

APPENDIX D – GROUNDWATER CHEMISTRY EXAMPLES ZORTMAN AND LANDUSKY MINES**Table D-1. Selected Groundwater chemistry data for wells at the Zortman and Landusky Mines**

Waterbody Segment	Site ID	Site Description	Sample Date	Hardness (mg/L)	Water Level (ft)	Field pH (su)	TDS (mg/L)	SO ₄ (mg/L)	AL dis (µg/L)	As dis (µg/L)	Cd dis (µg/l)	CN tot (µg/L)	Cr dis (µg/L)	Cu dis (µg/l)	Fe dis (µg/L)	Hg dis (µg/L)	Ni dis (µg/l)	Pb dis (µg/l)	Se (µg/l)	Zn dis (µg/l)
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	9/26/1994	848	27.6	8.18	1310	764	< 100	< 3	2.0	< 5	< 10	< 10	< 30	< 1	40	< 10	30	260
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	10/24/1994	743	23.64	7.31	1090	629	< 100	< 3	< 1	< 5	< 10	< 10	< 30	< 1	20	< 10	< 5	110
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	1/25/1995	739	20.7	7.4	1030	670	< 100	< 3	1.0	< 5	< 10	< 10	< 30	< 1	40	< 10	< 5	340
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	5/10/1995	773	21.7	7.17	1150	690	300	< 3	9.0	< 5	< 10	< 10	< 30	< 1	170	< 10	< 5	1580
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	8/3/1995		20.4	6.7						< 5			< 10					
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	5/30/1996	623	17.6	6.68	969	587	3100	< 3	17.4	< 5	< 1	29		< 0.6	210	< 3	1	1820
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	8/12/1996	855	23.4	6.52	1420	884	1500	< 3	23.0	< 5	< 1	11	< 10	< 0.6	250	< 3	1	2060
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	10/22/1996	391	23.11	7.98	950	522				< 5								
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	2/12/1997	599	24.28	6.89	878	475	< 100	< 3	1.5	< 5	< 1	2	< 10	< 0.6	< 20	< 3	< 1	< 100
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	4/15/1997	621	21.66	7.71	869	486	< 100	< 3	1.1	< 5		2	< 10		< 20	< 3	1	< 100
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	5/12/1997	643		6.94	1070	678	1600	< 3	16.6	< 5		20	< 10		190	< 3	2	1950
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	8/11/1997	788	23.68	6.55	1240	725	800	< 3	16.5	< 5		7	50		160	< 3	< 1	950
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	10/23/1997						< 100			< 5						< 3	< 1	
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	1/21/1998	798.2			1090	651	220	< 3	3.4	< 5		5	50		30	< 3	3	240
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	4/28/1998	1888.5			2480	1619.7	10600	< 3	24.2	< 5		97	30		230	< 3	5	2300
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	5/29/1998	928.3			1408	935	3390	< 3	2.8	< 5		2	190		400	< 3	< 1	2080
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	6/19/1998	1072.3			1552	1022.3	15400	< 3	51.1	< 5		255	20		390	< 3	5	4600
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	8/20/1998	843.5			1356	894.1	3930	< 3	18.7	< 5		80	< 10		270	< 3	< 1	2510
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	10/22/1998	656.6			1075	652.8	980	< 3	14.6	< 5		21	130		130	< 3	< 1	990
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	4/12/1999	994.2	22.49		1430	907	7160	< 3	35.6	< 5		75	< 10		230	< 3	< 1	3810
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	5/20/1999	947.6	17.94		1400	862	5170	< 3	27.6	< 5	< 1	50	< 10	< 0.6	280	< 3	2	2310
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	6/21/1999	656.7	22.65		1091	695	4250	< 3	21.3	< 5		43	20		340	< 3	1	1530

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Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	8/31/1999	727.9	23.64		1150	729.9	< 100	< 3	7.2	< 5		< 1	50		180	< 3	< 1	1260
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	11/1/1999	599.7	24.08		922	541	140	< 3	4.4	< 5		8	10		40	< 3	< 1	350
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	5/25/2000	584.2			1021	656.2	4840	< 3	29.3	< 5		69	10		280	< 3	< 1	1700
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	11/16/2000	680		7.22	1002	592	< 100	< 3	2.5	< 5		< 1	< 10		20	< 3	< 1	220
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	11/16/2000	680			1002	592	< 100	< 3	2.5	< 5		< 1	< 10		20	< 3	< 1	220
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	4/23/2001	442.1		5.96	797	496	5650	< 3	23.7	< 5		84	< 10		270	3	4	2370
Ruby Gulch	RG-110	Ruby Gulch Near Permit Boundary	10/25/2001	672.5			1026	580	120	< 3	3.1	< 5		4	240		40	< 3	< 1	220
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	9/13/1990	359	31.06	7.4	448	141	< 100	< 5	<1	< 5	< 20	< 10	< 30	< 1	< 30	< 10	< 5	220
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	9/13/1990	359	31.06	7.4	451	140	< 100	< 5	<1	< 5	< 20	< 10	< 30	< 1	< 30	10	< 5	190
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/9/1990	396	32.07	7.29	435	158	< 100	< 5	<1	< 5	< 20	< 10	< 30	< 1	< 30	< 10	< 5	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	11/6/1990	397	31.54	7.46	482													
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	12/13/1990	386	31.59		474													
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	1/12/1991	400	25.46		470													
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	3/20/1991	368	29.32		420	180	< 100	< 5	<1	< 5	< 20	< 10	< 30	< 1	< 30	< 10	< 5	70
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/17/1991	377	25.45		442	170	< 100	< 5	1.4	< 5	< 20	0.005	< 30	< 0.2	< 30	0.002	< 5	60
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/13/1991	379	26.78		468	169				< 5								
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	7/24/1991	438	28.78		533	181				< 5								
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	9/5/1991	426	31.7		546	200				< 5								
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/20/1991	498	31.77		584	285	< 100	< 5	<1	< 5	< 20	< 10	< 30	< 1	< 30	< 10	< 5	40
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/16/1992	465	33.42	7.74	642	244	< 100	< 5	<1	< 5	< 10	< 10	< 30	< 1	< 30	10	< 5	70
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/16/1992	448	33.42	7.74	587	251	< 100	< 5	<1	< 5	< 10	< 10	< 30	< 1	< 30	0.01	< 5	70
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/15/1993	406	29.45	7.49	538	219	< 100	< 5	2	< 5	< 10	< 10	< 30	< 1	< 10	20	< 5	90
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/13/1993	537	31.23	6.76	709	305	< 100	< 5	<1	< 5	< 10	< 10	< 30	< 1	< 10	< 10	< 5	130
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/21/1994	574	27.84	7.7	713	315	< 100	< 5	<1	< 5	< 10	< 10	< 30	< 1	< 10	20	< 5	260

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Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/30/1994	632	29.44	7.33	836	401	< 100	< 5	<1	< 5	< 10	< 10	< 30	< 1	< 10	< 10	< 5	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/13/1995	504	26.24	7.76	763	366	< 100	< 5	<1	< 5	< 10	< 10	< 30	< 1	< 10	< 10	< 5	30
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/19/1995	759	29.83	7.44	996	526	< 100	< 3	0.1	< 5	< 10	< 1	< 10	< 1	< 10	< 3	< 5	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/19/1995	795	29.83	7.44	990	524	< 100	< 3	0.1	< 5	< 10	< 1	< 10	< 1	< 10	< 3	< 5	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/1/1996	575	26	7.1	813	402	< 100	< 3	<0.1	< 5	< 1	< 1	< 10	< 0.6	< 20	< 3	3	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/23/1996	668	30	6.95	930	494	< 100	< 3	0.2	< 5	< 1	< 1	60	< 0.6	< 20	< 3	2	40
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	2/13/1997	604	29.9	7.8	842	452	< 100	< 3	0.4	< 5	9	0.003	< 10	< 0.6	< 20	< 3	5	40
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	4/17/1997	614	25.72	7.88	789	439	< 100	< 3	<0.1	< 5		0.001	< 10		< 20	< 3	4	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/15/1997	601	27	7.41	789	423	< 100	< 3	0.2	< 5		< 1	< 10		< 20	< 3	3	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/20/1997	778	26.49	7.17	1120	618	< 100	< 3	<0.1	< 5		0.001	< 10		< 20	< 3	6	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	8/14/1997	635	30.6	7.16	960	497	< 100	< 3	0.1	< 5		0.001	< 10		< 20	< 3	5	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	2/11/1998	703.7			956	518.3	< 100	< 3	<0.1	< 5		< 1	< 10		< 20	< 3	4	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	4/20/1998	662.8			901	468.1	< 100	< 3	<0.1	< 5		< 1	< 10		< 20	< 3	4	30
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/21/1998	628.9			881	465.5	< 100	< 3	<0.1	< 5		0.001	< 10		< 20	< 3	1	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/23/1998	607.9			896	474.8	< 100	< 3	<0.1	< 5		< 1	< 10		< 20	< 3	1	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	8/6/1998	596.4			838	440.1	< 100	< 3	<0.1	< 5		0.002	< 10		< 20	< 3	1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/7/1998	573.7			816	396	< 100	< 3	<0.1	< 5		0.004	< 10		< 20	< 3	< 1	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	2/16/1999	510.2	28.34		691	330.9	< 100	< 3	<0.1	< 5		< 1	< 10		< 20	3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	4/7/1999	488.4	23.49		652	306.9	< 100	< 3	<0.1	6		< 1	< 10		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/5/1999	479.3	22.62		660	301	< 100	< 3	<0.1	< 5		< 1	20		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/2/1999	495	23.21		674	192	< 100	< 3	<0.1	< 5		0.001	30		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	8/4/1999	464.7	30.67		683	287	< 100	< 3	<0.1	< 5		0.002	< 10		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/20/1999	481.9	29.69		641	271.2	< 100	< 3	<0.1	< 5		< 1	< 10		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/23/2000	415.6			562	229.9	< 100	< 3	0.1	< 5		0.004	< 10		< 20	< 3	< 1	10

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Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	11/14/2000	460.7		7.7	614	245	< 100	< 3	< 0.1	< 5		< 1	80		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	11/14/2000	460.7			614	245	< 100	< 3	< 0.1	< 5		< 1	80		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	4/23/2001	400.3		7.63	555	213.7	< 100	< 3	< 0.1	83		< 1	< 10		< 20	< 3	< 1	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/29/2001	456.8			629	243	< 100	< 3	0.1	< 5		< 1	< 10		< 20	< 3	2	10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	11/7/2002	435			626	229	< 100	< 3	0.1	< 5		0.001	< 10		< 20	< 3	2	< 10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/23/2003	404			522	186	< 100	< 3	< 0.1	< 5		0.001	< 10		< 20	< 3	2	< 10
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/7/2003	472			642	257	200	< 3	0.1			0.001	10		< 20	< 3	2	40
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/28/2004	375			501	204	< 100	< 3	< 0.1	< 5		0.001	30		< 20	< 3	2	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/25/2004	419			560	200	< 100	< 3	0.1	< 5		< 1	20		< 20	< 3	2	40
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/6/2005	360			487	180	< 100	3	< 0.1	< 5		0.003	< 10		< 20	< 3	2	20
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/6/2005	482			549	192	< 100	< 3	0.2	< 5		0.003	140		< 20	< 3	2	40
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	5/17/2006	377			477	171	< 100	2	< 0.1	< 5		0.002	70		4	< 3	2	22
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	11/8/2006	430					< 100	2	< 0.1	< 5		0.002	40		4		2	21
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	7/19/2007	401				172	< 100	< 3	< 0.1			0.002	30		5		1	31
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	9/26/2007	482					< 100	1	< 0.1			0.001	< 10		2		< 1	26
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	6/30/2009	428				217	< 100	1	< 0.1			0.006	400		8		1	38
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	9/18/2009	426				208	< 100	1	< 0.1			0.003	390		5		1	61
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	8/16/2010	462					< 100	1	< 0.1			0.004	830		8		2	33
Mill Gulch	ZL-136	Mouth of Mill Gulch (660 Feet North of Rock Creek)	10/14/2010	436					< 100	1	< 0.1			0.004	400		6		1	32