Appendix 25.A

Diversion Berm – Hydrology Analysis –

Worst Case Scenarios – 25 to 300 Acre Watersheds

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 25 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	25.000	25.000	23.18	1.33

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	25.000	0.154	0.000	0.000	89.000	M	23.18	1.329
	Σ	**25.000**						**23.18**	**1.329**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	7.99	125.00	1,565.00	2.820	0.154
#1	**1**	**Time of Concentration:**					**0.154**

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 50 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	50.000	50.000	40.29	2.62

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	50.000	0.259	0.000	0.000	89.000	M	40.29	2.620
	Σ	**50.000**						**40.29**	**2.620**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.65	125.00	2,214.03	2.370	0.259
#1	**1**	**Time of Concentration:**					**0.259**

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 75 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	75.000	75.000	53.74	3.92

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	75.000	0.351	0.000	0.000	89.000	M	53.74	3.925
	Σ	**75.000**						**53.74**	**3.925**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.61	125.00	2,711.08	2.140	0.351
#1	**1**	**Time of Concentration:**					**0.351**

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 100 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	100.000	100.000	64.30	5.22

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	100.000	0.437	0.000	0.000	89.000	M	64.30	5.219
	Σ	**100.000**						**64.30**	**5.219**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.99	125.00	3,131.02	1.990	0.437
#1	**1**	**Time of Concentration:**					**0.437**

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 200 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	200.000	200.000	93.34	10.42

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	200.000	0.731	0.000	0.000	89.000	M	93.34	10.423
	Σ	**200.000**						**93.34**	**10.423**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.82	125.00	4,427.12	1.680	0.731
#1	**1**	**Time of Concentration:**					**0.731**

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 250 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	250.000	250.000	103.55	13.02

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	250.000	0.870	0.000	0.000	89.000	M	103.55	13.017
	Σ	**250.000**						**103.55**	**13.017**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.53	125.00	4,950.29	1.580	0.870
#1	**1**	**Time of Concentration:**					**0.870**

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NAVAJO MINE PINABETE PERMIT DIVERSION BERM

Worst case scenario for 300 acre watershed.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.700 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	300.000	300.000	112.87	15.63

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	300.000	0.997	0.000	0.000	89.000	M	112.87	15.628
	Σ	**300.000**						**112.87**	**15.628**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.31	125.00	5,422.28	1.510	0.997
#1	**1**	**Time of Concentration:**					**0.997**

DIVERSION BERM

Berm Height Calculations

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
1	6	25	23.18	7.92	17.44	0.03	0.92	1.92	2.93
1	9	25	23.18	7.28	14.11	0.03	1.05	2.05	3.19
1	12	25	23.18	6.88	12.27	0.03	1.15	2.15	3.37
1	15	25	23.18	6.61	11.09	0.03	1.23	2.23	3.51
1	1	50	40.29	18.22	61.12	0.03	0.60	1.60	2.21
1	3	50	40.29	14.01	31.69	0.03	0.89	1.89	2.87
1	6	50	40.29	11.99	21.46	0.03	1.13	2.13	3.36
1	9	50	40.29	11.02	17.36	0.03	1.30	2.30	3.66
1	12	50	40.29	10.42	15.09	0.03	1.42	2.42	3.87
1	15	50	40.29	10.00	13.64	0.03	1.52	2.52	4.03
1	1	75	53.74	22.62	68.09	0.03	0.67	1.67	2.38
1	3	75	53.74	17.39	35.31	0.03	0.99	1.99	3.09
1	6	75	53.74	14.88	23.91	0.03	1.26	2.26	3.61
1	9	75	53.74	13.67	19.34	0.03	1.44	2.44	3.93
1	12	75	53.74	12.93	16.81	0.03	1.58	2.58	4.16
1	15	75	53.74	12.41	15.19	0.03	1.69	2.69	4.33
1	1	100	64.3	25.88	72.83	0.03	0.71	1.71	2.48
1	3	100	64.3	19.90	37.77	0.03	1.06	2.06	3.23
1	6	100	64.3	17.02	25.57	0.03	1.35	2.35	3.78
1	9	100	64.3	15.64	20.69	0.03	1.54	2.54	4.11
1	12	100	64.3	14.79	17.98	0.03	1.69	2.69	4.35
1	15	100	64.3	14.20	16.25	0.03	1.81	2.81	4.53
1	1	150	87.7	32.66	81.82	0.03	0.80	1.80	2.69
1	3	150	87.7	25.11	42.43	0.03	1.19	2.19	3.49
1	6	150	87.7	21.49	28.73	0.03	1.52	2.52	4.08
1	9	150	87.7	19.74	23.24	0.03	1.74	2.74	4.44
1	12	150	87.7	18.66	20.20	0.03	1.90	2.90	4.70
1	15	150	87.7	17.92	18.26	0.03	2.03	3.03	4.89
1	1	200	93.34	34.22	83.75	0.03	0.82	1.82	2.73
1	3	200	93.34	26.32	43.43	0.03	1.22	2.22	3.55
1	6	200	93.34	22.52	29.41	0.03	1.55	2.55	4.15
1	9	200	93.34	20.68	23.79	0.03	1.78	2.78	4.51
1	12	200	93.34	19.56	20.68	0.03	1.95	2.95	4.77
1	15	200	93.34	18.78	18.69	0.03	2.08	3.08	4.97
1	1	250	103.55	36.99	87.08	0.03	0.85	1.85	2.80
1	3	250	103.55	28.45	45.15	0.03	1.27	2.27	3.64
1	6	250	103.55	24.34	30.57	0.03	1.61	2.61	4.25
1	9	250	103.55	22.36	24.73	0.03	1.85	2.85	4.63
1	12	250	103.55	21.14	21.50	0.03	2.02	3.02	4.90
1	15	250	103.55	20.30	19.43	0.03	2.16	3.16	5.10
1	1	300	112.87	39.46	89.94	0.03	0.88	1.88	2.86
1	3	300	112.87	30.35	46.64	0.03	1.31	2.31	3.72
1	6	300	112.87	25.96	31.58	0.03	1.67	2.67	4.35
1	9	300	112.87	23.85	25.55	0.03	1.91	2.91	4.73
1	12	300	112.87	22.55	22.21	0.03	2.09	3.09	5.00
1	15	300	112.87	21.66	20.07	0.03	2.24	3.24	5.21
3	1	25	23.18	7.97	40.43	0.03	0.40	1.40	2.91

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
3	3	25	23.18	6.13	20.96	0.03	0.59	1.59	3.78
3	6	25	23.18	5.25	14.19	0.03	0.75	1.75	4.42
3	9	25	23.18	4.82	11.48	0.03	0.86	1.86	4.81
3	12	25	23.18	4.56	9.98	0.03	0.94	1.94	5.09
3	15	25	23.18	4.38	9.02	0.03	1.00	2.00	5.30
3	1	50	40.29	12.07	49.74	0.03	0.49	1.49	3.34
3	3	50	40.29	9.28	25.79	0.03	0.72	1.72	4.34
3	6	50	40.29	7.94	17.46	0.03	0.92	1.92	5.07
3	9	50	40.29	7.30	14.13	0.03	1.05	2.05	5.52
3	12	50	40.29	6.90	12.28	0.03	1.16	2.16	5.84
3	15	50	40.29	6.62	11.10	0.03	1.24	2.24	6.08
3	1	75	53.74	14.98	55.41	0.03	0.54	1.54	3.59
3	3	75	53.74	11.52	28.74	0.03	0.81	1.81	4.66
3	6	75	53.74	9.86	19.46	0.03	1.03	2.03	5.45
3	9	75	53.74	9.06	15.74	0.03	1.18	2.18	5.93
3	12	75	53.74	8.56	13.68	0.03	1.29	2.29	6.28
3	15	75	53.74	8.22	12.37	0.03	1.38	2.38	6.54
3	1	100	64.3	17.14	59.27	0.03	0.58	1.58	3.75
3	3	100	64.3	13.18	30.74	0.03	0.86	1.86	4.88
3	6	100	64.3	11.28	20.81	0.03	1.10	2.10	5.70
3	9	100	64.3	10.36	16.83	0.03	1.26	2.26	6.21
3	12	100	64.3	9.80	14.64	0.03	1.38	2.38	6.56
3	15	100	64.3	9.41	13.23	0.03	1.47	2.47	6.84
3	1	150	87.7	21.63	66.59	0.03	0.65	1.65	4.05
3	3	150	87.7	16.63	34.53	0.03	0.97	1.97	5.27
3	6	150	87.7	14.23	23.38	0.03	1.23	2.23	6.16
3	9	150	87.7	13.07	18.91	0.03	1.41	2.41	6.71
3	12	150	87.7	12.36	16.44	0.03	1.55	2.55	7.09
3	15	150	87.7	11.87	14.86	0.03	1.66	2.66	7.39
3	1	200	93.34	22.67	68.16	0.03	0.67	1.67	4.12
3	3	200	93.34	17.43	35.35	0.03	0.99	1.99	5.36
3	6	200	93.34	14.91	23.93	0.03	1.26	2.26	6.26
3	9	200	93.34	13.70	19.36	0.03	1.45	2.45	6.81
3	12	200	93.34	12.95	16.83	0.03	1.58	2.58	7.21
3	15	200	93.34	12.44	15.21	0.03	1.69	2.69	7.50
3	1	250	103.55	24.50	70.87	0.03	0.69	1.69	4.23
3	3	250	103.55	18.84	36.75	0.03	1.03	2.03	5.50
3	6	250	103.55	16.12	24.88	0.03	1.31	2.31	6.42
3	9	250	103.55	14.81	20.13	0.03	1.50	2.50	6.99
3	12	250	103.55	14.00	17.50	0.03	1.65	2.65	7.39
3	15	250	103.55	13.45	15.81	0.03	1.76	2.76	7.70
3	1	300	112.87	26.14	73.19	0.03	0.72	1.72	4.32
3	3	300	112.87	20.10	37.96	0.03	1.07	2.07	5.62
3	6	300	112.87	17.20	25.70	0.03	1.36	2.36	6.56
3	9	300	112.87	15.80	20.79	0.03	1.55	2.55	7.14
3	12	300	112.87	14.94	18.07	0.03	1.70	2.70	7.56
3	15	300	112.87	14.35	16.33	0.03	1.82	2.82	7.87

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
5	1	25	23.18	6.58	36.73	0.03	0.36	1.36	3.52
5	3	25	23.18	5.06	19.05	0.03	0.54	1.54	4.58
5	6	25	23.18	4.33	12.90	0.03	0.68	1.68	5.35
5	9	25	23.18	3.98	10.43	0.03	0.78	1.78	5.82
5	12	25	23.18	3.76	9.07	0.03	0.85	1.85	6.16
5	15	25	23.18	3.61	8.20	0.03	0.91	1.91	6.42
5	1	50	40.29	9.97	45.20	0.03	0.44	1.44	4.04
5	3	50	40.29	7.66	23.44	0.03	0.66	1.66	5.26
5	6	50	40.29	6.56	15.87	0.03	0.84	1.84	6.14
5	9	50	40.29	6.02	12.84	0.03	0.96	1.96	6.69
5	12	50	40.29	5.70	11.16	0.03	1.05	2.05	7.07
5	15	50	40.29	5.47	10.09	0.03	1.12	2.12	7.37
5	1	75	53.74	12.37	50.35	0.03	0.49	1.49	4.34
5	3	75	53.74	9.51	26.11	0.03	0.73	1.73	5.65
5	6	75	53.74	8.14	17.68	0.03	0.93	1.93	6.60
5	9	75	53.74	7.48	14.30	0.03	1.07	2.07	7.19
5	12	75	53.74	7.07	12.43	0.03	1.17	2.17	7.60
5	15	75	53.74	6.79	11.24	0.03	1.25	2.25	7.92
5	1	100	64.3	14.15	53.86	0.03	0.53	1.53	4.54
5	3	100	64.3	10.88	27.93	0.03	0.78	1.78	5.91
5	6	100	64.3	9.31	18.91	0.03	1.00	2.00	6.91
5	9	100	64.3	8.55	15.30	0.03	1.14	2.14	7.52
5	12	100	64.3	8.09	13.30	0.03	1.25	2.25	7.95
5	15	100	64.3	7.77	12.02	0.03	1.34	2.34	8.28
5	1	150	87.7	17.86	60.50	0.03	0.59	1.59	4.91
5	3	150	87.7	13.73	31.38	0.03	0.88	1.88	6.39
5	6	150	87.7	11.75	21.24	0.03	1.12	2.12	7.46
5	9	150	87.7	10.80	17.19	0.03	1.28	2.28	8.12
5	12	150	87.7	10.21	14.94	0.03	1.41	2.41	8.59
5	15	150	87.7	9.80	13.50	0.03	1.50	2.50	8.95
5	1	200	93.34	18.71	61.93	0.03	0.61	1.61	4.99
5	3	200	93.34	14.39	32.12	0.03	0.90	1.90	6.49
5	6	200	93.34	12.31	21.75	0.03	1.15	2.15	7.58
5	9	200	93.34	11.31	17.59	0.03	1.31	2.31	8.25
5	12	200	93.34	10.70	15.29	0.03	1.44	2.44	8.73
5	15	200	93.34	10.27	13.82	0.03	1.54	2.54	9.09
5	1	250	103.55	20.23	64.39	0.03	0.63	1.63	5.12
5	3	250	103.55	15.56	33.39	0.03	0.94	1.94	6.66
5	6	250	103.55	13.31	22.61	0.03	1.19	2.19	7.78
5	9	250	103.55	12.23	18.29	0.03	1.37	2.37	8.47
5	12	250	103.55	11.56	15.90	0.03	1.50	2.50	8.96
5	15	250	103.55	11.10	14.37	0.03	1.60	2.60	9.33
5	1	300	112.87	21.58	66.51	0.03	0.65	1.65	5.23
5	3	300	112.87	16.60	34.49	0.03	0.97	1.97	6.80
5	6	300	112.87	14.20	23.35	0.03	1.23	2.23	7.95
5	9	300	112.87	13.04	18.89	0.03	1.41	2.41	8.65
5	12	300	112.87	12.33	16.42	0.03	1.55	2.55	9.15

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
5	15	300	112.87	11.84	14.84	0.03	1.65	2.65	9.53
7	1	25	23.18	5.80	34.49	0.03	0.34	1.34	3.99
7	3	25	23.18	4.46	17.88	0.03	0.50	1.50	5.19
7	6	25	23.18	3.82	12.11	0.03	0.64	1.64	6.07
7	9	25	23.18	3.51	9.80	0.03	0.73	1.73	6.61
7	12	25	23.18	3.32	8.52	0.03	0.80	1.80	6.99
7	15	25	23.18	3.19	7.70	0.03	0.86	1.86	7.28
7	1	50	40.29	8.78	42.43	0.03	0.42	1.42	4.59
7	3	50	40.29	6.76	22.00	0.03	0.62	1.62	5.96
7	6	50	40.29	5.78	14.90	0.03	0.79	1.79	6.97
7	9	50	40.29	5.31	12.05	0.03	0.90	1.90	7.59
7	12	50	40.29	5.02	10.48	0.03	0.99	1.99	8.02
7	15	50	40.29	4.82	9.47	0.03	1.05	2.05	8.36
7	1	75	53.74	10.90	47.27	0.03	0.46	1.46	4.93
7	3	75	53.74	8.38	24.51	0.03	0.69	1.69	6.41
7	6	75	53.74	7.17	16.60	0.03	0.88	1.88	7.49
7	9	75	53.74	6.59	13.43	0.03	1.00	2.00	8.15
7	12	75	53.74	6.23	11.67	0.03	1.10	2.10	8.62
7	15	75	53.74	5.98	10.55	0.03	1.18	2.18	8.98
7	1	100	64.3	12.47	50.56	0.03	0.49	1.49	5.15
7	3	100	64.3	9.59	26.22	0.03	0.74	1.74	6.70
7	6	100	64.3	8.21	17.75	0.03	0.94	1.94	7.84
7	9	100	64.3	7.54	14.36	0.03	1.07	2.07	8.53
7	12	100	64.3	7.13	12.49	0.03	1.17	2.17	9.02
7	15	100	64.3	6.85	11.28	0.03	1.26	2.26	9.39
7	1	150	87.7	15.74	56.80	0.03	0.56	1.56	5.57
7	3	150	87.7	12.11	29.46	0.03	0.83	1.83	7.24
7	6	150	87.7	10.36	19.94	0.03	1.05	2.05	8.47
7	9	150	87.7	9.52	16.13	0.03	1.20	2.20	9.22
7	12	150	87.7	9.00	14.03	0.03	1.32	2.32	9.75
7	15	150	87.7	8.64	12.68	0.03	1.41	2.41	10.15
7	1	200	93.34	16.50	58.15	0.03	0.57	1.57	5.66
7	3	200	93.34	12.69	30.15	0.03	0.85	1.85	7.36
7	6	200	93.34	10.85	20.42	0.03	1.08	2.08	8.60
7	9	200	93.34	9.97	16.52	0.03	1.23	2.23	9.36
7	12	200	93.34	9.43	14.36	0.03	1.35	2.35	9.90
7	15	200	93.34	9.05	12.98	0.03	1.45	2.45	10.31
7	1	250	103.55	17.83	60.46	0.03	0.59	1.59	5.81
7	3	250	103.55	13.71	31.35	0.03	0.88	1.88	7.55
7	6	250	103.55	11.73	21.23	0.03	1.12	2.12	8.83
7	9	250	103.55	10.78	17.17	0.03	1.28	2.28	9.61
7	12	250	103.55	10.19	14.93	0.03	1.40	2.40	10.16
7	15	250	103.55	9.79	13.49	0.03	1.50	2.50	10.58
7	1	300	112.87	19.02	62.44	0.03	0.61	1.61	5.93
7	3	300	112.87	14.63	32.38	0.03	0.91	1.91	7.72
7	6	300	112.87	12.52	21.92	0.03	1.16	2.16	9.02
7	9	300	112.87	11.50	17.74	0.03	1.32	2.32	9.82

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
7	12	300	112.87	10.87	15.42	0.03	1.45	2.45	10.38
7	15	300	112.87	10.44	13.93	0.03	1.55	2.55	10.81
9	1	25	23.18	5.28	32.90	0.03	0.32	1.32	4.39
9	3	25	23.18	4.06	17.06	0.03	0.48	1.48	5.71
9	6	25	23.18	3.47	11.55	0.03	0.61	1.61	6.67
9	9	25	23.18	3.19	9.35	0.03	0.70	1.70	7.26
9	12	25	23.18	3.02	8.12	0.03	0.76	1.76	7.68
9	15	25	23.18	2.90	7.34	0.03	0.82	1.82	8.00
9	1	50	40.29	7.99	40.48	0.03	0.40	1.40	5.04
9	3	50	40.29	6.15	20.99	0.03	0.59	1.59	6.55
9	6	50	40.29	5.26	14.21	0.03	0.75	1.75	7.66
9	9	50	40.29	4.83	11.50	0.03	0.86	1.86	8.34
9	12	50	40.29	4.57	10.00	0.03	0.94	1.94	8.82
9	15	50	40.29	4.39	9.03	0.03	1.01	2.01	9.18
9	1	75	53.74	9.92	45.10	0.03	0.44	1.44	5.42
9	3	75	53.74	7.63	23.39	0.03	0.66	1.66	7.04
9	6	75	53.74	6.53	15.83	0.03	0.84	1.84	8.23
9	9	75	53.74	6.00	12.81	0.03	0.96	1.96	8.96
9	12	75	53.74	5.67	11.14	0.03	1.05	2.05	9.48
9	15	75	53.74	5.45	10.06	0.03	1.12	2.12	9.87
9	1	100	64.3	11.35	48.24	0.03	0.47	1.47	5.66
9	3	100	64.3	8.73	25.01	0.03	0.70	1.70	7.37
9	6	100	64.3	7.47	16.94	0.03	0.89	1.89	8.61
9	9	100	64.3	6.86	13.70	0.03	1.02	2.02	9.37
9	12	100	64.3	6.49	11.91	0.03	1.12	2.12	9.91
9	15	100	64.3	6.23	10.76	0.03	1.20	2.20	10.32
9	1	150	87.7	14.33	54.19	0.03	0.53	1.53	6.12
9	3	150	87.7	11.02	28.10	0.03	0.79	1.79	7.96
9	6	150	87.7	9.43	19.03	0.03	1.00	2.00	9.30
9	9	150	87.7	8.66	15.39	0.03	1.15	2.15	10.13
9	12	150	87.7	8.19	13.38	0.03	1.26	2.26	10.71
9	15	150	87.7	7.86	12.09	0.03	1.35	2.35	11.15
9	1	200	93.34	15.01	55.47	0.03	0.54	1.54	6.22
9	3	200	93.34	11.54	28.77	0.03	0.81	1.81	8.09
9	6	200	93.34	9.88	19.48	0.03	1.03	2.03	9.45
9	9	200	93.34	9.07	15.76	0.03	1.18	2.18	10.29
9	12	200	93.34	8.58	13.70	0.03	1.29	2.29	10.88
9	15	200	93.34	8.24	12.38	0.03	1.38	2.38	11.33
9	1	250	103.55	16.23	57.67	0.03	0.56	1.56	6.38
9	3	250	103.55	12.48	29.91	0.03	0.84	1.84	8.30
9	6	250	103.55	10.68	20.25	0.03	1.07	2.07	9.70
9	9	250	103.55	9.81	16.38	0.03	1.22	2.22	10.56
9	12	250	103.55	9.27	14.24	0.03	1.34	2.34	11.16
9	15	250	103.55	8.91	12.87	0.03	1.43	2.43	11.63
9	1	300	112.87	17.31	59.57	0.03	0.58	1.58	6.52
9	3	300	112.87	13.31	30.89	0.03	0.87	1.87	8.48
9	6	300	112.87	11.39	20.91	0.03	1.10	2.10	9.91

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
9	9	300	112.87	10.46	16.92	0.03	1.26	2.26	10.79
9	12	300	112.87	9.89	14.71	0.03	1.38	2.38	11.41
9	15	300	112.87	9.50	13.29	0.03	1.48	2.48	11.88
11	1	25	23.18	4.90	31.69	0.03	0.31	1.31	4.73
11	3	25	23.18	3.77	16.43	0.03	0.46	1.46	6.15
11	6	25	23.18	3.22	11.13	0.03	0.59	1.59	7.19
11	9	25	23.18	2.96	9.00	0.03	0.67	1.67	7.83
11	12	25	23.18	2.80	7.82	0.03	0.74	1.74	8.28
11	15	25	23.18	2.69	7.07	0.03	0.79	1.79	8.62
11	1	50	40.29	7.42	38.99	0.03	0.38	1.38	5.43
11	3	50	40.29	5.70	20.22	0.03	0.57	1.57	7.07
11	6	50	40.29	4.88	13.69	0.03	0.72	1.72	8.26
11	9	50	40.29	4.48	11.07	0.03	0.83	1.83	8.99
11	12	50	40.29	4.24	9.63	0.03	0.91	1.91	9.51
11	15	50	40.29	4.07	8.70	0.03	0.97	1.97	9.90
11	1	75	53.74	9.20	43.43	0.03	0.42	1.42	5.84
11	3	75	53.74	7.08	22.52	0.03	0.63	1.63	7.59
11	6	75	53.74	6.06	15.25	0.03	0.81	1.81	8.88
11	9	75	53.74	5.56	12.34	0.03	0.92	1.92	9.66
11	12	75	53.74	5.26	10.72	0.03	1.01	2.01	10.22
11	15	75	53.74	5.05	9.69	0.03	1.08	2.08	10.64
11	1	100	64.3	10.53	46.45	0.03	0.45	1.45	6.11
11	3	100	64.3	8.10	24.09	0.03	0.68	1.68	7.94
11	6	100	64.3	6.93	16.31	0.03	0.86	1.86	9.28
11	9	100	64.3	6.36	13.20	0.03	0.99	1.99	10.10
11	12	100	64.3	6.02	11.47	0.03	1.08	2.08	10.69
11	15	100	64.3	5.78	10.37	0.03	1.15	2.15	11.13
11	1	150	87.7	13.29	52.19	0.03	0.51	1.51	6.60
11	3	150	87.7	10.22	27.06	0.03	0.76	1.76	8.58
11	6	150	87.7	8.74	18.32	0.03	0.97	1.97	10.03
11	9	150	87.7	8.03	14.82	0.03	1.11	2.11	10.92
11	12	150	87.7	7.59	12.89	0.03	1.21	2.21	11.55
11	15	150	87.7	7.29	11.65	0.03	1.30	2.30	12.02
11	1	200	93.34	13.92	53.42	0.03	0.52	1.52	6.70
11	3	200	93.34	10.71	27.70	0.03	0.78	1.78	8.72
11	6	200	93.34	9.16	18.76	0.03	0.99	1.99	10.19
11	9	200	93.34	8.42	15.17	0.03	1.13	2.13	11.09
11	12	200	93.34	7.96	13.19	0.03	1.24	2.24	11.73
11	15	200	93.34	7.64	11.92	0.03	1.33	2.33	12.21
11	1	250	103.55	15.05	55.54	0.03	0.54	1.54	6.88
11	3	250	103.55	11.57	28.80	0.03	0.81	1.81	8.95
11	6	250	103.55	9.90	19.50	0.03	1.03	2.03	10.46
11	9	250	103.55	9.10	15.78	0.03	1.18	2.18	11.38
11	12	250	103.55	8.60	13.72	0.03	1.29	2.29	12.04
11	15	250	103.55	8.26	12.40	0.03	1.38	2.38	12.53
11	1	300	112.87	16.06	57.37	0.03	0.56	1.56	7.03
11	3	300	112.87	12.35	29.75	0.03	0.84	1.84	9.14

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
11	6	300	112.87	10.56	20.14	0.03	1.06	2.06	10.68
11	9	300	112.87	9.71	16.29	0.03	1.22	2.22	11.63
11	12	300	112.87	9.18	14.17	0.03	1.33	2.33	12.30
11	15	300	112.87	8.81	12.80	0.03	1.43	2.43	12.81
13	1	25	23.18	4.60	30.71	0.03	0.30	1.30	5.04
13	3	25	23.18	3.54	15.92	0.03	0.45	1.45	6.55
13	6	25	23.18	3.03	10.78	0.03	0.57	1.57	7.66
13	9	25	23.18	2.78	8.72	0.03	0.65	1.65	8.34
13	12	25	23.18	2.63	7.58	0.03	0.71	1.71	8.82
13	15	25	23.18	2.53	6.85	0.03	0.76	1.76	9.18
13	1	50	40.29	6.96	37.78	0.03	0.37	1.37	5.78
13	3	50	40.29	5.36	19.59	0.03	0.55	1.55	7.52
13	6	50	40.29	4.58	13.27	0.03	0.70	1.70	8.79
13	9	50	40.29	4.21	10.73	0.03	0.80	1.80	9.57
13	12	50	40.29	3.98	9.33	0.03	0.88	1.88	10.12
13	15	50	40.29	3.82	8.43	0.03	0.94	1.94	10.54
13	1	75	53.74	8.64	42.09	0.03	0.41	1.41	6.22
13	3	75	53.74	6.65	21.83	0.03	0.61	1.61	8.08
13	6	75	53.74	5.69	14.78	0.03	0.78	1.78	9.45
13	9	75	53.74	5.23	11.96	0.03	0.89	1.89	10.29
13	12	75	53.74	4.94	10.39	0.03	0.98	1.98	10.88
13	15	75	53.74	4.74	9.39	0.03	1.05	2.05	11.33
13	1	100	64.3	9.89	45.02	0.03	0.44	1.44	6.50
13	3	100	64.3	7.60	23.35	0.03	0.66	1.66	8.45
13	6	100	64.3	6.51	15.81	0.03	0.83	1.83	9.88
13	9	100	64.3	5.98	12.79	0.03	0.95	1.95	10.76
13	12	100	64.3	5.65	11.12	0.03	1.05	2.05	11.38
13	15	100	64.3	5.43	10.05	0.03	1.12	2.12	11.85
13	1	150	87.7	12.48	50.58	0.03	0.49	1.49	7.03
13	3	150	87.7	9.60	26.23	0.03	0.74	1.74	9.14
13	6	150	87.7	8.21	17.76	0.03	0.94	1.94	10.68
13	9	150	87.7	7.54	14.37	0.03	1.07	2.07	11.62
13	12	150	87.7	7.13	12.49	0.03	1.18	2.18	12.29
13	15	150	87.7	6.85	11.29	0.03	1.26	2.26	12.80
13	1	200	93.34	13.08	51.78	0.03	0.51	1.51	7.14
13	3	200	93.34	10.06	26.85	0.03	0.75	1.75	9.28
13	6	200	93.34	8.60	18.18	0.03	0.96	1.96	10.85
13	9	200	93.34	7.91	14.71	0.03	1.10	2.10	11.81
13	12	200	93.34	7.47	12.78	0.03	1.20	2.20	12.49
13	15	200	93.34	7.18	11.55	0.03	1.29	2.29	13.00
13	1	250	103.55	14.14	53.83	0.03	0.53	1.53	7.32
13	3	250	103.55	10.87	27.91	0.03	0.78	1.78	9.52
13	6	250	103.55	9.30	18.90	0.03	1.00	2.00	11.13
13	9	250	103.55	8.55	15.29	0.03	1.14	2.14	12.12
13	12	250	103.55	8.08	13.29	0.03	1.25	2.25	12.82
13	15	250	103.55	7.76	12.01	0.03	1.34	2.34	13.35
13	1	300	112.87	15.08	55.60	0.03	0.54	1.54	7.48

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
13	3	300	112.87	11.60	28.83	0.03	0.81	1.81	9.73
13	6	300	112.87	9.92	19.52	0.03	1.03	2.03	11.37
13	9	300	112.87	9.12	15.79	0.03	1.18	2.18	12.38
13	12	300	112.87	8.62	13.73	0.03	1.29	2.29	13.09
13	15	300	112.87	8.28	12.41	0.03	1.38	2.38	13.64
15	1	25	23.18	4.36	29.90	0.03	0.29	1.29	5.32
15	3	25	23.18	3.35	15.50	0.03	0.44	1.44	6.91
15	6	25	23.18	2.87	10.50	0.03	0.55	1.55	8.08
15	9	25	23.18	2.64	8.49	0.03	0.63	1.63	8.79
15	12	25	23.18	2.49	7.38	0.03	0.69	1.69	9.30
15	15	25	23.18	2.39	6.67	0.03	0.74	1.74	9.69
15	1	50	40.29	6.60	36.78	0.03	0.36	1.36	6.10
15	3	50	40.29	5.08	19.07	0.03	0.54	1.54	7.94
15	6	50	40.29	4.34	12.91	0.03	0.68	1.68	9.28
15	9	50	40.29	3.99	10.45	0.03	0.78	1.78	10.10
15	12	50	40.29	3.77	9.08	0.03	0.85	1.85	10.68
15	15	50	40.29	3.62	8.21	0.03	0.91	1.91	11.12
15	1	75	53.74	8.19	40.98	0.03	0.40	1.40	6.56
15	3	75	53.74	6.30	21.25	0.03	0.60	1.60	8.53
15	6	75	53.74	5.39	14.39	0.03	0.76	1.76	9.97
15	9	75	53.74	4.95	11.64	0.03	0.87	1.87	10.85
15	12	75	53.74	4.68	10.12	0.03	0.95	1.95	11.48
15	15	75	53.74	4.50	9.14	0.03	1.02	2.02	11.95
15	1	100	64.3	9.37	43.83	0.03	0.43	1.43	6.86
15	3	100	64.3	7.21	22.73	0.03	0.64	1.64	8.92
15	6	100	64.3	6.17	15.39	0.03	0.81	1.81	10.43
15	9	100	64.3	5.67	12.45	0.03	0.93	1.93	11.35
15	12	100	64.3	5.36	10.82	0.03	1.02	2.02	12.00
15	15	100	64.3	5.14	9.78	0.03	1.09	2.09	12.50
15	1	150	87.7	11.83	49.24	0.03	0.48	1.48	7.41
15	3	150	87.7	9.10	25.53	0.03	0.72	1.72	9.64
15	6	150	87.7	7.78	17.29	0.03	0.91	1.91	11.27
15	9	150	87.7	7.15	13.99	0.03	1.04	2.04	12.27
15	12	150	87.7	6.76	12.16	0.03	1.14	2.14	12.97
15	15	150	87.7	6.49	10.99	0.03	1.22	2.22	13.51
15	1	200	93.34	12.40	50.40	0.03	0.49	1.49	7.53
15	3	200	93.34	9.53	26.14	0.03	0.73	1.73	9.79
15	6	200	93.34	8.16	17.70	0.03	0.93	1.93	11.45
15	9	200	93.34	7.49	14.32	0.03	1.07	2.07	12.46
15	12	200	93.34	7.08	12.45	0.03	1.17	2.17	13.18
15	15	200	93.34	6.80	11.25	0.03	1.25	2.25	13.72
15	1	250	103.55	13.40	52.41	0.03	0.51	1.51	7.73
15	3	250	103.55	10.30	27.18	0.03	0.76	1.76	10.05
15	6	250	103.55	8.82	18.40	0.03	0.97	1.97	11.75
15	9	250	103.55	8.10	14.89	0.03	1.11	2.11	12.79
15	12	250	103.55	7.66	12.94	0.03	1.22	2.22	13.52
15	15	250	103.55	7.35	11.69	0.03	1.30	2.30	14.08

DIVERSION BERM HEIGHT CALCULATION									
Flow Slope (FS) (%)	Internal Slope (IS) (%)	Watershed Area (acres)	Peak Discharge (Q_{10}) (cfs)	Flow Area (ft^2)	Wetted Perimeter (ft)	Mannings Coefficient	Berm Height (B) (ft)	Berm + 1 Foot of Freeboard	Velocity (fps)
1	1	25	23.18	12.04	49.67	0.03	0.49	1.49	1.93
1	3	25	23.18	9.26	25.76	0.03	0.72	1.72	2.50
15	1	300	112.87	14.29	54.13	0.03	0.53	1.53	7.90
15	3	300	112.87	10.99	28.07	0.03	0.79	1.79	10.27
15	6	300	112.87	9.40	19.00	0.03	1.00	2.00	12.00
15	9	300	112.87	8.64	15.37	0.03	1.15	2.15	13.06
15	12	300	112.87	8.17	13.37	0.03	1.26	2.26	13.82
15	15	300	112.87	7.85	12.08	0.03	1.35	2.35	14.39