APPENDIX 11-X

LOWE ARROYO POST-MINING HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

OCTOBER 2006

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Lowe Arroyo Post-mining Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 11-77.

Revised October 2006

AAY/LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

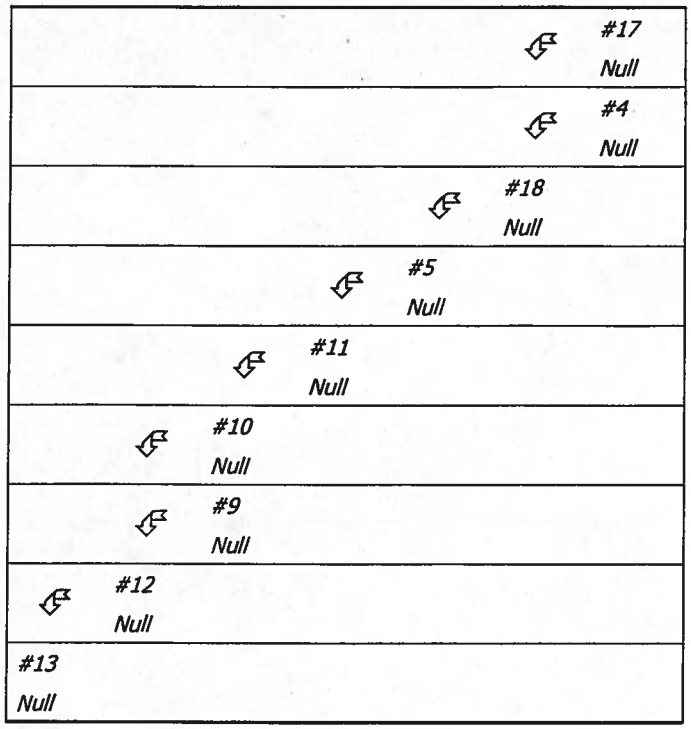
Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#15	0.000	0.000	
Null	#2	==>	#14	0.036	0.384	
Null	#3	==>	#14	0.018	0.411	
Null	#4	==>	#18	0.000	0.000	LSDS3
Null	#5	==>	#11	1.797	0.283	
Null	#6	==>	#16	0.053	0.371	
Null	#7	==>	#16	0.117	0.289	
Null	#8	==>	#15	0.000	0.000	
Null	#9	==>	#12	0.000	0.000	
Null	#10	==>	#12	0.000	0.000	
Null	#11	==>	#10	0.123	0.338	LSDS1
Null	#12	==>	#13	1.322	0.305	
Null	#13	==>	End	0.000	0.000	
Null	#14	==>	#6	0.669	0.249	Lowe Premanent Imp. #1
Null	#15	==>	#6	0.337	0.316	
Null	#16	==>	#10	0.299	0.325	
Null	#17	==>	#18	0.000	0.000	LSDS2
Null	#18	==>	#5	0.911	0.270	

#7 *Null*
#8 *Null*
#1 *Null*
#15 *Null*
#3 *Null*
#2 *Null*
#14 *Null*
#6 *Null*
#16 *Null*



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	3.52	26.00	739.00	5.62	0.036
#2	**Muskingum K:**					**0.036**
#3	8. Large gullies, diversions, and low flowing streams	6.84	36.00	526.00	7.84	0.018
#3	**Muskingum K:**					**0.018**
#5	8. Large gullies, diversions, and low flowing streams	0.55	79.00	14,363.00	2.22	1.797
#5	**Muskingum K:**					**1.797**
#6	8. Large gullies, diversions, and low flowing streams	2.65	25.00	942.00	4.88	0.053
#6	**Muskingum K:**					**0.053**
#7	8. Large gullies, diversions, and low flowing streams	0.61	6.00	989.00	2.33	0.117
#7	**Muskingum K:**					**0.117**
#11	8. Large gullies, diversions, and low flowing streams	1.40	22.00	1,572.00	3.54	0.123
#11	**Muskingum K:**					**0.123**
#12	8. Large gullies, diversions, and low flowing streams	0.79	100.00	12,666.00	2.66	1.322
#12	**Muskingum K:**					**1.322**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	8. Large gullies, diversions, and low flowing streams	0.32	13.00	4,071.00	1.69	0.669
#14	**Muskingum K:**					**0.669**
#15	8. Large gullies, diversions, and low flowing streams	0.96	34.00	3,555.00	2.93	0.337
#15	**Muskingum K:**					**0.337**
#16	8. Large gullies, diversions, and low flowing streams	1.11	38.00	3,411.00	3.16	0.299
#16	**Muskingum K:**					**0.299**
#18	8. Large gullies, diversions, and low flowing streams	0.44	29.00	6,531.00	1.99	0.911
#18	**Muskingum K:**					**0.911**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#7	278.700	278.700	4.19	0.75	6.7	10,989	6.03	4.52
#8	214.480	214.480	3.48	0.57	9.6	19,546	11.00	8.29
#1	402.420	402.420	13.95	2.69	30.1	21,411	0.90	0.43
#15	0.000	616.900	17.28	3.26	39.7	20,823	3.49	1.85
#3	811.800	811.800	85.75	11.16	235.6	29,599	2.09	1.34
#2	796.200	796.200	33.35	5.36	79.9	26,823	0.34	0.17
#14	0.000	1,608.000	111.83	16.52	315.5	28,636	1.60	0.96
#6	374.530	2,599.430	124.49	21.43	371.0	26,370	2.34	1.38
#16	0.000	2,878.130	127.01	22.17	377.7	32,117	3.11	1.49
#17	695.800	695.800	32.02	7.49	52.5	9,026	0.00	0.00
#4	719.100	719.100	83.25	10.49	267.2	36,175	2.32	1.47
#18	0.000	1,414.900	102.71	17.99	319.7	31,217	1.67	0.86
#5	658.600	2,073.500	106.40	22.28	344.3	28,218	1.72	0.86
#11	1,356.700	3,430.200	106.28	26.12	376.3	26,676	2.58	1.26
#10	489.200	6,797.530	146.28	51.88	785.8	25,161	2.74	1.49
#9	341.200	341.200	41.05	4.47	131.6	39,317	4.05	2.76
#12	0.000	7,138.730	155.08	56.35	917.4	32,790	3.54	1.59
#13	806.400	7,945.130	160.38	69.26	976.8	23,025	0.55	0.32

Particle Size Distribution(s) at Each Structure

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	65.798%
0.0500	34.761%
0.0020	27.312%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	62.047%
0.0500	32.780%
0.0020	25.755%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	95.982%
0.0020	93.193%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	90.832%
0.0500	80.714%
0.0020	76.902%

Size (mm)	In/Out
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.434%
0.0500	97.439%
0.0020	83.371%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.801%
0.0020	97.927%
0.0010	0.000%

Structure #14 (Lowe Premanent Imp. #1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.577%
0.0500	97.784%
0.0020	87.056%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.236%
0.0500	93.327%
0.0020	83.383%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.678%
0.0500	92.287%
0.0020	82.388%
0.0010	0.000%

Structure #17 (LSDS2):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #4 (LSDS3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.798%
0.0500	97.506%
0.0020	85.079%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.995%
0.0500	97.916%
0.0020	87.530%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.429%
0.0500	96.824%
0.0020	86.797%

Size (mm)	In/Out
0.0010	0.000%

Structure #11 (LSDS1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.562%
0.0500	92.309%
0.0020	82.338%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.419%
0.0500	90.876%
0.0020	80.787%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.269%
0.0500	88.918%
0.0020	84.861%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	95.967%
0.0500	90.595%
0.0020	81.371%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.305%
0.0010	0.000%

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)
#7	1	278.700	0.500	0.000	0.000	80.000	M	4.19	0.747
	Σ	**278.700**						**4.19**	**0.747**
#8	1	165.330	0.313	0.150	0.304	80.000	M	2.79	0.443
	2	49.150	0.344	0.000	0.000	80.000	M	0.79	0.132
	Σ	**214.480**						**3.48**	**0.575**
#1	1	305.210	2.419	0.000	0.000	81.200	M	2.98	1.089
	2	97.210	0.575	0.000	0.000	90.000	M	13.61	1.601
	Σ	**402.420**						**13.95**	**2.690**
#15	Σ	**616.900**						**17.28**	**3.264**
#3	1	256.900	2.055	0.489	0.335	83.500	M	4.68	1.473
	2	138.800	0.315	0.489	0.335	89.900	M	26.94	2.254
	3	54.800	0.221	0.489	0.335	93.000	M	19.03	1.374
	4	98.600	0.277	0.215	0.326	89.900	M	20.31	1.601
	5	111.900	0.466	0.215	0.326	92.700	M	26.99	2.692
	6	38.300	0.159	0.325	0.328	93.000	M	14.67	0.960
	7	112.500	0.437	0.000	0.000	84.700	M	6.87	0.804
	Σ	**811.800**						**85.75**	**11.157**
#2	1	549.100	2.696	0.433	0.371	80.300	M	3.98	1.585
	2	189.400	0.454	0.000	0.000	88.300	M	22.91	2.429
	3	57.700	0.638	0.000	0.000	92.500	M	11.23	1.350
	Σ	**796.200**						**33.35**	**5.364**
#14	Σ	**1,608.000**						**111.83**	**16.521**
#6	1	115.100	0.645	0.684	0.284	85.500	M	6.57	0.944
	2	133.500	0.490	0.341	0.295	80.000	M	2.02	0.358
	3	125.930	0.368	0.000	0.000	80.000	M	1.98	0.337
	Σ	**2,599.430**						**124.49**	**21.425**
#16	Σ	**2,878.130**						**127.01**	**22.172**
#17	1	470.600	1.256	0.366	0.352	87.000	M	23.44	4.936
	2	225.200	0.831	0.000	0.000	87.500	M	16.24	2.555
	Σ	**695.800**						**32.02**	**7.491**
#4	1	166.700	1.396	0.539	0.354	81.100	M	2.21	0.581
	2	66.500	0.818	0.539	0.354	82.600	M	1.70	0.320
	3	96.300	0.766	0.396	0.340	90.200	M	11.60	1.632

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	4	53.100	0.199	0.396	0.340	93.000	M	19.06	1.331
	5	112.200	0.398	0.305	0.351	92.700	M	29.36	2.699
	6	56.900	0.238	0.185	0.329	93.000	M	19.25	1.426
	7	89.500	0.413	0.185	0.329	91.900	M	20.49	1.928
	8	77.900	0.316	0.000	0.000	84.900	M	6.02	0.576
	Σ	**719.100**						**83.25**	**10.494**
#18	**Σ**	**1,414.900**						**102.71**	**17.985**
#5	1	87.500	0.772	1.520	0.200	91.500	M	12.90	1.783
	2	225.700	0.835	0.420	0.265	82.700	M	5.86	1.107
	3	345.400	1.922	0.000	0.000	81.800	M	4.50	1.406
	Σ	**2,073.500**						**106.40**	**22.281**
#11	1	382.400	1.784	0.800	0.301	80.000	M	3.27	1.024
	2	318.100	1.198	0.796	0.303	80.000	M	3.38	0.852
	3	221.800	0.668	0.499	0.312	80.000	M	3.06	0.594
	4	183.100	0.521	0.408	0.317	80.000	M	2.73	0.490
	5	114.200	0.543	0.408	0.317	82.200	M	3.17	0.506
	6	137.100	0.311	0.000	0.000	80.000	M	2.32	0.367
	Σ	**3,430.200**						**106.28**	**26.115**
#10	1	207.800	0.683	0.089	0.324	80.000	M	2.84	0.557
	2	37.900	0.192	0.000	0.000	88.300	M	7.08	0.486
	3	67.000	0.453	0.000	0.000	87.000	M	6.41	0.703
	4	176.500	1.247	0.097	0.362	87.000	M	8.84	1.851
	Σ	**6,797.530**						**146.28**	**51.884**
#9	1	202.500	0.395	0.000	0.000	82.700	M	7.91	0.994
	2	138.700	0.513	0.000	0.000	93.000	M	33.14	3.477
	Σ	**341.200**						**41.05**	**4.471**
#12	**Σ**	**7,138.730**						**155.08**	**56.354**
#13	1	128.300	0.245	1.141	0.305	91.800	M	36.58	2.725
	2	101.000	0.160	1.048	0.302	92.300	M	35.35	2.299
	3	133.900	0.165	0.948	0.300	90.500	M	36.74	2.369
	4	443.200	1.345	0.000	0.000	88.100	M	25.65	5.514
	Σ	**7,945.130**						**160.38**	**69.262**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#7	1	0.214	200.00	3.26	0.3640	1.0000	1	6.7	10,989	6.03	4.52
	Σ							**6.7**	**10,989**	**6.03**	**4.52**
#8	1	0.214	150.00	6.30	0.3640	1.0000	1	7.8	21,519	12.13	9.12
	2	0.214	175.00	5.10	0.3640	1.0000	1	1.7	15,951	8.90	6.74
	Σ							**9.6**	**19,546**	**11.00**	**8.29**
#1	1	0.146	300.00	2.28	0.3430	1.0000	2	3.6	3,954	1.40	1.08
	2	0.181	175.00	4.95	0.3390	1.0000	3	26.5	21,920	0.00	0.00
	Σ							**30.1**	**21,411**	**0.90**	**0.43**
#15	Σ							**39.7**	**20,823**	**3.49**	**1.85**
#3	1	0.215	300.00	2.93	0.3350	1.0000	2	9.9	8,127	3.11	2.36
	2	0.202	175.00	4.54	0.3220	1.0000	3	46.0	27,450	0.97	0.66
	3	0.208	175.00	5.72	0.3740	1.0000	3	42.7	41,239	3.24	2.21
	4	0.180	175.00	5.53	0.3450	1.0000	3	37.3	32,029	1.46	0.97
	5	0.205	175.00	4.67	0.3930	1.0000	3	64.6	31,864	0.64	0.44
	6	0.210	150.00	6.04	0.3990	1.0000	3	31.7	43,873	4.16	2.80
	7	0.100	300.00	2.77	0.3090	1.0000	2	3.6	5,995	3.36	2.28
	Σ							**235.6**	**29,599**	**2.09**	**1.34**
#2	1	0.150	400.00	1.06	0.3310	1.0000	2	2.9	2,216	0.77	0.59
	2	0.175	175.00	5.69	0.3280	1.0000	3	47.8	26,634	0.00	0.00
	3	0.201	175.00	5.48	0.3730	1.0000	3	29.1	28,229	0.00	0.00
	Σ							**79.9**	**26,823**	**0.34**	**0.17**
#14	Σ							**315.5**	**28,636**	**1.60**	**0.96**
#6	1	0.183	300.00	2.10	0.3180	1.0000	2	5.6	7,548	4.03	2.90
	2	0.214	175.00	4.60	0.3640	1.0000	1	4.7	15,827	8.69	6.55
	3	0.214	175.00	5.90	0.3640	1.0000	1	5.6	20,160	11.18	8.50
	Σ							**371.0**	**26,370**	**2.34**	**1.38**
#16	Σ							**377.7**	**32,117**	**3.11**	**1.49**
#17	1	0.185	200.00	3.00	0.2970	1.0000	3	33.1	8,353	0.00	0.00
	2	0.172	200.00	3.03	0.3630	1.0000	3	21.4	10,740	0.00	0.00
	Σ							**52.5**	**9,026**	**0.00**	**0.00**
#4	1	0.184	300.00	2.66	0.3150	1.0000	2	2.8	5,889	2.53	1.93
	2	0.217	200.00	3.33	0.2980	1.0000	2	2.1	8,263	4.02	2.99
	3	0.207	150.00	6.22	0.3420	1.0000	3	32.5	25,505	0.00	0.00
	4	0.209	150.00	6.14	0.3920	1.0000	3	43.8	44,069	3.71	2.51
	5	0.205	150.00	7.39	0.3680	1.0000	3	91.1	44,730	1.57	1.07

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	6	0.210	175.00	5.44	0.3990	1.0000	3	45.0	42,473	3.16	2.12
	7	0.198	175.00	4.66	0.3870	1.0000	3	43.6	30,224	0.78	0.53
	8	0.180	200.00	3.36	0.3680	1.0000	2	6.2	15,187	8.91	5.79
	Σ							**267.2**	**36,175**	**2.32**	**1.47**
#18	Σ							**319.7**	**31,217**	**1.67**	**0.86**
#5	1	0.198	300.00	2.56	0.3180	1.0000	3	15.0	10,611	0.00	0.00
	2	0.199	300.00	2.59	0.3410	1.0000	1	8.0	8,992	4.69	3.48
	3	0.190	300.00	2.01	0.3460	1.0000	1	6.1	5,250	2.28	1.74
	Σ							**344.3**	**28,218**	**1.72**	**0.86**
#11	1	0.214	200.00	3.59	0.3640	1.0000	1	7.6	8,832	4.01	3.11
	2	0.214	200.00	3.15	0.3640	1.0000	1	6.2	8,693	4.30	3.31
	3	0.214	300.00	2.82	0.3640	1.0000	1	4.9	9,998	5.36	4.05
	4	0.214	200.00	3.79	0.3640	1.0000	1	4.8	11,895	6.50	4.90
	5	0.222	300.00	2.92	0.3550	1.0000	1	4.8	11,824	6.48	4.74
	6	0.214	125.00	8.45	0.3640	1.0000	1	8.0	26,473	14.94	11.17
	Σ							**376.3**	**26,676**	**2.58**	**1.26**
#10	1	0.214	175.00	4.71	0.3640	1.0000	1	7.4	16,144	8.63	6.52
	2	0.198	150.00	6.30	0.2590	1.0000	3	9.2	27,402	1.69	1.05
	3	0.200	300.00	3.00	0.3340	1.0000	2	7.4	14,252	8.20	5.55
	4	0.200	400.00	1.30	0.3340	1.0000	2	8.0	5,357	2.56	1.89
	Σ							**785.8**	**25,161**	**2.74**	**1.49**
#9	1	0.214	175.00	5.50	0.3640	1.0000	1	21.0	27,988	16.20	11.17
	2	0.209	150.00	6.80	0.3850	1.0000	3	110.6	42,006	0.53	0.37
	Σ							**131.6**	**39,317**	**4.05**	**2.76**
#12	Σ							**917.4**	**32,790**	**3.54**	**1.59**
#13	1	0.194	150.00	7.45	0.2660	1.0000	3	71.4	33,733	2.23	1.57
	2	0.190	150.00	6.64	0.2120	1.0000	3	44.5	24,876	2.28	1.59
	3	0.183	150.00	7.16	0.2340	1.0000	3	52.9	28,985	2.41	1.66
	4	0.175	175.00	4.23	0.2690	1.0000	3	50.0	11,322	0.00	0.00
	Σ							**976.8**	**23,025**	**0.55**	**0.32**

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	0.65	38.00	5,863.00	0.800	2.035

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.48	75.00	5,055.00	3.650	0.384
#1	**1**	**Time of Concentration:**					**2.419**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.18	28.00	1,285.00	1.470	0.242
		8. Large gullies, diversions, and low flowing streams	1.33	55.00	4,147.00	3.450	0.333
#1	**2**	**Time of Concentration:**					**0.575**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.77	60.00	7,840.00	0.870	2.503
		8. Large gullies, diversions, and low flowing streams	1.22	28.00	2,301.00	3.300	0.193
#2	**1**	**Time of Concentration:**					**2.696**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	3.97	30.00	755.00	1.990	0.105
		8. Large gullies, diversions, and low flowing streams	2.84	180.00	6,347.19	5.050	0.349
#2	**2**	**Time of Concentration:**					**0.454**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	6.07	45.00	741.00	2.460	0.083
		8. Large gullies, diversions, and low flowing streams	0.36	13.00	3,598.00	1.800	0.555
#2	**3**	**Time of Concentration:**					**0.638**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	46.00	5,799.00	0.890	1.809
		8. Large gullies, diversions, and low flowing streams	3.31	160.00	4,837.00	5.450	0.246
#3	**1**	**Time of Concentration:**					**2.055**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	4.93	75.00	1,521.00	2.220	0.190
		8. Large gullies, diversions, and low flowing streams	2.98	70.00	2,345.00	5.180	0.125
#3	**2**	**Time of Concentration:**					**0.315**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	6.42	83.00	1,293.00	2.530	0.141
		8. Large gullies, diversions, and low flowing streams	3.21	50.00	1,559.00	5.370	0.080
#3	**3**	**Time of Concentration:**					**0.221**
#3	4	5. Nearly bare and untilled, and alluvial valley fans	8.98	60.00	668.00	2.990	0.062
		8. Large gullies, diversions, and low flowing streams	2.82	110.00	3,900.00	5.030	0.215
#3	**4**	**Time of Concentration:**					**0.277**
#3	5	5. Nearly bare and untilled, and alluvial valley fans	4.11	50.00	1,216.00	2.020	0.167
		8. Large gullies, diversions, and low flowing streams	1.86	82.00	4,404.00	4.090	0.299
#3	**5**	**Time of Concentration:**					**0.466**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	6	5. Nearly bare and untilled, and alluvial valley fans	9.01	53.00	588.00	3.000	0.054
		8. Large gullies, diversions, and low flowing streams	1.64	24.00	1,463.00	3.840	0.105
#3	**6**	**Time of Concentration:**					**0.159**
#3	7	5. Nearly bare and untilled, and alluvial valley fans	1.97	32.00	1,622.00	1.400	0.321
		8. Large gullies, diversions, and low flowing streams	2.16	40.00	1,849.00	4.410	0.116
#3	**7**	**Time of Concentration:**					**0.437**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.00	1.030	0.872
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.00	4.650	0.384
#4	**1**	**Time of Concentration:**					**1.396**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	0.86	37.00	4,286.00	0.920	1.294
		8. Large gullies, diversions, and low flowing streams	4.10	92.00	2,243.00	6.070	0.102
#4	**2**	**Time of Concentration:**					**0.818**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.00	0.960	0.717
		8. Large gullies, diversions, and low flowing streams	3.83	82.00	2,141.00	5.870	0.101
#4	**3**	**Time of Concentration:**					**0.766**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	0.63	10.00	1,582.00	0.790	0.556
		8. Large gullies, diversions, and low flowing streams	3.62	157.00	4,332.00	5.710	0.210
#4	**4**	**Time of Concentration:**					**0.199**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	8.38	73.00	871.00	2.890	0.083
		8. Large gullies, diversions, and low flowing streams	2.64	54.00	2,043.00	4.870	0.116
#4	**5**	**Time of Concentration:**					**0.398**
#4	6	5. Nearly bare and untilled, and alluvial valley fans	4.90	80.00	1,632.02	2.210	0.205
		8. Large gullies, diversions, and low flowing streams	2.57	86.00	3,346.04	4.800	0.193
#4	**6**	**Time of Concentration:**					**0.238**
#4	7	5. Nearly bare and untilled, and alluvial valley fans	12.89	70.00	543.00	3.590	0.042
		8. Large gullies, diversions, and low flowing streams	1.40	35.00	2,508.00	3.540	0.196
#4	**7**	**Time of Concentration:**					**0.413**
#4	8	5. Nearly bare and untilled, and alluvial valley fans	3.79	35.00	923.00	1.940	0.132
		8. Large gullies, diversions, and low flowing streams	1.04	21.00	2,027.00	3.050	0.184

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	**8**	**Time of Concentration:**					**0.316**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	62.00	3,617.00	1.300	0.772
#5	**1**	**Time of Concentration:**					**0.772**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	1.83	60.00	3,278.00	1.350	0.674
		8. Large gullies, diversions, and low flowing streams	1.40	29.00	2,064.00	3.550	0.161
#5	**2**	**Time of Concentration:**					**0.835**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	1.04	70.00	6,720.00	1.020	1.830
		8. Large gullies, diversions, and low flowing streams	2.13	31.00	1,452.00	4.380	0.092
#5	**3**	**Time of Concentration:**					**1.922**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.83	52.00	2,835.00	1.350	0.583
		8. Large gullies, diversions, and low flowing streams	4.22	58.00	1,376.00	6.150	0.062
#6	**1**	**Time of Concentration:**					**0.645**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.12	32.00	1,025.00	1.760	0.161
		8. Large gullies, diversions, and low flowing streams	0.34	7.00	2,064.00	1.740	0.329
#6	**2**	**Time of Concentration:**					**0.490**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	5.62	90.00	1,602.00	2.370	0.187
		8. Large gullies, diversions, and low flowing streams	0.55	8.00	1,452.00	2.220	0.181
#6	**3**	**Time of Concentration:**					**0.368**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	25.00	1,024.00	1.560	0.182
		8. Large gullies, diversions, and low flowing streams	1.58	68.00	4,313.00	3.760	0.318
#7	**1**	**Time of Concentration:**					**0.500**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	2.25	20.00	889.00	1.490	0.165
		8. Large gullies, diversions, and low flowing streams	4.35	145.00	3,334.00	6.250	0.148
#8	**1**	**Time of Concentration:**					**0.313**
#8	2	5. Nearly bare and untilled, and alluvial valley fans	3.93	70.00	1,783.00	1.980	0.250
		8. Large gullies, diversions, and low flowing streams	2.70	45.00	1,667.00	4.920	0.094
#8	**2**	**Time of Concentration:**					**0.344**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	5.13	65.00	1,267.00	2.260	0.155
		8. Large gullies, diversions, and low flowing streams	2.62	110.00	4,205.00	4.850	0.240
#9	**1**	**Time of Concentration:**					**0.395**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	2	5. Nearly bare and untilled, and alluvial valley fans	4.71	52.00	1,104.00	2.170	0.141
		8. Large gullies, diversions, and low flowing streams	2.41	150.00	6,233.00	4.650	0.372
#9	**2**	**Time of Concentration:**					**0.513**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	4.04	124.00	3,069.00	2.010	0.424
		8. Large gullies, diversions, and low flowing streams	1.02	29.00	2,831.00	3.030	0.259
#10	**1**	**Time of Concentration:**					**0.683**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	6.45	80.00	1,241.00	2.530	0.136
		8. Large gullies, diversions, and low flowing streams	3.49	40.00	1,147.00	5.600	0.056
#10	**2**	**Time of Concentration:**					**0.192**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	2.43	43.00	1,767.00	1.550	0.316
		8. Large gullies, diversions, and low flowing streams	2.84	71.00	2,501.00	5.050	0.137
#10	**3**	**Time of Concentration:**					**0.453**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	0.94	36.00	3,823.00	0.970	1.094
		8. Large gullies, diversions, and low flowing streams	1.58	33.00	2,085.00	3.770	0.153
#10	**4**	**Time of Concentration:**					**1.247**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	1.07	18.00	1,686.00	1.030	0.454
		8. Large gullies, diversions, and low flowing streams	0.19	12.00	6,274.00	1.310	1.330
#11	**1**	**Time of Concentration:**					**1.784**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	1.08	30.00	2,774.00	1.030	0.748
		8. Large gullies, diversions, and low flowing streams	0.69	28.00	4,040.00	2.490	0.450
#11	**2**	**Time of Concentration:**					**1.198**
#11	3	5. Nearly bare and untilled, and alluvial valley fans	2.71	62.00	2,289.00	1.640	0.387
		8. Large gullies, diversions, and low flowing streams	1.12	36.00	3,207.00	3.170	0.281
#11	**3**	**Time of Concentration:**					**0.668**
#11	4	5. Nearly bare and untilled, and alluvial valley fans	2.58	63.00	2,438.00	1.600	0.423
		8. Large gullies, diversions, and low flowing streams	2.00	30.00	1,500.00	4.240	0.098
#11	**4**	**Time of Concentration:**					**0.521**
#11	5	5. Nearly bare and untilled, and alluvial valley fans	3.22	45.00	1,399.00	1.790	0.217
		8. Large gullies, diversions, and low flowing streams	1.23	48.00	3,898.00	3.320	0.326

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#11	**5**	**Time of Concentration:**					**0.543**
#11	6	5. Nearly bare and untilled, and alluvial valley fans	8.20	111.00	1,353.00	2.860	0.131
		8. Large gullies, diversions, and low flowing streams	1.45	34.00	2,344.00	3.610	0.180
#11	**6**	**Time of Concentration:**					**0.311**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	778.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	3.74	98.00	2,620.00	5.800	0.125
#13	**1**	**Time of Concentration:**					**0.245**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	9.77	50.00	512.00	3.120	0.045
		8. Large gullies, diversions, and low flowing streams	3.65	87.00	2,386.00	5.720	0.115
#13	**2**	**Time of Concentration:**					**0.160**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	19.02	85.00	447.00	4.360	0.028
		8. Large gullies, diversions, and low flowing streams	3.12	82.00	2,627.00	5.300	0.137
#13	**3**	**Time of Concentration:**					**0.165**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.51	105.00	2,995.00	1.870	0.444
		8. Large gullies, diversions, and low flowing streams	0.72	60.00	8,278.00	2.550	0.901
#13	**4**	**Time of Concentration:**					**1.345**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.00	1.030	0.872
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.00	4.650	0.384
#17	**1**	**Time of Concentration:**					**1.256**
#17	2	5. Nearly bare and untilled, and alluvial valley fans	2.65	97.00	3,659.00	1.620	0.627
		8. Large gullies, diversions, and low flowing streams	1.41	37.00	2,624.00	3.560	0.204
#17	**2**	**Time of Concentration:**					**0.831**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	2.65	202.00	7,615.00	4.880	0.433
#2	**1**	**Muskingum K:**					**0.433**
#3	1	8. Large gullies, diversions, and low flowing streams	1.32	80.00	6,060.00	3.440	0.489
#3	**1**	**Muskingum K:**					**0.489**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	2	8. Large gullies, diversions, and low flowing streams	1.32	80.00	6,060.00	3.440	0.489
#3	**2**	**Muskingum K:**					**0.489**
#3	3	8. Large gullies, diversions, and low flowing streams	1.32	80.00	6,060.00	3.440	0.489
#3	**3**	**Muskingum K:**					**0.489**
#3	4	8. Large gullies, diversions, and low flowing streams	1.13	28.00	2,470.00	3.190	0.215
#3	**4**	**Muskingum K:**					**0.215**
#3	5	8. Large gullies, diversions, and low flowing streams	1.13	28.00	2,470.00	3.190	0.215
#3	**5**	**Muskingum K:**					**0.215**
#3	6	8. Large gullies, diversions, and low flowing streams	1.16	44.00	3,788.00	3.230	0.325
#3	**6**	**Muskingum K:**					**0.325**
#4	1	8. Large gullies, diversions, and low flowing streams	1.88	150.00	7,979.00	4.110	0.539
#4	**1**	**Muskingum K:**					**0.539**
#4	2	8. Large gullies, diversions, and low flowing streams	1.88	150.00	7,979.00	4.110	0.539
#4	**2**	**Muskingum K:**					**0.539**
#4	3	8. Large gullies, diversions, and low flowing streams	1.45	75.00	5,159.00	3.610	0.396
#4	**3**	**Muskingum K:**					**0.396**
#4	4	8. Large gullies, diversions, and low flowing streams	1.45	75.00	5,159.00	3.610	0.396
#4	**4**	**Muskingum K:**					**0.396**
#4	5	8. Large gullies, diversions, and low flowing streams	1.72	88.00	5,117.00	3.930	0.361
#4	**5**	**Muskingum K:**					**0.305**
#4	6	8. Large gullies, diversions, and low flowing streams	1.19	26.00	2,185.00	3.270	0.185
#4	**6**	**Muskingum K:**					**0.185**
#4	7	8. Large gullies, diversions, and low flowing streams	1.19	26.00	2,185.00	3.270	0.185
#4	**7**	**Muskingum K:**					**0.185**
#4	8	8. Large gullies, diversions, and low flowing streams	1.82	41.00	2,252.00	4.040	0.154
#4	**8**	**Muskingum K:**					**0.000**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.28	79.00	6,184.00	1.130	1.520
#5	**1**	**Muskingum K:**					**1.520**
#5	2	8. Large gullies, diversions, and low flowing streams	0.41	12.00	2,906.00	1.920	0.420
#5	**2**	**Muskingum K:**					**0.420**
#6	1	8. Large gullies, diversions, and low flowing streams	0.56	31.00	5,516.00	2.240	0.684
#6	**1**	**Muskingum K:**					**0.684**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	2	8. Large gullies, diversions, and low flowing streams	0.67	20.00	3,001.00	2.440	0.341
#6	**2**	**Muskingum K:**					**0.341**
#8	1	8. Large gullies, diversions, and low flowing streams	0.77	11.00	1,428.00	2.630	0.150
#8	**1**	**Muskingum K:**					**0.150**
#10	1	8. Large gullies, diversions, and low flowing streams	1.09	11.00	1,006.00	3.130	0.089
#10	**1**	**Muskingum K:**					**0.089**
#10	4	8. Large gullies, diversions, and low flowing streams	2.23	35.00	1,566.00	4.480	0.097
#10	**4**	**Muskingum K:**					**0.097**
#11	1	8. Large gullies, diversions, and low flowing streams	0.74	55.00	7,431.00	2.580	0.800
#11	**1**	**Muskingum K:**					**0.800**
#11	2	8. Large gullies, diversions, and low flowing streams	0.76	57.00	7,488.00	2.610	0.796
#11	**2**	**Muskingum K:**					**0.796**
#11	3	8. Large gullies, diversions, and low flowing streams	0.89	45.00	5,072.00	2.820	0.499
#11	**3**	**Muskingum K:**					**0.499**
#11	4	8. Large gullies, diversions, and low flowing streams	0.97	42.00	4,340.00	2.950	0.408
#11	**4**	**Muskingum K:**					**0.408**
#11	5	8. Large gullies, diversions, and low flowing streams	0.97	42.00	4,340.18	2.950	0.408
#11	**5**	**Muskingum K:**					**0.408**
#13	1	8. Large gullies, diversions, and low flowing streams	0.79	87.00	10,974.00	2.670	1.141
#13	**1**	**Muskingum K:**					**1.141**
#13	2	8. Large gullies, diversions, and low flowing streams	0.75	73.00	9,772.00	2.590	1.048
#13	**2**	**Muskingum K:**					**1.048**
#13	3	8. Large gullies, diversions, and low flowing streams	0.72	63.00	8,709.00	2.550	0.948
#13	**3**	**Muskingum K:**					**0.948**
#17	1	8. Large gullies, diversions, and low flowing streams	1.82	97.00	5,325.00	4.040	0.366
#17	**1**	**Muskingum K:**					**0.366**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#7	278.700	278.700	38.37	4.50	63.4	18,850	11.18	7.65
#8	214.480	214.480	34.84	3.47	98.7	37,329	23.18	15.44
#1	402.420	402.420	42.14	9.95	106.5	23,529	2.14	0.89
#15	0.000	616.900	76.99	13.42	205.2	29,704	10.27	4.75
#3	811.800	811.800	229.63	31.19	680.0	31,342	3.45	2.15
#2	796.200	796.200	98.19	19.55	267.2	31,076	1.43	0.57
#14	0.000	1,608.000	306.78	50.74	947.2	30,668	2.82	1.54
#6	374.530	2,599.430	371.51	71.68	1,278.7	31,412	5.73	2.92
#16	0.000	2,878.130	385.74	76.19	1,342.1	39,418	7.96	3.19
#17	695.800	695.800	107.98	23.66	197.6	10,805	0.00	0.00
#4	719.100	719.100	209.05	28.34	745.1	38,628	3.87	2.36
#18	0.000	1,414.900	281.35	51.99	942.7	31,892	2.52	1.30
#5	658.600	2,073.500	317.93	68.17	1,071.4	27,800	3.10	1.59
#11	1,356.700	3,430.200	329.29	90.61	1,313.1	49,956	9.02	2.36
#10	489.200	6,797.530	490.03	179.74	2,811.0	25,633	5.30	2.91
#9	341.200	341.200	124.17	12.44	415.7	44,172	9.65	6.64
#12	0.000	7,138.730	514.07	192.18	3,226.6	36,149	7.53	3.15
#13	806.400	7,945.130	526.84	226.99	3,426.3	26,382	3.26	1.74

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#7	278.700	278.700	70.54	7.81	121.3	20,847	12.64	8.62
#8	214.480	214.480	63.50	6.01	189.0	41,099	25.99	17.32
#1	402.420	402.420	62.78	15.70	168.4	24,194	2.85	1.16
#15	0.000	616.900	126.29	21.71	357.4	32,557	12.69	5.74
#3	811.800	811.800	330.71	45.57	1,009.5	32,083	4.00	2.47
#2	796.200	796.200	144.44	30.80	414.1	32,495	2.07	0.78
#14	0.000	1,608.000	445.23	76.37	1,423.6	31,363	3.35	1.79
#6	374.530	2,599.430	553.20	110.51	2,016.6	34,613	7.46	3.52
#16	0.000	2,878.130	577.83	118.31	2,137.9	32,523	7.73	3.85
#17	695.800	695.800	165.19	35.57	315.0	11,428	0.00	0.00
#4	719.100	719.100	295.77	41.07	1,093.9	39,439	4.49	2.71
#18	0.000	1,414.900	408.74	76.64	1,409.0	32,151	2.83	1.48
#5	658.600	2,073.500	473.26	102.24	1,625.2	27,559	3.50	1.83
#11	1,356.700	3,430.200	494.98	140.93	2,070.6	53,716	11.10	2.73
#10	489.200	6,797.530	755.19	279.47	4,476.3	28,766	6.86	3.43
#9	341.200	341.200	185.52	18.22	637.8	46,137	11.73	8.08
#12	0.000	7,138.730	790.51	297.70	5,114.1	37,829	9.10	3.72
#13	806.400	7,945.130	809.09	347.86	5,425.9	28,302	4.51	2.30

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#7	278.700	278.700	123.17	13.06	221.1	22,701	14.01	9.56
#8	214.480	214.480	109.74	10.05	340.7	43,735	27.99	18.85
#1	402.420	402.420	93.03	24.46	265.0	24,853	3.55	1.42
#15	0.000	616.900	202.21	34.51	605.7	34,974	14.78	6.61
#3	811.800	811.800	475.01	66.45	1,497.0	32,850	4.58	2.80
#2	796.200	796.200	210.49	47.96	636.3	33,914	2.62	0.94
#14	0.000	1,608.000	642.75	114.41	2,133.2	31,967	3.86	2.02
#6	374.530	2,599.430	819.57	168.97	3,159.0	37,263	9.12	4.08
#16	0.000	2,878.130	859.41	182.03	3,380.0	32,749	8.82	4.47
#17	695.800	695.800	249.75	53.06	496.7	12,051	0.00	0.00
#4	719.100	719.100	417.83	59.51	1,607.2	40,350	5.15	3.08
#18	0.000	1,414.900	592.70	112.58	2,103.9	32,465	3.15	1.65
#5	658.600	2,073.500	701.23	152.55	2,461.6	27,538	3.92	2.08
#11	1,356.700	3,430.200	739.03	217.05	3,235.5	56,622	12.91	3.02
#10	489.200	6,797.530	1,156.29	430.31	7,066.9	30,719	8.16	3.89
#9	341.200	341.200	274.45	26.68	975.2	47,970	13.69	9.46
#12	0.000	7,138.730	1,206.31	456.99	8,042.0	39,628	10.62	4.22
#13	806.400	7,945.130	1,234.79	529.13	8,532.8	29,888	5.70	2.82