APPENDIX 11-S

LOWE BOXCUT ROAD PROPOSAL
SEDCAD CALCULATIONS

(09/13/95)

APPENDIX 11-S

LOWE BOXCUT ROAD PROPOSAL, SEDCAD CALCULATIONS

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SEDCAD Calculations

SEDCAD was used to make all drainage calculations. Parameters used for each watershed are shown on EXHIBIT 11-103c, and in the SEDCAD calculations that follow in this appendices. The SEDCAD is laid out such that each of the drainage patterns comes first followed by its respective channel (ditch) calculations. The only problem that SEDCAD detected is that the two southern ditches will incur some erosion during major storm events, but this is acceptable providing that the ditches are repaired after any such storm event and none of the effluent leaves the permit area.

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION

by

Name: DJR

Company Name: BHP MINERALS
File Name: C:\SEDCAD3\LBRSW1

Date: 09-06-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRSW1 User: DJR
Date: 09-06-1995 Time: 09:02:59
LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947
34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962

38	18.5	0.966
39	19.0	0.969
40	19.5	0.973
41	20.0	0.976
42	20.5	0.979
43	21.0	0.982
44	21.5	0.985
45	22.0	0.988
46	22.5	0.991
47	23.0	0.994
48	23.5	0.997
49	24.0	1.000

****

Detailed Between Structure Routing:

J	B	To S	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	Muskingum X
2	1	2	1	5	1604.01	0.42	0.65	0.69	0.687	0.138
3	1	2	1	5	1616.43	5.49	2.34	0.19	0.191	0.289

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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRSW1 User: DJR
Date: 09-06-1995 Time: 09:02:59
LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	5.67	89	M	0.230	0.000	0.000	0.0	0.23	3.86
	Type: Null	Label: SUB-WATERSHED A							
111 Structure	5.67							0.23	
111 Total IN/OUT	5.67							0.23	3.86
	Type: Null	Label: SUB-WATERSHED A							
211 Structure	5.67							0.23	
Total IN/OUT	5.67							0.23	3.86
111 to 211 Routing					0.000	0.000			
212 1	7.26	89	M	0.204	0.000	0.000	0.0	0.29	5.18
	Type: Null	Label: SUB-WATERSHED B							
212 Structure	7.26							0.52	
212 Total IN/OUT	12.93							0.52	5.27
211 to 212 Routing					0.687	0.138			
	Type: Null	Label: SUB-WATERSHED B							
311 Structure	7.26							0.52	
311 Total IN/OUT	12.93							0.52	5.27
212 to 311 Routing					0.000	0.000			
312 1	4.57	89	M	0.162	0.000	0.000	0.0	0.18	3.54
	Type: Null	Label: SUB-WATERSHED C							
312 Structure	4.57							0.71	
312 Total IN/OUT	17.50							0.71	6.90
to 312 Routing					0.191	0.289			
	Type: Null	Label: SUB-WATERSHED C							
411 Structure	4.57							0.71	
411 Total IN/OUT	17.50							0.71	6.90

312 to 411 Routing 0.000 0.000

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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRSW1 User: DJR
Date: 09-06-1995 Time: 09:02:59
LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1237.00	2.22	1.49	0.23	0.230		
2	1	2	1	-a	5	1666.00	5.10	2.26	0.20	0.204		
3	1	2	1	-a	5	1724.00	8.70	2.95	0.16	0.162		

BHP MINERALS
NAVAJO MINE

12-Dec-95

PROJECT: LOWE BOXCUT RD SW DITCH
ENGINEER DJR
FILE NO : 17.3.29
DRWG NO :
MMD REF:

Channel Design

Precipitation Event:	10yr-6hr Event		
Design Flow	Q10	6.90	CFS
Bottom Channel Width	W =	0.00	Ft (min)
Side Slopes (Z1:1)	Z1 =	2.00	
(Z2:1)	Z2 =	4.00	
Manning's Roughness Coefficient	n =	0.032	
Channel Bed Slope	S =	5.49	%

STAGE FLOW

Flow Depth (Ft)	Area (Sq Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	0.00	0.00	0.00
0.25	0.19	0.12	0.49	2.61
0.50	0.75	0.24	3.11	4.15
0.75	1.69	0.35	9.18	5.44
1.00	3.00	0.47	19.79	6.60
1.25	4.69	0.59	35.90	7.66
1.50	6.75	0.71	58.41	8.65
1.75	9.19	0.83	88.16	9.60
2.00	12.00	0.94	125.92	10.49
2.25	15.19	1.06	172.45	11.35
2.50	18.75	1.18	228.47	12.19
2.75	22.69	1.30	294.68	12.99
3.00	27.00	1.42	371.75	13.77
3.25	31.69	1.53	460.33	14.53
3.50	36.75	1.65	561.05	15.27
3.75	42.19	1.77	674.53	15.99
4.00	48.00	1.89	801.38	16.70
4.25	54.19	2.00	942.18	17.39

Flow Depth at Peak Discharge	0.68 Ft
Minimum Channel Depth Required	0.98 Ft
Critical Depth	0.81 Ft
Flow Type	Supercritical flow
Froude Number	1.09
Flow Velocity	5.09 fps
Soil Type:	SPOILS W/ SHALE AND SANDSTONE COBBLES
Erosive Velocity	5.50 fps

Flow Velocity is Less than Erosive Velocity, Therefore No Riprap Required

Reference: 1. Hydraulic Engineering Circular No. 15;
Federal Highway Administration
2. Applied Hydrology and Sedimentology for Disturbed Areas
Chapter 3; B.J. Barfield and R.C. Warner
University of Kentucky

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE BOXCUT ROAD PLANNED DRAINAGE, SE PORTION

by

Name: DJR

Company Name: BHP MINERALS
File Name: C:\SEDCAD3\LBRSE1

Date: 09-06-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRSE1 User: DJR
Date: 09-06-1995 Time: 11:35:19
LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947
34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962

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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRSE1 User: DJR
Date: 09-06-1995 Time: 11:35:19
LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111 1	6.58	89	M	0.194	0.000	0.000	0.0	0.27	4.79
	Type: Null			Label: SUB-WATERSHED D					
111 Structure	6.58							0.27	
111 Total IN/OUT	6.58							0.27	4.79
	Type: Null			Label: SUB-WATERSHED A					
211 Structure	6.58							0.27	
Total IN/OUT	6.58							0.27	4.79
111 to 211 Routing					0.000	0.000			
212 1	1.73	89	M	0.571	0.000	0.000	0.0	0.07	0.73
	Type: Null			Label: SUB-WATERSHED E					
212 Structure	1.73							0.34	
212 Total IN/OUT	8.31							0.34	3.25
211 to 212 Routing					0.687	0.138			
	Type: Null			Label: SUB-WATERSHED B					
311 Structure	1.73							0.34	
311 Total IN/OUT	8.31							0.34	3.25
212 to 311 Routing					0.000	0.000			
312 1	3.33	89	M	0.209	0.000	0.000	0.0	0.13	2.35
	Type: Null			Label: SUB-WATERSHED F					
312 Structure	3.33							0.47	
312 Total IN/OUT	11.64							0.47	3.45
to 312 Routing					0.191	0.289			
	Type: Null			Label: SUB-WATERSHED C					
411 Structure	3.33							0.47	
411 Total IN/OUT	11.64							0.47	3.45

312 to 411 Routing 0.000 0.000

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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRSE1 User: DJR
Date: 09-06-1995 Time: 11:35:19
LOWE BOXCUT ROAD PLANNED DRAINAGE, SW PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1470.00	4.42	2.10	0.19	0.194		
2	1	2	1	-a	5	1617.00	0.62	0.79	0.57	0.571		
3	1	2	1	-a	5	1619.53	4.63	2.15	0.21	0.209		

BHP MINERALS
NAVAJO MINE

12-Dec-95

PROJECT: LOWE BOXCUT RD SE DITCH
ENGINEER DJR
FILE NO : 17.3.29
DRWG NO :
MMD REF:

Channel Design

Precipitation Event:	10yr-6hr Event	
Design Flow	Q10	4.79 CFS
Bottom Channel Width	W =	0.00 Ft (min)
Side Slopes (Z1:1)	Z1 =	2.00
(Z2:1)	Z2 =	4.00
Manning's Roughness Coefficient	n =	0.032
Channel Bed Slope	S =	5.49 %

STAGE FLOW

Flow Depth (Ft)	Area (Sq Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	0.00	0.00	0.00
0.25	0.19	0.12	0.49	2.61
0.50	0.75	0.24	3.11	4.15
0.75	1.69	0.35	9.18	5.44
1.00	3.00	0.47	19.79	6.60
1.25	4.69	0.59	35.90	7.66
1.50	6.75	0.71	58.41	8.65
1.75	9.19	0.83	88.16	9.60
2.00	12.00	0.94	125.92	10.49
2.25	15.19	1.06	172.45	11.35
2.50	18.75	1.18	228.47	12.19
2.75	22.69	1.30	294.68	12.99
3.00	27.00	1.42	371.75	13.77
3.25	31.69	1.53	460.33	14.53
3.50	36.75	1.65	561.05	15.27
3.75	42.19	1.77	674.53	15.99
4.00	48.00	1.89	801.38	16.70
4.25	54.19	2.00	942.18	17.39

Flow Depth at Peak Discharge	0.59 Ft
Minimum Channel Depth Required	0.89 Ft
Critical Depth	0.70 Ft
Flow Type	Supercritical flow
Froude Number	1.06
Flow Velocity	4.63 fps
Soil Type:	SPOILS W/ SHALE AND SANDSTONE COBBLES
Erosive Velocity	5.50 fps

Flow Velocity is Less than Erosive Velocity, Therefore No Riprap Required

Reference: 1. Hydraulic Engineering Circular No. 15;
Federal Highway Administration
2. Applied Hydrology and Sedimentology for Disturbed Areas
Chapter 3; B.J. Barfield and R.C. Warner
University of Kentucky

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE BOXCUT ROAD PLANNED DRAINAGE, NE PORTION

by

Name: DJR

Company Name: BHP MINERALS
File Name: C:\SEDCAD3\LBRNE1

Date: 09-06-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRNE1 User: DJR
Date: 09-06-1995 Time: 11:56:09
LOWE BOXCUT ROAD PLANNED DRAINAGE, NE PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.39	89	M	0.177	0.000	0.000	0.0	0.14	2.57
		Type: Null			Label: SUB-WATERSHED G					
111	Structure	3.39							0.14	
111	Total IN/OUT	3.39							0.14	2.57

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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRNE1 User: DJR
Date: 09-06-1995 Time: 11:56:09
LOWE BOXCUT ROAD PLANNED DRAINAGE, NE PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1225.00	3.67	1.92	0.18	0.177		

BHP MINERALS
NAVAJO MINE

12-Dec-95

PROJECT: LOWE BOXCUT RD NE DITCH
ENGINEER DJR
FILE NO : 17.3.29
DRWG NO :
MMD REF:

Channel Design

Precipitation Event:	10yr-6hr Event	
Design Flow	Q10	2.57 CFS
Bottom Channel Width	W =	0.00 Ft (min)
Side Slopes (Z1:1)	Z1 =	2.00
(Z2:1)	Z2 =	4.00
Manning's Roughness Coefficient	n =	0.032
Channel Bed Slope	S =	1.49 %

STAGE FLOW

Flow Depth (Ft)	Area (Sq Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	0.00	0.00	0.00
0.25	0.19	0.12	0.25	1.36
0.50	0.75	0.24	1.62	2.16
0.75	1.69	0.35	4.78	2.83
1.00	3.00	0.47	10.31	3.44
1.25	4.69	0.59	18.70	3.99
1.50	6.75	0.71	30.43	4.51
1.75	9.19	0.83	45.93	5.00
2.00	12.00	0.94	65.60	5.47
2.25	15.19	1.06	89.84	5.92
2.50	18.75	1.18	119.03	6.35
2.75	22.69	1.30	153.52	6.77
3.00	27.00	1.42	193.67	7.17
3.25	31.69	1.53	239.81	7.57
3.50	36.75	1.65	292.28	7.95
3.75	42.19	1.77	351.40	8.33
4.00	48.00	1.89	417.49	8.70
4.25	54.19	2.00	490.84	9.06

Flow Depth at Peak Discharge	0.60 Ft
Minimum Channel Depth Required	0.90 Ft
Critical Depth	0.54 Ft
Flow Type	Subcritical flow
Froude Number	0.56
Flow Velocity	2.44 fps
Soil Type:	SPOILS W/ SHALE AND SANDSTONE COBBLES
Erosive Velocity	5.50 fps

Flow Velocity is Less than Erosive Velocity, Therefore No Riprap Required

Reference: 1. Hydraulic Engineering Circular No. 15;
Federal Highway Administration
2. Applied Hydrology and Sedimentology for Disturbed Areas
Chapter 3; B.J. Barfield and R.C. Warner
University of Kentucky

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SEDCAD+ Version 3

LOWE BOXCUT ROAD PLANNED DRAINAGE, NW PORTION

by

Name: DJR

Company Name: BHP MINERALS
File Name: C:\SEDCAD3\LBRNW1

Date: 09-06-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRNW1 User: DJR
Date: 09-06-1995 Time: 12:07:58
LOWE BOXCUT ROAD PLANNED DRAINAGE, NE PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947
34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962

38	18.5	0.966
39	19.0	0.969
40	19.5	0.973
41	20.0	0.976
42	20.5	0.979
43	21.0	0.982
44	21.5	0.985
45	22.0	0.988
46	22.5	0.991
47	23.0	0.994
48	23.5	0.997
49	24.0	1.000

****

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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRNW1 User: DJR
Date: 09-06-1995 Time: 12:07:58
LOWE BOXCUT ROAD PLANNED DRAINAGE, NE PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	2.01	89	M	0.232	0.000	0.000	0.0	0.08	1.36
		Type: Null			Label: SUB-WATERSHED H					
111	Structure	2.01							0.08	
111	Total IN/OUT	2.01							0.08	1.36

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LBRNW1 User: DJR
Date: 09-06-1995 Time: 12:07:58
LOWE BOXCUT ROAD PLANNED DRAINAGE, NE PORTION
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	1070.00	1.64	1.28	0.23	0.232		

BHP MINERALS
NAVAJO MINE

12-Dec-95

PROJECT: LOWE BOXCUT RD NW DITCH
ENGINEER DJR
FILE NO : 17.3.29
DRWG NO :
MMD REF:

Channel Design

Precipitation Event:	10yr-6hr Event	
Design Flow	Q10	1.36 CFS
Bottom Channel Width	W =	0.00 Ft (min)
Side Slopes (Z1:1)	Z1 =	2.00
(Z2:1)	Z2 =	4.00
Manning's Roughness Coefficient	n =	0.032
Channel Bed Slope	S =	1.49 %

STAGE FLOW

Flow Depth (Ft)	Area (Sq Ft)	Hydraulic Radius	Discharge Rate (CFS)	Velocity (FPS)
0.00	0.00	0.00	0.00	0.00
0.25	0.19	0.12	0.25	1.36
0.50	0.75	0.24	1.62	2.16
0.75	1.69	0.35	4.78	2.83
1.00	3.00	0.47	10.31	3.44
1.25	4.69	0.59	18.70	3.99
1.50	6.75	0.71	30.43	4.51
1.75	9.19	0.83	45.93	5.00
2.00	12.00	0.94	65.60	5.47
2.25	15.19	1.06	89.84	5.92
2.50	18.75	1.18	119.03	6.35
2.75	22.69	1.30	153.52	6.77
3.00	27.00	1.42	193.67	7.17
3.25	31.69	1.53	239.81	7.57
3.50	36.75	1.65	292.28	7.95
3.75	42.19	1.77	351.40	8.33
4.00	48.00	1.89	417.49	8.70
4.25	54.19	2.00	490.84	9.06

Flow Depth at Peak Discharge	0.47 Ft
Minimum Channel Depth Required	0.77 Ft
Critical Depth	0.42 Ft
Flow Type	Subcritical flow
Froude Number	0.53
Flow Velocity	2.07 fps
Soil Type:	SPOILS W/ SHALE AND SANDSTONE COBBLES
Erosive Velocity	5.50 fps

Flow Velocity is Less than Erosive Velocity, Therefore No Riprap Required

Reference: 1. Hydraulic Engineering Circular No. 15;
Federal Highway Administration
2. Applied Hydrology and Sedimentology for Disturbed Areas
Chapter 3; B.J. Barfield and R.C. Warner
University of Kentucky

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