B.

3) LINE DITCH 16B–16E w/0.5' ROUNDED ROCK CEMENTED IN PLACE.

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- CONTOURS
- TREE LINES
- TRAVERSE STATION
- HORIZONTAL CONTROL
- VERTICAL CONTROL
- PHOTO CENTER
- DRILL HOLE
- SPOT ELEVATION
- WATER SPOT
- NEW LOCAL COORDINATE GRID TICK
- SECTION CORNER
- SWAMP
- MINE PORTAL
- DOWN SPOUT
- CATCH BASIN
- LIGHT POLE
- POWER POLE
- 4C UNLINED DITCH SECTION AND DITCH NUMBER
- 6A LINED DITCH SECTION AND DITCH NUMBER
- DITCH DRAINAGE BASIN DIVIDE
- SEDIMENT POND DRAINAGE BASIN DIVIDE
- SEDIMENT TRAP
- CULVERT
- BERM
- SILT FENCE

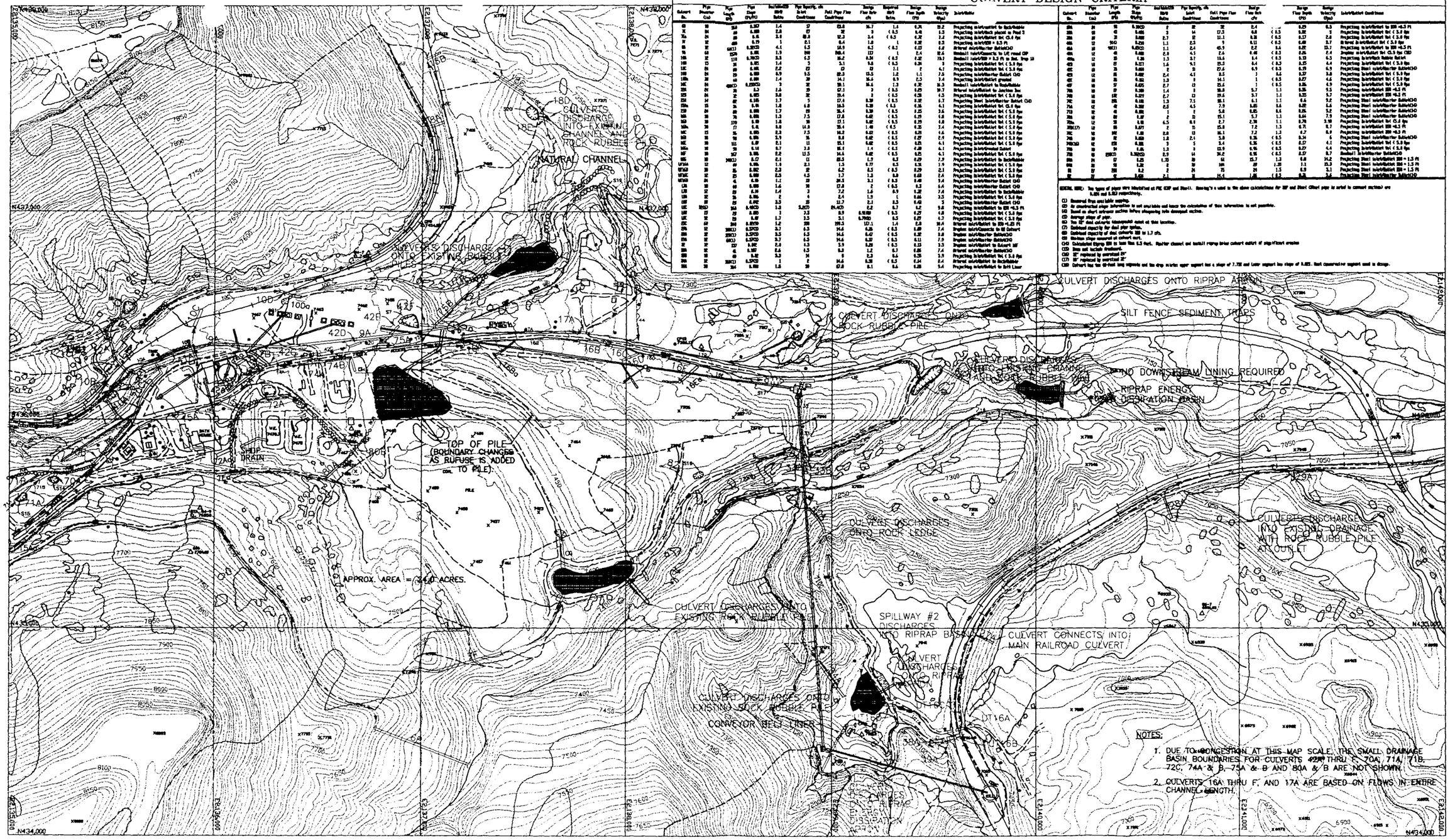
NORTH

SURFACE WATER & SEDIMENTATION CONTROL FACILITIES MAP A

CYPRUS Plateau Mining

F-12

MAP 731.720b



CULVERT DESIGN CRITERIA

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Inlet/Outlet Drop Ratio	Pipe Specific Ch Inlet Conditions	Full Pipe Flow Conditions	Design Flow Rate cfs	Required Riprap Ratio	Design Flow Depth (ft)	Design Velocity (ft/sec)	Inlet/Outlet
8A	36	50	0.100	1.4	0	0.2	16.7	1.4	0.74	9.2	Projecting inlet/outlet to Rock/Rubble
9A	36	40	0.100	1.4	0	0	0	0	1.5	4.5	Projecting inlet/Rock placed in Pond 3
10A	36	20	0.05	1.4	0.3	0.3	3.4	0.5	0.32	3.2	Projecting inlet/Outlet Int (3.0 Pipe
11A	36	40	0.05	1.4	0.1	0.1	1.8	1	0.22	2.3	Projecting inlet/OUTLET = 0.5 Ft.
12A	36	160	0.0625	4.1	0.5	0.9	6.5	0.5	0.47	4.2	Mitered Inlet/Flarter Outlet/CGO
13A	36	120	0.05	1.5	1.0	0.4	1.0	1	2.4	12.4	Headwall Inlet/Connects to LOC road CMP
14A	36	110	0.0625	2.5	1.5	0.2	0.4	0.5	1.2	10.1	Headwall Inlet/END = 1.5 Ft Ins. Drop 16
15A	36	0	0.05	1.4	0	0.1	0.1	0.5	0.34	3	Projecting Inlet/Outlet Int (3.0 Pipe
16A	36	0	0.05	1.4	0	0	0	0	1.1	7	Projecting Inlet/Outlet Int (3.0 Pipe
17A	36	0	0.05	0.9	0.5	0.3	0.5	1.2	1.1	7.5	Projecting Inlet/Flarter Outlet CGO
18A	36	0	0.05	1.4	0	0.1	0.1	0.5	0.3	3.4	Projecting Inlet/Outlet ground
19A	36	180	0.0625	3	0	0.1	0.4	1.5	0.35	6.5	Headwall Inlet/Outlet to Rock/Rubble
20A	36	30	0.2	1.4	0	0.1	1	0.5	0.25	10.7	Mitered Inlet/Outlet to Junction Box
21A	36	0	0.05	1.4	0	0.4	1	0.5	0.38	4.5	Projecting Inlet/Outlet Int (3.0 Pipe
22A	36	0	0.16	1.7	5	0.4	0.9	0.5	0.32	6.7	Projecting Inlet/Flarter Outlet CGO
23A	36	0	0.6	1.8	6.8	0.5	0.8	0.5	0.35	6.1	Projecting Inlet/Outlet Int (3.0 Pipe
24A	36	0	0.05	1.4	0	0.4	0.4	0.5	0.25	3.6	Projecting Inlet/Outlet Int (3.0 Pipe
25A	36	0	0.08	1.5	7.5	0.4	0.4	0.5	0.25	3.6	Projecting Inlet/Outlet Int (3.0 Pipe
26A	36	120	0.0	1.8	16	0.1	0.8	0.5	0.25	1.8	Projecting Inlet/Outlet Int (3.0 Pipe
27A	36	77	0.6	1.8	10.3	0.4	1.4	0.5	0.35	3.4	Projecting Inlet/Outlet Int (3.0 Pipe
28A	36	0	0.05	2.3	7.5	0.2	0.2	0.5	0.25	2.5	Projecting Inlet/Outlet Int (3.0 Pipe
29A	36	0	0.05	2.3	5	0.4	0.6	0.5	0.25	2.5	Projecting Inlet/Outlet Int (3.0 Pipe
30A	36	0	0.9	2.1	11	0.1	0.2	0.5	0.25	4.1	Projecting Inlet/Outlet Int (3.0 Pipe
31A	36	0	0.16	0.7	2.3	0.4	1.4	0.5	0.28	4.1	Projecting Inlet/Flarter Outlet
32A	36	50	0.05	2.2	13.5	0.4	0.2	0.5	0.25	4.1	Projecting Inlet/Outlet Int (3.0 Pipe
33A	36	180	0.17	2.1	11	0.3	1.0	0.5	0.29	7.9	Projecting Inlet/Outlet to Rock/Rubble
34A	36	0	0.05	1.1	2.1	0.1	0.7	0.5	0.25	1.9	Projecting Inlet/Outlet Int (3.0 Pipe
35A	36	0	0.02	2.3	2	0.2	0.3	0.5	0.29	2.1	Projecting Inlet/Outlet Int (3.0 Pipe
36A	36	0	0.05	2.3	4.5	0.1	0.2	0.5	0.25	2.4	Projecting Inlet/Outlet Int (3.0 Pipe
37A	36	0	0.6	1.1	0	0.3	0.3	0.5	0.28	2.4	Projecting Inlet/Flarter Outlet CGO
38A	36	0	0.05	1.4	0	0.2	2	0.5	0.3	6.4	Projecting Inlet/Outlet CGO
39A	36	0	0.05	2.4	3	0.2	0.4	1.5	0.3	7.4	Projecting Inlet/Outlet to Rock/Rubble
40A	36	0	0.16	2	4	0.4	1.5	1	0.46	3.3	Projecting Inlet/Outlet Int (3.0 Pipe
41A	36	0	0.02	2.3	3	0.1	0.1	0.5	0.42	3	Projecting Inlet/Flarter Outlet CGO
42A	36	180	0.0625	1.3	3.25	0.4	0.7	1.5	0.4	3.4	Projecting Inlet/Outlet to END =1.5 Ft
43A	36	0	0.05	1	3.5	0.9	0.9	0.5	0.27	4.8	Projecting Inlet/Outlet Int (3.0 Pipe
44A	36	0	0.05	1.7	3.5	0.1	0.7	0.5	0.27	4.8	Projecting Inlet/Outlet Int (3.0 Pipe
45A	36	20	0.0179	1.2	20	10.3	10.1	1.4	0.9	10.4	Mitered Inlet/Outlet to END =1.25 Ft
46A	36	180	0.5	2.1	0.5	0.4	0.6	0.5	0.28	7.4	Engine Inlet/Connects to GC Culvert
47A	36	180	0.5	2.1	0.5	0.4	0.7	0.5	0.28	7.4	Projecting Inlet/Outlet CGO
48A	36	180	0.5	2.1	0.5	0.4	0.7	0.5	0.28	7.5	Projecting Inlet/Outlet to Rock/Rubble
49A	36	20	0.02	2.3	0.5	0.3	0.3	0.5	0.25	3.3	Projecting Inlet/Outlet to Culvert 48
50A	36	0	0.05	2.4	0.5	0.3	0.3	1.2	0.3	7.4	Mitered Inlet/Flarter Outlet CGO
51A	36	0	0.6	2.3	0	0.3	0.3	0.5	0.25	3.9	Projecting Inlet/Outlet Int (3.0 Pipe
52A	36	180	0.0625	1	0	0.4	0.6	0.5	0.4	2.4	Projecting Inlet/Outlet to Rock/Rubble
53A	36	30	0.05	1.5	0	0.4	0.1	0.5	0.28	5.4	Projecting Inlet/Outlet to Drill Liner

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Inlet/Outlet Drop Ratio	Pipe Specific Ch Inlet Conditions	Full Pipe Flow Conditions	Design Flow Rate cfs	Design Flow Depth (ft)	Design Velocity (ft/sec)	Inlet/Outlet Conditions
54A	36	0	0.0625	2	0	0	2.4	0.25	6.3	Projecting Inlet/Outlet to END =0.5 Ft
55A	36	0	0.05	2	0	17.5	4.8	0.65	5.8	Projecting Inlet/Outlet Int (3.0 Pipe
56A	36	0	0.05	2.7	0	11.1	4.8	0.65	5.7	Projecting Inlet/Outlet Int (3.0 Pipe
57A	36	500	0.05	1.1	5	0.1	4.8	0.65	5.8	Projecting Inlet/Outlet Int (3.0 Pipe
58A	36	180	0.0625	1.1	2.4	45.5	5.2	0.65	5.8	Mitered Inlet/Flarter Outlet/CGO
59A	12	0	0.05	2.3	4.5	2.4	0.48	0.65	2.6	Engine Inlet/Outlet Int (3.0 Pipe CGO
60A	12	0	0.05	1.4	3	3.7	0.6	0.65	3.3	Projecting Inlet/Outlet Rubble Outlet
61A	12	0	0.05	1.4	5.5	3.5	0.4	0.65	4.4	Projecting Inlet/Outlet Int (3.0 Pipe
62A	12	0	0.05	2	0	2.4	0.7	0.65	5.9	Projecting Inlet/Flarter Outlet/CGO
63A	12	0	0.05	2.4	4.5	2.5	1	0.6	5.37	Projecting Inlet/Outlet Int (3.0 Pipe
64A	12	0	0.05	1.3	0	1.1	1	0.65	5.7	Projecting Inlet/Outlet Int (3.0 Pipe
65A	12	0	0.05	2.7	0	2.4	1	0.65	5.6	Projecting Inlet/Outlet Int (3.0 Pipe
66A	12	0	0.05	1.4	0	3.3	5.7	1.1	5.5	Projecting Inlet/Outlet END =0.5 Ft
67A	12	0	0.05	2.7	0	3.4	5.7	1.1	5.5	Projecting Inlet/Outlet END =0.5 Ft
68A	12	0	0.05	1.3	0	3.4	5.7	1.1	5.5	Projecting Inlet/Outlet END =0.5 Ft
69A	12	0	0.05	1.3	7.5	3.1	6.1	1.1	5.8	Projecting Inlet/Flarter Outlet/CGO
70A	12	0	0.05	2.5	4.5	7.9	6.85	1.1	5.8	Projecting Inlet/Outlet/Flarter Outlet/CGO
71A	12	0	0.05	1	1	3.4	6.85	1.1	5.8	Projecting Inlet/Outlet/Flarter Outlet/CGO
72A	12	0	0.05	1.9	0	3	15.1	1.7	7.9	Projecting Inlet/Outlet/Flarter Outlet/CGO
73A	12	0	0.05	1.8	4.5	6.1	2.7	1.1	3.98	Projecting Inlet/Outlet Int (3.0 Pipe
74A(7)	12	0	0.07	2	0	15.8	7.2	1.3	8.7	Projecting Inlet/Outlet END =0.5 Ft
75A	12	0	0.05	2.8	0	16.1	7.2	1.3	8.9	Projecting Inlet/Outlet END =0.5 Ft
76A	12	0	0.05	1.8	2.1	3.8	4.36	0.65	5.34	Projecting Inlet/Outlet/Flarter Outlet/CGO
77A(8)	12	0	0.05	1.3	1	3.4	4.36	0.65	5.37	Projecting Inlet/Outlet Int (3.0 Pipe
78A	12	0	0.05	1.3	0	3.5	4.36	0.65	5.37	Projecting Inlet/Outlet Int (3.0 Pipe
79A	36	180	0.0625	2.3	4	30.2	6.95	0.65	8.7	Headwall Inlet/Outlet/Flarter Outlet/CGO
80A	36	0	0.05	1.35	0	6	15.7	1.3	6.8	Mitered Inlet/Outlet/Flarter END =1.5 Ft
81A	36	0	0.05	1	0	16	0	1.35	1.1	Mitered Inlet/Outlet/Flarter END =1.5 Ft
82A	36	0	0.2	2	0	16	15	1.5	3.1	Projecting Inlet/Outlet/Flarter END =1.5 Ft
83A	36	0	0.05	2.1	0	16.4	1.35	1.5	3.3	Projecting Inlet/Outlet/Flarter Outlet/CGO

GENERAL NOTES: The types of pipe were identified as PVC (CMP and Steel). Manning's n used in the above calculations for CMP and Steel Culvert pipe is varied in current sections and 0.024 and 0.012 respectively.

(1) Mentioned drop zone table missing.
(2) As constructed slope information is not available and hence the calculation of this information is not possible.
(3) Based on short culvert outlet before changing into designed section.
(4) Average slope of pipe.
(5) The CP does not have measurable outlet at this location.
(6) Calculated capacity for dual pipe inlets.
(7) Calculated capacity of dual culverts 100 to 1.7 cfs.
(8) Minimum slope measured at culvert exit.
(9) Calculated Cfpro 100 is less than 1.5 Cfs. Rather channel and install riprap below culvert outlet if significant erosion
(10) Drop and outlet treatment.
(11) 12" replaced by corrugated 24"
(12) 12" replaced by corrugated 24"
(13) Culvert has two di-fold long segments and the drop exists upper segment has a slope of 7.72% and lower segment has slope of 3.82%. Most conservative segment used in design.

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- CONTOURS
- TREE LINES
- TRAVERSE STATION
- HORIZONTAL CONTROL
- VERTICAL CONTROL
- PHOTO CENTER
- DRILL HOLE
- SPOT ELEVATION
- WATER SPOT
- NEW LOCAL COORDINATE GRID TICK
- SECTION CORNER
- SWAMP
- MINE PORTAL
- DOWN SPOUT
- CATCH BASIN
- LIGHT POLE
- POWER POLE
- UNLINED DITCH SECTION AND DITCH NUMBER
- 6A LINED DITCH SECTION AND DITCH NUMBER
- BERM
- DITCH DRAINAGE BASIN DIVIDE
- CULVERT AND CULVERT NUMBER
- SEDIMENT TRAP

NORTH

SURFACE WATER & SEDIMENTATION CONTROL FACILITIES MAP B

CYPRUS Plateau Mining

F-12

MAP 731.720e

riprap lining already exists thereby providing adequate protection. Third, culvert inlet protection is generally only designed and used under highly critical flow conditions such as one would encounter in a large conveyance channel with the potential for high flows and damage, or at extreme and abrupt channel bends, and fourth, no locations were found where erosion appeared to be occurring at any of the sites visited in preparation for the 1986 permit submittal. Since that time, no changes have been made to the runoff conveyance system with the exception of the addition of riprap within Ditch 16 which parallels County Road 290 in the lower mine yard area.

Culvert outlet erosion protection was determined according to the methods presented earlier in the discussion regarding riprap design. The Barfield, et.al., method was used in the design of appropriate riprap at culvert outlets having exit velocities in excess of 5.0 feet per second as long as the average riprap size was larger than 0.5 feet and the slope was not limiting. At those locations where design procedures predicted riprap sizes less than 0.5 feet, no erosion protection is proposed with the understanding that the outlets will be monitored and riprap installed should severe erosion occur.

Under these guidelines it is expected that some minor erosion will occur downstream from the culverts (which have a velocity in excess of 5.0 feet per second but which required a riprap size of less than 0.5 feet) as exiting waters adjust to the new downstream channel configuration. In normal design it is common to accept this small amount of erosion as part of the design as long as erosion does not produce headcutting thereby threatening the structure. Headcutting is not considered a problem with CPMC conveyance facilities because downstream channel sections have been designed to be stable. Erosion, should it occur, will generally be limited to a very short section immediately downstream of the culvert.

It is felt that this solution is acceptable since all such culverts are located in existing diversion channels whereby the small amount of erosion that may occur is diverted into and contained within existing sedimentation facilities. In addition, the majority of culverts located throughout the mine plan area have been in place for sufficient time for anticipated erosion to have already occurred, therefore there would be no additional gain should riprap be installed at this time. As stated previously, riprap protection will be provided at these locations should serious erosion be noted.

Design Methodology for the November 1995 Amendment

An amendment to the MRP, dated November 1995, has been prepared to address several changes in the runoff and sediment control plan for the Cyprus Plateau Mine area. These changes consist of several new or modified culverts, and several new or modified diversion ditches, that were needed to improve the functioning of the overall mine site runoff and sediment control plan. Some of these features were installed to: abate previous NOVs that did not require the MRP to be revised as part of theabatement plan; and to address issues raised during a Division courtesy inspection and mid-term review. This amendment has been prepared to provide a demonstration of the adequacy of the recently installed or modified ditches and culverts.

Methodology used to assess the structures included in this amendment was the same as had been used elsewhere in the MRP. No new peak flow information was generated for this amendment. In most instances, the new or modified structures were in-line with, or replaced, existing permitted structures; therefore the design peak flows were equal to those previously derived. In a few instances, the new structures convey only a portion of the runoff that reports to a previously designed structure; the peak discharge for the downstream structure was used to assess the new structure, providing a conservative assessment of the contributing runoff.

Channel flow, channel lining, and culvert design methods were the same as those described above for the majority of runoff features at the mine area. The channels assessed in this amendment had all been lined with either smooth or rough-surfaced concrete, and appropriate Manning's roughness coefficients used to determine open channel flow characteristics.

RUNOFF CONTROL VARIANCE REQUESTS

With the submittal and approval of the 1986 permit application a variance was granted from providing ditch design and ditch erosion protection at some locations due to special conditions encountered at the site with respect to the design and installation of appropriate channels and/or linings. General problems encountered include 1) the inability to properly size riprap in steep slope areas due to a lack of general design methodologies, 2) the lack of adequate space to install a riprapped channel, 3) the evidence that minimal erosion has occurred historically, and 4) excessive maintenance and disposal problems which occur annually due to debris and rock fall from the

TABLE 742a
Diversion Ditch Peak Flow Design Data

Diversion Ditch Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm in.	S in.	Time of Excess Rainfall (To) in.	Runoff (Q) in.	Hydrograph Family No.	Hydraulic Length (hl) ft.	Average* Watershed Slope (Y) percent	Watershed Lag (L) hr.	Tp hr.	Computed To,Tp	Used To,Tp	Revised Tp hr.	484 AQ (Tp) rev.	Peak Flow (q) cfs
3	0.0	10.14	0.0158	75	2.1	3.33	12.4	0.431	4	1,640	66	0.07	0.07	177	50	0.25	13.2	0.61
4	0.0	3.7	0.0058	75	2.1	3.33	12.4	0.431	4	820	69	0.04	0.04	310	50	0.25	4.8	0.22
5	2.7	27.9	0.048	76	2.1	3.16	12.5	0.466	4	2,700	67	0.1	0.11	114	50	0.25	43.3	2.01
6A	0.0	33.2	0.0519	75	2.1	3.33	12.4	0.431	4	3,320	67	0.12	0.13	95	50	0.25	43.3	2.0
6B	0.0	85.3	0.1333	75	2.1	3.33	12.4	0.431	4	6,850	54	0.23	0.26	48	50	0.25	111.2	5.2
6C[17]	0.0	85.3	0.1333	75	2.0	Derived from computerized SCS unit hydrograph procedure												16.8
7A	1.2	11.7	0.0202	76	2.1	3.16	12.5	0.466	4	1,200	57	0.05	0.06	205	50	0.25	18.2	0.84
7B	0.7	4.6	0.0083	77	2.1	2.99	12.6	0.503	4	1,350	43	0.07	0.08	168	50	0.25	8.1	0.38
7C	3.4	17.1	0.032	77	2.1	2.99	12.6	0.503	4	4,100	55	0.15	0.16	79	50	0.25	31.2	1.4
7D	5.1	34.7	0.0622	77	2.1	2.99	12.6	0.503	4	6,880	53	0.22	0.25	50	50	0.25	60.5	2.8
7E[16]	6.4	41.1	0.0742	77	2.1	2.99	12.6	0.503	4	8,680	49	0.28	0.31	41	36	0.35	72.2	3.4
7G[17]	0.0	6.2	0.0097	75	2.0	Derived from computerized SCS unit hydrograph procedure												1.83
7H[17]	10.8	12.6	0.0366	73	2.0	Derived from computerized SCS unit hydrograph procedure												3.37
8[3,11,17]	12.3[3]	0.0	0.0192	70[2]	2.0	Derived from computerized SCS unit hydrograph procedure												1.23
9A	22.3	525.7	0.8563	76	2.6	3.16	12.9	0.756	3	8,000	64	0.24	0.26	50	50	0.26	1,205.1	117.1
9B	22.3	527.7	0.8594	76	2.1	Add flow derived from computerized SCS unit hydrograph procedure for "Area tributary to Culvert 9B" to Ditch 9A flows												118.0
9C	22.3	527.7	0.8594	76	2.1	The same peak flow derived for Ditch 9B is used for this swale crossing reach												118.0
10A	11.5[4]	6.1	0.0275	83[2]	2.1	Derived from computerized SCS unit hydrograph procedure												11.5
10B	13.0[5]	6.1	0.0298	83[2]	2.1	Derived from computerized SCS unit hydrograph procedure												3.0
10C	13.3[6]	6.1	0.0303	84[2]	2.1	Derived from computerized SCS unit hydrograph procedure												13.5
10D	16.7[7]	6.1	0.0356	85[2]	2.1	Derived from computerized SCS unit hydrograph procedure												16.6
11	0.0	6.5	0.0102	75	2.1	3.33	12.4	0.431	4	1,660	49	0.08	0.09	138	50	0.25	8.5	0.4
12	0.0	48.9	0.0764	75	2.1	3.33	12.4	0.431	4	3,780	55	0.14	0.16	78	50	0.25	63.7	3.0
14[16]	0.0	308.0	0.481	75	2.6	3.33	12.7	0.71	3	11,200	52	0.35	0.39	33	36	0.35	472.3	62.0
15A[12]	1.3	3.6	0.0077	79	2.1	2.66	12.8	0.582	4	1,720	21	0.11	0.12	107	50	0.26	8.3	0.39
15B[12]	1.3	3.6	0.0077	79	2.1	2.66	12.8	0.582	4	1,720	21	0.11	0.12	107	50	0.26	8.3	0.39
UT15	0.0	7.8	0.0122	75	2.1	Derived from computerized SCS unit hydrograph procedure												3.7
16[14,15,17]	15.2[11]	0.0	0.0238	70[2]	2.0	Derived from computerized SCS unit hydrograph procedure												1.38

Diversion Ditch Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm In.	S In.	Time of Excess Rainfall (To) in.	Runoff (Q) In.	Hydrograph Family No.	Hydraulic Length (hl) ft.	Average* Watershed Slope (Y) percent	Watershed Lag (L) hr.	Tp hr.	Computed To,Tp	Used To,Tp	Revised Tp hr.	484 AQ (Tp) rev.	Peak Flow (q) cfs
UT16	1.7	2.6	0.0067	81	2.1	Derived from computerized SCS unit hydrograph procedure												3.1
17A[8]	0.5	2.9	0.0053	77	2.1	2.99	12.6	0.503	4	1,880	13	0.16	0.18	70	50	0.25	5.2	0.24
17B	1.3	4.3	0.0088	78	2.1	Add flows derived from computerized SCS unit hydrograph procedure for Ditch No.17A and Ditch No.44												1.6[9]
18A	0.0	25.8	0.0404	75	2.1	3.33	12.4	0.431	4	2,800	48	0.12	0.13	95	50	0.25	33.7	1.6
18B	0.0	5.4	0.0084	75	2.1	3.33	12.4	0.431	4	950	72	0.04	0.05	248	50	0.25	7	0.3
18C	0.7	33.3	0.0531	75	2.1	3.33	12.4	0.431	4	3,140	50	0.13	0.14	88	50	0.25	44.3	2.1
18D	0.7	34.8	0.0555	75	2.1	3.33	12.4	0.431	4	3,520	50	0.14	0.16	78	50	0.25	46.3	2.2
18	0.7	35.4	0.0564	75	2.1	3.33	12.4	0.431	4	3,760	50	0.15	0.17	73	50	0.25	47.1	2.2
20	4.5	5.9	0.0163	81	2.1	2.35	13.3	0.669	3	3,700	34	0.15	0.17	78	75	0.18	29.3	2.0
21	3.9	3.3	0.0113	83	2.1	2.05	13.8	0.764	3	2,550	38	0.1	0.11	125	75	0.18	23.2	1.5
22	1.7	1.9	0.0056	82	2.1	2.2	13.5	0.715	3	1,800	43	0.07	0.08	169	75	0.18	10.8	0.7
23	1.0	1.5	0.0039	81	2.1	2.35	13.3	0.669	3	1,100	44	0.05	0.06	221	75	0.18	7	0.5
24	Peak flow same as 25-year, 24-hour peak inflow pond #4																	10.3
25	0.0	8.2	0.0128	75	2.1	3.33	12.4	0.431	4	1,560	46	0.08	0.09	138	50	0.25	10.7	0.5
26	0.0	2.4	0.0037	75	2.1	3.33	12.4	0.431	4	850	60	0.04	0.05	248	50	0.25	8.1	0.14
27	0.33	0.0	0.0005	76	2.0	Derived from computerized SCS unit hydrograph procedure												0.26
28	0.76	0.0	0.0012	76	2.0	Derived from computerized SCS unit hydrograph procedure												0.47
29	0.52	0.0	0.0008	76	2.0	Derived from computerized SCS unit hydrograph procedure												0.37
30	0.93	0.0	0.0015	76	2.0	Derived from computerized SCS unit hydrograph procedure												0.52
32[17]	0.67	0.0	0.001	70	2.0	Derived from computerized SCS unit hydrograph procedure												0.12
33[17]	1	0.0	0.0016	70	2.0	Derived from computerized SCS unit hydrograph procedure												0.2
34	0.69	0.0	0.0011	83	2.0	Derived from computerized SCS unit hydrograph procedure												0.56
35	0.22	0.09	0.0005	84	2.0	Derived from computerized SCS unit hydrograph procedure												0.26
36	0.22	0.04	0.0004	87	2.0	Derived from computerized SCS unit hydrograph procedure												0.19
37	0.18	0.7	0.0014	74	2.0	Derived from computerized SCS unit hydrograph procedure												0.35
38	0.88	0.7	0.0025	81	2.0	Derived from computerized SCS unit hydrograph procedure												1.1
39	0.12	0.0	0.0002	90	2.0	Derived from computerized SCS unit hydrograph procedure												0.06
40	0.15	0.0	0.0002	90	2.0	Derived from computerized SCS unit hydrograph procedure												0.11
41	1.9	0.0	0.003	90	2.1	Derived from computerized SCS unit hydrograph procedure												2.2
42A	0.4	0.0	0.0006	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.46
42B	0.8	0.0	0.0012	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.91

Diversion Ditch Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm in.	S in.	Time of Excess Rainfall (To) in.	Runoff (Q) in.	Hydrograph Family No.	Hydraulic Length (hl) ft.	Average* Watershed Slope (Y) percent	Watershed Lag (L) hr.	Tp hr.	Computed To,Tp	Used To,Tp	Revised Tp hr.	484 AQ (Tp) rev.	Peak Flow (q) cfs
42C	0.9	0.0	0.0014	90	2.1	Derived from computerized SCS unit hydrograph procedure												1.0
42D	0.9	0.0	0.0014	90	2.1	Derived from computerized SCS unit hydrograph procedure (same as Ditch No. 42C)												1.0
43	0.8	1.0	0.0027	82	2.1	Derived from computerized SCS unit hydrograph procedure												1.3
44A	0.8	1.4	0.0034	80	2.1	Derived from computerized SCS unit hydrograph procedure												1.4
44B	0.8	1.4	0.0034	80	2.1	Derived from computerized SCS unit hydrograph procedure												1.4
45	0.2	1.5	0.0026	76	1.5[1]	Derived from computerized SCS unit hydrograph procedure												0.22
46	0.1	0.4	0.0008	78	0.9	Derived from computerized SCS unit hydrograph procedure												0.02
47	0.6	14.7	0.0239	76	0.9	Derived from computerized SCS unit hydrograph procedure												0.13
48	0.4	5.6	0.0094	76	0.9	Derived from computerized SCS unit hydrograph procedure												0.06
49	0.9	12.3	0.0206	76	0.9	Derived from computerized SCS unit hydrograph procedure												0.13
50	1.6	16.2	0.0278	76	0.9	Derived from computerized SCS unit hydrograph procedure												0.19
51	5.0	52.1	0.0892	76	1.5	Derived from computerized SCS unit hydrograph procedure												5.5
52	0.3	1.3	0.0025	78	0.9	Derived from computerized SCS unit hydrograph procedure												0.04
53	0.2	1.0	0.0019	78	0.9	Derived from computerized SCS unit hydrograph procedure												0.03
57	1.7	14.6	0.0255	77	1.5	Derived from computerized SCS unit hydrograph procedure												2.3
58	1.0	26.5	0.043	76	1.5	Derived from computerized SCS unit hydrograph procedure												3.0
59	0.9	11.3	0.0191	77	2.1	Derived from computerized SCS unit hydrograph procedure												6.1
60	0.5	2.9	0.0053	79	2.1	Derived from computerized SCS unit hydrograph procedure												2.1
61	0.8	7.2	0.0555	78	2.1	Add flows derived from computerized SCS unit hydrograph procedure for Ditch No. 58 and Ditch No. 61												17.2
62	0.7	11.7	0.0194	76	2.1	Derived from computerized SCS unit hydrograph procedure												6.4
63	0.5	14.7	0.2017	76	2.1	Add flows derived from computerized SCS unit hydrograph procedure for Ditch No. 57 and Ditch No. 63												15.9
64	0.3	0.0	0.0005	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.37
65	0.22	0.0	0.0003	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.27
66	0.27	0.0	0.0004	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.33
67	0.31	0.0	0.0005	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.37
68	0.34	0.0	0.0005	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.41
69	0.55	0.0	0.0009	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.65
70A	3.5	0.0	0.0055	90	2.1	Derived from computerized SCS unit hydrograph procedure												4.1
70B	4.9	0.0	0.0077	90	2.1	Derived from computerized SCS unit hydrograph procedure												5.7
70C	5.3	0.0	0.0083	90	2.1	Derived from computerized SCS unit hydrograph procedure												6.1
71A	0.7	0.0	0.0011	90	2.1	Derived from computerized SCS unit hydrograph procedure (Same as Ditch No. 71B)												0.85

Diversion Ditch Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm in.	S in.	Time of Excess Rainfall (To) in.	Runoff (Q) in.	Hydrograph Family No.	Hydraulic Length (hl) ft.	Average* Watershed Slope (Y) percent	Watershed Lag (L) hr.	Tp hr.	Computed To,Tp	Used To,Tp	Revised Tp hr.	484 AQ (Tp) rev.	Peak Flow (q) cfs
71B	0.7	0.0	0.0011	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.85
72A	2.2	2.5	0.0073	84	2.6	Derived from computerized SCS unit hydrograph procedure												5.7
72B	2.4	5.3	0.012	81	2.1(11)	Derived from computerized SCS unit hydrograph procedure (Same as Ditch No. 72D)												7.2
72C	2.4	5.3	0.012	81	2.1(11)	Derived from computerized SCS unit hydrograph procedure (Same as Ditch No. 72D)												7.2
74A	0.3	0.0	0.0005	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.36
74B	2.4	0.0	0.0038	90	2.1	Derived from computerized SCS unit hydrograph procedure												2.85
75A	0.8	0.0	0.0013	90	2.1	Derived from computerized SCS unit hydrograph procedure (Same as Ditch No. 75B)												0.96
75B	0.8	0.0	0.0013	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.96
76(17)	0.0	1.0	0.0016	75	2.0	Derived from computerized SCS unit hydrograph procedure												0.35
77	1.0	0.0	0.0016	90	2.1	Derived from computerized SCS unit hydrograph procedure												1.2
78	0.4	0.0	0.0006	90	2.1	Derived from computerized SCS unit hydrograph procedure												0.48
79	0.0	1.3	0.002	75	2.1	Derived from computerized SCS unit hydrograph procedure												0.65
80A	31.4(15)	35.2	0.104	81	2.1	Derived from computerized SCS unit hydrograph procedure												29.0
80B	31.4(15)	35.2	0.104	81	2.1	Derived from computerized SCS unit hydrograph procedure												29.0
80C	31.4(15)	35.2	0.104	81	2.1	Derived from computerized SCS unit hydrograph procedure												29.0
81(17)	10.0	0.0	0.0156	70	2.0	Derived from computerized SCS unit hydrograph procedure												1.2

GENERAL NOTE: The diversion ditches above were designed using the "SCS Design Hydrograph - Emergency Spillway Method" unless otherwise noted in the Comment Section. Computer printouts are presented in the Exhibit entitled " Diversion Ditch and Culvert Peak Flow Calculations".

(1) All disturbed area is from coal stock and refuse pile.
(2) These weighted curve numbers include runoff from the coal stock and refuse piles for which a CN = 70 was assumed.
(3) The tributary area to this ditch was reduced with the construction of the conveyor belt system. Since the design has not been modified it is considered conservative.
(4) Includes 1.6 acres coal stock and refuse pile.
(5) Includes 1.2 acres coal stock and refuse pile.
(6) Includes 1.3 acres coal stock and refuse pile.
(7) Includes 1.1 acres coal stock and refuse pile.
(8) Ditch Design Data taken from previous calculations for Ditch No. 17.
(9) Additional flow contributing to Ditch No. 17B is added by Ditch No. 44 which has a discharge rate of 1.4 cfs. The combined flow totalling 1.6 cfs is used in the ditch design criteria for Ditch No. 17B.
(10) Ditch designed using the 10-year, 6-hour precipitation event. The drainage area to Ditch #45 is less than two acres which qualifies for a small area exemption. There is insufficient space along roadway to design a channel with lining to maintain velocities less than 5 fps which would be required if the 10-year, 24-hour event is used. However, utilizing the roadway with a berm as the channel and the 10-year, 6-hour precipitation event, velocities can be maintained below 5 fps without requiring a channel lining which, if required, would eliminate accessibility along the roadway.
(11) Precipitation value of 2.6 inches was used for Ditch 72A portion of flow.
(12) Ditch Design Data Taken from previous calculations for Ditch No. 15.
(13) This value obtained by adding Ditch # 7G Upper and Ditch # 7G Lower contributing flow rates together.
(14) Includes Ditches 16A through 16F (including 16Ba and 16Fa)
(15) Includes 7.8 acres of future coal refuse pile.
(16) Data is based upon disturbed areas which existed prior to the construction of Pond 9. The construction of Pond 9 has reduced the total drainage area to this structure.
(17) Designed for 100 Year - 6 Hour Runoff.

TABLE 742b
Culvert Peak Flow Design Data

Rev: 8/95

Culvert Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm in.	Peak Flow (q) cfs	Comments
1A(11)	0.0	19.6	0.0306	75	2.1	1.2	Flow from ditches previously identified as 1A (0.67 cfs) and 1B (0.52 cfs)
2A(12)	0.0	10.2	0.0160	75	2.1	0.62	Flow from ditch previously identified as 2 (0.05 cfs) and adjacent watershed (0.57 cfs)
2B(12)	0.0	29.8	0.0466	75	2.1	1.8	Flow from culverts 1A and 2A
2C	0.0	22.3	0.0348	75	2.1	1.4	Flow from adjacent watershed
2D	0.0	52.1	0.0814	75	2.1	3.2	Flow from culverts 2B and 2C (previously identified as downspout #3)
4A	0.0	24.3	0.0380	75	2.1	11.0	Flow from adjacent watershed
5A	1.0	14.1	0.0236	76	2.6	1.5	Flow from adjacent watershed (previously identified as downspout #4)
5B	2.4	40.0	0.0663	76	2.6	4.3	Flow from adjacent watershed (previously identified as downspout #5)
6A	0.0	33.2	0.0519	75	2.1	2.0	Flow from ditch 6A
6B(10)	0.0	85.3	0.1333	75	2.0	16.7	Flow from ditch 6C
7A	1.9	16.3	0.0284	76	2.1	1.2	Flow from ditch 7A (0.84 cfs) and ditch 7B (0.38cfs)
7B	3.4	17.1	0.0320	77	2.1	1.4	Flow from ditch 7C
7E(13)	6.4	35.3	0.0652	77	2.1	3.0	Flow from ditch 7H
7F	0.0	10.5	0.0164	75	2.1	4.6	Flow from ditch 7G Upper
8A(10)	12.3	0.0	0.0192	70	2.0	1.23	Flow from ditch 8
9A	22.3	525.7	0.8563	76	2.6	117.1	Flow from ditch 9
10A	0.14	0.76	0.0014	77	2.1	0.54	Flow from adjacent watershed
10B	0.19	1.2	0.0022	77	2.1	0.8	Flow from adjacent watershed
10C	13.0	6.1	0.0298	84	2.1	13.0	Flow from ditch 10B
10D(14)	13.3	6.1	0.0303	84	2.1	13.5	Flow from ditch 10C
10	16.7	6.1	0.0356	85	2.1	16.6	Flow from ditch 10D
12A	0.0	48.9	0.0764	75	2.1	3.0	Flow from ditch 12
12B	0.0	48.9	0.0764	75	2.1	3.0	Flow from culvert 12A
15A(19)	1.3	3.6	0.0077	79	2.1	0.39	Flow from ditch 15A
15B	1.3	3.6	0.0077	79	2.1	0.39	Flow from ditch 15B

Culvert Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm in.	Peak Flow (q) cfs	Comments
16A(10)	15.2	0.0	0.0238	70	2.0	1.38	Flow from ditch 16F(3)
16B(10)(15)	15.2	0.0	0.0238	70	2.0	1.38	Flow from ditch 16F(3)
16C(10)	15.2	0.0	0.0238	70	2.0	1.38	Flow from ditch 16F(3)
16D(10)	15.2	0.0	0.0238	70	2.0	1.38	Flow from ditch 16F(3)
16E(10)(16)	15.2	0.0	0.0238	70	2.0	1.38	Flow from ditch 16F(3)
16F(10)	15.2	0.0	0.0238	70	2.0	1.35	Flow from ditch 16F(3)
16G(10)	15.7	1.5	0.0269	71	2.0	2.55	Flow from ditch 16E (1.38 cfs) and ditch 76 (0.35 cfs) and adjacent watershed (0.82 cfs)
UT16A	0.74	0.0	0.0012	90	2.0	0.77	Flow from adjacent watershed
UT16B	0.48	0.0	0.0008	90	2.0	0.5	Flow from adjacent watershed
UT16C	1.22	0.0	0.0019	90	2.0	1.3	Flow from adjacent watershed
UT16D	1.7	2.6	0.0067	81	2.1	3.1	Flow from ditch UT16
17A	1.3	4.3	0.0088	78	2.1	1.6	Flow from ditch 17B
17B	1.3	4.3	0.0088	78	2.1	1.6	Flow from ditch 17B
18A	0.0	31.2	0.0488	75	2.1	1.9	Flow from ditch 18A (1.6 cfs) and ditch 18B (0.3 cfs)
18B	0.7	33.3	0.0531	75	2.1	2.1	Flow from ditch 18C
18C	0.7	34.8	0.0555	75	2.1	2.2(3)	Flow from ditch 18D
18D	0.0	3.6	0.0056	75	2.1	1.7(4)	Flow from adjacent watershed
18	0.0	3.6	0.0056	75	2.1	1.7(4)	Flow from adjacent watershed
21A	3.9	3.3	0.0113	83	2.1	1.5	Flow from ditch 21
22A	1.7	1.9	0.0056	82	2.1	0.7	Flow from ditch 22
23A	1.0	1.5	0.0039	81	2.1	0.5	Flow from ditch 23
23B	0.0	37.9	0.0592	75	2.1	16.4	Flow from adjacent watershed
25A	0.0	8.2	0.0128	75	2.1	0.5	Flow from ditch 25
25B	14.1	109.3	0.1928	77	2.1	43.8	Flow from pond 2 (17.2 cfs), pond 3 (5.8 cfs) and adjacent watershed (20.8 cfs)(5)
25C	22.3	525.7	0.8563	76	2.6	117.1	Flow from downstream ditch 9A(8)
26A	0.0	2.4	0.0037	75	2.1	0.14	Flow from ditch 26
26B	0.0	12.2	0.0191	75	2.1	5.7	Flow from adjacent watershed
27A	0.33(6)	0.0	0.0005	86	2.0	0.26	Flow from ditch 27
28A	0.76(6)	0.0	0.0012	86	2.0	0.47	Flow from ditch 28

Culvert Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area ml2	Weighted CN	Design Storm in.	Peak Flow (q) cfs	Comments
29A	0.52(6)	0.0	0.0008	86	2.0	0.37	Flow from ditch 29
32	0.67	0.0	0.001	70	2.0	0.2	Flow from ditch 32 (conservative estimate of runoff to culvert 32)
33A(10)	5.7(7)	0.0	0.0089	70	2.0	1.46	Flow from adjacent watershed
33B	5.8(7)	2.7	0.0133	72	2.0	2.56	Flow from adjacent watershed
34A	0.37	0.32	0.0011	83	2.0	0.56	Flow from ditch 34
35A	0.29	20.04	0.0318	75	2.0	8.1	Flow from adjacent watershed
37A	0.12	5.38	0.0086	75	2.0	2.4	Flow from adjacent watershed
38A	0.94	1.04	0.0031	82	2.0	1.5	Flow from adjacent watershed
39A	0.0	0.63	0.001	75	2.0	0.31	Flow from ditch 39
40A	0.15	0.0	0.0002	90	2.0	0.11	Flow from ditch 40
41A	1.9	0.0	0.0030	90	2.1	2.2	Flow from ditch 41
42A(17)	0.4	0.0	0.0006	90	2.1	0.4	Flow from ditch 42A
42B	0.4	0.0	0.0006	90	2.1	0.4	Flow from ditch 42A
42C	0.8	0.0	0.0012	90	2.1	0.9	Flow from ditch 42B
42D	0.9	0.0	0.0014	90	2.1	1.0	Flow from ditch 42C
42	0.9	0.0	0.0014	90	2.1	1.0	Flow from ditch 42D
42F	0.9	0.0	0.0014	90	2.1	1.0	Flow from ditch 42D
46A	0.1	0.39	0.0008	78	0.9	0.02	Flow from ditch 46
46B	0.0	13.2	0.0206	75	2.1	6.2	Flow from culvert 46A (0.02 cfs) and adjacent watershed (6.18 cfs)
47A	0.6	14.7	0.0239	76	0.9	0.13	Flow from ditch 47
48A	0.4	5.6	0.0094	76	0.9	0.06	Flow from ditch 48
52A	0.5	2.3	0.0044	78	0.9	0.07	Flow from ditch 52 (0.04 cfs) and ditch 53 (0.03 cfs)
54A	1.2	0.0	0.0019	90	2.1	1.4	Flow from adjacent watershed
55A	3.1	0.7	0.0059	87	2.6	1.1	Flow from adjacent watershed (previously identified as downspout #2)
56A	1.8	0.0	0.0028	90	2.6	0.8	Flow from adjacent watershed (previously identified as downspout #1)
57A	1.0	0.8	0.0028	83	2.1	1.6	Flow from adjacent watershed
57B	1.7	14.6	0.0255	77	2.1	8.4	Flow from ditch 57 - Disturbed area includes 0.6 acres with a conservative CN of 100
58A	1.0	26.5	0.0430	76	2.1	12.7	Flow from ditch 58 - Disturbed area includes 1.0 acres with a conservative CN of 100
59A	0.9	11.3	0.0191	77	2.1	6.4	Flow from adjacent watershed - Disturbed area includes 0.9 acres with a CN of 100

Culvert Number	Disturbed Area ac.	Undisturbed Area ac.	Total Area mi2	Weighted CN	Design Storm in.	Peak Flow (q) cfs	Comments
60A	0.5	2.9	0.0053	79	2.1	2.1	Flow from ditch 60 - Disturbed area includes 0.5 acres with a conservative CN of 100
61A	1.8	33.7	0.0555	78	2.1	17.2	Flow from ditch 61 (4.5 cfs) and culvert 58A (12.7 cfs) - Dist. area incl 0.8 ac with a CN=100
62A	0.7	11.7	0.0194	76	2.1	6.4	Flow from ditch 62 - Disturbed area includes 0.7 acres with a conservative CN of 100
63A	10.8	118.3	0.2017	76	2.1	58.3	Flow from adjacent watershed
64A	0.3	0.0	0.0005	90	2.1	0.37	Flow from ditch 64
65A	0.22	0.0	0.0003	90	2.1	0.27	Flow from ditch 65
66A	0.27	0.0	0.0004	90	2.1	0.33	Flow from ditch 66
67A	0.31	0.0	0.0005	90	2.1	0.37	Flow from ditch 67
68A	0.34	0.0	0.0005	90	2.1	0.41	Flow from ditch 68
69A	0.55	0.0	0.0009	90	2.1	0.65	Flow from ditch 69
69B	0.55	0.0	0.0009	90	2.1	0.65	Flow from ditch 69
70A	4.9	0.0	0.0077	90	2.1	5.7	Flow from ditch 70B(8)
70B	4.9	0.0	0.0077	90	2.1	5.7	Flow from ditch 70B(8)
70C	5.3	0.0	0.0083	90	2.1	6.1	Flow from ditch 70C
71A	0.7	0.0	0.0011	90	2.1	0.85	Flow from ditch 71B
71B	0.7	0.0	0.0011	90	2.1	0.85	Flow from ditch 71B
72A(18)	2.2	2.5	0.0073	84	2.6	5.7	Flow from ditch 72A
72B	2.4	5.3	0.0120	81	2.1(2)	7.2	Flow from ditch 72A (5.7 cfs) and adjacent watershed (1.5 cfs)
72C	2.4	5.3	0.0120	81	2.1(2)	7.2	Flow from ditch 72C
74A	0.3	0.0	0.0005	90	2.1	0.36	Flow from ditch 74A
74B	0.3	0.0	0.0005	90	2.1	0.36	Flow from ditch 74A
75A	0.8	0.0	0.0013	90	2.1	0.96	Flow from ditch 75A
75B	0.8	0.0	0.0013	90	2.1	0.96	Flow from ditch 75B
80A	5.1	40.9	0.0719	77	2.1	15.7	Flow from ditch 7E
80B	31.4(11)	35.2	0.1040	81	2.1	29.0	Flow from ditch 80A
82	3.3	0.0	0.0052	90	1.35	1.86	Flow from portion of Refuse Pile

GENERAL NOTE: Computerized SCS Unit Hydrograph Procedure printouts for each of the above referenced culverts where the flow is calculated from an adjacent watershed not part of the existing ditch system are presented in an Exhibit entitled "Diversion Ditch and Culvert Peak Flow Calculations"

(1) The design data shown in this table is a compiled summary representing the entire drainage for the respective culvert. For culverts fed solely by existing ditches, the data represents specific data for the ditch as presented in the table entitled "Diversion Ditch Peak Flow Design Data". When the culvert is fed by an adjacent watershed, the data represents data for the respective watershed. When an existing culvert is feed by both a ditch (or upstream culvert) and an adjacent watershed, then the data is a compilation of all tributary areas. In these cases the flow rate is given as a direct sum of the individual flow rates calculated for each contributing ditch, culvert or tributary area as shown in the comment section. In some cases where existing culverts, ditches and watersheds combine to produce a design flow rate, it was easier to recalculate the design flow from the entire watershed. In these cases the comment section will simply state that the flow was calculated from an adjacent watershed.

(2) Precipitation value used for Ditch 72A portion of flow is 2.6 inches.

(3) Two 12" dual culverts (downspouts) exist at this location.

(4) Dual culverts 18D & 18E are installed to handle this flow.

(5) Pond flows are for spillway capacities.

(6) Disturbed area consists of roadway and railroad ballast material (for which CN's of 95 and 70 were used respectively).

(7) Disturbed area consists of coal refuse pile area for which a CN of 70 was used.

(8) Design flow produced by using this downstream ditch is conservative.

(9) All disturbed area is from coal stock and refuse pile.

(10) Designed for 100 year - 6 hour runoff.

(11) Culverts designed to handle undisturbed area drainage tributary to Culvert 54A.

(12) Culverts designed to handle undisturbed area drainage tributary to Culvert 55A.

(13) Same inputs conservatively used to assess Culvert 7Ea

(14) Same inputs conservatively used to assess Culvert 10Da

(15) Same inputs conservatively used to assess Culvert 16Ba

(16) Same inputs conservatively used to assess Culvert 16Ea

(17) Same inputs conservatively used to assess Culvert 42Aa

(18) Same inputs conservatively used to assess Culvert 72Aa

(19) Same inputs used to assess Culvert 15Aa

TABLE 742c
Diversion Ditch Design Criteria

Ditch No.	Manning's n	Max Channel Slope (S max) ft/ft	Channel Side Slope (m)	Bottom Width (B) ft	Flow Depth (D) at S max ft	Flow Area at S max ft2	Wetted Perimeter at S max ft	Hydraulic Radius at S max ft	Vel at S max fps	Q cfs	Min Channel Slope (S min) ft/ft	Flow Depth (D) at S min ft/ft	Freeboard ft	Total Required Channel Depth ft	Comments
3	0.03	0.19	1.5	1	0.12	0.14	1.42	0.1	4.5	0.61	0.053	0.17	0.5	0.7	No lining required.
4	0.03	0.44	2	0	0.14	0.04	0.65	0.06	5.3	0.22	0.09	0.19	0.5	0.7	Lining required, Riprap D50 = 0.75 ft.
5	0.0352	0.14	1	2	0.18	0.38	2.49	0.15	5.3	2.01	0.05	0.24	0.6	0.8	Lining required, Riprap D50 = 0.50 ft.
6A	0.0395	0.158	1.5	0	0.5	0.38	1.81	0.21	5.3	2	0.083	0.57	0.4	1.0	Lining required, Riprap D50 = 1.0'.
6B	0.03	0.059	1.3	2.5	0.34	1.01	3.63	0.28	5.1	5.2	0.018	0.48	1.0	1.5	Lining required where erosion occurs, D50 = 0.50 ft.
6C(15)	0.03	0.02	2	2.5	0.84	3.51	6.26	0.56	4.8	16.8	0.01	1.0	0.5	1.5	No lining required.
7A	0.03	0.11	0	2.3	0.07	0.15	2.43	0.06	2.6	0.4	0.032	0.1	0.9	1.0	No lining required.
7B	0.03	0.077	1.5	0	0.35	0.19	1.27	0.15	3.8	0.71	0.042	0.39	0.5	0.9	No lining required.
7C	0.03	0.091	1.5	0	0.44	0.29	1.59	0.18	4.8	1.4	0.022	0.57	0.5	1.1	No lining required.
7D	0.03	0.143	0	4	0.14	0.57	4.28	0.13	4.9	2.8	0.111	0.15	0.8	1.0	No lining required.
7E(14)	0.03	0.143	0	2.7	0.21	0.56	3.12	0.18	6	3.4	0.04	0.31	0.7	1.0	No lining required, have received variance since channel has already eroded to bedrock.
7G(15)	0.03	0.01	2	0	0.92	1.69	4.11	0.41	2.7	6.1	0.01	0.92	0.58	1.5	No Lining Required.
7H(15)	0.03	0.2	2	3	0.19	0.64	3.85	0.17	5.3	3.4	0.067	0.23	0.5	0.75	Lining required, Riprap D50 = 0.75 ft for 20 % Slopes
8(15)	0.03	0.12	5.3(15)	0.1	0.23	0.3	2.6	0.12	4.1	1.2	0.08	0.25	0.5	0.8	No lining required.
9A	0.035	0.045	1	2	2.5	11.25	9.07	1.24	10.4	117	0.03	2.8	0.7	3.5	Lining required, grouted riprap D50 = 1.25 ft.
9B	0.024	0.2	-	-	1.5	4.77	5.71	0.84	24.7	118	0.07	1.92	0.6	2.5	Lining required, 60" half round CMP in place .
9C	0.015	0.07	5	9	0.61	7.31	15.2	0.48	16.1	118	0.04	0.71	1.0	1.7	Swale crossing with concrete lining
10A	0.03	0.03	3	0	0.89	2.38	5.63	0.42	4.83	11.5	-	-	0.6	1.5	Lining required at designated locations, D50 = 0.50 ft.
10B	0.03	0.02	3	0	1.01	3.04	6.36	0.48	4.28	13	-	-	1	2.0	No lining required.
10C	0.03	0.027	3	0	0.96	2.79	6.1	0.46	4.83	13.5	0.0026	1.5	0.5	2.0	No lining required.
10D	0.03	0.02	3	0	1.1	3.65	6.98	0.52	4.55	16.6	0.004	1.49	1	2.5	No lining required.
11	0.03	0.5	1.5	1	0.07	0.08	1.24	0.06	5.4	0.4	0.02	0.17	0.5	0.7	Lining required at designated locations, D50 = 0.75 ft.
12	0.03	0.143	1.5	2.5	0.19	0.53	3.17	0.17	5.7	3	0.02	0.34	0.6	1.0	Lining required at designated locations, D50 = 0.50 ft.
14(14)	0.023	0.26	Half-round dia = 54"		1.04	2.78	4.5	0.62	22.4	62	0.05	1.53	0.7	2.25	Lining required, 54 inch half round CMP in place.
15A(1)	0.03	0.13	*	0	0.17	0.12	1.46	0.08	3.3	0.39	0.11	0.17	0.6	0.75	No lining required.
15B	0.03	0.1	2	0	0.24	0.12	1.07	0.11	3.4	0.39	0.1	0.24	0.5	0.75	No lining required.
UT15	0.03	0.025	*	*	0.2	1.46	8.19	0.18	2.5	3.7	0.025	0.2	0.55	0.75	No lining required.

Ditch No	Manning's n	Max Channel Slope (S max) ft/ft	Channel Side Slope (m)	Bottom Width (B) ft	Flow Depth (D) at S max ft	Flow Area at S max ft2	Wetted Perimeter at S max ft	Hydraulic Radius at S max ft	Vel at S max fps	Q cfs	Min Channel Slope (S min) ft/ft	Flow Depth (D) at S min ft/ft	Freeboard ft	Total Required Channel Depth ft	Comments
16Ba	0.022	0.10	2	1.0	0.18	0.25	1.81	0.14	5.7	1.4	0.04	0.23	0.5	0.75	Rough concrete lining in place
16Ea	0.022	0.10	2(16)	1.0	0.18	0.25	1.83	0.14	5.6	1.4	0.04	0.23	0.5	0.75	Rough concrete lining in place
16(13)	0.03	0.06	4(16)	0.1	0.3	0.39	2.62	0.15	3.6	1.4	0.04	0.33	0.5	0.8	No lining required, Riprap installed with D50 = 0.6 ft
UT16	0.03	0.02	*	*	0.21	1.31	6.61	0.2	2.4	3.1	0.015	0.23	0.52	0.75	No lining required
17A(2)	0.03	0.1	2	0	0.18	0.07	0.82	0.08	3	0.24	0.05	0.21	0.5	0.7	No lining required
17B	0.03	0.1	2	1	0.23	0.34	2.03	0.17	4.7	1.6(3)	0.05	0.28	0.5	0.8	No lining required.
18A	0.03	0.019	1.5	0	0.62	0.58	2.24	0.26	2.8	1.6	0.003	0.88	0.5	1.4	No lining required.
18B	0.03	0.005	1.5	0	0.43	0.27	1.53	0.18	1.1	0.3	0.005	0.43	0.6	1.0	No lining required.
18C	0.03	0.05	1.5	0	0.57	0.49	2.07	0.24	4.3	2.1	0.038	0.6	0.5	1.1	No lining required
18D	0.03	0.085	1.5	3	0.17	0.54	3.6	0.15	4.1	2.2	0.022	0.25	0.5	0.8	No lining required
18E	0.03	0.12	1.5	3	0.15	0.48	3.54	0.14	4.55	2.2	0.05	0.19	0.8	1.0	No lining required.
20	0.0369	0.22	1.5	3	0.13	0.43	3.48	0.12	4.7	2	0.06	0.2	0.8	1.0	Lining required, riprap liner D50 = 0.67 ft in place
21	0.01	0.12	3	2	0.08	0.17	2.49	0.07	8.7	1.5	0.1	0.08	0.4	0.5	Lining required, conveyor belt liner in place.
22	0.03	0.22	2	1	0.12	0.15	1.52	0.1	4.8	0.7	0.13	0.14	0.8	1.0	No lining required.
23	0.03	0.12	2	0	0.25	0.13	1.12	0.11	4	0.5	0.09	0.26	0.5	0.8	No lining required.
24	0.01	0.091	1	2	0.27	0.62	2.77	0.22	16.6	10.3	0.029	0.38	1.1	1.5	Lining required, conveyor belt liner in place
25	0.03	0.14	2	0	0.24	0.12	1.09	0.11	4.2	0.5	0.02	0.35	0.5	0.9	No lining required
26	0.03	0.4	2	0	0.12	0.03	0.55	0.06	4.6	0.14	0.08	0.17	0.5	0.7	Lining required where erosion occurs, D50 = 0.75 ft
27	0.025	0.008	25&1.5	0	0.15	0.29	3.97	0.07	0.9	0.26	-	-	0.85	1.0	No lining required
28	0.025	0.008	25&1.5	0	0.18	0.44	4.89	0.09	1.09	0.47	-	-	0.82	1.0	No lining required
29	0.025	0.008	25&1.5	0	0.17	0.38	4.54	0.08	0.97	0.37	-	-	0.83	1.0	No lining required
30	0.025	0.008	25&1.5	0	0.19	0.48	5.1	0.09	1.09	0.52	-	-	0.81	1.0	No lining required
32(15)	0.03	0.1	2.6(16)	0.6	0.09	0.07	1.11	0.07	2.7	0.2	0.1	0.09	0.5	0.6	No lining required
33(15)	0.03	0.06	6.7(16)	0.6	0.07	0.07	1.56	0.05	1.6	0.12	0.06	0.07	0.5	0.6	Lining required, riprap D50 = 1.0 ft
34	0.025	0.057	1.5	2	0.09	0.2	2.32	0.09	2.7	0.56	-	-	0.91	1.0	No lining required
35	0.025	0.005	1	0	0.46	0.21	1.3	0.16	1.25	0.26	-	-	1.04	1.5	No lining required
36	0.025	0.005	1	0	0.41	0.16	1.13	0.14	1.15	0.19	-	-	0.99	1.4	No lining required.
37	0.025	0.074	1	0	0.31	0.09	0.85	0.11	3.7	0.35	-	-	0.99	1.3	No lining required.
38	0.025	0.074	1	2	0.13	0.28	4.96	0.06	3.9	1.09	-	-	1.07	1.2	No lining required
39	0.025	0.074	1	0	0.16	0.03	0.49	0.06	2.58	0.06	-	-	1.04	1.2	No lining required
40	0.025	0.208	50&1	0	0.05	0.05	2.28	0.03	2.15	0.11	-	-	0.95	1.0	No lining required

Ditch No.	Manning's n	Max Channel Slope (S max) ft/ft	Channel Side Slope (m)	Bottom Width (B) ft	Flow Depth (D) at S max ft	Flow Area at S max ft2	Wetted Perimeter at S max ft	Hydraulic Radius at S max ft	Vel at S max fps	Q cfs	Min Channel Slope (S min) ft/ft	Flow Depth (D) at S min ft/ft	Freeboard ft	Total Required Channel Depth ft	Comments
41	0.03	0.029	3	0	0.48	0.7	3.05	0.23	3.15	2.2	-	-	1	1.5	No lining required.
42A	0.03	0.1	3	0	0.2	0.12	1.28	0.1	3.28	0.4	-	-	0.8	1.0	No lining required.
42B	0.03	0.1	3	0	0.27	0.22	1.73	0.13	4.01	0.9	-	-	0.7	1.0	No lining required.
42C	0.03	0.075	3	0	0.3	0.27	1.9	0.14	3.7	1	-	-	0.7	1.0	No lining required.
42D	0.03	0.05	3	0	0.32	0.31	2.05	0.15	3.18	1	-	-	0.7	1.0	No lining required.
43	0.03	0.08	2(4)	0	0.22	0.41	3.8	0.11	3.2	1.3	-	-	0.5	0.75	No lining required.
44A	0.022	0.02	2	2	0.20	0.48	2.90	0.17	2.90	1.4	-	-	0.5	0.70	Rough concrete lining in place.
44B	0.03	0.02	2	0	0.51	0.53	2.28	0.23	2.6	1.4	-	-	0.5	1.0	No lining required.
45	0.03	0.2	2(5)	0	0.11	0.07	1.35	0.05	3.1	0.22	-	-	0.6	0.75	No lining required.
46	0.03	0.005	30&0(6)	0	0.06	0.05	1.86	0.03	0.37	0.02	0.005	0.06	0.54	0.6(7)	No lining required.
47	0.03	0.05	30&0(6)	0	0.08	0.1	2.48	0.04	1.35	0.13	0.005	0.12	0.58	0.7(7)	No lining required.
48	0.03	0.06	30&0(6)	0	0.06	0.05	1.86	0.03	1.11	0.06	0.005	0.07	0.53	0.6(7)	No lining required.
49	0.03	0.11	30&0(6)	0	0.07	0.07	2.17	0.03	1.77	0.13	0.02	0.1	0.5	0.6(7)	No lining required.
50	0.03	0.085	30&0(6)	0	0.09	0.12	2.79	0.04	1.56	0.19	0.03	0.1	0.5	0.6(7)	No lining required.
51(17)	0.04	0.48	1.25	0.5	0.24	0.27	1.7	0.16	7.6	2.0	0.10	0.41	0.5	0.9	No lining recommended due to location.
52	0.03	0.01	30&0(6)	0	0.07	0.07	2.17	0.03	0.54	0.04	0.01	0.07	0.53	0.6(7)	No lining required.
53	0.03	0.055	30&0(6)	0	0.05	0.04	1.55	0.02	0.8	0.03	0.01	0.06	0.54	0.6(7)	No lining required.
57	0.035	0.09	2	2	0.23	0.55	3.01	0.18	4.1	2.3	0.09	0.23	0.52	0.75	No lining required.
58	0.030	0.1	2	2	0.19	0.46	2.86	0.16	4.6	3.0	0.07	0.26	0.49	0.75	No lining required.
59	0.03	0.08	*	0	0.33	1.27	6.15	0.21	4.9	6.1	0.05	0.36	0.44	0.8	No lining required.
60	0.03	0.03	*	*	0.35	0.61	2.45	0.25	3.4	2.1	0.01	0.48	0.52	1.0	No lining required.
61	0.03	0.015	*	*	1.26	4	5.43	0.74	4.3	17.2	0.015	1.26	0.44	1.7	No lining required.
62	0.03	0.02	*	*	0.48	1.9	5.47	0.35	3.4	6.4	0.01	0.58	0.52	1.1	No lining required.
63	0.03	0.03	*	*	0.47	1.81	5.41	0.33	4.1	15.9	0.03	0.47	0.53	1.0	No lining required.
64	0.03	0.12	2	0	0.22	0.1	0.98	0.1	3.7	0.37	0.12	0.22	0.58	0.8	No lining required.
65	0.03	0.11	2	0	0.2	0.08	0.89	0.09	3.4	0.27	0.11	0.2	0.5	0.7	No lining required.
66	0.03	0.12	2	0	0.21	0.09	0.96	0.1	3.7	0.33	0.12	0.21	0.59	0.8	No lining required.
67	0.03	0.12	2	0	0.22	0.1	1	0.1	3.7	0.37	0.12	0.22	0.58	0.8	No lining required.
68	0.03	0.12	2	0	0.23	0.11	1.04	0.1	3.8	0.41	0.12	0.23	0.57	0.8	No lining required.
69	0.03	0.09	2	0	0.29	0.17	1.3	0.13	3.8	0.65	0.09	0.29	0.51	0.8	No lining required.
70A	0.035(9)	0.095	1.8	0	0.64	0.74	2.64	0.28	5.6	4.1	0.095	0.64	0.56	1.2	Lining required, grouted riprap D50 = 0.75 ft.

Ditch No.	Manning's n	Max Channel Slope (S max) ft/ft	Channel Side Slope (m)	Bottom Width (B) ft	Flow Depth (D) at S max ft	Flow Area at S max ft2	Wetted Perimeter at S max ft	Hydraulic Radius at S max ft	Vel at S max fps	Q cfs	Min Channel Slope (S min) ft/ft	Flow Depth (D) at S min ft/ft	Freeboard ft	Total Required Channel Depth ft	Comments
70B	0.035	0.08	2	0	0.71	1.01	3.19	0.32	5.6	5.7	0.08	0.71	0.54	1.25	Lining required, grouted riprap D50 = 0.5 ft.
70C	0.035	0.11	2	0	0.69	0.95	3.09	0.31	6.4	6.1	0.11	0.69	0.56	1.25	Lining required, grouted riprap D50 = 0.75 ft.
71A	0.03	0.125	2	0	0.3	0.18	1.35	0.13	4.7	0.85	0.125	0.3	0.5	0.8	No lining required.
71B	0.03	0.125	2	0	0.3	0.18	1.35	0.13	4.7	0.85	0.125	0.3	0.5	0.8	No lining required.
72A(10)	0.038	0.29	2	3	0.13	0.42	3.58	0.12	5.5	2.3	0.06	0.42	0.98	1.4	Lining required, riprap D50 = 0.75 ft.
72B(11)	0.035	0.125	2	2	0.39	1.08	3.74	0.29	6.6	7.2	0.125	0.39	1.11	1.5	Lining required, riprap D50 = 0.5 ft.
72C(11)	0.035	0.065	2	2	0.47	1.38	4.1	0.34	5.2	7.2	0.065	0.47	1.03	1.5	Lining required, riprap D50 = 0.5 ft.
74A	0.03	0.09	*	*	0.12	0.12	1.24	0.09	3.1	0.36	0.09	0.12	0.48	0.6	No lining required.
74B	0.03	0.005	2	0	0.9	1.54	3.92	0.39	1.9	2.9	0.005	0.9	0.1	1.0	No lining required.
75A	0.03	0.83	2	0	0.34	0.23	1.53	0.15	4.1	0.96	0.05	0.38	0.62	1.0	No lining required.
75B	0.03	0.83	2	0	0.34	0.23	1.53	0.15	4.1	0.96	0.05	0.38	0.62	1.0	No lining required.
76(15)	0.03	0.12	6.3(16)	0.1	0.13	0.12	1.79	0.07	3	0.35	0.12	0.13	0.5	0.63	No lining required.
77	0.03	0.08	*	*	0.32	0.29	1.95	0.15	4.1	1.2	0.06	0.31	0.69	1.0	No lining required.
78	0.03	0.085	*	0	0.25	0.22	3.69	0.06	2.2	0.48	0.085	0.25	0.5	0.75	No lining required.
79	0.03	0.05	2	0	0.33	0.22	1.48	0.15	3	0.65	0.05	0.33	0.67	1.0	No lining required.
80A	0.038	0.065	2	6	0.62	4.52	8.79	0.51	6.4	29	0.05	0.67	0.33	1.0	Lining required, riprap D50 = 0.75 ft.
80B	0.03	0.01	10	10	0.62	10	22.4	0.45	2.9	29	0.01	0.62	0.38	1.0	No lining required.
80C	0.042	0.24	2	10	0.34	3.62	11.5	0.32	8	29	0.24	0.34	0.66	1.0	Lining required, riprap D50 = 2.0 ft
81	0.04	0.33	2	2	0.12	0.26	2.52	0.10	4.7	1.2	0.25	0.12	0.5	0.75	Lining required, riprap D50 = 1.0 ft

* Natural side slope and bottom width varies.
(1) Ditch design based on area tributary to ditch 15B.
(2) Ditch design taken from previous calculations for Ditch No. 17.
(3) Ditch 44 contributes 1.4 cfs of total 1.6 cfs reported by Ditch 17B.
(4) Channel consists of roadway and berm : $M_1 = 2$, $M_2 = 15$.
(5) Channel consists of roadway and berm : $M_1 = 2$, $M_2 = 10$.
(6) 0 indicates an assumed vertical side slope.
(7) Ditch depth accounted for by road and road berm.
(8)
(9) Mannings n for minimum slope is 0.03.
(15) Construction of this ditch is progressive as refuse pile is enlarged.
(17) Configuration varies throughout the channel length. For a complete set of data parameters see the Ditch Design details included in the Exhibits.

(10) Maximum channel slope design taken from west interceptor ditch from report entitled "Treatment of Underflow for Thickener Tank Using Settling Ponds." Minimum channel slope design taken from north interceptor ditch information given in same report. North interceptor ditch has a total flow rate of 5.7 cfs, S max = 0.115, n=0.035, b = 2, V max = 6.0 fps and a riprap D_{50} = 0.5 feet.
(11) Ditch design based on area tributary to ditch 72D.
(12)
(13) Includes Ditches 16A through 16F also designed for 100 Yr - 6 Hour Runoff.
(14) Data is based upon disturbed areas which existed prior to the construction of Pond 9. The construction of Pond 9 has reduced the total drainage area to this structure.
(15) Designed for 100 Year - 6 Hour Runoff.
(16) Averaged.

TABLE 742d
Culvert Design Criteria

Rev: 8/95

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Available(15) HW/D Ratio	Pipe Capacity cfs		Design Flow Rate (cfs)	Required* HW/D Ratio	Design Flow Depth (ft)	Design Velocity (fps)	Inlet/Outlet Conditions
					Inlet Conditions	Full Pipe Flow Conditions					
1A(12)	13	400(1)	N.A.	2.5	5.0	-.-(2)	1.20	0.6	-.-(2)	-.-(2)	Dropbox inlet/Connects to Culvert 2A
2A(13)	15	100(1)	N.A.	2.2	8.0	-.-(2)	0.63	<0.5	-.-(2)	-.-(2)	Dropbox inlet/Connects to Culvert 2B
2B(13)	15	170(1)	N.A.	N.A.	-.-(3)	-.-(2)	1.80	-.-(3)	-.-(2)	-.-(2)	Buried pipe/Connects to Culvert 2C
2C	13	180(1)	N.A.	1.9	5.2	-.-(2)	1.40	0.7	-.-(2)	-.-(2)	Dropbox inlet/Connects to Culvert 2D
2D	15	600(1)	N.A.	N.A.	-.-(3)	-.-(2)	3.20	-.-(3)	-.-(2)	-.-(2)	Buried pipe/Outlet to Rock/Rubble
4A	30(4)	245	0.1	2.0	38.0	70.6	11.00	0.7	0.52	20.2	Projecting inlet/Outlet to Rock/Rubble
5A	18(4)	180	0.10(4)	2.3	11.5	18.0	1.50	<0.5	0.29	6.3	Projecting inlet/Monitor Outlet (14)
5B	12	280	0.30(4)	1.7	3.5	10.6	4.30	2.2	0.44	12.9	Projecting inlet/Variance granted
6A	12	32	0.119	2.2	4.0	6.7	2.00	2.0	0.37	7.6	Projecting inlet/Monitor Outlet (14)
6B	18	560	0.367	1.4	17.0	23.8	16.70	1.4	0.74	19.2	Projecting inlet/Outlet to Rock Rubble
7A	27	61	0.03	1.6	28.5	32.0	0.84	<0.5	0.31	3.7	Projecting inlet/Outlet Vel < 5.0 fps
7B	21	50	0.071	1.1	9.5	22.9	1.40	<0.5	0.29	5.4	Projecting inlet/Monitor Outlet (14)
7E	24	40	0.068	2.8	27.0	32.0	3.00	<0.5	0.41	6.5	Projecting inlet/Rock placed in Pond 5
7Ea	24	80	0.01	3.0	28.0	12.3	3.4	<0.5	0.72	3.3	Projecting inlet/Outlet Vel <5.0 fps
7F	12	480(1)	0.19	1.0	2.1	8.4	1.80	1.0	0.32	8.5	Projecting inlet/D50 = 1.5 ft
8A	12	60(1)	0.32(5)	4.1	6.5	10.9	0.50	<0.5	0.15	6.8	Mitered inlet/Monitor Outlet (14)
9A	60	1570	0.031	1.9	240.0	248.4	117.00	1.0	2.40	12.6	Headwall inlet/Connects to 1/2 round CMP
10A	12	110	0.70(5)	3.3	6.5	16.2	0.54	<0.5	0.12	10.1	Headwall inlet/D50 = 0.5 ft in Sed. Trap 10
10B	15	34	0.021	1.4	5.0	5.1	0.80	<0.5	0.34	3.0	Projecting inlet/Outlet Vel < 5.0 fps
10C	24	80	0.001	2.2	23.0	13.0	13.00	1.1	2.00	4.1	Projecting inlet/Outlet Vel < 5.0 fps
10D	24	20	0.033	0.9	9.5	22.3	13.50	1.2	1.10	7.5	Projecting inlet/Monitor Outlet (14)
10Da	30	40	0.004	1.4	30	14.1	16.6	0.9	2.5	3.4	Projecting inlet/Outlet grouted
10	24	430(1)	0.233(5)	3.0	32.0	59.1	16.60	1.3	0.72	16.3	Projecting inlet/Outlet to Rock/Rubble
12A	24	73	0.3	1.6	19.0	67.1	3.00	<0.5	0.29	10.7	Mitered inlet/Outlet to Junction Box
12B	24	72	0.025	3.8	32.0	19.4	3.00	<0.5	0.53	4.5	Projecting inlet/Outlet Vel < 5.0 fps
15A	14	82	0.105	1.7	5.0	17.4	0.39	<0.5	0.12	6.7	Projecting Steel inlet/Monitor Outlet (14)

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Available(15) HW/D Ratio	Pipe Capacity cfs		Design Flow Rate (cfs)	Required* HW/D Ratio	Design Flow Depth (ft)	Design Velocity (fps)	Inlet/Outlet Conditions
					Inlet Conditions	Full Pipe Flow Conditions					
15Aa	15	34	0.04	1.8	6.8	10.5	0.39	<0.5	0.16	4.1	Projecting inlet/Outlet Vel <5.0 fps
15B	24	80	0.088	1.7	20.0	36.4	0.39	<0.5	0.15	3.6	Projecting inlet/Outlet Vel < 5.0 fps
16A	18	70	0.098	1.3	7.5	17.8	0.62	<0.5	0.19	4.8	Projecting inlet/Outlet Vel < 5.0 fps
16B	18	110	0.09	1.8	10.0	17.1	0.62	<0.5	0.19	4.8	Projecting inlet/Outlet Vel < 5.0 fps
16Ba	30	17	0.01	0.8	14.0	33.4	1.40	<0.5	0.33	3.4	Projecting inlet/Outlet Vel <5.0 fps
16C	15	56	0.085	2.3	7.5	10.2	0.62	<0.5	0.21	4.6	Projecting inlet/Outlet Vel < 5.0 fps
16D	18	90	0.024	3.9	16.0	8.8	0.62	<0.5	0.27	2.9	Projecting inlet/Outlet Vel < 5.0 fps
16Ea	18	50	0.10	0.7	3.0	18.0	1.4	<0.5	0.28	6.1	Projecting inlet/Grouted Outlet
16E	18	111	0.07	2.1	11.0	15.1	0.62	<0.5	0.21	4.1	Projecting inlet/Outlet Vel < 5.0 fps
16F	18	167	0.066	2.2	11.5	14.6	0.62	<0.5	0.21	4.1	Projecting inlet/Outlet Vel < 5.0 fps
16G	18	140(1)	0.17	2.1	11.0	23.5	1.90	0.5	0.29	7.9	Projecting inlet/Outlet to Rock Rubble
UT16A	12	49	0.006	1.0	2.1	1.5	0.77	0.5	0.51	1.9	Projecting inlet/Outlet Vel < 5.0 fps
UT16B	18	26	0.012	2.3	12.0	6.2	0.50	<0.5	0.29	2.1	Projecting inlet/Outlet Vel < 5.0 fps
UT16C	12	25	0.008	2.5	4.5	1.7	1.30	0.8	0.63	2.4	Projecting inlet/Outlet Vel < 5.0 fps
UT16D	24	41	0.04	1.1	13.0	24.5	3.10	<0.5	0.48	5.4	Projecting inlet/Monitor Outlet (14)
17A	18	40	0.098	1.6	10.5	17.8	2.00	<0.5	0.30	6.4	Projecting inlet/Monitor Outlet (14)
17B	12	20	0.14	1.4	3.0	7.2	1.60	0.9	0.32	7.4	Projecting inlet/Outlet to Rock/Rubble
18A	12	54	0.016	2.0	4.0	2.4	1.90	1.0	0.66	3.5	Projecting inlet/Outlet Vel < 5.0 fps
18B	18	20	0.042	3.5	15.0	11.7	2.10	0.5	0.43	5.0	Projecting inlet/Monitor Outlet (14)
18C	12(6)	160	0.40(5)	1.3	5.2(7)	24.4(7)	2.20	0.7	0.20	9.8	Projecting inlet/Outlet to D50 = 0.5 ft
18D	15	20	0.065	1.0	3.5	8.9	0.91(8)	<0.5	0.27	4.8	Projecting inlet/Outlet Vel < 5.0 fps
18	12	20	0.07	1.7	3.5	5.1	0.79(8)	0.5	0.27	4.7	Projecting inlet/Outlet Vel < 5.0 fps
21A	15	120	0.26	1.7	6.0	17.8	1.50	0.6	0.24	9.1	Projecting inlet/Outlet to D50 = 0.5 ft
22A	24	38	0.132	0.5	3.5	22.3	0.70	<0.5	0.18	5.0	Half round CMP pipe/Outlet to Belt Liner
23A	18	81	0.105	1.1	6.0	18.4	0.50	<0.5	0.17	4.5	Projecting inlet/Outlet Vel < 5.0 fps
23B	30(4)	590	0.057(4)	4.3	60.0	53.0	16.40	0.9	0.95	9.6	Projecting inlet/Outlet to D50 = 0.75 ft
25A	12	160	0.55(1)	2.0	4.0	14.3	0.50	<0.5	0.13	8.3	Projecting inlet/Monitor Outlet (14)
25B	60	572	0.094	6.6	350.0	432.5	43.80	0.6	1.10	13.7	Projecting inlet/Outlet to D50 = 1.5 ft
25C	60	340	0.02(9)	1.2	150.0	199.5	117.10	1.4	2.80	10.4	Mitered inlet/Outlet to D50 = 1.25 ft

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Available(15) HW/D Ratio	Pipe Capacity cf.		Design Flow Rate (cfs)	Required* HW/D Ratio	Design Flow Depth (ft)	Design Velocity (fps)	Inlet/Outlet Conditions
					Inlet Conditions	Full Pipe Flow Conditions					
26A	12	75	0.314	3.2	5.0	10.8	0.14	<0.5	0.08	4.8	Projecting inlet/Outlet Vel < 5.0 fps
26B	30(4)	420	0.139	2.0	37.0	82.8	5.70	<0.5	0.44	9.8	Projecting inlet/Outlet to D50 = 1.5 ft
27A	12	100(1)	0.57(5)	3.7	6.5	14.6	0.26	<0.5	0.09	7.4	Dropbox inlet/Connects to RR Culvert
28A	12	120(1)	0.57(5)	3.5	6.5	14.6	0.47	<0.5	0.12	8.8	Dropbox inlet/Monitor Outlet (14)
29A	12	60(1)	0.57(5)	3.7	6.5	14.6	0.37	<0.5	0.11	7.9	Dropbox inlet/Monitor Outlet (14)
32	12	137	0.042	2.0	4.5	5.9	0.20	<0.5	0.13	3.5	Dropbox inlet/Outlet to Culvert 16F
33A	12	41	0.187	2.6	4.5	8.3	1.20	0.7	0.26	7.4	Mitered inlet/Monitor Outlet (14)
33B	18	40	0.02	3.3	14.0	8.0	2.30	0.6	0.55	3.9	Projecting inlet/Outlet Vel < 5.0 fps
4A	12	160(1)	0.57(5)	1.0	2.0	14.6	0.56	<0.5	0.14	8.4	Mitered inlet/Outlet to Rock/Rubble
35A	30	164	0.093	1.5	30.0	67.8	8.10	0.6	0.58	9.4	Projecting inlet/Outlet to Belt Liner
37A	24	90	0.18(5)	2.0	22.0	52.0	2.40	<0.5	0.29	8.5	Projecting inlet/Outlet to D50 = 0.5 ft
38A	18	45	0.095	3.0	14.0	17.5	0.80	<0.5	0.22	5.0	Projecting inlet/Outlet Vel < 5.0 fps
39A	18	31	0.038	2.7	12.0	11.1	0.31	<0.5	0.17	2.8	Projecting inlet/Outlet Vel < 5.0 fps
40A	12	9(4)	0.218	1.1	2.5	9.0	0.11	<0.5	0.08	3.7	Mitered inlet/Outlet Vel < 5.0 fps
41A	18	90(1)	0.65(5)	1.1	2.4	45.9	2.20	0.6	0.22	13.7	Projecting inlet/Outlet to D50 = 0.5 ft
42A	12	40	0.008	2.0	4.5	2.6	0.40	<0.5	0.26	2.4	Dropbox inlet/Outlet Vel <5.0 fps (18)
42Aa	12	35	0.30	1.5	3.2	10.6	0.4	<0.5	0.13	6.5	Projecting inlet/Rock Rubble Outlet
42B	18	27	0.117	1.6	9.5	19.5	0.40	<0.5	0.15	4.4	Projecting inlet/Outlet Vel < 5.0 fps
42C	18	75	0.069	2.0	11.0	27.6	0.90	<0.5	0.19	6.9	Projecting Steel inlet/Monitor Outlet (14)
42D	12	26	0.032	2.4	4.5	3.5	1.00	0.6	0.37	3.8	Projecting inlet/Outlet Vel < 5.0 fps
42	18	36	0.061	1.3	8.0	14.1	1.00	<0.5	0.27	4.6	Projecting inlet/Outlet Vel < 5.0 fps
42F	18	57	0.075	2.7	13.0	15.6	1.00	<0.5	0.26	4.9	Projecting inlet/Outlet Vel < 5.0 fps
46A	15	160(1)	0.45(4)	1.6	6.0	23.5	0.0(10)	-.-	0.00	0.0	Projecting inlet/Outlet to Rock/Rubble
46B	30(4)	400	0.176	3.4	53.0	93.2	6.20	<0.5	0.44	10.7	Projecting inlet/Outlet D50 = 1.5 ft
47A	15	60	0.65(5)	1.9	6.5	28.2	0.13	<0.5	0.06	5.6	Projecting inlet/Outlet to Rock/Rubble
48A(11)	12	200	0.70(1)	1.2	2.8	16.1	0.06	<0.5	0.05	4.1	Projecting inlet/Outlet to Rock/Rubble
52A	15	21(4)	0.09(4)	2.1	6.5	10.5	0.07	<0.5	0.07	2.4	Projecting inlet/Outlet Vel < 5.0 fps
54A	12	370(1)	0.65(1)	3.5	5.5	15.6	1.40	0.8	0.20	12.5	Dropbox inlet/Outlet to Rock/Rubble
55A	15	430(1)	0.58(1)	4.8	11.5	26.6	1.10	<0.5	0.17	11.0	Dropbox inlet/Outlet to Rock/Rubble
56A	15	380(1)	0.66(1)	2.4	7.5	28.4	0.80	<0.5	0.15	9.6	Dropbox inlet/Outlet to Rock/Rubble

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Available(15) HW/D Ratio	Pipe Capacity cfs		Design Flow Rate (cfs)	Required* HW/D Ratio	Design Flow Depth (ft)	Design Velocity (fps)	Inlet/Outlet Conditions
					Inlet Conditions	Full Pipe Flow Conditions					
57A	12	20(4)	0.1	1.1	2.3	6.1	1.60	0.9	0.35	6.5	Projecting inlet/Monitor Outlet (14)
57B	30	380	0.085	1.4	29.0	64.8	8.40	0.6	0.61	9.1	Grated inlet/Outlet to Rock Draw
58A	24	160	0.094	1.6	19.0	37.6	12.70	1.1	0.80	10.8	Grated inlet/Outlet to Rock Draw
59A	15	147	0.139	3.2	9.0	13.0	6.10	1.8	0.60	10.5	Grated inlet/Outlet to Rock Ledge
60A	24	71	0.093	1.9	21.0	37.4	2.10	<0.5	0.32	6.5	Grated inlet/Outlet to Rock Ledge
61A	24	48	0.074	1.9	21.0	33.3	17.20	1.5	1.00	10.7	Grated inlet/Outlet to Rock Ledge
62A	24	310	0.096	1.9	21.0	38.0	6.40	0.7	0.56	9.0	Grated inlet/Outlet to Rock/Rubble
63A	42	220	0.091	2.4	100.0	164.4	58.30	1.3	1.40	16.2	Projecting inlet/Outlet to Belt Liner
64A	15	24	0.082	0.6	1.6	10.0	0.37	<0.5	0.17	3.7	Projecting inlet/Outlet Vel < 5.0 fps
65A	13	20	0.103	1.4	3.5	14.2	0.27	<0.5	0.10	6.3	Projecting Steel inlet/Outlet to Culvert
66A	13	26	0.068	1.4	3.5	11.5	0.33	<0.5	0.12	5.9	Projecting Steel inlet/Monitor Outlet (14)
67A	13	21	0.087	1.1	2.8	13.0	0.37	<0.5	0.12	5.9	Projecting Steel inlet/Monitor Outlet (14)
68A	13	34	0.082	1.0	2.4	12.6	0.41	<0.5	0.13	6.6	Projecting Steel inlet/Monitor Outlet (14)
69A	13	45	0.061	1.1	2.8	10.9	0.65	<0.5	0.18	6.5	Projecting Steel inlet/Monitor Outlet (14)
69B	13	62	0.073	1.1	2.8	11.9	0.65	<0.5	0.17	7.0	Projecting Steel inlet/Monitor Outlet (14)
70A	18	27	0.109	1.4	8.0	18.8	5.70	1.1	0.56	9.5	Projecting inlet/Outlet D50 = 0.5 ft
70B	18	102	0.119	2.7	13.0	19.6	5.70	1.1	0.55	9.7	Projecting inlet/Outlet D50 = 0.5 ft
70C	18	265	0.101	1.3	7.5	18.1	6.10	1.1	0.60	9.2	Projecting inlet/Monitor Outlet (14)
71A	12	40	0.168	2.5	4.5	7.9	0.85	0.6	0.22	6.6	Projecting inlet/Monitor Outlet (14)
71B	12	40	0.091	1.0	2.0	5.8	0.85	0.6	0.26	5.2	Projecting inlet/Monitor Outlet (14)
72A	18	80	0.07	2.0	11.0	15.1	5.70	1.1	0.64	7.9	Projecting inlet/Monitor Outlet (14)
72Aa	12	53	0.01	6.5	8.0	2.7	2.20	1.1	0.70	3.90	Projecting inlet/Outlet Vel <5.0 fps
72B(17)	18	80	0.077	2.0	11.0	15.8	7.20	1.3	0.71	8.7	Projecting inlet/Outlet D50 = 0.5 ft
72C	18	102	0.08	2.8	13.0	16.1	7.20	1.3	0.70	8.9	Projecting inlet/Outlet D50 = 0.5 ft
74A	10	22	0.069	1.8	2.4	5.8	0.36	<0.5	0.14	6.0	Projecting Steel inlet/Monitor Outlet (14)
74B(16)	12	250	0.031	3.0	5.0	3.4	0.36	<0.5	0.17	4.1	Projecting inlet/Outlet Vel < 5.0 fps
75A	18	54	0.06	1.3	8.0	13.9	0.96	<0.5	0.27	4.4	Projecting inlet/Outlet Vel < 5.0 fps
75B	18	290(1)	0.362(5)	2.9	14.0	34.2	0.96	<0.5	0.17	8.7	Headwall inlet/Monitor Outlet (14)
80A	24	67	0.25	1.8	20.0	61.0	15.70	1.3	0.80	14.2	Projecting Steel inlet/Outlet D50 = 1.5 ft
80B	30	55	0.22	2.0	39.0	104.0	29.00	1.4	1.10	15.3	Projecting Steel inlet/Outlet D50 = 1.5 ft

Culvert No.	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Available(15) HW/D Ratio	Pipe Capacity cfs		Design Flow Rate (cfs)	Required* HW/D Ratio	Design Flow Depth (ft)	Design Velocity (fps)	Inlet/Outlet Conditions
					Inlet Conditions	Full Pipe Flow Conditions					
81	27	200	0.20	2.0	24.0	75.0	24.0	1.5	0.9	5.1	Projecting Steel inlet/Outlet Vel 5.1 fps
82	27	42	0.034	2.1	31.0	14.4	1.86	<0.5	0.31	5.6	Projecting Steel inlet/Monitor Outlet (14)

GENERAL NOTE: Two types of pipes were identified at CPMC (CMP and Steel). Mannings n used in the above calculations for CMP and Steel are 0.024 and 0.013 respectively. All culverts are CMP unless specified in the comment section. Revised:11/95

* Required HW/D ratio is that required to hydraulically pass the given design flow rate. All culverts should maintain an additional freeboard of approximately 0.5 feet.

N.A. Data not available.

(1) Measured from available mapping.

(2) As constructed slope information is not available and hence the calculation of this information is not possible.

(3) Continuous pipe section, Inlet flow not applicable.

(4) Based on short entrance section before steepening into downspout section.

(5) Average slope of pipe.

(6) Two 12" dual culverts (downspouts) exist at this location.

(7) Combined capacity for dual pipe system.

(8) Combined capacity of dual culverts 18D and 18E is 1.7 cfs.

(9) Minimum slope measured at culvert exit.

(10) Calculated runoff rate is less than degree of significance.

(11) Not yet installed - Some data unavailable.

(12) Designed to handle undisturbed area drainage tributary to Culvert 54A.

(13) Designed to handle undisturbed area drainage tributary to Culvert 55A.

(14) Calculated Riprap D_{50} is less than 0.5 feet. Monitor channel and install riprap below culvert outlet if significant erosion occurs.

(15) Does not include Freeboard.

(16) 12" replaced by oversized 24"

(17) 18" replaced by oversized 32"

(18) Culvert has two 40-foot long segments and two drop inlets; upper segment has a slope of 7.75% and lower segment has slope of 0.82%. Most conservative segment used in design.

Attachment to:

Exhibit 732.300 B

MRP Amendment Nov., 1995

13-782 500 SHEETS, FILLER 5 SQUARE
42-381 50 SHEETS EYE-EASE® 5 SQUARE
42-382 100 SHEETS EYE-EASE® 5 SQUARE
42-389 200 SHEETS EYE-EASE® 5 SQUARE
42-392 100 RECYCLED WHITE 5 SQUARE
42-398 200 RECYCLED WHITE 5 SQUARE
Made in U.S.A.
National® Brand

Exhibit 732.300 b

Amendment to reflect runoff + sediment control features already installed on site.

1 Tasks

1) Identify features on the ground (culverts and ditches) which have not been incorporated in MRP.

2) Measure and describe features sufficiently to assess adequacy + demonstrate after-the-fact design parameters.

3) Revise maps, MRP text to reflect features

4) Perform any needed calculations to demonstrate designs.

2 Technique

Since most new features are in-line or within areas + structures for which designs have been done, use previously generated design information wherever possible.

Use most relevant previously generated design peak flows - which are either exactly relevant (same drainage area, same basin characteristics), or that will reflect a conservative design (previously calc'd design flow reflects a larger, but similar characteristic area than than the new structure needs to pass).

Run hydraulic calculations using same methods as previous MRP information was generated with, based on field measurements. Where exact information is not available, use conservative best estimate based on available info. (e.g. culvert grades taken to be same as inline ditch)

3 Structures addressed

Ditches

9C : concrete swale crossing placed at road crossing in Sagebrush Canyon creek below 9B. Used design peak equal to that of 9B

16Ba : grouted ditch placed to direct a portion of runoff

that previously entered 16B directly. Used design flow equal to that for which 16B was designed (very conservative).

16Ea: Similar to 16Ba: 16Ea captures a portion of the runoff that used to drain directly to 16E. Used conservative design flow for 16E

44A: Original ditch 44 renamed to 44A + 44B. Rough concrete placed in the upper reach of 44, so that portion named 44A with same design flow as previous 44. (Lower reach simply renamed 44B, no additional work needed)

Culverts

7Ea: Inline w/ existing ditch 7E, so used that design peak

10Da: Use flow from 10D - inline

15Aa: Inline with existing ditch 15A; used that design peak

16Ba + 16Ea: placed along with new ditches 16Ba + 16Ea use same flows - conservative

32: use peak from ditch 32 as conservative max

42Aa: use over-estimate, conservative flow from 42A

42A: use over-estimate, conservative flow of previous 42A

72Aa: Inline w/ existing 72A use same peak

72B: culvert enlarged - oversize so no new design info generated.

UT16A: culvert extended at inlet end. Same configuration, except assume less HW due to topographic constraints, so generated new designs.

(4) "Designs": All are adequately sized as installed - see attached printouts

Exhibit 72.3006

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 13:23:00

ROJECT TITLE: Plateau Ditch 9C (concrete swale crossing at Sagebrush Creek)

HANNEL ROUGHNESS IS KNOWN

ORMAL FLOW CONDITIONS:

LOW DEPTH IN FT	=	.6074178
LOW RATE IN CFS	=	118
LOW AREA IN SQ FT	=	7.311922
ANNING ROUGHNESS	=	.015
LOW VELOCITY IN FPS	=	16.13803
HANNEL SLOPE FT/FT	=	.07 (maximum slope)
ETTED PERIMETER IN FT	=	15.19574
OTTOM WIDTH IN FT	=	9
OP WIDTH IN FT	=	15.07418
LOW FROUDE NUMBER	=	4.083416
IGHT SIDE SLOPE	=	5
EFT SIDE SLOPE	=	5

RITICAL FLOW CONDITIONS:

EPTH IN FT	=	1.354479
FLOW AREA IN SQ FT	=	21.36338
FLOW VELOCITY IN FPS	=	5.52347
WETTED PERIMETER IN FT	=	22.81303
SLOPE IN FT/FT	=	3.374824E-03

Exhibit 732.300L

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 13:23:48

ROJECT TITLE: Plateau Ditch 9C (concrete swale crossing at Sagebrush Creek)

HANNEL ROUGHNESS IS KNOWN

ORMAL FLOW CONDITIONS:

LOW DEPTH IN FT	=	.7078989
LOW RATE IN CFS	=	118
LOW AREA IN SQ FT	=	8.877495
ANNING ROUGHNESS	=	.015
LOW VELOCITY IN FPS	=	13.29204
HANNEL SLOPE FT/FT	=	.04 (minimum slope)
ETTED PERIMETER IN FT	=	16.22149
OTTOM WIDTH IN FT	=	9
OP WIDTH IN FT	=	16.07899
LOW FROUDE NUMBER	=	3.152447
IGHT SIDE SLOPE	=	5
EFT SIDE SLOPE	=	5

RITICAL FLOW CONDITIONS:

EPTH IN FT	=	1.354479
LOW AREA IN SQ FT	=	21.36338
LOW VELOCITY IN FPS	=	5.52347
ETTED PERIMETER IN FT	=	22.81303
LOPE IN FT/FT	=	3.374824E-03

Exhibit 732.3006

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 13:30:20

ROJECT TITLE: Plateau Ditch 44A (Grouted reach of original Ditch 44)

HANNEL ROUGHNESS IS KNOWN

ORMAL FLOW CONDITIONS:

LOW DEPTH IN FT	=	.2010214
LOW RATE IN CFS	=	1.4
LOW AREA IN SQ FT	=	.4827999
ANNING ROUGHNESS	=	.022
LOW VELOCITY IN FPS	=	2.899752
HANNEL SLOPE FT/FT	=	.02
ETTED PERIMETER IN FT	=	2.898303
OTTOM WIDTH IN FT	=	2
OP WIDTH IN FT	=	2.804086
LOW FROUDE NUMBER	=	1.23153
IGHT SIDE SLOPE	=	2
EFT SIDE SLOPE	=	2

RITICAL FLOW CONDITIONS:

EPTH IN FT	=	.2289325
LOW AREA IN SQ FT	=	.5626852
LOW VELOCITY IN FPS	=	2.48807
ETTED PERIMETER IN FT	=	3.023817
LOPE IN FT/FT	=	1.270334E-02

Exhibit 732.300L

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 13:43:01

ROJECT TITLE:
lateau Ditch 16Ba (grouted ditch drains north west side of refuse pile)

HANNEL ROUGHNESS IS KNOWN

ORMAL FLOW CONDITIONS:

LOW DEPTH IN FT	=	.1811411
LOW RATE IN CFS	=	1.4
LOW AREA IN SQ FT	=	.2467903
ANNING ROUGHNESS	=	.022
LOW VELOCITY IN FPS	=	5.672833
HANNEL SLOPE FT/FT	=	.1 (maximum slope)
ETTED PERIMETER IN FT	=	1.810397
OTTOM WIDTH IN FT	=	1
OP WIDTH IN FT	=	1.724564
LOW FROUDE NUMBER	=	2.642699
IGHT SIDE SLOPE	=	2
EFT SIDE SLOPE	=	2

RITICAL FLOW CONDITIONS:

EPTH IN FT	=	.3165504
LOW AREA IN SQ FT	=	.5169587
LOW VELOCITY IN FPS	=	2.708147
ETTED PERIMETER IN FT	=	2.415656
LOPE IN FT/FT	=	1.249078E-02

Exhibit 732.300b

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 13:50:21

PROJECT TITLE:
Plateau Ditch 16Ba (grouted ditch drains north west part of refuse pile)

CHANNEL ROUGHNESS IS KNOWN

NORMAL FLOW CONDITIONS:

FLOW DEPTH IN FT	=	.2325622
FLOW RATE IN CFS	=	1.4
FLOW AREA IN SQ FT	=	.3408275
MANNING ROUGHNESS	=	.022
FLOW VELOCITY IN FPS	=	4.107649
CHANNEL SLOPE FT/FT	=	.04 (minimum slope)
WETTED PERIMETER IN FT	=	2.040963
BOTTOM WIDTH IN FT	=	1
TOP WIDTH IN FT	=	1.930249
FLOW FROUDE NUMBER	=	1.72268
RIGHT SIDE SLOPE	=	2
LEFT SIDE SLOPE	=	2

CRITICAL FLOW CONDITIONS:

DEPTH IN FT	=	.3165504
FLOW AREA IN SQ FT	=	.5169587
FLOW VELOCITY IN FPS	=	2.708147
WETTED PERIMETER IN FT	=	2.415656
SLOPE IN FT/FT	=	1.249078E-02

Exhibit 732-3006

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 14:05:48

PROJECT TITLE:
Plateau Ditch 16Ea (grouted ditch drains north east part of refuse pile)

CHANNEL ROUGHNESS IS KNOWN

NORMAL FLOW CONDITIONS:

FLOW DEPTH IN FT	=	.2335557
FLOW RATE IN CFS	=	1.4
FLOW AREA IN SQ FT	=	.3427422
MANNING ROUGHNESS	=	.022
FLOW VELOCITY IN FPS	=	4.084703
CHANNEL SLOPE FT/FT	=	.04 (minimum slope)
WETTED PERIMETER IN FT	=	2.069748
BOTTOM WIDTH IN FT	=	1
TOP WIDTH IN FT	=	1.934223
FLOW FROUDE NUMBER	=	1.710023
RIGHT SIDE SLOPE	=	1
LEFT SIDE SLOPE	=	3

CRITICAL FLOW CONDITIONS:

DEPTH IN FT	=	.3165504
FLOW AREA IN SQ FT	=	.5169587
FLOW VELOCITY IN FPS	=	2.708147
WETTED PERIMETER IN FT	=	2.44869
SLOPE IN FT/FT	=	1.271905E-02

Exhibit 732-3006

OPCHFLOW: OPEN CHANNEL FLOW ANALYSIS: VERSION 1

ON DATE 08-21-1995 AT TIME 14:01:44

PROJECT TITLE:
Plateau Ditch 16Ea (grouted ditch drains north east part of refuse pile)

CHANNEL ROUGHNESS IS KNOWN

NORMAL FLOW CONDITIONS:

FLOW DEPTH IN FT	=	.1818369
FLOW RATE IN CFS	=	1.4
FLOW AREA IN SQ FT	=	.2479894
MANNING ROUGHNESS	=	.022
FLOW VELOCITY IN FPS	=	5.645402
CHANNEL SLOPE FT/FT	=	.1 (maximum slope)
WETTED PERIMETER IN FT	=	1.832467
BOTTOM WIDTH IN FT	=	1
TOP WIDTH IN FT	=	1.727348
FLOW FROUDE NUMBER	=	2.62567
RIGHT SIDE SLOPE	=	1
LEFT SIDE SLOPE	=	3

CRITICAL FLOW CONDITIONS:

DEPTH IN FT	=	.3165504
FLOW AREA IN SQ FT	=	.5169587
FLOW VELOCITY IN FPS	=	2.708147
WETTED PERIMETER IN FT	=	2.44869
SLOPE IN FT/FT	=	1.271905E-02

Exhibit 732.3006

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 08-21-1995 AT TIME 15:11:04

PROJECT TITLE: Plateau Culvert 7Ea (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	2
PIPE ROUGHNESS MANNING'S N	=	.024
PIPELINE SLOPE FT/FT	=	.01
DESIGN FLOW RATE IN CFS	=	3.4
FLOW ANGLE IN RADIAN	=	2.572018
FLOW DEPTH IN FT	=	.7190465
FLOW AREA IN SQ FT	=	1.016372
FLOW VELOCITY IN FPS	=	3.345233
FLOW WETTED PERIMETER IN FT	=	2.572018
FLOW FROUDE NUMBER	=	.8101393

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	2.415208
DEPTH IN FT	=	.64474
FLOW AREA IN SQ FT	=	.8755186
FLOW VELOCITY IN FPS	=	3.883413
WETTED PERIMETER IN FT	=	2.415208
SLOPE IN FT/FT	=	.0151378

Exhibit 732.300b

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

7Ea

PIPE (EQUIVALENT) DIAMETER IN FEET 2

MANNING ROUGHNESS .024

PIPELINE SLOPE FT/FT .01

DESIGN FLOW RATE (<=QF) IN CFS 3.4

THE FLOWING FULL CAPACITY, QF, IN CFS 12.28681

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

If Inlet control (from nomograph)

with projecting + 6' HW = 3 HW/D Q = 28 cfs

Requires HW/D : < 0.5'

Exhibit 732.300b

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

10Da

PIPE (EQUIVALENT) DIAMETER IN FEET 2.5

MANNING ROUGHNESS .024

PIPELINE SLOPE FT/FT .004

DESIGN FLOW RATE (<=QF) IN CFS 16.6

THE FLOWING FULL CAPACITY, QF, IN CFS 14.08951

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

from nomograph:

Inlet condition with HW = 3.5' (HW/D = 1.4)

Q = 30 cfs

at design Q, req'd HW/D = .89'

depth ≈ culvert dia' = 2.5'

V = Q/A = 16.6/4.0897 = 3.4 cfs

Exhibit 732300b

10 Da

Diameter: 24 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.40	1.90	Outlet (Subcritical)	1
0.80	3.60	Outlet (Subcritical)	1
1.20	5.04	Outlet (Subcritical)	1
1.60	7.16	Outlet (Subcritical)	1
2.00	10.21	Outlet (Subcritical)	1
2.40	12.63	Inlet (Supercritical)	4
2.80	14.92	Outlet	6
3.20	17.13	Outlet	6
3.60	19.08	Outlet	6
4.00	20.85	Outlet	6
4.40	22.48	Outlet	6
4.80	24.01	Outlet	6
5.20	25.43	Outlet	6
5.60	26.79	Outlet	6
6.00	28.08	Outlet	6

Diameter: 30 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.40	2.45	Outlet (Subcritical)	1
0.80	5.12	Outlet (Subcritical)	1
1.20	7.46	Outlet (Subcritical)	1
1.60	9.49	Outlet (Subcritical)	1
2.00	12.65	Outlet (Subcritical)	1
2.40	17.02	Outlet (Subcritical)	1
2.80	21.47	Outlet (Subcritical)	1
3.20	24.62	Outlet	6
ok w/ outlet control → 3.60	28.33	Outlet	6
4.00	31.61	Outlet	6
4.40	34.58	Outlet	6
4.80	37.31	Outlet	6
5.20	39.86	Outlet	6
5.60	42.25	Outlet	6
6.00	44.51	Outlet	6

Diameter: 36 inches

Headwater (ft)	Discharge (cfs)	Control	Flow Type
0.40	2.90	Outlet (Subcritical)	1
0.80	6.57	Outlet (Subcritical)	1
1.20	10.01	Outlet (Subcritical)	1
1.60	13.06	Outlet (Subcritical)	1
2.00	15.78	Outlet (Subcritical)	1
2.40	20.07	Outlet (Subcritical)	1
2.80	25.89	Outlet (Subcritical)	1
3.20	31.88	Outlet (Subcritical)	1
3.60	36.86	Inlet	5
4.00	42.35	Outlet	6

EXHIBIT 12.300

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 09-07-1995 AT TIME 08:04:15

ROJECT TITLE: Plateau Culvert 15Aa (full flow and open channel analysis

ORMAL FLOW CONDITIONS ARE:

IPE (EQUIVALENT) DIAMETER IN FT	=	1.25
IPE ROUGHNESS MANNING'S N	=	.016
IPELINE SLOPE FT/FT	=	.04
ESIGN FLOW RATE IN CFS	=	.39
LOW ANGLE IN RADIAN	=	1.484655
LOW DEPTH IN FT	=	.1644393
LOW AREA IN SQ FT	=	9.538341E-02
LOW VELOCITY IN FPS	=	4.088761
LOW WETTED PERIMETER IN FT	=	.9279096
LOW FROUDE NUMBER	=	2.144655

RITICAL FLOW CONDITIONS ARE:

LOW ANGLE IN RADIAN	=	1.823893
EPTH IN FT	=	.24237
LOW AREA IN SQ FT	=	.1671388
LOW VELOCITY IN FPS	=	2.333389
ETTED PERIMETER IN FT	=	1.139933
LOPE IN FT/FT	=	8.120404E-03

Exhibit 732.3006

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

15Aa

PIPE (EQUIVALENT) DIAMETER IN FEET	1.25
MANNING ROUGHNESS	.016
PIPELINE SLOPE FT/FT	.04
DESIGN FLOW RATE (<=QF) IN CFS	.39
THE FLOWING FULL CAPACITY, QF, IN CFS	10.52545

. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

from nomograph

Inlet configuration at HW = 2.25 (HW/D = 1.8)

Q = 6.8 cfs

Required HW/D at design: <.5 cfs

Exhibit 732.3006

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 08-21-1995 AT TIME 16:08:49

PROJECT TITLE: Plateau Culvert 16Ba (Full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	2.5
PIPE ROUGHNESS MANNING'S N	=	.016
PIPELINE SLOPE FT/FT	=	.01
DESIGN FLOW RATE IN CFS	=	1.4
FLOW ANGLE IN RADIAN	=	1.531474
FLOW DEPTH IN FT	=	.3489103
FLOW AREA IN SQ FT	=	.4158182
FLOW VELOCITY IN FPS	=	3.366856
FLOW WETTED PERIMETER IN FT	=	1.914343
FLOW FROUDE NUMBER	=	1.211164

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	1.612152
DEPTH IN FT	=	.3845808
FLOW AREA IN SQ FT	=	.4789115
FLOW VELOCITY IN FPS	=	2.923296
WETTED PERIMETER IN FT	=	2.01519
SLOPE IN FT/FT	=	6.694126E-03

Exhibit 732.300b

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

16Ba

PIPE (EQUIVALENT) DIAMETER IN FEET 2.5

MANNING ROUGHNESS .016

PIPELINE SLOPE FT/FT .01

DESIGN FLOW RATE (<=QF) IN CFS 1.4

THE FLOWING FULL CAPACITY, QF, IN CFS 33.41621

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

From Nomograph:

Inlet conditions at HW = 2 (HW/D = .8')

Q = 14 cfs

At design Q, HW/D req'd is: < .5

Exhibit 722.3006

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 08-21-1995 AT TIME 16:17:01

PROJECT TITLE: Plateau Culvert 16Ea (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	1.5
PIPE ROUGHNESS MANNING'S N	=	.024
PIPELINE SLOPE FT/FT	=	.1
DESIGN FLOW RATE IN CFS	=	1.4
FLOW ANGLE IN RADIAN	=	1.796097
FLOW DEPTH IN FT	=	.2826469
FLOW AREA IN SQ FT	=	.2310103
FLOW VELOCITY IN FPS	=	6.060335
FLOW WETTED PERIMETER IN FT	=	1.347073
FLOW FROUDE NUMBER	=	2.406762

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	2.299173
DEPTH IN FT	=	.4433512
FLOW AREA IN SQ FT	=	.4367577
FLOW VELOCITY IN FPS	=	3.205438
WETTED PERIMETER IN FT	=	1.72438
SLOPE IN FT/FT	=	1.663468E-02

Exhibit 732.3006

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

KoEa

PIPE (EQUIVALENT) DIAMETER IN FEET 1.5

MANNING ROUGHNESS .024

PIPELINE SLOPE FT/FT .1

DESIGN FLOW RATE (<=QF) IN CFS 1.4

THE FLOWING FULL CAPACITY, QF, IN CFS 18.04136

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

From nomograph

Inlet conditions at HW = 1 (HW/D = .66)

Q = 3 cfs

at Design flow, req'd HW/D = < .5

Exhibit 7323006

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 11-06-1995 AT TIME 11:43:26

PROJECT TITLE: Plateau Culvert 32 (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	1
PIPE ROUGHNESS MANNING'S N	=	.016
PIPELINE SLOPE FT/FT	=	.0418
DESIGN FLOW RATE IN CFS	=	.2
FLOW ANGLE IN RADIAN	=	1.449407
FLOW DEPTH IN FT	=	.1256519
FLOW AREA IN SQ FT	=	5.709565E-02
FLOW VELOCITY IN FPS	=	3.502894
FLOW WETTED PERIMETER IN FT	=	.7247033
FLOW FROUDE NUMBER	=	2.103419

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	1.769843
DEPTH IN FT	=	.1833249
FLOW AREA IN SQ FT	=	9.869847E-02
FLOW VELOCITY IN FPS	=	2.026374
WETTED PERIMETER IN FT	=	.8849217
SLOPE IN FT/FT	=	8.819269E-03

Exhibit 732.300b

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

32

PIPE (EQUIVALENT) DIAMETER IN FEET 1

MANNING ROUGHNESS .016

PIPELINE SLOPE FT/FT .0418

DESIGN FLOW RATE (<=QF) IN CFS 0.2

THE FLOWING FULL CAPACITY, QF, IN CFS 5.934334

L. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
L. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

From nomograph:

Inlet conditions at HW = 2' (HW/D = 2')

Q = 4.5 cfs

At design Q, HW/D req'd is <.5'

Exhibit 732.300 b

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 11-06-1995 AT TIME 11:47:48

PROJECT TITLE: Plateau Culvert 42A (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	1
PIPE ROUGHNESS MANNING'S N	=	.016
PIPELINE SLOPE FT/FT	=	.0082
DESIGN FLOW RATE IN CFS	=	.4
FLOW ANGLE IN RADIAN	=	2.157434
FLOW DEPTH IN FT	=	.2637702
FLOW AREA IN SQ FT	=	.1655784
FLOW VELOCITY IN FPS	=	2.415775
FLOW WETTED PERIMETER IN FT	=	1.078717
FLOW FROUDE NUMBER	=	.9822034

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	2.146403
DEPTH IN FT	=	.2613432
FLOW AREA IN SQ FT	=	.1634425
FLOW VELOCITY IN FPS	=	2.447344
WETTED PERIMETER IN FT	=	1.073201
SLOPE IN FT/FT	=	8.49204E-03

Exhibit 732.3006

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

42A

PIPE (EQUIVALENT) DIAMETER IN FEET	1
MANNING ROUGHNESS	.016
PIPELINE SLOPE FT/FT	.0082
DESIGN FLOW RATE (<=QF) IN CFS	.4
THE FLOWING FULL CAPACITY, QF, IN CFS	2.628396

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

From nomograph:

Inlet conditions at HW = 2' (HW/D = 2')

Q = 4.5 cfs

At design Q, HW/D req'd is <.5'

Exhibit 732.3006

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 08-21-1995 AT TIME 16:31:41

PROJECT TITLE: Plateau Culvert 42A (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	1
PIPE ROUGHNESS MANNING'S N	=	.024
PIPELINE SLOPE FT/FT	=	.3
DESIGN FLOW RATE IN CFS	=	.4
FLOW ANGLE IN RADIAN	=	1.491587
FLOW DEPTH IN FT	=	.1327252
FLOW AREA IN SQ FT	=	6.184033E-02
FLOW VELOCITY IN FPS	=	6.468271
FLOW WETTED PERIMETER IN FT	=	.7457936
FLOW FROUDE NUMBER	=	3.775869

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	2.146403
DEPTH IN FT	=	.2613432
FLOW AREA IN SQ FT	=	.1634425
FLOW VELOCITY IN FPS	=	2.447344
WETTED PERIMETER IN FT	=	1.073201
SLOPE IN FT/FT	=	1.910709E-02

Exhibit 732.3006

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

42A

PIPE (EQUIVALENT) DIAMETER IN FEET 1

MANNING ROUGHNESS .024

PIPELINE SLOPE FT/FT .3

DESIGN FLOW RATE (<=QF) IN CFS .4

THE FLOWING FULL CAPACITY, QF, IN CFS 10.59871

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

from nomograph:

Inlet conditions at HW = 1.5' (HW/D = 1.5)

Q = 3.2 cfs

At design Q, req'd HW/D = 2.5

Exhibit 732.3006

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 08-21-1995 AT TIME 16:42:30

PROJECT TITLE: Plateau Culvert 72Aa (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	1
PIPE ROUGHNESS MANNING'S N	=	.024
PIPELINE SLOPE FT/FT	=	.02
DESIGN FLOW RATE IN CFS	=	2.3
FLOW ANGLE IN RADIAN	=	3.973264
FLOW DEPTH IN FT	=	.7019771
FLOW AREA IN SQ FT	=	.5890402
FLOW VELOCITY IN FPS	=	3.904657
FLOW WETTED PERIMETER IN FT	=	1.986632
FLOW FROUDE NUMBER	=	.8575128

Exhibit 732.300b

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

72Aa

PIPE (EQUIVALENT) DIAMETER IN FEET 1

MANNING ROUGHNESS .024

PIPELINE SLOPE FT/FT .02

DESIGN FLOW RATE (<=QF) IN CFS 2.3

THE FLOWING FULL CAPACITY, QF, IN CFS 2.736576

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

from nomograph

Inlet conditions at HW = 6.5' (HW/D = 6.5)

Q = 8 cfs

At design flow, reqd HW/D = 1.1

Exhibit 732.300b

OPCHFLOW: OPEN CHANNEL FLOW IN A PIPE: VERSION 1

ON DATE 11-06-1995 AT TIME 11:58:30

PROJECT TITLE: Plateau Culvert UT16A (full flow and open channel analysis)

NORMAL FLOW CONDITIONS ARE:

PIPE (EQUIVALENT) DIAMETER IN FT	=	1
PIPE ROUGHNESS MANNING'S N	=	.024
PIPELINE SLOPE FT/FT	=	.006
DESIGN FLOW RATE IN CFS	=	.77
FLOW ANGLE IN RADIAN	=	3.1747
FLOW DEPTH IN FT	=	.5082765
FLOW AREA IN SQ FT	=	.4009752
FLOW VELOCITY IN FPS	=	1.920318
FLOW WETTED PERIMETER IN FT	=	1.58735
FLOW FROUDE NUMBER	=	.5343881

CRITICAL FLOW CONDITIONS ARE:

FLOW ANGLE IN RADIAN	=	2.601109
DEPTH IN FT	=	.3665177
FLOW AREA IN SQ FT	=	.2608198
FLOW VELOCITY IN FPS	=	2.95223
WETTED PERIMETER IN FT	=	1.300555
SLOPE IN FT/FT	=	1.926347E-02

Exhibit 737.300b

OPEN CHANNEL FLOW IN A PIPE DEVELOPED BY CU-DENVER

COMPUTATION

VI16A

PIPE (EQUIVALENT) DIAMETER IN FEET 1

MANNING ROUGHNESS .024

PIPELINE SLOPE FT/FT .006

DESIGN FLOW RATE (<=QF) IN CFS .77

THE FLOWING FULL CAPACITY, QF, IN CFS 1.498885

1. FLOW RATE, ROUGHNESS AND PIPE SLOPE MUST BE GREATER THAN ZERO
1. FLOW RATE MUST BE LESS THAN THE FLOWING FULL CAPACITY

From nomograph:

Inlet conditions at HW = 1' (HW/D = 1')

Q = 2.1 cfs

at design Q, HW/D [illegible] = .5'