APPENDIX A

WATER RIGHTS

Table A-1
Ground Water Rights, Application for Ground Water Rights, and Other Known Wells

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
Basin 50 – Susie Creek Area												
36901	1	RFP		33 N.	52 E.	12	NE¼ SW¼	IRD	5.400	N.S.	Jefferson, Thomas F.	Application Only
36902	2	RFP		33 N.	52 E.	13	NW¼ SE¼	IRD	5.400	N.S.	Jefferson, Dorothy	Application Only
36993	3	RFA		34 N.	52 E.	25	NE¼ SW¼	IRD	5.400	N.S.	Newman, Claude W.	Application Only
36994	4	RFP		33 N.	52 E.	12	NW¼ NE¼	IRD	5.400	N.S.	Johnson, Ernest W.	Application Only
36995	5	RFA		33 N.	52 E.	13	NE¼ SW¼	IRD	5.400	N.S.	Stoltman, Dorothy J.	Application Only
36996	6	RFA		34 N.	52 E.	36	NE¼ SE¼	IRD	5.400	N.S.	Boyer, David E.	Application Only
36997	7	RFA		34 N.	52 E.	24	SW¼ SW¼	IRD	5.400	N.S.	Kaiser, Joseph F.	Application Only
36998	8	RFP		33 N.	53 E.	8	NW¼ SW¼	IRD	5.400	N.S.	Johnson, Barbara L.	Application Only
36999	9	RFA		33 N.	52 E.	1	SW¼ NE¼	IRD	5.400	N.S.	Salley, Curtis R.	Application Only
39438	10	CER	11400	34 N.	52 E.	15	NE¼ NE¼	STK	0.026	18.82	Maggie Creek Ranch, Inc.	
43062	11	CER	13266	33 N.	53 E.	19	SE¼ SW¼	IND	0.036	0.18	Van Waters & Rogers, Inc.	
43131	12	CER	13228	33 N.	52 E.	24	SW¼ NE¼	QM	0.167	0.18	Meta-Tantay, Inc.	
43298	13	CER	12982	33 N.	53 E.	19	SW¼ SE¼	IND	0.033	1.14	E.I. Dupond Denemours	
46662	14	CER	11855	34 N.	52 E.	21	SW¼ NE¼	STK	0.009	6.51	Maggie Creek Ranch, Inc	
49309	15	CER	12146	35 N.	53 E.	15	NE¼ SE¼	STK	0.016	11.21	Maggie Creek Ranch, Inc	
49310	16	CER	12966	35 N.	53 E.	22	SW¼ NE¼	STK	0.010	11.21	Maggie Creek Ranch, Inc	
49316	17	CER	12151	34 N.	53 E.	25	NW¼ SE¼	STK	0.022	13.75	Maggie Creek Ranch, Inc	
49317	18	CER	12968	34 N.	53 E.	30	NW¼ NE¼	STK	0.009	6.51	Maggie Creek Ranch, Inc	
49637	19	CER	12675	33 N.	52 E.	25	NW¼ NW¼	IND	0.031	0.71	Thatcher Chemical Co.	
51576	20	CER	13752	33 N.	52 E.	24	NE¼ SW¼	QM	0.334	16.82	Prisons Department - Nevada	
52372	21	CER	13591	34 N.	53 E.	26	SW¼ NW¼	STK	0.031	22.41	Maggie Creek Ranch, Inc	
53179	22	CER	13593	34 N.	53 E.	5	SW¼ SW¼	STK	0.031	22.41	Maggie Creek Ranch, Inc	
56510	24	CER	14768	33 N.	52 E.	24	NE¼ SW¼	QM	0.089	13.88	Prisons Department - Nevada	
58029	25	CER	14529	35 N.	53 E.	9	NE¼ SW¼	STK	0.025	17.93	Maggie Creek Ranch, Inc	
58030	26	CER	14530	35 N.	53 E.	28	NE¼ SE¼	STK	0.011	7.98	Maggie Creek Ranch, Inc	
59836	27	PER		33 N.	52 E.	25	NE¼ NW¼	IND	0.600	24.19	P.S.F. Limited Liabilities Company	
60045	28	RFP		33 N.	53 E.	19	SW¼ SE¼	IND	0.110	30.70	E.I. Dupond Denemours	Application Only
63609	29	PER		33 N.	52 E.	25	NW¼ NE¼	IND	0.020	1.14	Continental Lime, Inc.	
64120	116	PER		33 N.	53 E.	20	SE¼ NE¼	QM	0.490	18	Board of Regents (on behalf of UNR)	
64121	117	PER		33 N.	53 E.	20	NE¼ SE¼	OTH	1.500	302	Board of Regents (on behalf of UNR)	
64873	118	APP		33 N.	53 E.	20	SE¼ NE¼	OTH	1.000	202	Board of Regents (on behalf of UNR)	Application Only
65003	119	APP		35 N.	54 E.	14	NW¼ NW¼	STK	0.010	N.S.	Lauglin, Catalina; Lauglin, Patrick	Application Only

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
Basin 51 – Maggie Creek Area												
18551	30	CER	5876	33 N.	52 E.	16	NE¼ NE¼	IRR	5.000	1339.95	Hadley, Robert H.; Newmont Gold Company	
20227	31	CER	5706	33 N.	52 E.	26	NW¼ NW¼	IRR	0.045	5.59	Meierhoff, Randy & Carmelia	
22214	32	CER	7188	33 N.	52 E.	26	NW¼ NW¼	IRR	0.011	7.20	Meierhoff, Ralph J.	
31273	120	CER	10672	33 N.	52 E.	4	SW¼ SW¼	IRR	1.000	78.42	Newmont Gold Company	
39872	121	CER	11673	34 N.	51 E.	7	LT01 (NE¼ NE¼)	STK	0.031	22.41	Elko Land and Livestock, Co.	
39874	122	CER	11674	35 N.	51 E.	31	SE¼ SE¼	STK	0.006	4.36	Elko Land and Livestock, Co.	
46041	123	CER	11926	35 N.	51 E.	27	NE¼ NE¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46045	124	CER	11930	34 N.	51 E.	3	LT02 (NW¼ NE¼)	STK	0.009	6.51	Elko Land and Livestock, Co.	
46046	125	CER	11931	35 N.	51 E.	30	NE¼ NE¼	STK	0.005	2.76	Elko Land and Livestock, Co.	
48256	33	CER	11577	33 N.	52 E.	15	NE¼ SW¼	IRR	2.061	443.22	Newmont Gold Company	
49311	34	CER	12147	37 N.	52 E.	16	SW¼ SE¼	STK	0.018	22.41	Maggie Creek Ranch Inc.	
49312	35	CER	12967	37 N.	52 E.	27	SE¼ SW¼	STK	0.018	11.21	Maggie Creek Ranch, Inc	
49319	36	CER	12152	34 N.	52 E.	20	NE¼ NW¼	STK	0.010	7.21	Maggie Creek Ranch, Inc	
51981	37	PER		33 N.	52 E.	23	SW¼ SW¼	MUN	2.000	735.57	Carlin - City of	
53269	38	CER	13727	37 N.	51 E.	36	SE¼ NW¼	STK	0.031	22.41	Maggie Creek Ranch Inc.	
54522	23	CER	13919	33 N.	52 E.	26	SW¼ NE¼	COM	0.056	0.03	The Anschutz Marketing and Trans.	
57020	39	RFP		34 N.	51 E.	35	NW¼	REC	5.000	N.S.	Elko County	Application Only
57021	40	RFP		34 N.	51 E.	34	NE¼	REC	5.000	N.S.	Elko County	Application Only
57022	41	RFP		33 N.	51 E.	3	NE¼	REC	5.000	N.S.	Elko County	Application Only
57023	42	RFP		33 N.	51 E.	2	NW¼	REC	20.000	N.S.	Elko County	Application Only
57024	43	RFP		34 N.	51 E.	35	NE¼	REC	5.000	N.S.	Elko County	Application Only
57025	44	RFP		34 N.	51 E.	35	SE¼	REC	10.000	N.S.	Elko County	Application Only
57026	45	RFP		34 N.	51 E.	35	SW¼	REC	40.000	N.S.	Elko County	Application Only
57027	46	RFP		33 N.	51 E.	2	NE¼	REC	5.000	N.S.	Elko County	Application Only
57028	47	RFP		34 N.	51 E.	34	SE¼	REC	15.000	N.S.	Elko County	Application Only
60768	126	PER		35 N.	51 E.	25	SW¼ NW¼	STK	0.063	45.25	Newmont Gold Company	
60769	127	PER		35 N.	51 E.	12	NW¼ SE¼	STK	0.063	45.25	Newmont Gold Company	
62012	49	PER		34 N.	51 E.	11	SE¼ SW¼	STK	0.007	5.07	Maggie Creek Ranch, Inc	
62013	50	PER		35 N.	52 E.	30	NE¼ SW¼	STK	0.007	5.07	Maggie Creek Ranch, Inc	
62014	51	PER		35 N.	52 E.	18	NW¼	STK	0.007	5.07	Maggie Creek Ranch, Inc	
62530	128	PER		34 N.	51 E.	9	NW¼ NW¼	STK	0.004	3.10	Elko Land and Livestock, Co.	
62531	129	PER		35 N.	51 E.	29	NW¼ SW¼	STK	0.004	3.10	Elko Land and Livestock, Co.	
NP	111			33 N.	52 E.	8		DOM			Callahan	No water right permit required or obtained for use

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
NP	112			33 N.	52 E.	9	NW¼ NW¼	DOM			Crouse	No water right permit required or obtained for use
NP	113			33 N.	52 E.	9	NW¼ NW¼	DOM			Whitlock Lot 1 Bock A	No water right permit required or obtained for use
NP	114			33 N.	52 E.	10	SW¼ SW¼	STK			Hadley	No water right permit required or obtained for use
NP	115			34 N.	52 E.	17	NW¼ SE¼	STK			Hadley	No water right permit required or obtained for use
Basin 52 – Mary Creek Area												
30971	53	CER	10102	33 N.	52 E.	27	SE¼ SE¼	STK	0.003	2.18	Eklund, Jo Ann; Eklund, L.W.	
30987	54	CER	10103	33 N.	52 E.	27	SE¼ SE¼	IRR	0.280	41.20	Eklund, Jo Ann; Eklund, L.W.	
34410	55	CER	10868	33 N.	52 E.	34	NE¼ NW¼	IRR	0.100	9.81	Jones, Melvin R.; Jones, Rachel S.	
35107	56	CER	12535	33 N.	52 E.	33	NE¼ NE¼	IRR	0.897	101.91	Jones, Melvin R.; Jones, Rachel S.	
42982	57	CER	11266	33 N.	52 E.	33	NE¼ SW¼	STK	0.015	10.87	Barrows, Elmer; Cater, Diana J.; Cater, Franklin L.; Newmont Gold Company	
43918	58	RFA		33 N.	52 E.	33	NE¼ SW¼	OTH	4.000	N.S.	Barrows, Elmer; Newmont Gold Company	Application Only
47027	59	PER		33 N.	52 E.	27	SW¼ SE¼	ENV	1.000	724.21	Southern Pacific Transportation Co.	
47028	60	PER		33 N.	52 E.	27	SW¼ SE¼	ENV	1.000	724.21	Southern Pacific Transportation Co.	
50436	61	PER		33 N.	52 E.	27	SE¼ SW¼	MUN	0.890	644.58	Carlin - City of	
52266	62	PER		33 N.	52 E.	27	NE¼ NW¼	MUN	0.560	405.58	Carlin - City of	
57712	48	PER		33 N.	52 E.	27	SE¼ SE¼	MUN	2.000	735.57	Carlin - City of	
58323E	52	PER		33 N.	52 E.	27	SW¼ SE¼	ENV	0.446	322.96	Southern Pacific Transportation Co.	
Basin 61 – Boulder Flat												
12487	130	CER	4872	33 N.	48 E.	25	SE¼ SE¼	IRR	5.587	861.84	Newmont Gold Company	
16951	131	CER	5605	34 N.	49 E.	5	NE¼ NW¼	IRR	3.500	681.92	Elko Land and Livestock, Co.	
16952	132	CER	5606	34 N.	49 E.	6	NE¼ NE¼	IRR	3.500	592	Elko Land and Livestock, Co.	
17490	133	CER	6214	33 N.	48 E.	24	NW¼ SW¼	IRR	5.998	1444.80	Newmont Gold Company	
21083	63	CER	7306	33 N.	48 E.	26	NW¼ NE¼	MM	0.334	242.04	Baroid Division; National Lead Co.	
22976	134	CER	7620	32 N.	45 E.	1	SE¼ SE¼	IRR	3.000	671.40	The 25 Corporation	
23881	135	CER	7642	35 N.	50 E.	22	NW¼ NW¼	STK	0.045	5.10	Newmont Gold Company	
24682	136	CER	8622	32 N.	45 E.	2	SE¼ SE¼	IRR	3.000	1200.00	25 Corporation, Inc.	
25247	137	CER	8461	33 N.	48 E.	23	NE¼ NE¼	IRR	3.686	760.50	Newmont Gold Company	

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
26873	138	CER	8659	35 N.	50 E.	20	LT01 (NE¼ NE¼)	STK	0.025	12.03	Elko Land and Livestock, Co.	
27956	139	CER	8972	35 N.	49 E.	28	SW¼ NE¼	STK	0.008	3.93	Elko Land and Livestock, Co.	
27957	140	CER	8973	33 N.	49 E.	26	SE¼ SW¼	STK	0.003	1.96	Elko Land and Livestock, Co.	
28197	64	CER	10722	36 N.	50 E.	30	NW¼ SE¼	MM	0.140	96.83	Polar Resources Company	
28966	141	CER	10226	34 N.	49 E.	7	SE¼ NE¼	IRR	0.600	291.55	Elko Land and Livestock, Co.	
28967	142	CER	10227	34 N.	49 E.	8	SE¼ NW¼	IRR	5.106	1021.44	Elko Land and Livestock, Co.	
28969	143	CER	9282	36 N.	50 E.	30	NW¼ SE¼	STK	0.009	6.72	Elko Land and Livestock, Co.	
29529	144	CER	10228	34 N.	50 E.	19	LT04 (NW¼ NW¼)	STK	0.012	17.93	Elko Land and Livestock, Co.	
29952	145	CER	10043	33 N.	49 E.	2	SW¼ NW¼	IRR	5.124	2794.25	Elko Land and Livestock, Co.	
29953	146	CER	10044	33 N.	49 E.	3	SE¼ NW¼	IRR	4.902	2673.19	Elko Land and Livestock, Co.	
30240	147	CER	10046	33 N.	49 E.	3	SW¼ NW¼	IRR	4.233	2308.35	Elko Land and Livestock, Co.	
30241	148	CER	10047	33 N.	49 E.	1	SW¼ NW¼	IRR	5.793	3159.06	Elko Land and Livestock, Co.	
30242	149	CER	10048	33 N.	49 E.	2	SW¼ NE¼	IRR	5.347	2915.85	Elko Land and Livestock, Co.	
30253	150	CER	10229	34 N.	49 E.	7	SE¼ NE¼	IRR	4.524	1017.88	Elko Land and Livestock, Co.	
30615	65	CER	10865	35 N.	50 E.	10	SW¼ SE¼	MM	0.160	64.29	Polar Resources Company	
30849	151	CER	10057	33 N.	49 E.	1	SW¼ SW¼	IRR	5.459	2976.93	Elko Land and Livestock, Co.	
31288	152	PER		34 N.	49 E.	5	NE¼ NW¼	IRR	6.000	2560.00	Elko Land and Livestock, Co.	
31289	153	PER		34 N.	49 E.	6	NE¼ NE¼	IRR	5.400	2560.00	Elko Land and Livestock, Co.	
34766	154	PER		33 N.	49 E.	1	SE¼ NW¼	IRR	3.790	2743.18	Elko Land and Livestock, Co.	
34767	155	PER		33 N.	49 E.	2	SW¼ SE¼	IRR	3.790	2742.80	Elko Land and Livestock, Co.	
34768	156	PER		33 N.	49 E.	2	SW¼ SW¼	IRR	3.790	2742.80	Elko Land and Livestock, Co.	
34769	157	PER		33 N.	49 E.	3	SW¼ SE¼	IRR	3.790	2742.80	Elko Land and Livestock, Co.	
34770	158	PER		33 N.	49 E.	3	SW¼ SW¼	IRR	3.790	20889.92	Elko Land and Livestock, Co.	
34771	159	PER		33 N.	49 E.	11	SW¼ NW¼	IRR	3.790	2742.80	Elko Land and Livestock, Co.	
34772	160	PER		33 N.	49 E.	10	SW¼ NE¼	IRR	3.790	2742.80	Elko Land and Livestock, Co.	
34773	161	PER		33 N.	49 E.	10	SW¼ NW¼	IRR	3.790	2742.80	Elko Land and Livestock, Co.	
36022	162	PER		34 N.	49 E.	8	SE¼ NE¼	IRR	2.870	2039.72	Elko Land and Livestock, Co.	
39871	163	CER	10875	33 N.	49 E.	8	SW¼ SE¼	STK	0.031	22.41	Elko Land and Livestock, Co.	
39873	164	CER	10876	33 N.	48 E.	1	SE¼ NW¼	STK	0.062	44.82	Elko Land and Livestock, Co.	
40859	66	CER	12278	32 N.	49 E.	22	LT08 (NE¼ NE¼)	STK	0.019	13.51	BLM	
43562	67	CER	11638	33 N.	48 E.	26	NE¼ NE¼	QM	0.010	0.03	Davis, Joanna; Davis, John N.	
44882	68	RFA		35 N.	48 E.	34	SE¼ SE¼	STK	0.005	3.62	BLM	Application Only
45664	69	CER	12985	32 N.	49 E.	28	NE¼ SW¼	IRR	4.460	2176.20	Zeda Corporation	
45665	70	CER	12986	32 N.	49 E.	28	NW¼ SW¼	IRR	5.120	2498.20	Zeda Corporation	
45666	71	CER	12987	32 N.	49 E.	28	NW¼ NE¼	IRR	5.400	2634.80	Zeda Corporation	
46042	165	CER	11927	35 N.	49 E.	23	NE¼ NE¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46043	166	CER	11928	35 N.	49 E.	19	SE¼ NE¼	STK	0.009	6.51	Elko Land and Livestock, Co.	

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
46044	167	CER	11929	34 N.	50 E.	10	SE¼ NE¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46047	168	CER	11915	33 N.	48 E.	5	LT04 (NW¼ NW¼)	STK	0.011	7.95	Elko Land and Livestock, Co.	
46048	169	CER	11916	34 N.	49 E.	16	NE¼ SE¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46049	170	CER	11917	34 N.	49 E.	30	NE¼ NW¼	STK	0.016	11.57	Elko Land and Livestock, Co.	
46050	171	CER	11918	34 N.	49 E.	34	SE¼ NW¼	STK	0.016	11.57	Elko Land and Livestock, Co.	
46051	172	CER	11919	34 N.	49 E.	2	SE¼ NW¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46052	173	CER	11920	34 N.	49 E.	8	NE¼ SE¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46053	174	CER	11921	34 N.	49 E.	4	NW¼ SW¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46054	175	CER	11932	33 N.	47 E.	14	SE¼ NE¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46055	176	CER	11933	33 N.	47 E.	10	SW¼ SE¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46056	177	CER	11934	33 N.	47 E.	1	NW¼ SW¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46057	178	CER	11935	33 N.	47 E.	17	SW¼ SE¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46058	179	CER	11936	33 N.	47 E.	21	SW¼ NE¼	STK	0.011	7.95	Elko Land and Livestock, Co.	
46059	180	CER	11937	33 N.	47 E.	27	SE¼ NW¼	STK	0.011	7.95	Elko Land and Livestock, Co.	
46060	181	CER	11938	33 N.	47 E.	28	NE¼ NW¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46061	182	CER	11939	33 N.	47 E.	29	SW¼ NW¼	STK	0.016	11.57	Elko Land and Livestock, Co.	
46062	183	CER	11940	32 N.	49 E.	11	NE¼ SE¼	STK	0.009	6.51	Elko Land and Livestock, Co.	
46063	184	CER	11941	34 N.	48 E.	1	NE¼ SW¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46064	185	CER	11942	34 N.	48 E.	34	SE¼ SE¼	STK	0.011	7.95	Elko Land and Livestock, Co.	
46065	186	CER	11943	35 N.	48 E.	34	SE¼ SE¼	STK	0.013	9.42	Elko Land and Livestock, Co.	
46066	187	CER	11944	33 N.	49 E.	15	NW¼ SW¼	STK	0.016	11.21	Elko Land and Livestock, Co.	
46067	188	CER	11945	34 N.	48 E.	21	NW¼ NW¼	STK	0.011	7.95	Elko Land and Livestock, Co.	
46489	189	PER		33 N.	48 E.	19	SW¼ SE¼	STK	0.100	67.23	Elko Land and Livestock, Co.	
46490	190	PER		33 N.	47 E.	24	NW¼ SE¼	STK	0.100	67.23	Elko Land and Livestock, Co.	
47688	191	CER	12827	33 N.	48 E.	1	SE¼ NW¼	STK	0.116	82.92	Elko Land and Livestock, Co.	
52941	192	PER		35 N.	48 E.	36	NE¼ SW¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52942	193	PER		35 N.	48 E.	36	NE¼ NW¼	IRR	5.400	3090.44	Elko Land and Livestock, Co.	
52943	194	PER		35 N.	48 E.	25	NE¼ SW¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52944	195	PER		35 N.	49 E.	31	NE¼ NE¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52945	196	PER		35 N.	48 E.	25	NE¼ NW¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52946	197	PER		35 N.	49 E.	30	NE¼ SE¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52947	198	PER		35 N.	49 E.	30	NE¼ NE¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52948	199	PER		35 N.	49 E.	19	NE¼ SE¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52949	200	PER		35 N.	49 E.	29	NE¼ SE¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
52950	201	PER		35 N.	49 E.	29	NE¼ NE¼	IRR	5.400	3909.44	Elko Land and Livestock, Co.	
53715	72	PER		36 N.	49 E.	3	SE¼ SW¼	MM	1.000	645.44	Cordex Exploration Co.	
54497	73	PER		33 N.	45 E.	35	NE¼ SE¼	IND	1.000	389.92	Coastal Chem Inc.	
54520	74	CER	14782	33 N.	45 E.	27	NE¼ SE¼	IND	0.347	1.75	FMC Corporation	
54568	202	PER		34 N.	48 E.	2	SW¼ NW¼	STK	0.062	8.96	Elko Land and Livestock, Co.	

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
54827	203	PER		35 N.	48 E.	24	NE¼ SE¼	IRR	5.400	2560.00	Elko Land and Livestock, Co.	
54828	204	PER		35 N.	48 E.	25	SW¼ SE¼	IRR	5.400	2560.00	Elko Land and Livestock, Co.	
54829	205	PER		35 N.	48 E.	36	SW¼ NW¼	IRR	2.530	1800.28	Elko Land and Livestock, Co.	
54830	206	PER		34 N.	48 E.	1	NE¼ NW¼	IRR	5.400	2560.00	Elko Land and Livestock, Co.	
54831	207	PER		34 N.	48 E.	1	NW¼ SW¼	IRR	5.400	2560.00	Elko Land and Livestock, Co.	
54832	208	PER		34 N.	48 E.	2	SW¼ SW¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
54833	209	PER		34 N.	48 E.	11	NW¼ NE¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
54834	210	PER		34 N.	48 E.	11	NE¼ SW¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
54835	211	PER		34 N.	48 E.	14	NW¼ NW¼	IRR	2.210	7680.00	Elko Land and Livestock, Co.	
54836	212	PER		34 N.	48 E.	15	SW¼ SE¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
54837	213	PER		34 N.	48 E.	22	NE¼ NW¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
54838	214	PER		34 N.	48 E.	12	NW¼ SW¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
54839	215	PER		34 N.	48 E.	11	SE¼ SE¼	IRR	2.210	1599.97	Elko Land and Livestock, Co.	
55625	75	PER		33 N.	45 E.	35	NE¼ NW¼	IND	0.200	3.93	Sierra Chemical Company	
56207	218	RFA		34 N.	49 E.	5	NE¼ NW¼	IRR	2.667	N.S.	Elko Land and Livestock, Co.	Application Only
56208	219	RFA		34 N.	48 E.	23	NW¼ NW¼	IRR	0.833	N.S.	Elko Land and Livestock, Co.	Application Only
56209	220	RFA		34 N.	48 E.	23	NW¼ NW¼	IRR	0.934	N.S.	Elko Land and Livestock, Co.	Application Only
56210	221	RFA		34 N.	49 E.	5	NE¼ NW¼	IRR	4.466	N.S.	Elko Land and Livestock, Co.	Application Only
56211	222	RFA		34 N.	49 E.	6	NE¼ NE¼	IRR	4.466	N.S.	Elko Land and Livestock, Co.	Application Only
56212	223	RFA		34 N.	48 E.	14	NW¼ SE¼	IRR	0.934	N.S.	Elko Land and Livestock, Co.	Application Only
56213	224	RFA		34 N.	48 E.	14	NW¼ SE¼	IRR	0.350	N.S.	Elko Land and Livestock, Co.	Application Only
56214	225	RFA		34 N.	49 E.	6	NE¼ NE¼	IRR	3.150	N.S.	Elko Land and Livestock, Co.	Application Only
56429	226	RFA		34 N.	48 E.	11	SE¼ SE¼	IRR	1.110	N.S.	Elko Land and Livestock, Co.	Application Only
56430	227	RFA		34 N.	48 E.	12	NW¼ SW¼	IRR	1.110	N.S.	Elko Land and Livestock, Co.	Application Only
56431	228	RFA		34 N.	48 E.	22	NE¼ NW¼	IRR	1.110	4352.36	Elko Land and Livestock, Co.	Application Only
56432	229	RFA		34 N.	48 E.	15	SW¼ SE¼	IRR	1.110	4352.36	Elko Land and Livestock, Co.	Application Only
56433	230	RFA		34 N.	48 E.	14	NW¼ NW¼	IRR	1.110	4352.36	Elko Land and Livestock, Co.	Application Only
56434	231	RFA		34 N.	48 E.	11	NE¼ SW¼	IRR	1.110	4352.36	Elko Land and Livestock, Co.	Application Only
56435	232	RFA		34 N.	48 E.	11	NW¼ NE¼	IRR	1.110	4352.36	Elko Land and Livestock, Co.	Application Only
56436	233	RFA		34 N.	48 E.	2	SW¼ SW¼	IRR	1.110	4352.36	Elko Land and Livestock, Co.	Application Only
57755	76	PER		36 N.	49 E.	4	NE¼ NE¼	MM	1.000	645.20	Dee Gold Mining Company	
57756	77	PER		36 N.	49 E.	3	SE¼ SW¼	MM	1.000	645.20	Dee Gold Mining Company	
57757	78	PER		36 N.	49 E.	4	NE¼ NE¼	MM	1.000	645.20	Dee Gold Mining Company	
57758E	85	PER		36 N.	49 E.	10	SE¼ SW¼	ENV	0.250	181.13	Cordex Exploration Company	
57759E	86	PER		36 N.	49 E.	10	NE¼ SW¼	ENV	0.250	181.13	Cordex Exploration Company	
57788	87	PER		36 N.	49 E.	28	NW¼ NE¼	STK	0.031	22.41	Packer, Willis; Rhoads, Dean A; Rhoads, Sharon	
57789	79	PER		35 N.	49 E.	18	SW¼ NE¼	STK	0.031	22.41	Packer, Willis; Rhoads, Dean A; Rhoads, Sharon	

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
57882	80	PER		36 N.	49 E.	3	SW¼ SW¼	MM	1.000	645.20	Dee Gold Mining Company	
57883	81	PER		36 N.	49 E.	3	SW¼ SW¼	MM	1.000	645.20	Cordex Exploration Co.	
58254	82	PER		36 N.	49 E.	2	NE¼ NW¼	MM	2.000	1084.50	Dee Gold Mining Company	
59055	235	CER	14588	32 N.	50 E.	11	NW¼ SE¼	STK	0.009	5.03	Elko Land and Livestock, Co.	
59060	236	PER		33 N.	48 E.	25	SE¼ SE¼	OTH	0.500	77.13	Newmont Gold Company	
59342	83	PER		32 N.	50 E.	14	NE¼ NE¼	QM	0.160	1.60	Transportation Department-Nevada	
62579	84	PER		37 N.	49 E.	27	SE¼ NE¼	MM	2.000	1448.00	Meridian Gold Company	
63002	237	PER		33 N.	49 E.	32	NW¼ NE¼	STK	0.003	1.96	Elko Land and Livestock, Co.	
64229	238	RFP		35 N.	49 E.	3	NE¼ NW¼	STO	78.000	N.S.	Newmont Gold Company	Application Only
64359	239	RFA		32 N.	49 E.	5	LT03 (NE¼ NW¼)	QM	0.110	N.S.	Transportation Department - Nevada	Application Only
V05780	88	VST		32 N.	45 E.	15	NW¼ NW¼	STK	0.025	N.S.	Julian Tomera Ranches, Inc.	
V05782	89	VST		32 N.	45 E.	9	NW¼ NE¼	STK	0.025	N.S.	Julian Tomera Ranches, Inc.	
Basin 62 – Rock Creek Valley												
42931	90	PER		37 N.	49 E.	22	NW¼ NE¼	MM	1.000	724.24	Baroid Drilling Fluids Inc; FMC Minerals Corp.	
42932	91	PER		37 N.	49 E.	22	NE¼ NE¼	MM	1.000	724.24	Baroid Drilling Fluids Inc; FMC Minerals Corp.	
42934	92	PER		37 N.	49 E.	15	NE¼ SE¼	MM	0.220	159.03	Baroid Drilling Fluids Inc; FMC Minerals Corp.	
44881	93	CER	12662	35 N.	46 E.	10	SE¼ NW¼	STK	0.006	4.36	BLM	
44954	94	CER	12610	36 N.	46 E.	22	NW¼ SW¼	STK	0.008	6.05	BLM	
52750	95	CER	14005	37 N.	48 E.	8	NE¼ NE¼	MM	0.116	33.03	Newmont Exploration, LTD.; Touchstone Resources Co.	
52751	96	CER	14006	37 N.	48 E.	9	NE¼ NW¼	MM	0.223	51.15	Newmont Exploration, LTD.; Touchstone Resources Co.	
52752	97	PER		37 N.	48 E.	9	SE¼ NW¼	MM	0.400	289.81	Newmont Exploration, LTD.; Touchstone Resources Co.	
52754	98	PER		37 N.	48 E.	9	SW¼ SW¼	MM	0.500	362.26	Newmont Exploration, LTD.; Touchstone Resources Co.	
59063	99	CER	14938	35 N.	48 E.	11	SE¼ NW¼	STK	0.018	12.89	Packer, Willis; Rhoads, Dean A; Rhoads, Sharon	
61410	100	PER		37 N.	49 E.	22	SE¼ SW¼	MM	0.780	565.00	Baroid Drilling Fluids, Inc.	
62577	101	PER		37 N.	49 E.	16	SW¼ SW¼	MM	2.000	1448.00	Meridian Gold Company	
62578	102	PER		37 N.	49 E.	22	NE¼ SW¼	MM	2.000	1448.00	Meridian Gold Company	
Basin 63 – Willow Creek Valley												
44946	103	CER	12271	38 N.	46 E.	33	NW¼ NW¼	STK	0.010	7.25	BLM	
45107	240	CER	10777	38 N.	47 E.	5	NW¼ NE¼	IRR	4.650	3365.67	Barrick Goldstrike Mines, Inc.	
46559	241	CER	10779	38 N.	46 E.	2	SW¼ NW¼	IRR	2.160	1563.40	Barrick Goldstrike Mines, Inc.	

Table A-1 (Continued)

App[1] #	Map[2] #	Status Permit/ Certificate[3]	Certificate Number	Township	Range	Section	Subdivision	Use[4]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[5]	Owner	Comment
48243	242	CER	11576	38 N.	46 E.	33	NW¼ NW¼	STK	0.007	5.07	Barrick Goldstrike Mines, Inc.	
58714	104	PER		39 N.	46 E.	17	SE¼ SE¼	QM	0.100	40.00	Midas Water Cooperative	
60669	105	PER		39 N.	46 E.	34	NE¼ SE¼	MM	0.250	5.00	Midas Joint Venture	
61888	106	PER		39 N.	46 E.	22	NW¼ NW¼	MM	0.250	4.50	Midas Joint Venture	
62114	107	PER		39 N.	46 E.	21	NE¼ NW¼	MM	0.018	0.30	Midas Joint Venture	
62582	108	PER		39 N.	46 E.	27	NW¼ NW¼	MM	0.545	59.95	Midas Joint Venture	
63022	109	PER		39 N.	46 E.	27	NW¼ NE¼	MM	0.056	40.51	Midas Joint Venture	
64391	243	RFA		39 N.	46 E.	21	NW¼ NE¼	MM	0.150	N.S.	Romarco Nevada, Inc.	Application Only
64392	244	RFA		39 N.	46 E.	21	NW¼ SE¼	MM	0.150	N.S.	Romarco Nevada, Inc.	Application Only
64598	245	RFA		39 N.	46 E.	22	NW¼ NW¼	MM	0.250	N.S.	Midas Joint Venture	Application Only
64802T	246	PER		39 N.	46 E.	27	NW¼ SW¼	MM	0.545	59.95	Midas Joint Venture	
64803	247	RFA		39 N.	46 E.	27	NW¼ SW¼	MM	0.545	N.S.	Midas Joint Venture	Application Only
V04120	110	VST		39 N.	46 E.	17	NE¼ SW¼	QM	0.084	N.S.	The Midas Water Cooperative	

[1]NP = No water right permit required or obtained for use
[2]Refer to Figure 3-5.
[3]Status:
APP - Application
CER - Certificate
PER - Permit
RFA - Ready for Action
RFP - Ready for Action (protested)
VST - Vested Right

[4]Use:
COM - Commercial
DOM - Domestic
ENV - Environmental
IND - Industrial
IRD - Irrigation (DLE)
IRR - Irrigation
MM - Mining and Milling
MUN - Municipal
OTH - Other
QM - Quasi-municipal
REC - Recreation
STK - Stock Watering
STO - Storage

[5]Annual Duty – Annual or Seasonal Amounts
N.S. – Not Specified

Table A-2
Surface Water Rights and Application for Surface Water Rights

App #	Map[1] #	Status Permit/ Certificate [2]	Certificate Number	Township	Range	Section	Subdivision	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[4]	Owner	Comment
Basin 50 – Susie Creek Area												
46542	1	RFA		35 N.	54 E.	19	NE¼ SE¼	STK	0.100	N.S.	Dressi Ranching Company	Application Only
54712	2	PER		34 N.	53 E.	16	NW¼ NW¼	STK	0.031	22.4	Maggie Creek Ranch Inc.	
56340	3	RFA		33 N.	53 E.	7	LT01 (NE¼ NE¼)	STK	0.015	N.S.	Maggie Creek Ranch Inc.	Application Only
56557	4	RFA		34 N.	53 E.	16	NW¼ NW¼	STK	0.031	N.S.	Maggie Creek Ranch Inc.	Application Only
R05315	5	RES		35 N.	54 E.	12	SW¼ SW¼	OTH	0.012	N.S.	BLM	
Basin 51 – Maggie Creek Area												
00322		PRO						DEC		96	Elko Land and Livestock/JW Pruett [5]	Dispersed Points of Diversion, not illustrated [6]
00325		PRO						DEC		N.S.	Roy Ash/Charles Thorton [5]	Dispersed Points of Diversion, not illustrated [6]
00326		PRO						DEC		N.S.	Roy Ash/Charles Thorton [5]	Dispersed Points of Diversion, not illustrated [6]
00327		PRO						DEC		906.5 [7]	Roy Ash/Charles Thorton [5]	Dispersed Points of Diversion, not illustrated [6]
00328		PRO						DEC		N.S.	Roy Ash/Charles Thorton [5]	Dispersed Points of Diversion, not illustrated [6]
00329		PRO						DEC		N.S.	Roy Ash/Charles Thorton [5]	Dispersed Points of Diversion, not illustrated [6]
2286	6	CER	346	33 N.	52 E.	26	SW¼ SE¼	OTH	7.570	150.0	Nevada Land & Resource Company, LLC; Vogeler, A.H.; Vogeler, Mary B.	
2473	7	CER	11156	38 N.	53 E.	33	NE¼ NE¼	IRR	0.257	62.6	25 Corporation, Inc.	
2480	8	CER	11157	37 N.	53 E.	21	NE¼ SW¼	IRR	0.240	58.6	Munson, Freda F. Bank-1/2 Interest; Secrist, John D. & Marian L.-1/2 Interest	
3474	118	CER	3609	34 N.	51 E.	29	SW¼ SE¼	IRR		29.84	Charles Drake	
6969	9	CER	1680	33 N.	52 E.	26	SW¼ SE¼	OTH	6.570	576.0	Nevada Land & Resource Company, LLC; Vogeler, A.H.; Vogeler, Mary B.	
7887	83	CER	2540	38 N.	53 E.	34	SE¼ NE¼	STK	0.022	10.1	W.T. Jenkins Co.	
8246	10	CER	2233	37 N.	53 E.	10	SE¼ SW¼	STK	0.082	37.7	BLM	
10299	84	CER	2811	37 N.	53 E.	3	SW¼ SE¼	MM	0.500	361.9	Huber, Albert H.; Oldham, John	

Table A-2 (Continued)

App #	Map[1] #	Status Permit/ Certificate[2]	Certificate Number	Township	Range	Section	Subdivision	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[4]	Owner	Comment
18552	11	CER	6423A	33 N.	52 E.	9	SE¼ SE¼	IRR	5.143	809.9	Newmont/Robert HHadley	
31193S01	33	CER	14197	33 N.	52 E.	26	SE¼ SW¼	IRR		N.S.	Carlin-City	
35659	12	CER	11721	37 N.	53 E.	10	SW¼ SE¼	STK	0.011	5.1	BLM	
45509	85	CER	11660	33 N.	51 E.	10	SE¼ NW¼	STK	0.346	84.2	Newmont Gold Company	
63506	86	PER		33 N.	52 E.	26	NW¼ NE¼	IRR	0.350	15.8	Newmont Gold Company	
R04600	13	RES		38 N.	53 E.	26	SE¼ SE¼	OTH	0.007	N.S.	BLM	
V06241	15	VST		37 N.	51 E.	18	NE¼ NE¼	STK	0.006	N.S.	26 Ranch Inc.	
V06243	51	VST		37 N.	51 E.	21	SE¼ NE¼	STK	0.006	N.S.	26 Ranch Inc.	
V06244	52	VST		37 N.	51 E.	21	SE¼ NW¼	STK	0.002	N.S.	26 Ranch Inc.	
V06245	53	VST		37 N.	51 E.	16	SE¼ SE¼	STK	0.002	N.S.	26 Ranch Inc.	
V06246	54	VST		37 N.	51 E.	26	NW¼ SE¼	STK	0.003	N.S.	26 Ranch Inc.	
V06247	16	VST		37 N.	52 E.	11	SW¼ NE¼	STK	0.002	N.S.	26 Ranch Inc.	
V06248	17	VST		37 N.	51 E.	1	SW¼ SW¼	STK	0.006	N.S.	26 Ranch Inc.	
V06249	18	VST		37 N.	53 E.	5	SW¼ NE¼	STK	0.005	N.S.	26 Ranch Inc.	
V06250	19	VST		37 N.	53 E.	7	SE¼ SE¼	STK	0.006	N.S.	26 Ranch Inc.	
V06251	20	VST		38 N.	53 E.	22	NE¼ SW¼	STK	0.006	N.S.	26 Ranch Inc.	
V06252	21	VST		38 N.	53 E.	17	SW¼ SE¼	STK	0.003	N.S.	26 Ranch Inc.	
V06254	22	VST		38 N.	52 E.	3	SE¼ SE¼	STK		N.S.	26 Ranch Inc.	
Basin 52 – Marys Creek Area												
04723	35	VST		32 N.	51 E.	35	NE¼ SE¼	DOM	0.000	N.S.	Johnson, Leo N.	
20075	87	CER	6043	32 N.	51 E.	35	SE¼ NE¼	DOM	0.002	1.6	Palisade Ranch, Inc.	
31214	88	CER	10430	33 N.	52 E.	33	NE¼ NE¼	DEC	0.132	32.1	Jones, Melvin R.; Jones, Rachel S.	
31215	89	CER	10431	33 N.	52 E.	33	NE¼ NE¼	DEC	0.278	67.8	Jones, Melvin R.; Jones, Rachel S.	
31216	90	CER	10432	33 N.	52 E.	33	NE¼ NE¼	DEC	1.240	32.1	Jones, Melvin R.; Jones, Rachel S.	
46299	23	RFA		32 N.	51 E.	11	NE¼ SW¼	STK	0.100	N.S.	Palisade Ranch Inc.	Application Only
50434	24	PER		33 N.	52 E.	28	SE¼	MUN	0.144	35.2	Carlin-City	
50437	25	PER		33 N.	52 E.	28	SW¼ SE¼	MUN	1.000	N.S.	Carlin-City	
50438	26	PER		33 N.	52 E.	28	SW¼ SE¼	MUN	3.000	N.S.	Carlin-City	
50439	27	PER		33 N.	52 E.	28	SW¼ SE¼	MUN	0.770	N.S.	Carlin-City	
62455	28	PER		32 N.	52 E.	5	SE¼ SW¼	STK	0.003	1.7	Palisade Ranch Inc.	
62456	29	PER		32 N.	51 E.	17	SE¼ SE¼	STK	0.003	1.7	Palisade Ranch Inc.	
62467	30	RFA		32 N.	52 E.	4	NE¼ NW¼	DEC	2.860	N.S.	Newmont Gold Company; Palisade Ranch	Application Only

Table A-2 (Continued)

App #	Map[1] #	Status Permit/ Certificate [2]	Certificate Number	Township	Range	Section	Subdivision	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[4]	Owner	Comment
62468	31	PER		32 N.	52 E.	4	NE¼ NW¼	DEC	2.577	560.9	Newmont Gold Company; Palisade Ranch	
62469	32	PER		32 N.	52 E.	4	NE¼ NW¼	DEC	5.347	1073.2	Newmont Gold Company; Palisade Ranch	
V01580	91	VST		32 N.	51 E.	35	SE¼ SW¼	OTH	0.060	N.S.	Central Pacific Railroad Co.	
V01582	34	VST		33 N.	52 E.	28	SW¼ SE¼	OTH	0.000	N.S.	Central Pacific Railway Co.	
Basin 61 – Boulder Flat												
00168	[6]	PRO						DEC		1072.52	Roy Ash/Charles Thorton [4]	
00171	[6]	PRO						DEC		1815.9	William Dunphy/Newmont [4]	
00333	[6]	PRO						DEC		13488.2[7]	Roy Ash/Charles Thorton [4]	
2345	36	PER	1903	33 N.	50 E.	18	SE¼ NE¼	IRR	1.250	455.0	Elko Land & Livestock	
3035	37	CER	11160	36 N.	49 E.	15	SW¼ SW¼	IRR	3.154	675.8	Packer, Willis; Rhoade, Sharon; Rhoads, Dean	
3146	38	CER	11162	35 N.	49 E.	8	NE¼ NE¼	IRR	0.812	53.0	Fox, Almond C.	
3147	39	CER	11163	35 N.	49 E.	8	SE¼ SW¼	IRR	1.286	139.4	Fox, Almond C.	
4034	40	CER	1913	33 N.	50 E.	18	NW¼ NW¼	DOM	0.025	N.S.	Weber, Thomas R.	
7626	41	CER	1624	32 N.	50 E.	14	NE¼ NE¼	DOM	0.025	18.1	Primeaux, Roy L.	
7657	42	CER	2517	32 N.	50 E.	12	SW¼ SE¼	DOM	0.006	4.4	Lewis. H. E.	
7932	43	CER	8109	32 N.	45 E.	16	NW¼ SW¼	IRR	5.505	1761.6	Lander County; Licking, Lillian F.; Venturacci, Eddie; Venturacci, Gloria; Veturacci, Leila;Venturacci, Louie	
9822	44	CER	3939	31 N.	49 E.	11	SE¼ NW¼¼	IRR	8.835	1744.9	Horseshoe Ranch Inc.	
10733	45	CER	3347	32 N.	45 E.	13	SE¼ SW	IRR	0.000	694.9	Lander County; Licking, Lillian F.; Venturacci, Eddie; Venturacci, Gloria; Veturacci, Leila;Venturacci, Louie	
16842	46	CER	4458	32 N.	50 E.	14	N¼E NE¼	DOM	0.007	N.S.	Transportation Dept. - Nevada	
55272	119	PER		35 N.	49 E.	3	NE¼ NW¼	STO	100.0		Barrick Goldstrike Mines, Inc.	Primary storage right at the TS Ranch Reservoir associated with mine dewatering rights

Table A-2 (Continued)

App #	Map[1] #	Status Permit/ Certificate[2]	Certificate Number	Township	Range	Section	Subdivision	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[4]	Owner	Comment
55272 S01	92	PER		35 N.	49 E.	3	NE¼ NW¼	IRR	80.000	21612.0	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S02	93	PER		35 N.	49 E.	3	NE¼ NW¼	STK	0.100	22.4	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S03	94	PER		35 N.	49 E.	3	NE¼ NW¼	IRR	18.000	7200.0	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S04	95	PER		35 N.	49 E.	3	NE¼ NW¼	STK	1.000	45.9	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S06	97	PER		35 N.	49 E.	3	NE¼ NW¼	IRR	100.000	72000.0	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S07	98	PER		35 N.	49 E.	3	NE¼ NW¼	IRR	10.000	7239.7	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S08	99	PER		35 N.	49 E.	3	NE¼ NW¼	STK	0.100	47.0	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 SO9	120	PER		35 N.	49 E.	3	NE¼ NW¼	STK	0.065		Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S010	100	PER		35 N.	49 E.	3	NE¼ NW¼	WLD	10.000	7238.7	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights

Table A-2 (Continued)

App #	Map[1] #	Status Permit/ Certificate[2]	Certificate Number	Township	Range	Section	Subdivision	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[4]	Owner	Comment
55272 S011	101	PER		35 N.	49 E.	3	NE¼ NW¼	WLD	45.000	32574.2	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
55272 S013	103	PER		35 N.	49 E.	3	NE¼ NW¼	STK	2.000	1447.9	Barrick Goldstrike Mines, Inc.	Secondary storage right at the TS Ranch Reservoir associated with mine dewatering rights
V06227	47	VST		33 N.	46 E.	15	NW¼ SE¼	STK	0.016	N.S.	26 Ranch Inc.	
V06236	48	VST		36 N.	49 E.	5	SW¼ SE¼	STK		N.S.	26 Ranch Inc.	
V06238	49	VST		37 N.	50 E.	10	SE¼ NW¼	STK		N.S.	26 Ranch Inc.	
V06240	14	VST		37 N.	50 E.	10	LT01 (NE¼ NE¼)	STK	0.006	N.S.	26 Ranch Inc.	
V06242	50	VST		37 N.	50 E.	28	SE¼ NW¼	STK	0.003	N.S.	26 Ranch Inc.	
Basin 62 – Rock Creek Valley												
19	55	CER	97	37 N.	47 E.	18	SW¼ SW¼	IRR	1.500	600.0	25 Corporation	
27455	105	CER	8343	38 N.	49 E.	29	NW¼ SW¼	STK	0.006	4.1	25 Corporation, Inc.	
27456	106	CER	8344	38 N.	49 E.	28	NW¼ SW¼	STK	0.009	6.4	25 Corporation, Inc.	
27457	107	CER	8345	33 N.	46 E.	11	SW¼ NW¼	STK	0.047	33.9	25 Corporation, Inc.	
27658	108	CER	8346	37 N.	49 E.	8	NW¼ SE¼	STK	0.022	16.1	25 Corporation, Inc.	
27659	109	CER	8347	34 N.	46 E.	28	SW¼ SW¼	STK	0.047	33.9	25 Corporation, Inc.	
27693	110	CER	8644	36 N.	46 E.	7	SE¼ NW¼	STK	0.033	23.6	25 Corporation, Inc.	
27695	111	CER	8623	36 N.	46 E.	5	SE¼ SE¼	STK	0.033	23.6	25 Corporation, Inc.	
46744	56	CER	12245	37 N.	48 E.	18	NE¼ NE¼	STK	0.017	12.3	BLM	
V06228	57	VST		33 N.	46 E.	16	NE¼ SE¼	STK	0.003	N.S.	26 Ranch Inc.	
V06229	58	VST		33 N.	46 E.	11	SW¼ NW¼	STK	0.003	N.S.	26 Ranch Inc.	
V06232	59	VST		36 N.	46 E.	7	SE¼ NW¼	STK	0.016	N.S.	26 Ranch Inc.	
V06233	60	VST		34 N.	46 E.	28	SW¼ SW¼	STK	0.013	N.S.	26 Ranch Inc.	
V06234	61	VST		37 N.	48 E.	6	LT07 (NE¼ NE¼)	STK		N.S.	26 Ranch Inc.	
V06235	62	VST		37 N.	48 E.	12	NE¼ SW¼	STK		N.S.	26 Ranch Inc.	
V06237	63	VST		37 N.	49 E.	21	NW¼ NE¼	STK		N.S.	26 Ranch Inc.	
V06239	64	VST		36 N.	46 E.	5	SE¼ SE¼	STK		N.S.	26 Ranch Inc.	
V06261	65	VST		38 N.	49 E.	32	SE¼ NW¼	STK	0.005	N.S.	26 Ranch Inc.	
V06262	66	VST		38 N.	49 E.	32	SE¼ NW¼	STK	0.005	N.S.	26 Ranch Inc.	
V06263	67	VST		38 N.	49 E.	35	SW¼ NE¼	STK	0.016	N.S.	26 Ranch Inc.	
Basin 63 – Willow Creek Valley												
1486	112	CER	256	39 N.	47 E.	7	SW¼ NE¼	IRR	3.540	N.S.	Barrick Goldstrike Mines, Inc.	

Table A-2 (Continued)

App #	Map[1] #	Status Permit/ Certificate[2]	Certificate Number	Township	Range	Section	Subdivision	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)[4]	Owner	Comment
1487	113	CER	182	39 N.	46 E.	22	E2 NW¼	STK	0.056	40.5	Barrick Goldstrike Mines, Inc.	
1760	114	PER		39 N.	48 E.	27		IRR	29.770	21555.8	Barrick Goldstrike Mines, Inc.	
1997	68	CER	231	39 N.	46 E.	15	SE¼ SW¼	MM	0.100	72.4	Rex Mines Company	
3930	69	CER	1318	38 N.	48 E.	17	NW¼ NW¼	STK	0.188	N.S.	Russell Land and Cattle Company	
3931	70	CER	1319	38 N.	48 E.	20	SW¼ NW¼	STK	0.019	N.S.	Russell Land and Cattle Company	
10208	115	CER	2673	39 N.	48 E.	27	NE¼ SW¼	IRR		21555.8	Barrick Goldstrike Mines, Inc.	
26445	71	CER	8818	39 N.	46 E.	20	NE¼ SE¼	QM	0.050	1.8	Kratz, Albert G.; Lukens, Edwin R.;Tieber, Betty Jane; Tieber, Stephen V.	
27488	72	CER	8638	39 N.	46 E.	20	NW¼ SE¼	QM	0.009	1.1	Baker, Joseph; Pullen, Loretta; Swindlehurst, Donald; Timmons,Edna G.; Timmons, Wilbur V.	
31184	73	CER	9284	39 N.	46 E.	9	SE¼ SW¼	QM	0.011	7.9	Midas Water	
42837	74	CER	11785	39 N.	46 E.	20	NW¼ SE¼	DOM	0.001	0.8	Murdock, John G.	
46406	75	CER	13952	39 N.	46 E.	20	NE¼ NW¼	DOM	0.005	3.2	Wilkerson, Byron L.	
R05587	76	RES		41 N.	49 E.	32	SW¼ NW¼	OTH	0.002	N.S.	BLM	
R09057	116	RES		41 N.	48 E.	34	SW¼ SW¼	OTH	0.013	9.2	BLM	
V06255	77	VST		38 N.	50 E.	10	NE¼ NW¼	STK	0.005	N.S.	26 Ranch Inc.	
V06256	78	VST		38 N.	50 E.	15	NW¼ NE¼	STK	0.005	N.S.	26 Ranch Inc.	
V06257	79	VST		38 N.	50 E.	16	SE¼ SE¼	STK	0.003	N.S.	26 Ranch Inc.	
V06258	80	VST		38 N.	50 E.	21	SE¼ SE¼	STK	0.003	N.S.	26 Ranch Inc.	
V06259	81	VST		38 N.	50 E.	8	SW¼ SW¼	STK	0.016	N.S.	26 Ranch Inc.	
V06260	82	VST		38 N.	50 E.	5	NE¼ SE¼	STK	0.016	N.S.	26 Ranch Inc.	

[1]Refer to Figure 3-8.

[2]Status:
- APP - Application
- CER - Certificate
- PER - Permit
- RFA – Ready for Action
- RFP - Ready for Action (protested)
- VST - Vested Right
- RES - Reserved
- PRO - Proof (Decreed)

[3]Use:
- COM - Commercial
- DEC - as decreed
- DOM - Domestic
- ENV - Environmental
- IND - Industrial
- IRD - Irrigation (DLE)
- IRR - Irrigation
- MM - Mining and Milling
- MUN - Municipal
- OTH - Other
- QM - Quasi-municipal
- REC - Recreation

Table A-2 (Continued)

REL - Relinquished (to state)
STK - Stock Watering
WLD - Wildlife

[4]Annual Duty - Annual or Seasonal Amounts
N.S. - Not Specified
[5]Current Ownership Record, Transfer in Progress
[6]Dispersed Points of Diversion, Not Illustrated on Map (Harvest, Meadow, or Div. Pasture)
[7]Newmont Gold Record

APPENDIX B

WATER QUALITY

Table B-1
Nevada Standards for Toxic Materials Applicable to
Class A, B, C and Waters Upstream and Tributary to the Humboldt River

		Municipal	Propagation of Aquatic Life (warm water)						
Constituent	Units	or Domestic Supply	Single Value Limit	1-hour Avg.	96-hour Avg.	Propagation of Wildlife	Water Contact Recreation	Irrigation	Watering of Livestock
Inorganic Nonmettalic Constituents									
Cyanide	mg/L as CN	0.2		0.022	0.0052				
Fluoride	mg/L as F							1.0	2.0
Metals and Semi-metals[1]									
Antimony	µg/L as Sb	146							
Arsenic (total)	µg/L as As	50						100	200
Arsenic (III)	µg/L as As			342[2]	180[2]				
Barium	µg/L as Ba	2000							
Beryllium	µg/L as Be	0						100	
Boron	µg/L as B							750	5,000
Cadmium	µg/L as Cd	5		5.3[2,3]	1.3[2,3]			10	50
Chromium (total)	µg/L as Cr	100						100	1,000
Chromium (III)	µg/L as Cr			2,057[2,3]	245[2,3]				
Chromium (VI)	µg/L as Cr			15[2]	10[2]				
Copper	µg/L as Cu			22.1[2,3]	14.2[2,3]			200	500
Iron	µg/L as Fe		1,000					5,000	
Lead	µg/L as Pb	50		68.4[2,3]	1.3[2,3]			5,000	100
Manganese	µg/L as Mg							200	
Mercury	µg/L as Hg	2		2[2]	0.012				10
Molybdenum	µg/L as Mo		19						
Nickel	µg/L as Ni	13.4		1,699[2,3]	189[2,3]			200	
Selenium	µg/L as Se	50		20	0.005			20	50
Silver	µg/L as Ag		6.9[2,3]						
Thallium	µg/L as Tl	13							
Zinc	µg/L as Zn			140[2,3]	127[2,3]			2,000	25,000

[1]The standards for metals are expressed as total recoverable, unless otherwise noted.
[2]Standard applies to the dissolved fraction.
[3]Hardness derived standard (Nevada Administrative Code 445A.144). Values calculated assuming a hardness of 150 mg/L as $CaCO_3$.
Source: Nevada Administrative Code 445A.144.

Table B-2
Selected Water Quality Standards for Class A, B, C, and Waters Upstream and Tributary to the Humboldt River

Item	Class A Specification	Class B Specification	Class C Specification	Waters Tributary to the Humboldt River Upstream of Battle Mountain and Palisade Control Points
Floating Solids or Sludge Deposits	None attributed to human activities	See Nevada Administrative Code 445A.125	See Nevada Administrative Code 445A.126	See Nevada Administrative Code 445A.121
Odor-Producing Substances	None attributed to human activities	See Nevada Administrative Code 445A.125	Not specified	See Nevada Administrative Code 445A.121
Sewage, Industrial Wastes, or Other Wastes	None allowed	None that are not effectively treated to the satisfaction of the department	None that are not effectively treated to the satisfaction of the department	See Nevada Administrative Code 445A.121
Toxic Materials, Oil, Deleterious Substances, Colored or Other Wastes	None allowed	See Nevada Administrative Code 445A.125	See Nevada Administrative Code 445A.126	See Nevada Administrative Code 445A.121
Settleable Solids	See Nevada Administrative Code 445A.124	See Nevada Administrative Code 445A.125	See Nevada Administrative Code 445A.126	See Nevada Administrative Code 445A.121
pH	Range between 6.5 and 8.5	Range between 6.5 to 8.5	Range between 6.5 to 8.5	Range between 6.5 to 9.0 and maximum $\Delta pH \pm 0.5$
Dissolved Oxygen	Must not be less than 6.0 mg/L [2]	For trout waters, not less than 6.0 mg/L; for nontrout waters, not less than 5.0 mg/L	For waters with trout, not less than 6.0 mg/L; for waters without trout, not less than 5.0 mg/L	$\geq$ 5.0 mg/L
Temperature	Must not exceed 20° C; allowable temperature increase above natural receiving water temperature: None	Must not exceed 20°C for trout waters or 24°C for nontrout waters; allowable temperature increase above natural receiving water temperatures: None	Must not exceed 20°C for trout waters or 34°C for nontrout waters; allowable temperature increase above normal receiving water temperatures: 3°C	Maximum ΔTemperature $\leq$ 2°C
Nitrate Species	Not Specified	Not Specified	Not Specified	Nitrate $\leq$ 10 mg/L; Nitrite $\leq$ 10 mg/L; and un-ionized ammonia $\leq$ 0.02 mg/L
Chloride	Not Specified	Not Specified	Not Specified	$\leq$ 250 mg/L
Sulfate	Not Specified	Not Specified	Not Specified	$\leq$ 250 mg/L
Total Phosphates	Must not exceed 0.15 mg/L in any stream at the point where it enters any reservoir or lake, nor 0.075 mg/L in any reservoir or lake, nor 0.30 mg/L in streams and other flowing waters	Must not exceed 0.3 mg/L	Must not exceed 1.0 mg/L	Total Phosphorus: April – November seasonal average $\leq$ 0.1 mg/L
Turbidity	Not Specified	Not Specified	Not Specified	$\leq$ 50 NTU
Suspended Solids	Not Specified	Not Specified	Not Specified	Annual Median $\leq$ 80 mg/L

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Total Dissolved Solids	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less)	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less)	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less)	Annual average $\leq$ 500 mg/L

Source: Nevada Administrative Code 445A.124 through 445A-126 and 445A-204 and 445A-205.

Table B-3
Stream Water Quality Summary

		Maggie Creek[1]				Rock Creek		Boulder Creek	
Constituent	**Units**	***n***	**Min.**	**Max.**	**Avg.**	***n***	**Value**	***n***	**Value**
Stream Discharge	cfs	5	0.09	2.49	0.75	1	2.6	1	36.9
Physical and Aggregrate Properties									
SAR	ratio	5	1.2	1.4	1.3	1	1.9	1	0.5
Temperature	°C	5	0.5	26.0	7.6	1	4.0	1	7.0
TDS	mg/L @180°C	5	372.0	460.0	399.0	1	263.0	1	134.0
Turbidity	NTU	5	0.3	2.4	1.5	1	2.6	1	50.0
Inorganic Nonmetallic Constituents									
Chloride	mg/L as Cl	5	19.0	32.0	21.0	1	22.0	1	4.0
Cyanide	µg/L as CN	5	<0.01	<0.01	<0.01	1	<0.01	1	<0.01
Dissolved Oxygen	mg/L as O_2	5	9.4	13.0	12.0	1	11.6	1	10.0
Fluoride	mg/L as F	5	0.3	0.6	0.4	1	0.6	1	0.2
Nitrate	mg/L as N	5	0.45	1.4	0.94		--		--
Nitrite	mg/L as N	5	0.01	0.08	0.02	1	<0.01	1	<0.01
pH	standard units	5	8.1	8.8	8.4	1	8.4	1	7.9
Sulfate	mg/L as SO_4	5	57.0	96.0	73.0	1	31.0	1	23.0
Total Ammonia	mg/L as N	5	0.01	0.03	0.02	1	0.02	1	0.02
Metals (dissolved)									
Aluminum	µg/L as Al	5	5.0	10.0	5.6	1	120.0	1	340.0
Arsenic	µg/L as As	5	6.0	25.0	12.0	1	6.0	1	3.0
Barium	µg/L as Ba	5	91.0	110.0	97.0	1	60.0	1	57.0
Beryllium	µg/L as Be	5	<0.5	<0.5	<0.5	1	<0.5	1	<0.5
Cadmium	µg/L as Cd	5	0.5	1.0	0.6	1	<1.0	1	<1.0
Chromium	µg/L as Cr	5	0.5	8.0	1.5	1	<1.0	1	<1.0
Copper	µg/L as Cu	5	0.5	3.0	1.0	1	<1.0	1	2.0
Iron	µg/L as Fe	5	3.0	11.0	9.0	1	130.0	1	65.0
Lead	µg/L as Pb	5	<1.0	<1.0	<1.0	1	<1.0	1	<1.0
Magnesium	µg/L as Mg	5	18.0	26.0	21.0	1	7.5	1	5.7
Manganese	µg/L as Mn	5	6.0	130.0	25.0	1	19.0	1	7.0
Mercury	µg/L as Hg	3	<0.1	<0.1	<0.1	1	0.05	1	--
Molybdenum	µg/L as Mo	5	5.0	10.0	6.0	1	<10.0	1	<10.0
Nickel	µg/L as Ni	5	0.5	2.0	1.7	1	<1.0	1	2.0
Selenium	µg/L as Se	5	0.5	5.0	1.6	1	<1.0	1	1.0
Silver	µg/L as Ag	5	<1.0	<1.0	<1.0	1	<1.0	1	<1.0
Thallium	µg/L as Tl	5	1.5	44.0	11.0	1	15.0	1	4.0
Water Type	---	Ca,Na-HCO_3				Na,Ca-HCO_3		Ca,Mg-HCO_3	

[1]Data summarized from two sampling sites.
n = sample size.
SAR = sodium adsorption ratio.
TDS = total dissolved solids.
Source: Data summarized from USGS database.

Table B-3 (Continued)
Stream Water Quality Summary

		Antelope Creek[1]				Bell Creek[1]			
Constituent	**Units**	***n***	**Min.**	**Max.**	**Avg.**	***n***	**min**	**max**	**Avg**
Physical and Aggregrate Properties									
Alkalinity	mg/L as $CaCO_3$	5	121.5	200.0	156.0	36	60.5	140.0	91.3
TDS	mg/L @180°C	5	184.0	333.0	275.0	36	109.0	280.0	185.0
TSS	mg/L@103-5°C	4	6.1	41.7	16.5	28	0.05	300.0	33.7
Inorganic Nonmetallic Constituents									
Chloride	mg/L as Cl	5	9.0	26.3	17.9	36	4.0	8.8	5.4
Fluoride	mg/L as F	5	0.31	**4.4**	**1.2**	36	0.2	0.6	0.3
Nitrate	mg/L as N	1	<0.05	<0.05	<0.05	16	<0.05	0.55	0.091
pH	standard units	5	7.6	8.4	8.1	36	7.4	9.0	8.0
Sulfate	mg/L as SO_4	1	36.0	36.0	36.0	26	21.2	82.0	41.8
Metals									
Arsenic (T)	µg/L as As	1	18.0	18.0	18.0	36	<1.0	17.0	3.0
Iron (D)	µg/L as Fe	5	<1.0	120.0	30.0	33	<10.0	646.0	190.0
Magnesium (T)	µg/L as Mg	1	330.0	330.0	330.0	36	6,700.0	18,000	10,600
Manganese (T)	µg/L as Mn	1	33.0	33.0	33.0	36	<2.0	**590.0**	51.0
Water Type	---	Na-HCO_3				Ca,Mg-HCO_3			

		Boulder Creek[2]				Brush Creek[1]			
Constituent	**Units**	***n***	**min**	**max**	**avg**	***n***	**min**	**Max**	**avg**
Physical and Aggregrate Properties									
Alkalinity	mg/L as $CaCO_3$	86	22.0	100.0	64.0	66	84.9	220.0	151.0
TDS	mg/L @180°C	85	72.0	250.0	144.0	66	156.0	470.0	282.0
TSS	mg/L@103-5°C	66	0.05	460.0	54.8	54	0.005	92.6	11.0
Inorganic Nonmetallic Constituents									
Chloride	mg/L as Cl	86	<3.0	40.6	5.5	66	5.0	33.0	14.0
Fluoride	mg/L as F	85	0.1	**1.2**	0.27	66	0.12	**1.7**	0.58
Nitrate	mg/L as N	50	<0.05	0.71	0.13	41	<0.05	19.0	0.51
pH	standard units	95	7.1	9.0	7.9	88	7.6	9.4	8.2
Sulfate	mg/L as SO_4	43	8.0	100.0	30.0	47	30.0	130.0	67.0
Metals									
Arsenic (T)	µg/L as As	95	<5.0	**505.0**	15.0	86	<5.0	42.0	5.0
Iron (D)	µg/L as Fe	66	<10.0	**1,310.0**	370.0	54	<10.0	739.0	71.0
Magnesium (T)	µg/L as Mg	86	4,080	21,000	774.0	66	12,000	41,900	20,300
Manganese (T)	µg/L as Mn	86	<5.0	**1,060.0**	73.0	65	<5.0	200.0	17.0
Water Type	---	Na-HCO_3				Ca,Mg-HCO_3			

[1]Data summarized from two sampling sites.
[2]Data summarized from four sampling sites.
(T) = Total
(D) = Dissolved
n = sample size.
Source: Data summarized from the Boulder Valley Monitoring Plan.

Table B-3 (Continued)
Stream Water Quality Summary

		Rock Creek[2]				Rodeo Creek[2]			
Constituent	**Units**	***n***	**min**	**max**	**Avg**	***n***	**min**	**max**	**avg**
Physical and Aggregrate Properties									
Alkalinity	mg/L as $CaCO_3$	8	107.0	147.0	121.0	78	30.0	330.0	120.0
TDS	mg/L @180°C	8	190.0	258.0	212.0	78	130.0	2,300.0	561.0
TSS	mg/L@103-5°C	8	1.1	8.3	4.2	81	<5.0	14,000	426.0
Inorganic Nonmetallic Constituents									
Chloride	mg/L as Cl	8	20.4	33.3	24.9	78	4.0	1,000.0	140.0
Fluoride	mg/L as F	8	0.38	**1.35**	0.65	77	0.1	**1.1**	0.41
Nitrate	mg/L as N	0	---	---	---	55	<0.05	14.0	1.5
pH	standard units	8	7.8	8.7	8.3	106	7.1	10.0	8.2
Sulfate	mg/L as SO_4	8	34.0	40.2	36.1	61	12.0	1,100.0	96.0
Metals									
Arsenic (T)	µg/L as As	0	---	---	---	107	<5.0	**1,400.0**	**140.0**
Iron (D)	µg/L as Fe	8	4.9	32.0	20.0	54	<10.0	**6,330.0**	250.0
Magnesium (T)	µg/L as Mg	0	---	---	---	78	3,700.0	250,00.0	40,000
Manganese (T)	µg/L as Mn	0	---	---	---	78	<5.0	**4,400.0**	**290.0**
Water Type	---	Na-HCO_3				Ca,Mg-HCO_3			

[1]Data summarized from two sampling sites.
[2]Data summarized from four sampling sites.
(T) = Total
(D) = Dissolved
n = sample size.
Source: Data summarized from the Boulder Valley Monitoring Plan.

Table B-4
Stream Water Quality Summary for Lahontan Cutthroat Trout Streams

Constituent	Units	Nelson Creek	Lewis Creek	Toe Jam Creek	Upper Rock Creek	Frazer Creek
Sample Date	mm/dy/yr	8/13/97	8/13/97	8/14/97	8/14/97	8/15/97
Stream Discharge	cfs	<0.1	0.2-0.3	0.09	0.29	0.15
Physical and Aggregrate Properties						
Alkalinity	mg/L as $CaCO_3$	65.0	80.0	65.0	59.0	63.0
TDS	mg/L @180°C	140.0	150.0	100.0	90.0	140.0
Temperature	°C	**23.3**	17.0	16.4	14.2	15.2
TSS	mg/L @103 C	<5.0	<5.0	<5.0	<5.0	<5.0
Turbidity	NTU	1.3	1.2	2.3	0.4	1.1
Inorganic Nonmetallic Constituents						
Chloride	mg/L as Cl	4.0	4.0	1.0	1.0	9.0
Dissolved Oxygen	mg/L as O_2	7.8	6.6	8.13	**5.6**	9.4
Fluoride	mg/L as F	0.1	0.2	0.1	<0.1	0.3
Nitrate	mg/L as N	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrite	mg/L as N	<0.01	<0.01	<0.01	<0.01	<0.01
pH, field	su	8.6	7.6 (lab)	7.9	8.0	8.1
Phosphorus, ortho	mg/L as P	0.1	0.09	0.044	0.027	0.021
Sulfate	mg/L as SO_4	<10.0	<10.0	10.0	10.0	10.0
Total Ammonia	mg/L as N	**0.19**	0.06	<0.05	<0.05	0.09
Total Phosphate	mg/L as PO_4	0.226	0.093	0.056	0.045	0.031
Metals						
Arsenic total	µg/L as As	3.0	3.0	2.0	5.0	1.0
Arsenic,dissolved	µg/L as As	3.0	3.0	2.0	5.0	2.0
Cadmium, dissolved	µg/L as Cd	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium, total	µg/L as Cd	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium, total	µg/L as Cr	0.4	0.5	0.7	0.4	0.5
Chromium, dissolved	µg/L as Cr	<0.4	<0.4	<0.4	<0.4	<0.4
Copper, dissolved	µg/L as Cu	1.0	1.0	<1.0	1.0	1.0
Copper, total	µg/L as Cu	1.0	<1.0	2.0	2.0	1.0
Iron, dissolved	µg/L as Fe	100.0	140.0	560.0	180.0	130.0
Iron, total	µg/L as Fe	150.0	230.0	680.0	210.0	210.0
Lead, dissolved	µg/L as Pb	<0.4	<0.4	<0.4	<0.4	<0.4
Lead, total	µg/L as Pb	<0.4	<0.4	<0.4	<0.4	<0.4
Magnesium, dissolved	µg/L as Mn	4,400.0	5,800.0	3,700.0	2,900.0	4,300.0
Manganese, dissolved	µg/L as Mg	6.0	13.0	19.0	21.0	7.0
Manganese, total	µg/L as Mg	9.0	21.0	29.0	21.0	21.0
Mercury, dissolved	µg/L as Hg	<0.2	<0.2	<0.2	<0.2	<0.2
Mercury, total	µg/L as Hg	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel, dissolved	µg/L as Ni	<1.0	1.0	<1.0	<1.0	<1.0
Nickel, total	µg/L as Ni	<1.0	1.0	1.0	<1.0	<1.0
Potassium, dissolved	µg/L as K	6,000.0	5,000.0	1,500.0	1,100.0	2,300.0
Selenium, dissolved	µg/L as Se	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium, total	µg/L as Se	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc,dissolved	µg/L as Zn	10.0	1.0	<10.0	10.0	<10.0
Zinc, total	µg/L as Zn	10.0	100.0	10.0	10.0	10.0
Water Type	---	Ca,Na-HCO_3	Ca,Na-HCO_3	Ca-HCO_3	Ca-HCO_3	Ca,Na-HCO_3

Source: AATA International, Inc. 1998.

APPENDIX C

HUMBOLDT RIVER INFORMATION

Table C-1
Water Withdrawals by County[1]
(thousands of acre-feet/year)

Year	Use	Elko		Eureka		Humboldt		Lander		Pershing		Total	
		Flow	Percent	Flow	Percent	Flow	Percent	Flow	Percent	Flow	Percent	Flow	Percent
1990	Municipal/Industrial	11.6	1.2	0.4	0.3	3.2	0.7	0.9	0.5	1.2	0.5	17.3	0.9
	Irrigation/Livestock	960.4	98.3	121.2	82.2	433.8	93.4	156.1	88.8	216.4	98.6	1887.9	95.1
	Domestic	0.8	0.1	0.1	0.1	0.6	0.1	0.2	0.1	0.2	0.1	1.9	0.1
	Mining	4.4	0.5	25.8	17.5	27.1	5.8	18.6	10.6	1.7	0.8	77.6	3.9
2000	Municipal/Industrial	15.6	1.5	0.5	0.2	4.5	0.8	1.3	0.5	1.7	0.8	23.6	1.0
	Irrigation/Livestock	1000.7	98.3	121.3	42.8	433.8	81.4	161.9	62.1	216.4	99.1	1934.1	83.6
	Domestic	1.2	0.1	0.1	0.0	0.8	0.2	0.3	0.1	0.3	0.1	2.7	0.1
	Mining	0.0	0.0	161.8	57.0	94.1	17.6	97.4	37.3	0.0	0.0	353.3	15.3
2010	Municipal/Industrial	18.9	1.8	0.6	0.3	5.4	1.2	1.6	0.9	2.1	1.0	28.6	1.3
	Irrigation/Livestock	1040.9	98.1	121.4	58.9	433.9	94.1	168.2	97.7	216.4	98.9	1980.8	93.5
	Domestic	1.4	0.1	0.1	0.0	1.0	0.2	0.3	0.2	0.3	0.1	3.1	0.1
	Mining	0.0	0.0	83.9	40.7	21.0	4.6	2.0	1.2	0.0	0.0	106.9	5.0
2020	Municipal/Industrial	21.9	2.0	0.7	0.6	6.3	1.4	1.9	1.1	2.4	1.1	33.2	1.6
	Irrigation/Livestock	1081.2	97.9	121.6	96.9	433.9	97.9	174.0	97.6	216.5	98.7	2027.2	97.9
	Domestic	1.6	0.1	0.2	0.2	1.2	0.3	0.4	0.2	0.4	0.2	3.8	0.2
	Mining	0.0	0.0	3.0	2.4	2.0	0.5	2.0	1.1	0.0	0.0	7.0	0.3

Flow = thousands of acre-feet/year
Percent = Percent of total flow withdrawal
[1]More recently revised agency estimates indicate different levels of water usage than shown in the table (Nevada Division of Water Planning 1998).
Source: Nevada Division of Water Planning 1992a, 1992b; Horton 1998

Table C-2
Consumptive Water Uses by County[1]
(thousands of acre-feet/year)

Year	Use	Elko	Eureka	Humboldt	Lander	Pershing	Total
1990	Municipal/Industrial	4.4	0.2	1.3	0.4	0.5	6.6
	Irrigation/Livestock	515.6	73.4	227.4	83.3	110.6	1010.3
	Domestic	0.4	0.0	0.3	0.1	0.1	1.0
	Mining	3.9	12.5	7.0	7.4	1.6	32.4
2000	Municipal/Industrial	5.9	0.2	1.8	0.5	0.6	9.1
	Irrigation/Livestock	537.2	73.4	227.4	86.4	110.6	1035.0
	Domestic	0.6	0.0	0.4	0.2	0.2	1.4
	Mining	0.0	19.4	13.0	6.4	0.0	38.8
2010	Municipal/Industrial	18.9	0.2	2.1	0.7	0.8	22.7
	Irrigation/Livestock	1040.9	73.5	227.4	89.7	110.6	1542.1
	Domestic	1.4	0.0	0.5	0.2	0.2	2.3
	Mining	0.0	19.4	8.0	2.0	0.0	29.4
2020	Municipal/Industrial	21.9	0.3	2.5	0.8	0.9	26.4
	Irrigation/Livestock	1081.2	73.6	227.4	92.8	110.6	1585.6
	Domestic	1.6	0.1	0.6	0.2	0.2	2.7
	Mining	0.0	3.0	2.0	2.0	0.0	7.0

[1]More recently revised agency estimates indicate different levels of water usage than shown in the table (Nevada Division of Water Planning 1998).

Source: Nevada Division of Water Planning 1992a, 1992b; Horton 1998.

Table C-3
Water Use by Category for 1995 in the Humboldt River Basin

County	Water Withdrawal (acre-feet/year)			
	Irrigation/Livestock	Municipal/Industrial	Domestic	Mining
Elko	910,300	20,200	700	5,400
Eureka	125,000	5,100	100	114,200
Humboldt	600,500	8,100	1,400	76,600
Lander	161,700	1,400	250	35,600
Pershing	117,200	1,700	150	2,100
Five-County Total	**1,914,700 (87.5%)**	**36,500 (1.7%)**	**2,600 (0.1%)**	**233,900 (10.7%)**

Source: Horton 1998.

Table C-4
Water Use by Source for 1995 in the Humboldt River Basin

County	Water Withdrawal (acre-feet/year)			Consumptive Use (acre-feet/year)
	Groundwater	Surface Water	Total	
Elko	124,200	812,400	936,600	477,300 (51% of total)
Eureka	220,700	23,700	244,400	93,400 (38% of total)
Humboldt	546,900	139,700	686,600	334,800 (49% of total)
Lander	144,000	55,000	199,000	94,100 (47% of total)
Pershing	40,900	80,300	121,200	65,300 (54% of total)
Five-County Total	**1,076,700**	**1,111,100**	**2,187,800**	**1,064,900 (49% of total)**

Source: Horton 1998.

Table C-5
Water Use Forecast for Selected Purveyors in the Humboldt River Basin (1990-2020)

Water Purveyor	Current Water Supply (acre-feet/year)	Water Use (acre-feet/year)			
		1990	2000	2010	2020
Elko County					
Carlin City Water	4,538	777	1,186	1,381	1,559
Elko City Water	17,154	5,957	9,829	12,378	14,926
Eureka County					
Eureka Water Association	1,522	307	371	460	520
Humboldt County					
Winnemucca City Water	5,854	2,540	3,192	3,696	4,167
Lander County					
Lander County Sewer/Water District #1	2,896	919	1,294	1,553	1,811
Pershing County					
Lovelock City Water	3,795	1,204	1,960	2,350	2,700
Imlay City Water	560	49	65	82	98

Source: Nevada Division of Water Planning 1992a.

Table C-6
Active NPDES Facility Locations in the Humboldt River Basin

Permit No.	Facility	City/County	Permitted Flow (cfs)	Discharge Type	Receiving Water
NV0022675	Barrick Goldstrike Mines	Carlin/Eureka	100.8	Mine Dewatering	Humboldt River
NV0021962	Lone Tree Mining Co.	Valmy/Humboldt	108.0	Mine Cooling Water	Humboldt River
NV0020311	Lovelock, City of	Lovelock/Pershing	0.5	Waste/Process Municipal	Toulon River
NV0020656	NDOW - Gallagher	Elko/Elko	3.0	Waste/Process Hatchery	Ruby Marsh
NV0022268	Newmont/Gold Quarry	Carlin/Eureka	72.0	Mine Dewatering	Humboldt River
NV0021725	Twin Creeks Mining	Golconda/Humboldt	14.55	Mine Pump/Well Test	Humboldt River

Source: Narala 1999.

Table C-7
Water Release from Public Sewage Treatment Facilities in the Humboldt River Basin (1990)

County	Total Release (gallons/day)	Total Release (acre-feet/year)
Elko	3,840,000	4,300
Eureka	60,000	70
Humboldt	890,000	1,000
Lander	460,000	520
Pershing	250,000	280
State Total	**152,230,000**	**170,520**

Source: Internet - Nevada Division of Water Planning, 1999.

Table C-8
Monthly Flow Ranges for 1946-1990, Humboldt River Gages[1]
(cfs)

	Carlin		
	Minimum	Average	Maximum
Jan	10	148	452
Feb	22	287	1,324
Mar	107	521	2,190
Apr	108	751	3,684
May	79	985	5,728
Jun	67	1,228	4,876
Jul	7	377	1,908
Aug	1	53	492
Sep	1	27	154
Oct	18	48	331
Nov	6	79	361
Dec	7	104	625

	Palisade		
	Minimum	Average	Maximum
Jan	30	176	543
Feb	36	350	1,779
Mar	129	634	2,949
Apr	121	913	4,222
May	83	1,078	5,719
Jun	78	1,270	4,635
Jul	24	360	1,960
Aug	92	67	571
Sep	10	41	199
Oct	15	66	370
Nov	23	100	411
Dec	24	125	720

	Argenta[2]		
	Minimum	Average	Maximum
Jan	10	166	514
Feb	24	329	1,528
Mar	108	588	2,467
Apr	105	838	4,277
May	52	946	6,263
Jun	40	1,146	4,971
Jul	7	353	2,030
Aug	0	50	519
Sep	0	16	111
Oct	0	37	297
Nov	0	81	403
Dec	5	115	743

	Battle Mountain[2]		
	Minimum	Average	Maximum
Jan	10	178	622
Feb	23	338	1,518
Mar	102	614	2,713
Apr	97	823	4,065
May	51	950	6,465
Jun	35	1,108	4,776
Jul	6	371	2,055
Aug	0	63	658
Sep	0	23	177
Oct	0	42	351
Nov	0	84	419
Dec	4	117	727

	Comus		
	Minimum	Average	Maximum
Jan	0	152	762
Feb	0	280	904
Mar	66	582	3,267
Apr	94	806	5,312
May	31	850	6,227
Jun	25	970	4,630
Jul	0	417	1,930
Aug	0	64	637
Sep	0	17	190
Oct	0	32	259
Nov	0	64	386
Dec	0	105	791

	Imlay		
	Minimum	Average	Maximum
Jan	11	126	779
Feb	19	203	991
Mar	34	432	1,991
Apr	46	596	4,489
May	28	690	6,223
Jun	13	732	5,355
Jul	1	475	2,340
Aug	1	122	936
Sep	3	48	292
Oct	6	46	301
Nov	6	66	412
Dec	10	97	685

[1] Input data are daily flows in cfs; these are then averaged for each month of each year in the record.
[2] Includes periods of highly-correlated synthesized data (RTi 1998).
Source: USGS 1999; RTi 1998.

Table C-9
General Rainfall Conditions for Recent Years in the Humboldt River Basin

Recent Year	Annual Precipitation at Battle Mountain	Basin-wide Precipitation for Calendar Year in Upper Humboldt[1]	Basin-Wide Precipitation for Calendar Year in Lower Humboldt[1]
1991	Almost exactly average	Low	Average to high
1992	37% above average	Low	Low
1993	8% below average	Average **-**	Low
1994	24% above average	Low	Generally high
1995	26% below average	High to very high	High to very high
1996	57% above average	High to very high	High to very high
1997	16% above average	Average	Average **+**
1998	Approx. 116% above average	High to very high	High to very high

[1]Very generally, the upper Humboldt subbasin is upstream of Emigrant Pass/Palisade, and the lower Humboldt subbasin is downstream of Emigrant Pass/Palisade. This corresponds to the administration areas for the Edwards Decree vs Bartlett Decree. Qualitative examinations were based on rating several stations in each subbasin with their historical averages.

Source: National Climatic Data Center precipitation station data 1999.

Table C-10
Comparison of River Flows for 1991 - 1998 with Average Annual Premine Discharge Conditions (1946-1990) [1]

Recent Year	Elko	Carlin	Battle Mountain	Comus	Imlay
1991	-65%	-60%	-67%	-75%	-80%
1992	-85%	-80%	-85%	-85%	-90%
1993	+15%	+5%	+25%	+5%	Average
1994	-67%	-67%	-67%	-60%	-70%
1995	+60%	+60%	+50%	+40%	+30%
1996	+25%	+30%	+70%	+50%	+50%
1997	+60%	+60%	+125%	+120%	+115%
1998	+60%	+65%	+110%	+125%	+130%

[1] All percentages are approximate.

Source: USGS 1999.

Table C- 11
Flow Changes Between Humboldt River Gages in Recent High-flow Years
(all values are mean monthly flows in cfs)

Month	Carlin Flow	Battle Mtn. Flow	Difference (dQ)	Mine Q	Difference,[1] Mine Q - dQ	Battle Mtn Flow	Comus Flow	Difference (dQ)	Mine Q	Difference,[1] Mine Q - dQ
Jan-95	76.71	108.32	31.61	33.14	1.53	108.32	107.23	-1.09	70.48	na
Feb-95	233.21	248	14.79	36.69	21.90	248	279.36	31.36	74.03	42.67
Mar-95	408.77	449.48	40.71	33.14	-7.57	449.48	416.55	-32.93	70.48	na
Apr-95	482.13	551.27	69.14	18.99	-50.15	551.27	490.87	-60.4	79.67	na
May-95	1155.81	1164.06	8.25	18.38	10.13	1164.06	687.32	-476.74	79.05	na
Jun-95	3132.33	2563.33	-569	18.99	na	2563.33	2060.67	-502.66	79.67	na
Jul-95	1384.03	1417.87	33.84	13.03	-20.81	1417.87	1450	32.13	73.71	41.58
Aug-95	140.32	182.94	42.62	13.03	-29.59	182.94	274	91.06	73.71	-17.35
Sep-95	48.87	52.1	3.23	13.47	10.24	52.1	71.57	19.47	74.14	54.67
Oct-95	61.77	61.35	-0.42	21.90	22.32	61.35	70.87	9.52	82.57	73.05
Nov-95	78.07	98.2	20.13	22.63	2.50	98.2	113.77	15.57	83.30	67.73
Dec-95	107.29	113.84	6.55	21.90	15.35	113.84	126.74	12.9	82.57	69.67
Jan-96	141.23	181.03	39.8	15.63	-24.17	181.03	199.32	18.29	70.21	51.92
Feb-96	407.62	446.03	38.41	17.30	-21.11	446.03	423	-23.03	71.88	na
Mar-96	1019.77	1457.06	437.29	15.63	-421.66	1457.06	1114.13	-342.93	70.21	na
Apr-96	1126.93	1723.67	596.74	15.85	-580.89	1723.67	1433.33	-290.34	70.43	na
May-96	1372.35	1604.84	232.49	15.34	-217.15	1604.84	1142.16	-462.68	69.92	na
Jun-96	1334.4	1606.63	272.23	15.85	-256.38	1606.63	1320.5	-286.13	70.43	na
Jul-96	237.48	415.1	177.62	14.80	-162.82	415.1	369.1	-46	69.38	na
Aug-96	45.29	41.74	-3.55	14.80	na	41.74	69.39	27.65	69.38	41.73
Sep-96	22.17	14.5	-7.67	15.29	na	14.5	38	23.5	69.87	46.37
Oct-96	27.84	31.65	3.81	35.37	31.56	31.65	51.65	20	89.95	69.95
Nov-96	60.4	109.17	48.77	36.55	-12.22	109.17	128.03	18.86	95.32	76.46
Dec-96	142.26	234.84	92.58	35.37	-57.21	234.84	211.16	-23.68	94.15	na
Jan-97	394.32	1123.32	729	27.87	-701.13	1123.32	750.42	-372.9	89.51	na
Feb-97	391.14	812.79	421.65	30.86	-390.79	812.79	774.93	-37.86	92.50	na
Mar-97	1070.23	1693.03	622.8	27.87	-594.93	1693.03	1304.45	-388.58	82.91	na
Apr-97	1020.37	1533.33	512.96	28.23	-484.73	1533.33	1604.33	71	83.27	12.27
May-97	1646.13	1910.97	264.84	27.32	-237.52	1910.97	1482.26	-428.71	82.36	na
Jun-97	2055.53	2074	18.47	28.23	9.76	2074	2100	26	74.46	48.46
Jul-97	307.77	509.87	202.1	14.61	-187.49	509.87	595.68	85.81	60.84	-24.97
Aug-97	124.23	137.77	13.54	14.61	1.07	137.77	149.39	11.62	60.84	49.22
Sep-97	45.67	63.6	17.93	23.20	5.27	63.6	81.97	18.37	76.04	57.67
Oct-97	54.23	168.94	114.71	159.72	45.01	168.94	174.94	6	212.55	206.55
Nov-97	86.5	255.83	169.33	160.82	-8.51	255.83	257.63	1.8	222.46	220.66
Dec-97	92.29	328.13	235.84	159.72	-76.12	328.13	303.32	-24.81	221.36	na
Jan-98	225.52	426.29	200.77	141.73	-59.04	426.29	476.71	50.42	191.73	141.31
Feb-98	253.18	440.96	187.78	146.12	-41.66	440.96	578.14	137.18	196.12	58.94
Mar-98	457.61	703.94	246.33	141.73	-104.60	703.94	714.71	10.77	191.73	180.96

Table C- 11 (Continued)

Apr-98	822.77	1322.33	499.56	65.37	-434.19	1322.33	939.27	-383.06	129.66	na
May-98	1808.1	2262.26	454.16	64.85	-389.31	2262.26	1967.77	-294.49	129.13	na
Jun-98	2655.33	2918.67	263.34	65.37	-197.97	2918.67	2683.67	-235	129.66	na
Jul-98	1036.42	1249.9	213.48	32.28	-181.20	1249.9	1621.74	371.84	96.56	-275.28
Aug-98	137.74	210.97	73.23	32.28	-40.95	210.97	324.61	113.64	96.56	-17.08
Sep-98	58.87	95.37	36.5	32.95	-3.55	95.37	152.63	57.26	97.23	39.97

[1]A positive Mine Q - dQ indicates the possibility that some or all of the mine discharge is involved in the flow increase.
Negative Mine Q - dQ indicates that there is more gain in the streamflow between the gages than can be accounted for by the mine discharges.
na: The Mine Q - dQ approach may not give insight to gage losses between stations, only the increases. However, it is quite possible for the entire mine discharge amount to be withdrawn from the river as part of the streamflow losses between gages.

Source: USGS 1999; Barrick 1999, and Newmont 1999a, b.

Figure C-1. All Humboldt Basin Counties - Demand

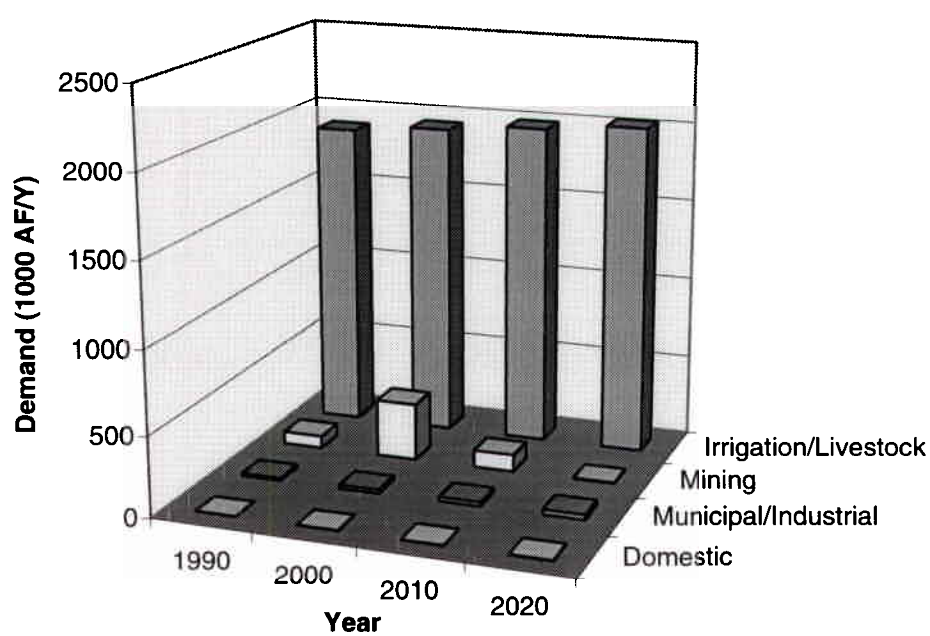


Figure C-2. All Humboldt Basin Counties - Consumptive Use

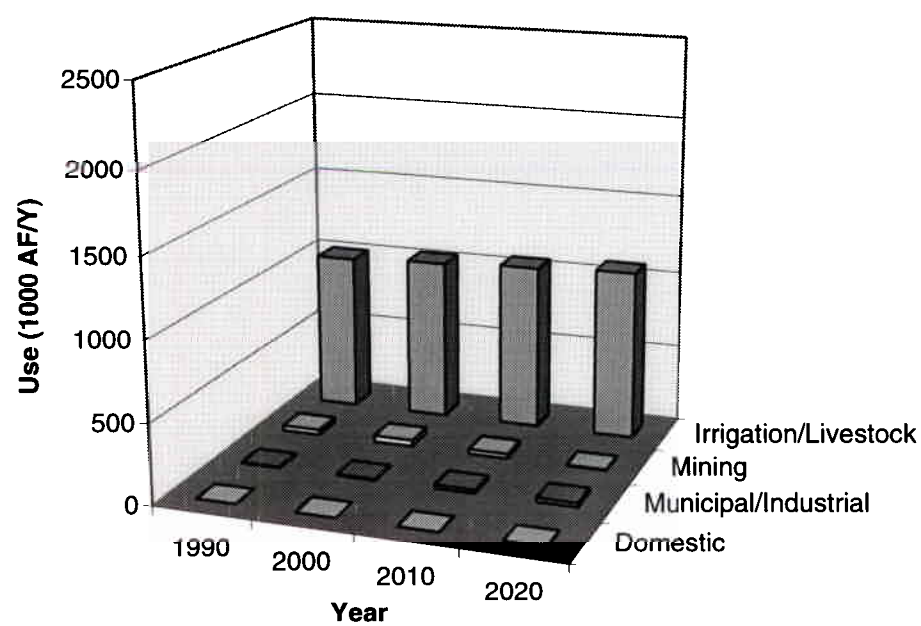
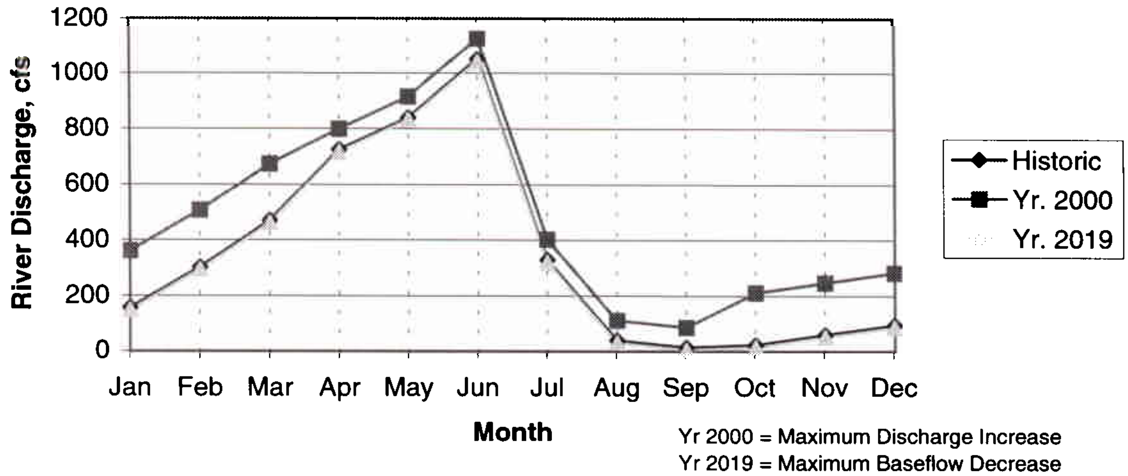
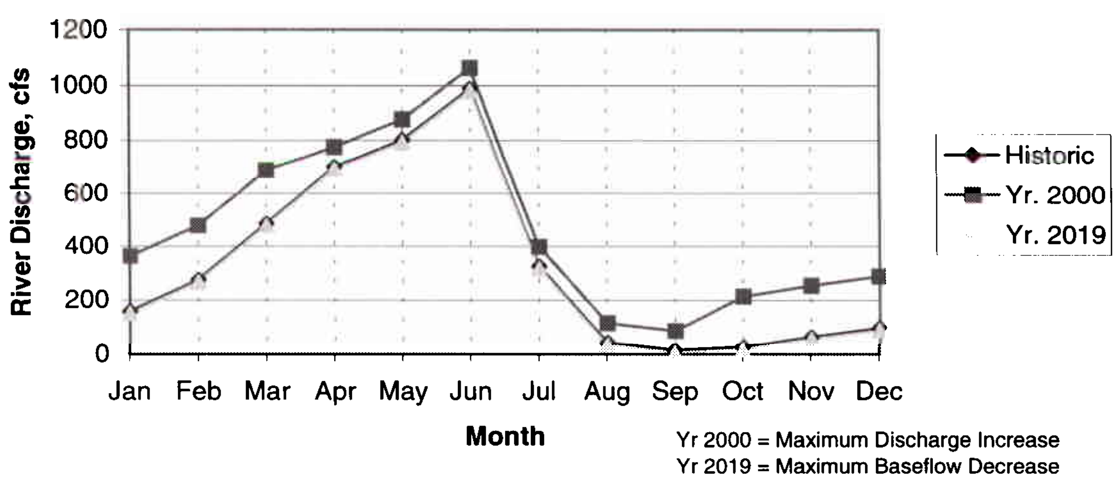


Figure C-3. Predicted Flow Changes at Argenta



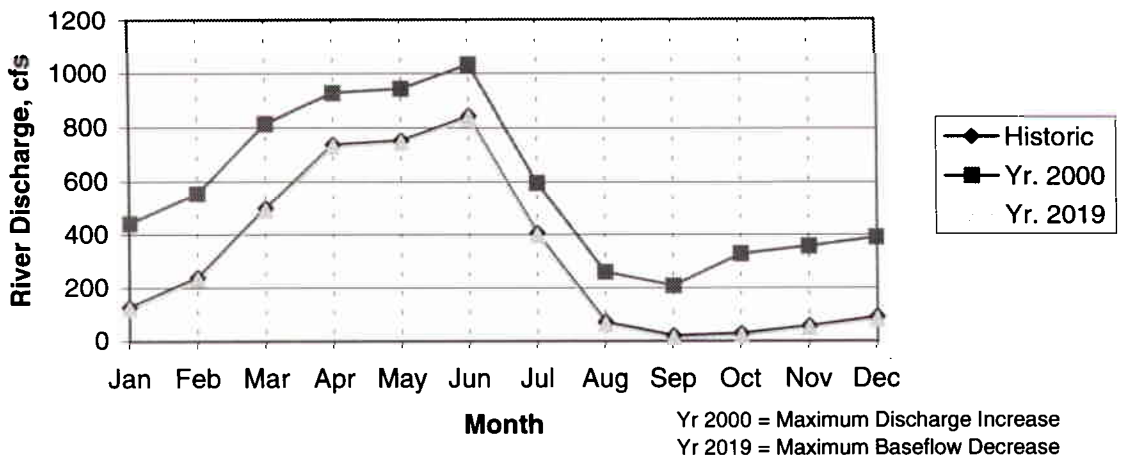
Source: Hydrologic Consultants 1997

Figure C-4. Predicted Flow Changes at Battle Mountain



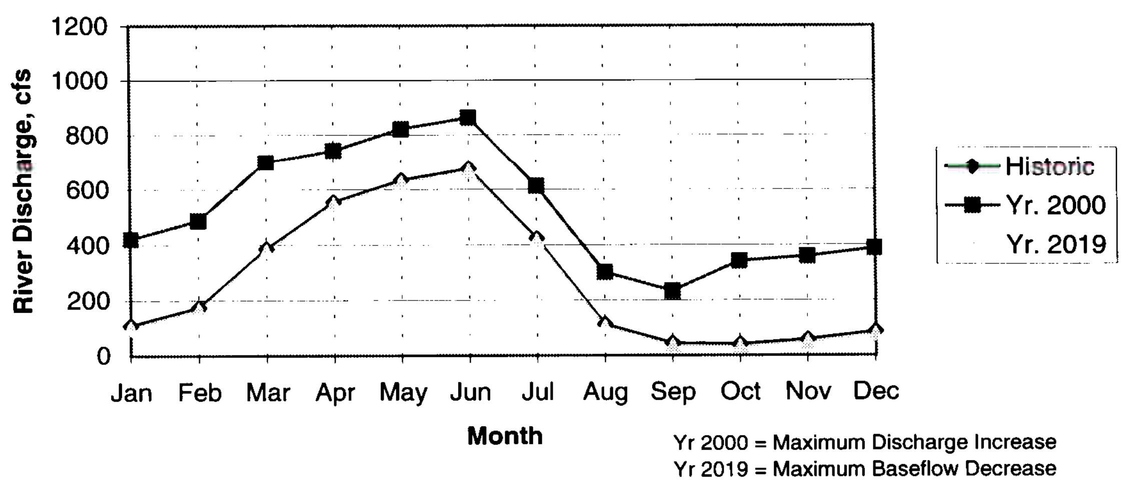
Source: Hydrologic Consultants 1997

Figure C-5. Predicted Flow Changes at Comus



Source: Hydrologic Consultants 1997

Figure C-6. Predicted Flow Changes at Imlay



Source: Hydrologic Consultants 1997

SUMMARY OF HUMBOLDT RIVER FLOW ANALYSES

Existing river flow data and mine discharge schedules were the basis for the cumulative impact assessment. Using historic flow gaging data for the Humboldt River, two detailed studies were performed independently to predict changes in river flows as a result of mining activities (HCI 1997; RTi. 1998). Discharge records and projections from Barrick Goldstrike Mines Inc. and Newmont Mining Company were incorporated into each analysis.

Data collection along the Humboldt River has been conducted for decades by the U.S. Geological Survey stream gaging program, which is operated in cooperation with other state and Federal agencies in Nevada. This program has emphasized the collection of flow data, but water quality sampling and analyses also have been included over time. For several locations, flow data extend back to the 1890s or early 1900s. More recent, continuous data sets for daily average flows typically have a period of record starting in the late 1940s. The most extensive and useful data for daily average flows are available for the gaging stations at Carlin, Palisade, Argenta, Battle Mountain, Comus, Imlay, and Rye Patch. These gage locations are shown in Figure 1-1 in Chapter 1.0.

Flow data from the various locations along the river were reviewed for this cumulative impact assessment. Reference locations were selected for analysis based on the availability of data. Primary gaging locations for data retrieval were Carlin, Palisade, Argenta, Battle Mountain, and Comus. Due to the availability of data and the locations of discharges, quantitative analysis for the cumulative impact assessment focused on estimating changes in flow at the Battle Mountain and Comus gages. Because the drainage system comprises an integrated network, potential impacts associated with the river analysis were subsequently used to qualitatively ascertain potential effects on tributary channels.

For the selected river locations, analyses by RTi focused on seasonal flow variations within average years, high-flow years, and low-flow years. Analyses were conducted using a monthly basis with inputs of daily data. In order to assess future potential impacts of mine discharges to the Humboldt River, scenarios were simulated by modeling (HCI 1997;.RTi 1998). The scenario independently modeled by HCI (1997) includes the effects of ground water drawdown and mounding on the river flows. An independent model by RTi (1998) includes the effects of irrigation withdrawals and returns using the StateMod model (Colorado Division of Water Resources 1996). For quantitative evaluations of the Humboldt River upstream of Comus by RTi, the average return flow percentage was assumed to be 30 percent. The impact analysis presented for the project is very sensitive to the return flow percentage. Since this number is not known to have been determined explicitly either through experimental or analytical means for the Boulder Flat region or other regions included within the Carlin to Comus reach of the Humboldt River, the 30 percent return flow percentage used in the subsequent analysis represents a reasonable approximation based on agency estimates (Natural Resources Conservation Service 1997; Testolin 1997). All scenarios used USGS streamflow data as a basis of comparisons for an average flow year, high flow year, and low-flow year.

HCI. (1997) examined the net changes to flows on a quarterly basis (through 2013) or an annual basis (2014 through 2095) for the duration of mining and beyond. Potential impacts to river flows due to ground water contributions and pit lake formation were also examined, as an outcome of ground water conditions simulated through the year 2095. Irrigation withdrawals that form a part of the mine water management programs were accounted for in the analysis. In addition, the maximum calculated net flow increases (Year 2000) were combined with average historical flows, and month-by-month comparisons were made to the historical average year, wet year, and dry year. The same procedure was conducted with maximum calculated net flow decreases (Years 2016 through 2019).

The scenario modeled by HCI (1997) was based on a variable time step and simulated the changes in river flow for the period January 1997 through the year 2095. The change in flow was derived by a streamflow accounting model using inputs from ground water models developed for the various mining operations. The simulations accounted for changes in baseflows along selected reaches of the river from Palisade to Comus, as well as the effects of direct discharge to the river or its tributaries. Inputs were based on the most current water management data available at the time of analysis, and included both ground water pumping estimates and irrigation water use by the mining companies or nearby ranches.

Both historical peak monthly discharges and the projected peak monthly discharges are less than those that were analyzed. In general, the assessments are thus conservative in terms of identifying potential impacts to peak monthly river flows from both historical and currently projected peak discharges. However, the mining operations have permit approvals to discharge at higher rates than are currently projected, and they may discharge up to those rates, if necessary. Therefore, while the impact analyses represent a higher flow case than is expected, short periods may be possible where peak discharges are similar to those simulated for analysis.

Using the available data, the low-flow discharges (specifically for August and September) were under-simulated relative to both the historical and currently projected discharges for those months. However, substantial irrigation withdrawals typically occur in these months due to the over-adjudication of water rights in the Humboldt River basin, and the difference in predicted potential impacts is not expected to be significant. It is highly likely that any additional discharge will be used to meet basin water demands. For example, the annual appropriation of Humboldt River water to agricultural users is more than 690,000 acre-feet (Hydrologic Consultants 1997). In contrast, the average annual streamflow at Battle Mountain is approximately 275,000 acre-feet, and approximately 250,000 acre-feet at Comus for the period 1946 through 1996.

Both investigations used existing daily flow data from several decades for their analyses. To enhance modeling and statistical analysis, RTi (1998) used a consistent baseline timeframe for all gaging stations, 1946 through 1990. Highly correlated monthly statistical relationships were developed between gages to synthesize missing historical streamflow data, where necessary. HCI (1997) used the available historical data for each gage and did not fill missing data. The periods of record used in that investigation extended from the turn of the century to the mid-1990s but were discontinuous for several interim periods at each gage.

Both investigations used mine discharge data and projections available at the time of analysis. Since the streamflow analyses and other environmental analyses have taken place over several years, the mine discharge estimates were re-checked during preparation of the cumulative impact assessment and were found to be reasonably consistent with those used in the investigations. The currently projected discharges actually are somewhat less than those used by either investigation. No changes were identified that would significantly affect the results of calculations or simulations.

The potential impacts during mining projected by both studies are similar in magnitude at the locations investigated. There is consistency in the magnitude, location, and seasonality of potential impacts estimated from both investigations. In addition, the analyses conducted by HCI (1997) provide a quantitative basis for long-term postmining impact assessment. The analyses conducted by RTi (1998) provide a quantitative basis for assessing potential effects during high-flow or low-flow years, and incorporate the historical effects of other dominant uses of river water.

TREATMENT OF STREAMFLOW DATA

The U.S. Geological Survey streamgage data sets have periods of discontinuous records, particularly at Battle Mountain and the Argenta gage (which is no longer in operation). This is typical for most long-term gaging networks, as a result of changing data collection priorities through the years, the river stability at the gaging location, or the operation of instruments under remote and often harsh conditions. In recent years, additional data has been collected at the Old U.S. Highway 40 Bridge at Dunphy, just upstream of Barrick's discharge outfall. Less than 10 years of record currently exist for this site. Further information regarding the agency streamgaging and data compilation program can be obtained from the U.S. Geological Survey, Water Resources Division, in Carson City and Elko, Nevada.

Tabulations of average daily flows for the Battle Mountain and Argenta gages were developed using the historical data available for these gages. Statistical distributions of these data indicate that the flows at both locations show a distinct central tendency. On the basis of this result, it was determined that the analysis should consider the effects to the average monthly flow hydrograph. The monthly flow hydrograph was developed by averaging the instantaneous daily flow values for each month, using the U.S. Geological Survey streamgaging data. In the RTi analysis, data filling was conducted for periods when data were missing at Battle Mountain and Argenta as described below.

Under RTi's approach, if necessary data were missing for a particular gage or period, a continuous record was statistically synthesized. This was produced solely for analysis purposes using a statistical approach based on available upstream and downstream data characteristics (RTi 1998). Data-filling was conducted for the Battle Mountain gage (1981 through 1991) and Argenta gage (1982 through 1996), by loading all available daily values into a database. Statistical time series tools were applied to explore correlations with the other gages for the available periods of data. Both linear and logarithmic regression equations for streamflows were then developed for the Battle Mountain and Argenta gages in terms of flows at the other gages. Linear regression produced the most useful relationships. As summarized on a monthly basis in Table C-12 below, the most useful correlations were found with the Carlin gage.

Table C-12
Data Filling Results
Monthly Correlation Coefficients (r squared values) with the Carlin Gage

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Battle Mountain	0.89	0.93	0.96	0.94	0.94	0.90	0.97	0.96	0.85	0.91	0.96	0.98
Argenta	0.94	0.99	0.98	0.99	0.96	0.97	0.99	0.92	0.64	0.81	0.96	0.97

Streamflow Simulations. The immediate influence of the projected mine discharges to the surface water environment of the Humboldt River was analyzed by developing a simple river network model of the Humboldt River in order to simulate the immediate influence of the projected average instantaneous mine discharges presented in Chapter 5.0. This analysis, although simplified, makes an attempt to explicitly account for irrigation diversions and lagged return flows.

The model chosen for this analysis is the Stream Simulation Model (StateMod) (Colorado Division of Water Resources 1996) as developed by the State of Colorado. StateMod is a monthly water allocation and accounting model that simulates irrigation diversions, reservoir storage, reservoir operations, and instream flow requirements based on the prior appropriation doctrine, the same legal standard used in Nevada. Water diversions are based upon priorities or (in a sense), rights.

StateMod represents the river basin using a network of nodes to reflect the stream system's physical and legal operational parameters. The nodes are located at major stream features, including stream gaging stations, diversion structures, minimum streamflow reaches, and locations for water imports (mine discharges) into the stream system.

StateMod first computes the baseflows for the river basin of interest. Baseflows are defined as those flows available in a stream system in the absence of human activity. StateMod generates baseflows using an inverse modeling approach in which the monthly streamflow data at the known gages are adjusted by adding back into the gage value depletions attributable to historic diversions. Once this baseflow file is created, the model allocates water on assigned priority sequence. For each priority, the amount of water available at a structure is calculated by observing the flow at the node and at all other downstream nodes to the lower end of the basin. The available flow is generally the minimum of physical availability, legal availability, demand, and capacity. After the diversion is made for the first priority, the flows at all of the nodes are adjusted downstream to reflect the diversion and any return flows. The general river network modeled for the Humboldt River analysis is shown in Figure C-7.

The process is then repeated for the next priority. The amount of water available for the next priority can include any return flow that accrues to the river from the more senior diversions that occur in the same monthly time step and return flows from previous time steps. The returns are assigned to accrue to one or multiple locations in the network, and vary in time depending on the return pattern. Return flows are specified as a percentage of the diversion assigned return flows, including both surface and ground water components.

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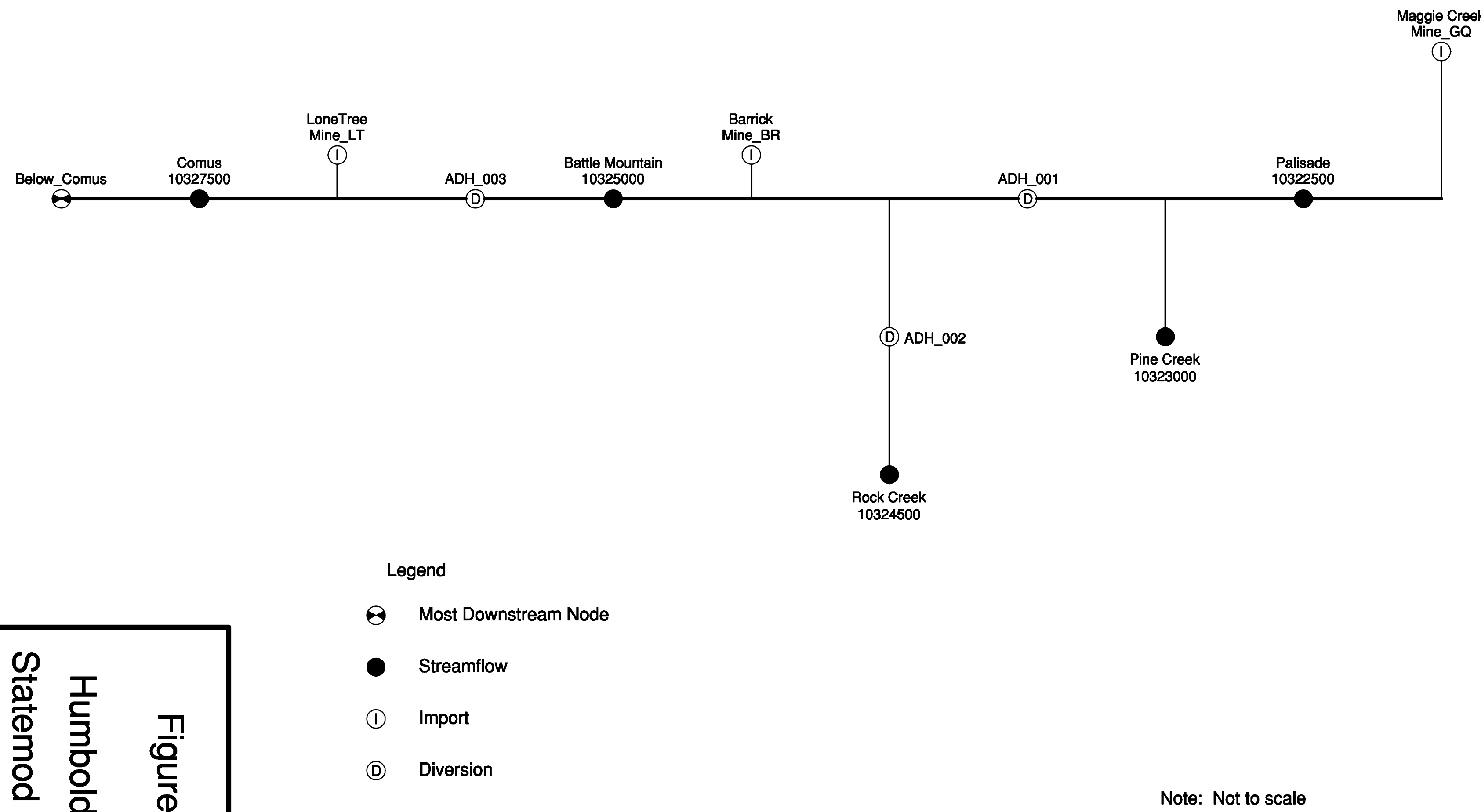

Figure C-7

Humboldt River Statemod Network

APPENDIX D

SUMMARY OF THE BARRICK AND NEWMONT HYDROLOGIC MODELS

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D1 .0 BARRICK MODEL

The dewatering requirements, general area of drawdown and mounding of ground water levels, and postclosure pit lake development were estimated using the U.S. Geological Survey (USGS) modular three-dimensional, finite-difference ground water flow model MODFLOW (McDonald and Harbaugh 1988). The calibrated model was used to simulate the hydrologic effects resulting from: 1) the Goldstrike Mine (independent of other dewatering activities in the northern Carlin Trend area) and, 2) the combined or cumulative dewatering and water management activities at the Goldstrike Mine, Gold Quarry Mine (from existing operation and proposed expansion) and proposed Leeville Mine. This section provides a summary of the model setup and presentation of the results of the modeling under the cumulative scenario. Details regarding the model design, model modifications, calibration, simulations, and sensitivity analyses are presented in McDonald Morrissey Associates, Inc. (1998).

D1.1 Model Setup, Assumptions, and Calibration

D1.1.1 Introduction

MODFLOW is designed to simulate flow in an anisotropic, heterogeneous porous medium. As described in Section 3.1.2, the hydrogeology of the region is controlled by flow thorough both porous sediments and fractured rock aquifers. Flow within porous media occurs within interconnected pores within the sediments and sedimentary rocks. Flow within the fractured rock is controlled primarily by a network of interconnected fractures and locally by flow through solution cavities in carbonate rocks. For the purpose of developing the regional numerical model, it was assumed that flow through the fractured medium can be treated as equivalent to flow within a porous medium. This assumption of an equivalent porous medium for the bedrock aquifers is consistent with the distribution of fractures observed in cores and reported during drilling (McDonald Morrissey Associates, Inc. 1998), and the general patterns of drawdown and mounding that have been observed to date in bedrock areas (Barrick 1999a). Flow through discrete fractures or solution cavities is not explicitly represented in the model. The model also assumes that the temperature of the ground water will remain constant throughout the model simulation periods.

Key components of the ground water flow model include (McDonald Morrissey Associates, Inc. 1998):

- Precipitation varies seasonally, with greater precipitation occurring during April through June (wetter months), compared to October through December (drier months).

- Recharge to ground water occurs as both a percentage of precipitation that infiltrates where it falls, and as infiltration of runoff along streams.

- Little hydraulic communication occurs between the modeled area and areas outside the model; however, there is some ground water flow to and from the model from the south.

- Modeled pumping rates for the 1990 through 1996 period vary according to actual mine pumping records.

- Most of the pumped ground water originates from water stored in the marine carbonate rocks and, to a lesser extent, the marine clastic rocks.

- Most of the infiltration that has occurred caused by mine water management activities has been confined to the volcanic rocks and alluvium in the area.

- Bedrock ground water flow is compartmentalized and controlled by near vertical faults.

- Higher permeability rocks exist between the Post and Siphon faults caused by increased fracture density and solution cavities.

D1.1.2 Model Grid and Discretization

The numerical model domain and finite difference grid is illustrated in Figure D-1 (McDonald Morrisey Associates, Inc. 1998). The modeled area includes six ground water basins: Susie Creek, Maggie Creek, Marys Creek, Boulder Flat, Rock Creek, and Willow Creek described in Section 3.1.1. The model domain extends approximately 50 miles east-west and 60 to 70 miles north-south. In order to provide more detailed flow information in the mine area, the grid cell dimensions vary from 75 feet in the mine area to 10,000 feet at the model boundaries. Four model layers were used to vertically subdivide the modeled area. The vertical and horizontal discretization was designed to simulate variations in the hydraulic properties of the six general hydrostratigraphic units recognized in the modeled area. The top of the first layer is the water table; layer four generally represents the top 2,000 feet of low-permeability marine carbonate rocks.

D1.1.3 Hydrostratigraphic Units

Six primary hydrostratigraphic units were further subdivided into model zones to represent variable hydraulic conductivity and storage properties within the units. The initial hydraulic parameters for the model were estimated from earlier model versions. The model parameters were then refined by model calibration. This process led to the selection of the 15 model zones shown in Table D-1. The most permeable rocks in the modeled area are fractured volcanics and carbonates, and alluvium. These rocks have hydraulic conductivities that are 1,000 to 10,000 times greater than most of the rocks in the study area (McDonald Morrissey Associates, Inc. 1998).

D1.1.4 Hydrostructural Units

Long-term monitoring of drawdown and mounding in the vicinity of the Goldstrike property has resulted in the recognition of three major faults or fault zones that tend to impede the movement of ground water across the faults. These faults include the (1) Boulder Narrows Fault located in Boulder Valley; (2) Siphon Fault located between the TS Ranch Reservoir and the Betze-Post Pit; and (3) Post Fault located on the east side of the Betze-Post Pit. The locations of these major hydrostructural features are illustrated in Figure D-2 (McDonald Morrisey Associates, Inc. 1998) and a generalized cross section is shown in Figure D-3 (Barrick Goldstrike Mines Inc. 1999a).

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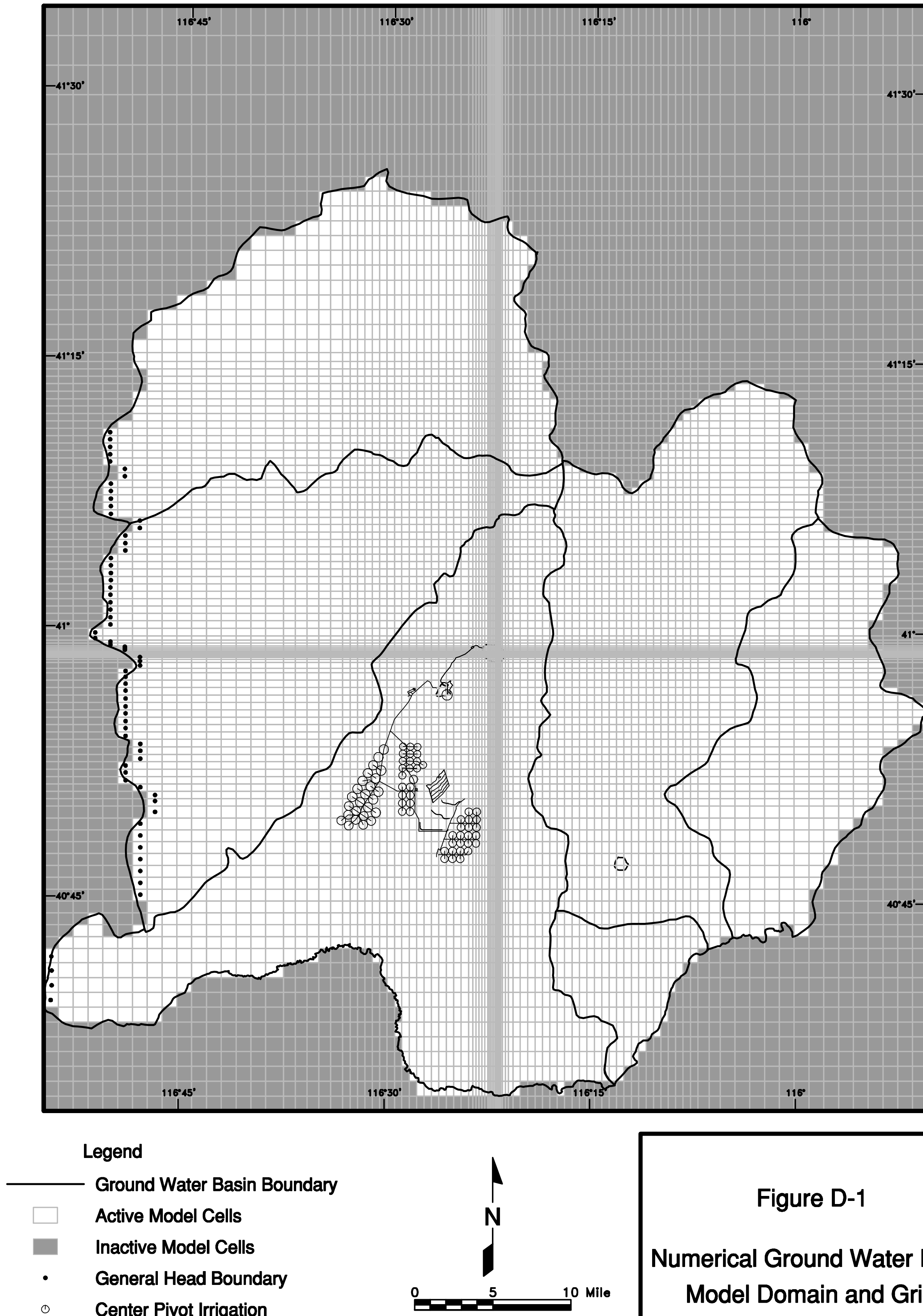


Figure D-1

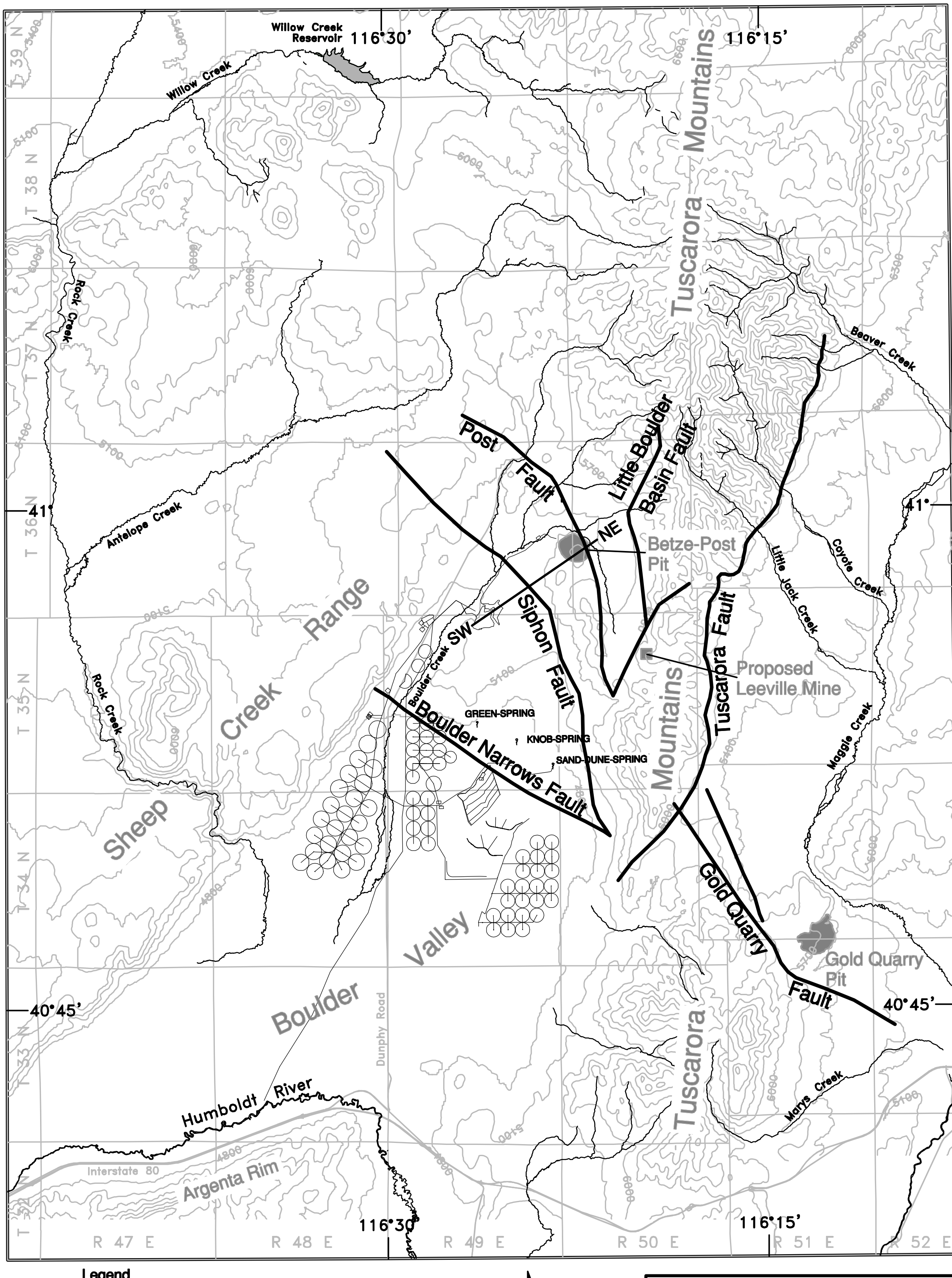
Numerical Ground Water Flow Model Domain and Grid

Table D-1
Hydraulic Parameters Used in the Hydrologic Model

Hydrostratigraphic Unit	Model Zones (subdivided by relative permeability)	Hydraulic Conductivity (feet/day)	Storage (unitless)
Alluvium	NA	20.0	0.250
Carlin Formation	moderate	0.1	0.100
	low	0.05	0.050
Volcanic Rocks	high	45.0	0.030
	medium high	2.0	0.030
	medium low	0.1	0.030
	low	0.02	0.030
Intrusive Rocks	high	3.0	0.030
	medium	0.01	0.030
	Low	0.003	0.030
Marine Clastics	medium	0.2	0.030 - 0.050
	low	0.02	0.030
Marine Carbonates	high	40.0	0.008 - 0.016
	medium	0.1	0.010 - 0.030
	low	0.01	0.010 - 0.030

NA = Not applicable.

Source: McDonald Morrissey Associates, Inc. 1998.



Legend

- Stream
- Faults (includes inferred faults)
- SW——NE Line of Cross Section in Figure 3.2-6
- Center Pivot Irrigation
- Spring

Figure D-2

Major Hydrostructural Features

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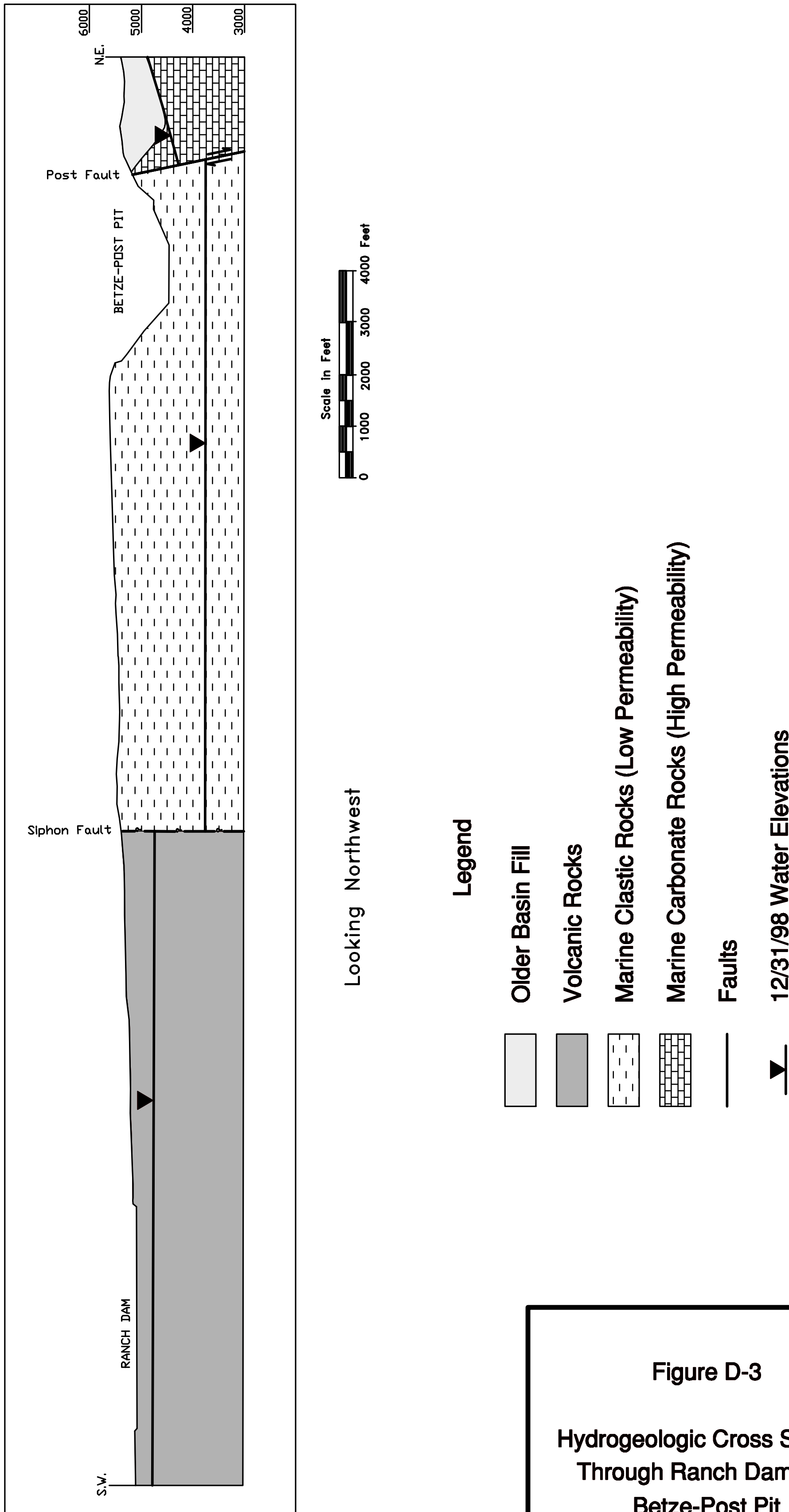

Figure D-3

Hydrogeologic Cross Section Through Ranch Dam and Betze-Post Pit

D1.1.4.1 Boulder Narrows Fault

The Boulder Narrows Fault in Boulder Valley has no surface expression. McDonald Morrissey Associates, Inc. (1997) reports that evidence for this fault includes (1) offset of rhyolite in the area of the fault by approximately 700 feet, (2) the presence of Green, Knob, and Sand Dune springs (see the section on Seeps and Springs below for a description of these springs), (3) Newmont gravity surveys indicating that the basin is 3,000 feet deep just to the south of the fault, and (4) water-table gradients in the alluvium that are noticeably steeper, and water levels are elevated north of the inferred fault. The Boulder Narrows Fault is thought to impede ground water flow across the fault (McDonald Morrissey Associates, Inc. 1997).

D1.1.4.2 Siphon Fault

The Siphon Fault separates highly permeable marine carbonate rocks north of the fault from less permeable volcanic rocks south of the fault. As illustrated in Figure D-3, the fault acts as a pronounced barrier that separates the drawdown cone developed from mine dewatering activity north of the fault from the ground water mound developed from the infiltration activities south of the fault (McDonald Morrissey Associates, Inc. 1996b). Wells located on either side of the fault record dramatically different water levels. For example, the water level in monitoring well NA-50D, located east of the Siphon Fault, was 4,375 feet amsl in late 1997, but the water level in monitoring well NA-7D, west of the fault, was 4,759 feet amsl. Both of these wells are completed in volcanic rocks, and their head difference of nearly 400 feet provides evidence that the Siphon Fault is a barrier to ground water flow (Barrick 1999a).

D1.1.4.3 Post Fault

The Post Fault generally trends north-south and is exposed in the east wall of the Betze-Post Pit. Near vertical movement along the Post Fault has juxtaposed low permeability marine clastic rocks against the high permeability marine carbonate hydrostratigraphic unit. Exploratory drilling prior to active dewatering in the area revealed a 100-foot drop in ground water elevations across the fault from east to west (BLM 1991a). As mine dewatering has progressed, there has been a significant difference in the rates of observed water level decline in wells on either side of the Post Fault. As shown in Figure D-3, much greater water level declines are seen on the west side of the Post Fault than on the east side (McDonald Morrissey Associates, Inc. 1996b). For example, monitoring well PZ95-1D, located on the east side of the Post Fault, had a water level of 4,819 feet amsl at the end of 1997. At the same time, monitoring well PZ96-2D, located on the west side of the fault, had a water level of 4,214 feet amsl. Both of these wells are completed in marine clastic rocks, and the difference in head of approximately 600 feet between the two wells is evidence that the fault is a barrier to ground water flow (McDonald Morrissey Associates, Inc. 1998). Again, this is probably controlled more by the juxtaposition of the different rock types across the fault than by the hydraulic characteristics of the fault itself.

In addition to modeling the known hydrostratigraphic units in the study area, the ground water model also incorporated the hydrostructural units discussed in Section 3.1.2 and shown in Figure D-2. Faults that may impede flow are represented in the model using the horizontal flow barrier module designed for MODFLOW. Faults represented as barriers to flow are shown in Figure D-4 (McDonald Morrisey Associates, Inc. 1998),

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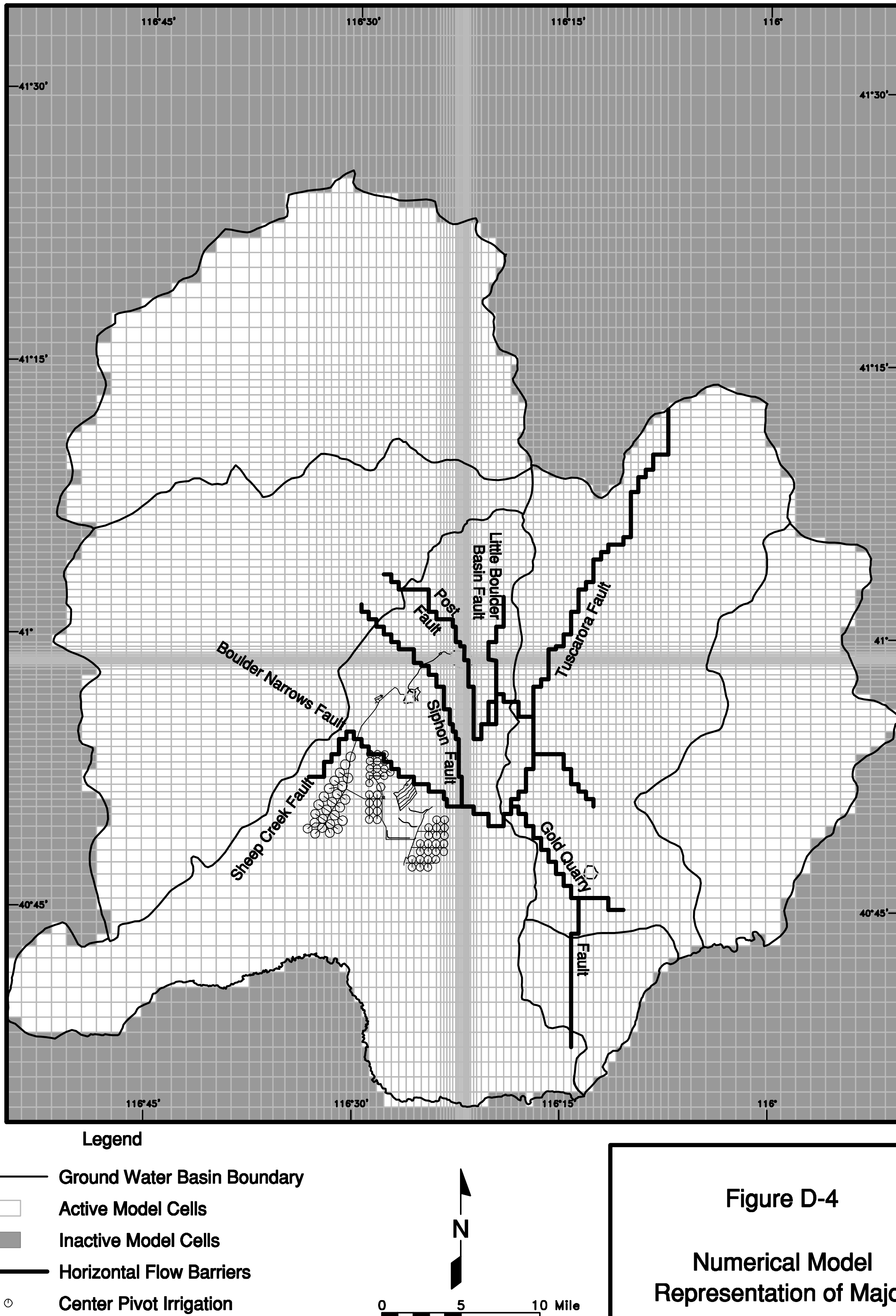

Legend

- Ground Water Basin Boundary
- Active Model Cells
- Inactive Model Cells
- Horizontal Flow Barriers
- Center Pivot Irrigation

Figure D-4

Numerical Model Representation of Major Hydrostructural Features and include the Post, Siphon, Boulder Narrows, Gold Quarry, Tuscarora, Sheep Creek, and Little Boulder Basin faults. All of these faults were assumed to consist of a 100-foot wide low permeability zone. During the calibration process the assumed hydraulic parameters of the low permeability hydrostructural zones were modified to better represent the observed head distribution (McDonald Morrissey Associates, Inc. 1998).

D1.1.5 Recharge, Evaporation, and Evapotranspiration

The numerical model incorporated ground water recharge due to direct infiltration and infiltration along stream channels and mountain fronts, as described in Section 3.1.2. Recharge along streams was simulated with the modified version of the RIV 2 Package (Miller 1988) River module of MODFLOW. Green, Sand Dune, and Knob springs, as well as the canal that captures their discharge also were modeled with the River Package. Seepage from the TS Ranch Reservoir and infiltration ponds was simulated as ground water injection with the Well Package. Ground water recharge from injection wells and irrigated areas also was simulated with the Well Package. Evapotranspiration from natural and irrigated areas was simulated in the model using the Evapotranspiration Package assuming an extinction depth of 20 feet from the land surface (McDonald Morrissey Associates, Inc. 1998).

D1.1.6 Dewatering Wells, Injection Wells, Infilatration Ponds, and Irrigation

Mine dewatering wells were simulated with the Well Package for MODFLOW, and their pumping rates were selected to correspond to actual mine pumping records. Dewatering wells that penetrate more than one hydrostratigraphic unit were modeled as multiple wells in the same location that pump water from different layers. The pumping rates of these wells were proportioned according to the transmissivity of the rock units screened in the actual dewatering wells (McDonald Morrissey Associates, Inc. 1998). Infiltration from infiltration ponds, reservoir leakage, injection wells, and irrigation were also simulated using the Well module.

D1.1.7 Model Calibration

The hydraulic conductivity estimates and zones, as well as the hydraulic characteristics of the low permeability faults, were modified during steady-state and transient model calibrations. In addition, model calibrations required small adjustments to the initial estimates for the ratio of vertical to horizontal hydraulic conductivity and for aquifer storage. Specifications for evapotranspiration and recharge from streams were represented by long-term seasonal averages and were not allowed to vary during model calibrations (McDonald Morrissey Associates, Inc. 1998).

The calibration procedure involved adjusting calibration parameters until the model was able to approximately match, within some relatively small degree of error, the ground water elevations and streamflows actually measured at various locations throughout the study area. Steady-state calibrations were used to adjust the model so that it would match premining heads at 144 wells and surface water flows at 6 sites prior to 1990. Transient calibrations were used to modify the model to match changes in heads at 76 wells and changes in streamflow at 6 locations due to mine dewatering and water management activities from 1987 through 1996. In this time period, water levels in the Betze-Post Pit area had fallen approximately 1,300 feet. As previously mentioned, historic records of mine pumping rates, injection rates, and irrigation rates were used to specify the transient stresses in the model (McDonald Morrissey Associates, Inc. 1998).

D1.1.8 Sensitivity Analysis

A sensitivity analysis was performed to determine how sensitive the ground water flow model is to specified changes in certain model parameters. Results of the sensitivity analysis indicate that the model is very sensitive to changes in the hydraulic conductivity of the low-permeability marine clastic rocks, highly permeable volcanic rocks, alluvium, and high-permeability carbonate rocks. The model is also sensitive to changes in the storage properties of the high-permeability carbonate rocks and to changes in recharge (McDonald Morrissey Associates, Inc. 1998).

D1.1.9 Simulated Premine Ground Water Elevations

The model simulated elevation of the regional ground water surface in the hydrologic study area prior to the initiation of mine dewatering and water management activities is shown in Figure D-5 (McDonald Morrissey Associates, Inc. 1998). According to this evaluation, the elevation of the potentiometric surface ranged from over 7,000 feet amsl in the Tuscarora Mountains to approximately 5,300 feet amsl in the vicinity of the mines, and less than 4,600 feet amsl in the lower part of Boulder Flat (McDonald Morrissey Associates, Inc. 1998.) Based on these elevations, the depth to ground water in the mountains prior to pumping was in the range of 150 to 400 feet below the land surface. In the vicinity of the mines, the depth was 200 to 400 feet. The premining depth to ground water in the rhyolite ranged from approximately 500 feet near the TS Ranch Reservoir to near land surface (0 to 50 feet) in the northern portion of Boulder Flat. In the alluvium in the southern half of Boulder Valley, depth to ground water was less than 10 feet near the Humboldt River (McDonald Morrissey Associates, Inc. 1996a).

D1.2 Predictive Model Simulations: Cumulative Scenario

D1.2.1 Predicted Drawdown: End of Mining and Postmining

The cumulative drawdown of the ground water surface at the end of mining and in the postmining period was estimated using Barrick’s hydrologic model, as described above. The hydrogeologic conditions in the vicinity of the mine and surrounding region are complex. Regional ground water flow models like Barrick’s hydrologic model are based on a simplified conceptual model of the hydrostratigraphic and hydrostructural conditions and ground water flow patterns. It is important to understand that unknown conditions may exist that could influence the future drawdown patterns. For long-term predictions, there is also the uncertainty of future climatic conditions.

The model predicts that the areal extent and magnitude of the cone of drawdown will vary over time and persist for an extended period postmining. To illustrate the variations in the cone of depression over time, model predictions corresponding to the year 2012 (near the end of mining) , 2061 (approximately 50 years postmining), and 2111 (approximately 100 years postmining) are presented in Figures D-6, D-7, and D-8

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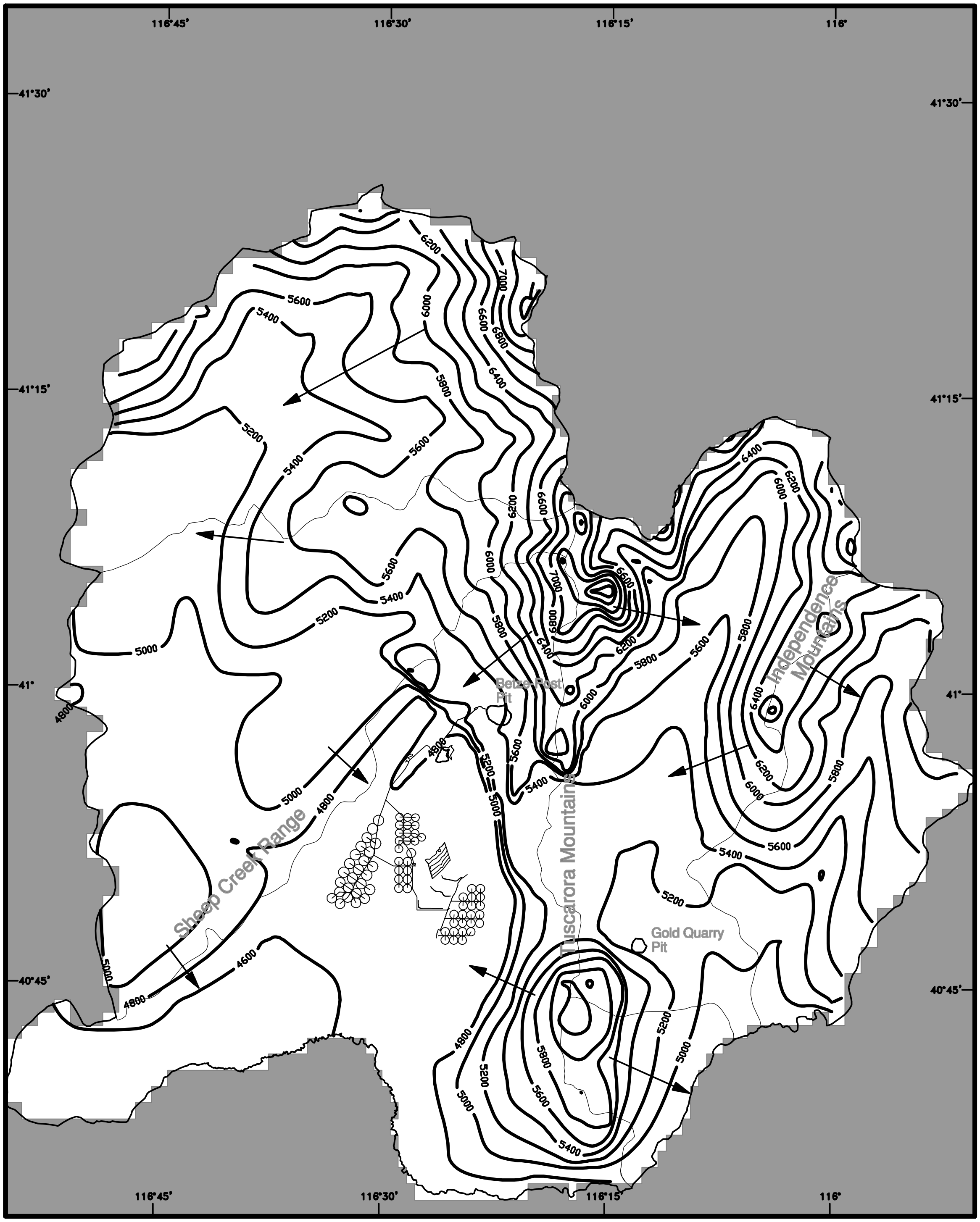

Legend

Contours of Heads Simulated for Model Layer 1

General Direction of Ground Water Flow

Ground Water Basin Boundary

Inactive Model Cells

Center Pivot Irrigation

N

0 5 10 Mile

200' Contour Interval

Figure D-5

Elevation of Premine Potentiometric Surface (Barrick Model)

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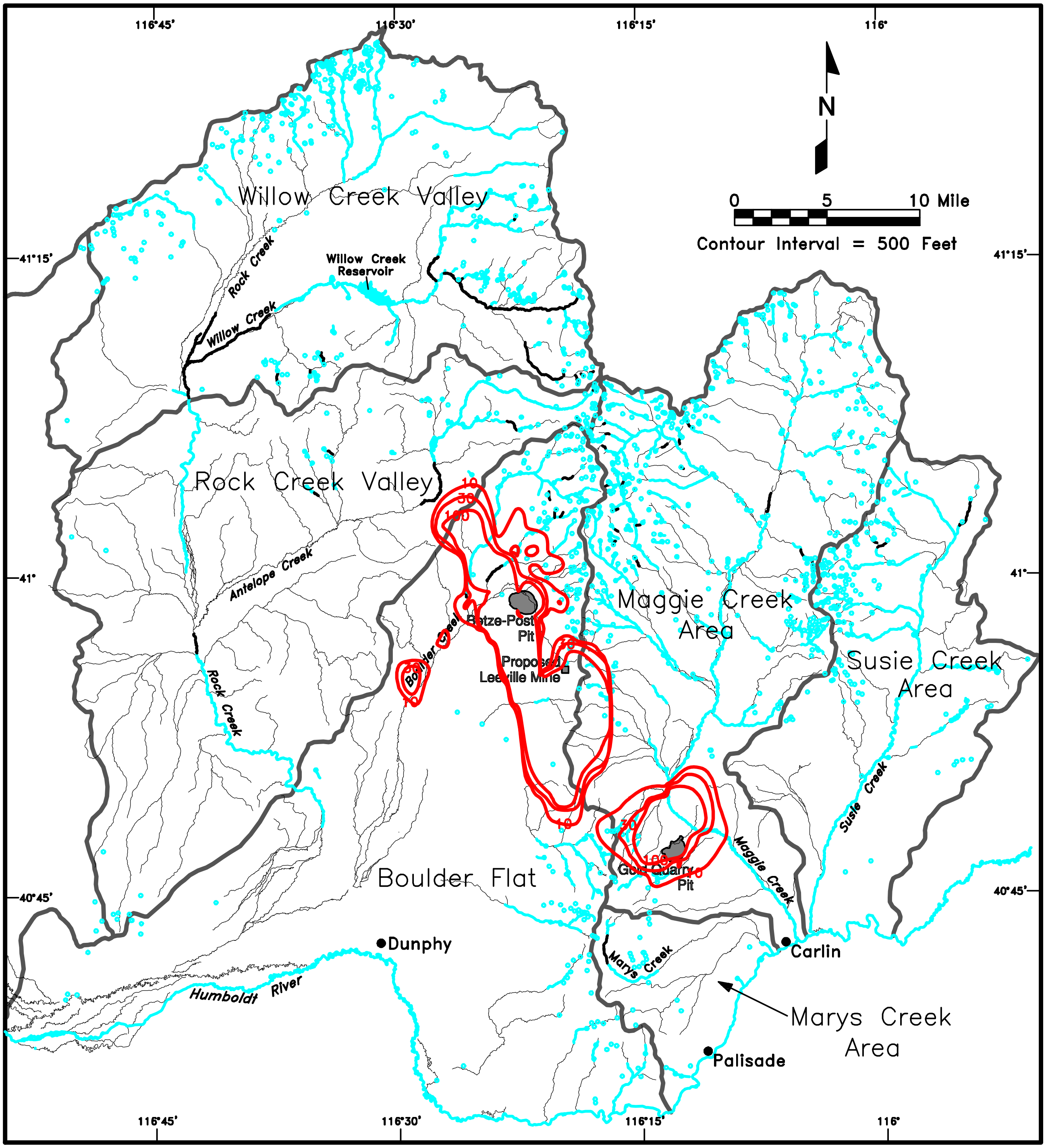

Legend
- Ground Water Basin Boundary
- Contour of Drawdown in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-6

Predicted Cumulative Drawdown at End of Mining (Barrick Model)

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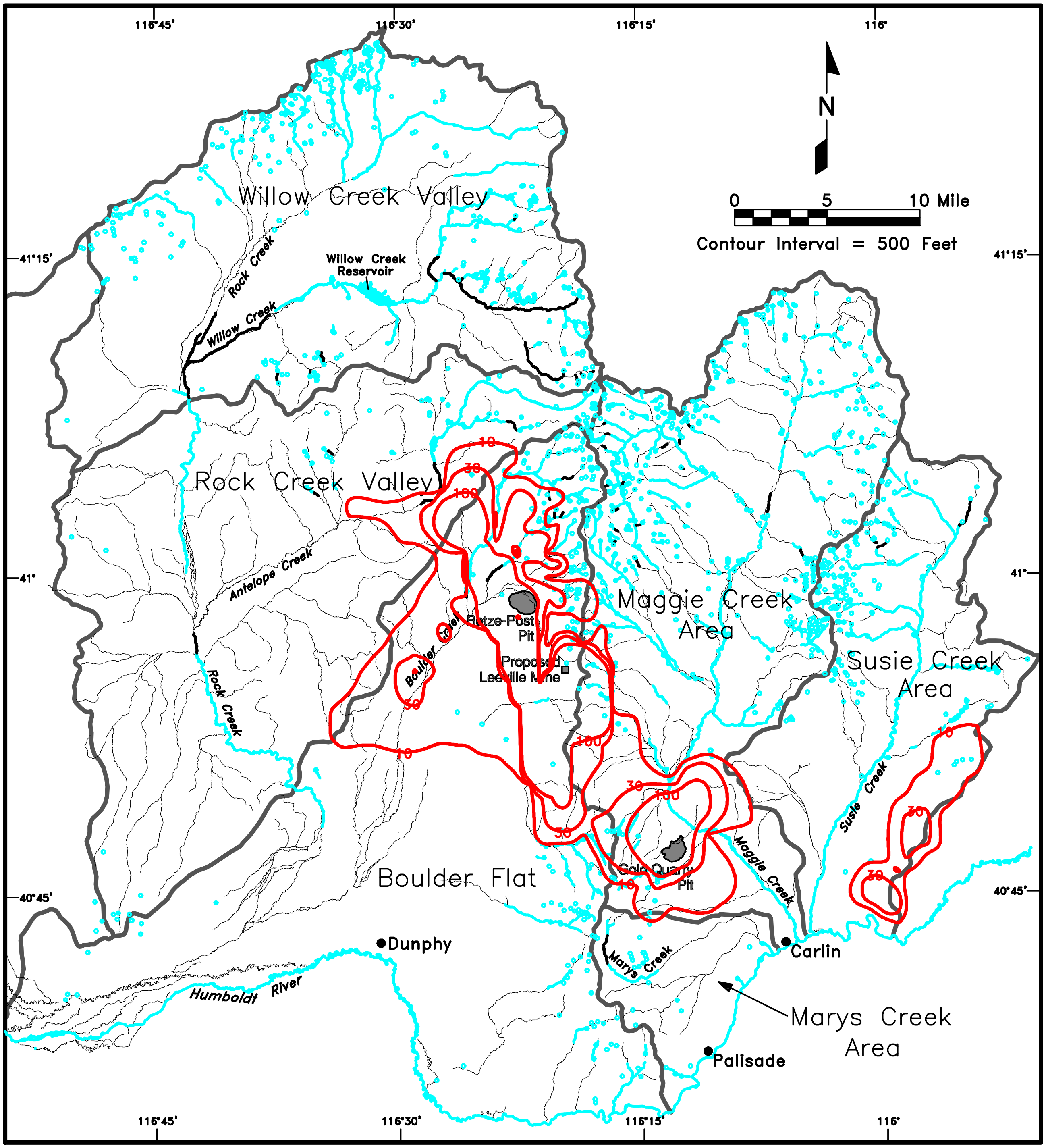
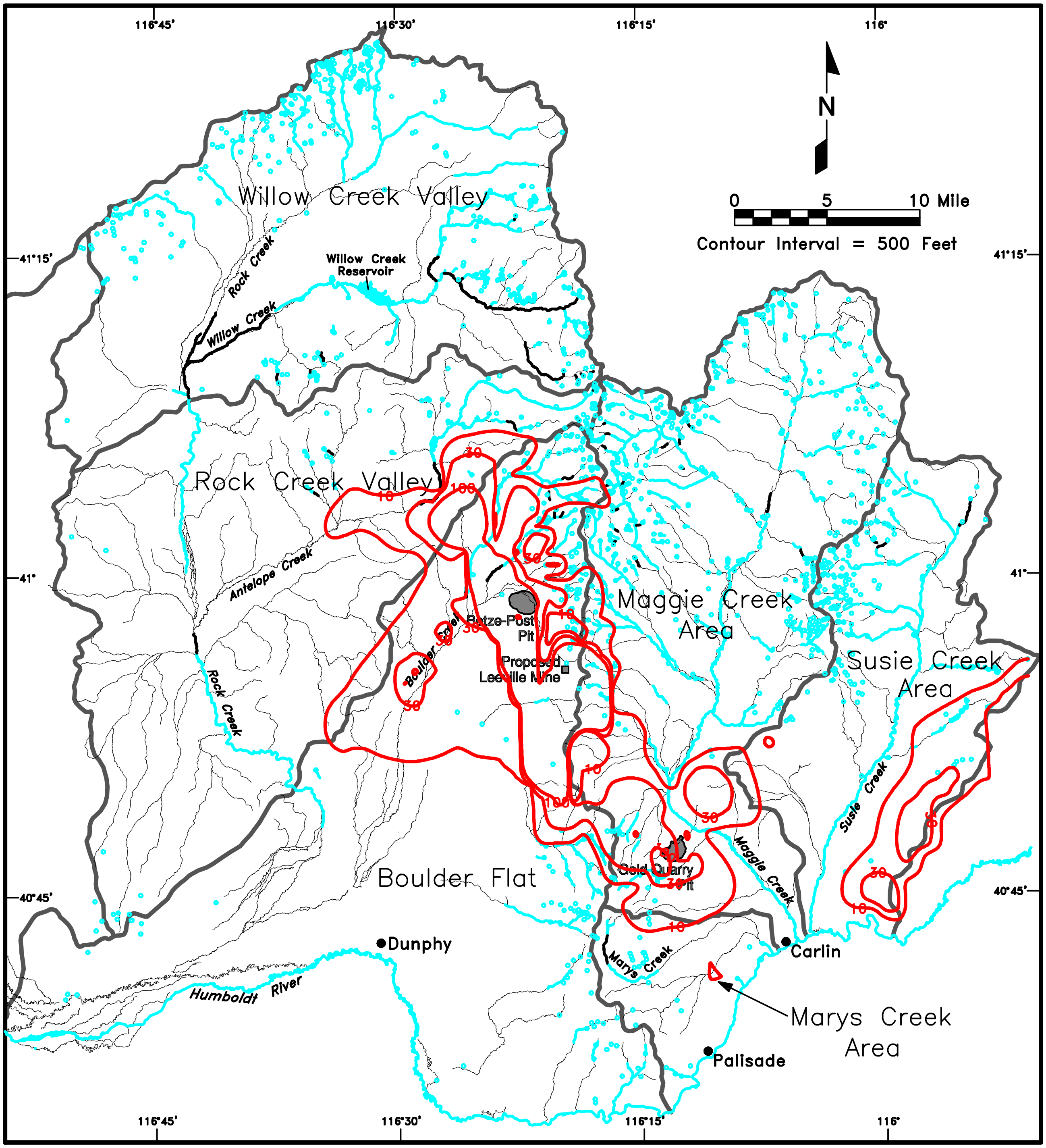


Legend

- Ground Water Basin Boundary
- Contour of Drawdown in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-7

Predicted Cumulative Drawdown at 50 Years Post Mining (Barrick Model)



Legend
Ground Water Basin Boundary
Contour of Drawdown in Feet
Stream (Intermittent or Ephemeral)
Perennial Steam
Discontinuous Flowing Stream Reach
Spring and Seeps

Figure D-8

Predicted Cumulative Drawdown at 100 Years Post Mining (Barrick Model)

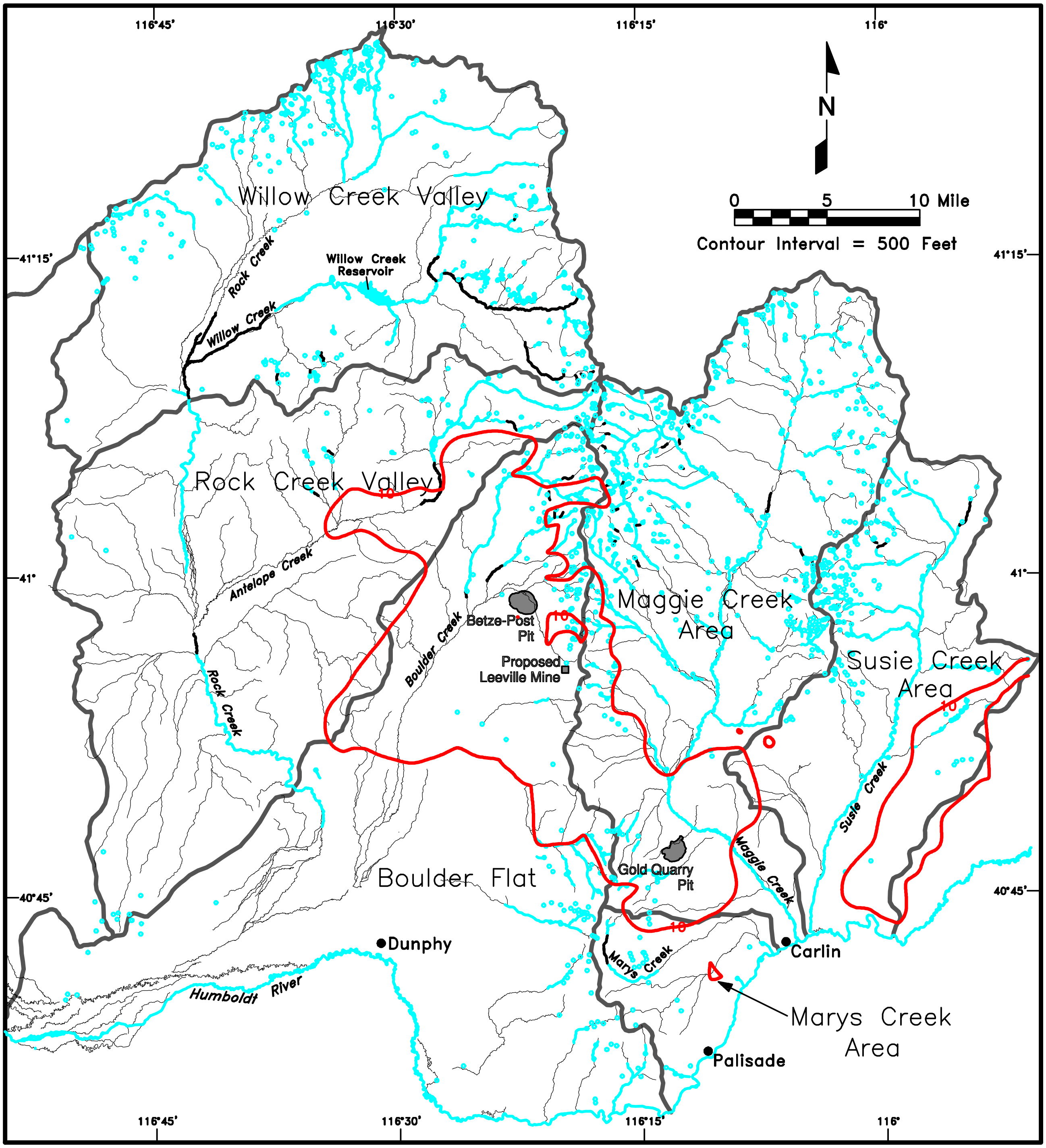
(Barrick 1998c). For the purposes of comparison, the end of mining refers to the currently planned cessation of mine dewatering at the Goldstrike Mine and Gold Quarry Mine. (It should be noted that the proposed Leeville Mine as currently planned, would extend dewatering an additional 7 years.) As shown in Figure D-6 (Barrick Goldstrike Mines, Inc. 1998c), at the end of mining the drawdown area, as defined by the 10-foot drawdown contour, the cone of depression is predicted to be elongated and extend up to approximately 19 miles northwest-southeast and 6 miles northeast-southwest. At the end of mining, the model also predicts that a separate cone of depression, 5 to 7 miles in diameter, will be centered just to the north of the Gold Quarry Mine. Comparison of the predictions for the end of mining, 50 years postmining (Figure D-7), and 100 years postmining (Figure D-8) indicates that the maximum areal extent of the 10-foot drawdown contour will merge with the cone of depression for the Gold Quarry Mine after mining ceases, and the combined cone of depression will continue to expand and reach a maximum extent (in most directions) approximately 100 years postmining. At 100 years postmining (Figure D-8), the 10-foot drawdown contour is predicted to encompass an area, centered between the Goldstrike and Leeville mines, extending approximately 29 miles in a northwest-southeast direction, and 17 miles in a northeast-southwest direction. The model simulations also predict the postmining development of a separate, elongated cone of depression east of Susie Creek in the Adobe Range that reaches a maximum length (aligned in a northeast-southwest direction) of approximately 16 miles, and width (oriented in a northwest-southeast direction) of 4 miles. The model simulations also indicate that the area that will experience 100 feet of drawdown or more (defined by the area enclosed within the 100-foot contour) will continue to expand after the end of mining, up to approximately the 100-year postmining time frame.

D1.2.2 Predicted Maximum Extent of the 10-Foot Drawdown Contour

For the cumulative analysis, the area that is predicted to experience a change in ground water elevation of 10 feet or more due to pit dewatering and mine water management activities was selected as the area of potential concern regarding impacts to water resources. The calibrated model was used to estimate the change in ground water levels over regular time intervals throughout the future mining and postmining period up to final recovery. These results were then used to determine the maximum extent of drawdown irrespective of time as presented in Figure D-9 (Barrick Goldstrike Mines, Inc. 1998c). Comparison between the predicted maximum drawdown and the previously presented drawdowns for selected postmining periods indicates that for the vast majority of the area, the maximum areal extent of drawdown (as defined by the 10-foot contour) is predicted to occur at approximately 100 years postmining.

D1.2.3 Predicted Drawdown at Recovery

After the pit lake levels reach equilibrium, the numerical ground water model predicts there will be a long-term cone of drawdown that will persist for the foreseeable future. The area of cumulative, long-term residual drawdown, as shown in Figure D-10 (Barrick Goldstrike Mines Inc. 1998c), is predicted to result in an elongated cone of drawdown centered between the Goldstrike Mine and Leeville Mine that will extend a maximum length of approximately 18 miles in a northwest-southeast direction with a width of up to 6 miles. This permanent drawdown will be maintained by continuous inflow of ground water into the lake to replace water lost through evaporation.



Legend

- Ground Water Basin Boundary
- Maximum Extend of Drawdown Contour in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-9

Predicted Maximum Extent of the 10-foot Drawdown Contour (Barrick Model)

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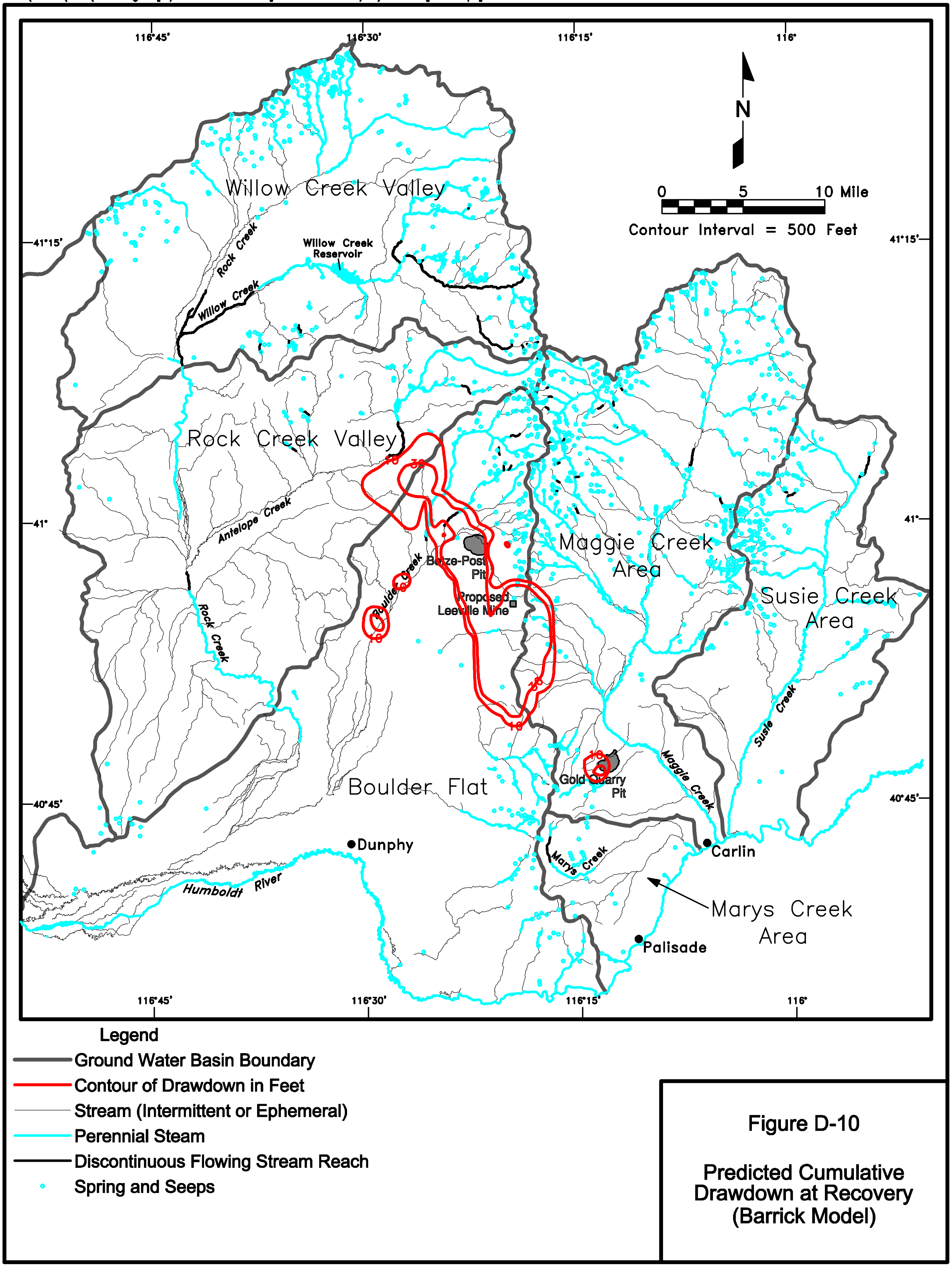

Figure D-10

Predicted Cumulative Drawdown at Recovery (Barrick Model)

D2 .0 NEWMONT MODEL

D2.1 Model Setup, Assumptions, and Calibration

This section summarizes the numerical ground water flow model (*MINEDW*) conducted by Hydrologic Consultants, Inc. (HCI) for Newmont Gold Company. The model was developed to assess dewatering requirements and pit filling of the Gold Quarry Mine and to predict the extent of ground water drawdown, or cone of depression, that would result from dewatering. Additional information about the model setup and implementation is contained in HCI (1999b).

D2.1.1 Introduction

HCI developed a ground water model to simulate the ground water flow system in the vicinity of the Gold Quarry Mine. Flow in the region occurs in porous sediments and fractured water-bearing bedrock. For purposes of the numerical model, it was assumed that the flow through the fractured medium can be treated as flow through a porous medium. The primary objective of the model was to estimate the amount of ground water that would have to be managed during the proposed mining operation and to design an effective dewatering system. The modeling was expanded to predict the rate at which the pit would fill with ground water after dewatering operations cease and to predict drawdown in the ground water table that would occur as a result of dewatering activities and subsequent pit infilling. The maximum extent of the 10-foot drawdown contour was of particular interest. In addition, the model was used to simulate the cumulative dewatering effects of the Gold Quarry, Goldstrike, and Leeville mines in the Carlin Trend area.

D2.1.2 History of Numerical Code Development

The numerical modeling described in this document utilizes a numerical code referred to as *MINEDW* that solves the problem of three-dimensional ground water flow with an unconfined or phreatic surface using the finite-element method. This code was developed by HCI to address mine dewatering and has several capabilities (e.g., simulation of an excavation, calculation of the seepage face on the pit highwall) for that purpose (Atkinson et al. 1992). Complete documentation of *MINEDW*, including a description of its mathematical basis, several validations of its problem-solving capabilities, and instructions for users, has been produced under separate cover (HCI 1992).

The basic core of *MINEDW* originated in an earlier three-dimensional finite-element code, referred to as *FLOW3D* (Durbin and Berenbrock 1985). *MINEDW* was developed from *FLOW3D* in 1991. It incorporates many of the features of *FLOW3D*, but instead of using a deforming grid, *MINEDW* calculates the position of the phreatic surface using an algorithm for saturated-unsaturated flow. *MINEDW* also includes routines to calculate the height of the seepage face on a pit wall, non-Darcian ground water flow (which can occur near a pit), element removal (to simulate excavation of a pit), and pit infilling, all of which are fully described and validated in HCI (1992).

In 1998, Sandia National Laboratories (Sandia) of Albuquerque, New Mexico was contracted to thoroughly review the MINEDW code. The primary goals of the peer review were to:

- Review the code for accuracy
- Check that the code deals properly with interbasin transfer of water
- Check how the code treats a free surface
- Check if the code deals adequately with the intersection of the water table with various lithologic boundaries
- Check if the code adequately deals with stream routing
- Test the code against other accepted ground water modeling codes

Sandia performed the requested peer review and accepted the code as valid (Sandia 1998)

D2.1.3 Conceptual Hydrogeologic Model

The available geologic, hydrologic, and climatologic data have been incorporated into a conceptual hydrogeologic model that describes the surface water and ground water flow system of the lower Maggie Creek basin and adjacent areas. This conceptual model is the framework upon which the numerical model was developed. Essential components of the conceptual hydrogeologic model used in this investigation are:

- Areal and vertical extent and hydraulic characteristics of the primary hydrostratigraphic units and significant geologic structures

- Recharge to the study area

- Surface water outflow from the study area

- Outflow from the shallow, unconfined ground water system in the study area

- Ground water through-flow in the deep carbonate bedrock system

To account for geothermal ground water in the area, the hydraulic conductivities were increased in areas of higher water temperature to account for the decreased viscosity of the hotter water.

D2.1.4 Model Grid and Discretization

The hydraulic properties assigned to the elements are intended to represent the specific properties of the hydrostratigraphic and hydrostructural units in the region. The assumption is made that the hydraulic properties of a specified hydrostratigraphic unit are invariant within the model domain. This, however, did not preclude simulation of well defined or geologically inferred heterogeneities.

D2.1.5 Model Boundaries

The model domain is composed of eight hydrologic basins (part of Clovers Area, Willow Creek Valley, Rock Creek, Independence Valley, Maggie Creek Area, Susie Creek Area, Marys Creek Area, and Boulder Flats Basin; see Figure D-11). The model boundaries were selected to coincide with known hydrologic boundaries of these basins.

All boundaries, with the exception of the southern boundary along the Humboldt River, are considered no-flow boundaries in steady state simulations. The Humboldt River is simulated using specified heads. In transient simulations, all nodes along the Humboldt River, except for nodes in the uppermost layer, are converted to a variable flux boundary. This allows flow into and out of the model domain beneath the Humboldt River. Similarly, all no-flow boundaries are converted to specified flux boundaries in the transient calibration.

D2.1.6 Hydrostratigraphic Units

Eight major hydrogeologic units have been identified in the study area. These units are Quaternary alluvium, Tertiary sediments, Tertiary volcanic rocks, Tertiary and Mesozoic intrusives, Paleozoic siliciclastic rocks, Paleozoic carbonates, Paleozoic Eureka Quartzite, and the Paleozoic Pogonip Group. The hydraulic conductivity of the Eureka Quartzite is quite low, and it is assumed to act as the effective bottom to the ground water system throughout most of the model domain. Eureka Quartzite and the Pogonip Group are only included in the conceptual model south of the Carlin Pit, where these units have been brought to the surface by faulting and erosion. In general, the top of the Eureka Quartzite forms the "no-flow" bottom of the model domain.

The 8 hydrogeologic units were further subdivided into 15 zones to represent variable hydraulic conductivity within the units. The zones are listed in Table D-2.

D2.1.7 Faults

There are numerous faults in the hydrologic study area. Faults control much of the bedrock ground water flow. Where there is evidence that a fault acts as a barrier to ground water flow, it is represented in the model as a discrete feature. These faults include the following: Wells, Tuscarora, Castle Reef, Soap Creek, Range Front, Siphon, Genesis, Post, Four Corners, Basin Bounding, Hardie Leeville, Chukar Gulch, Gray/Challenger, GPX, and Maggie Creek (Figure D-12) (HCI 1998a). Some faults are represented simply by a juxtaposition of different lithologic units with different hydraulic properties (e.g., the fault on the eastern boundary of Sheep Creek Range, Boulder Narrows fault). The hydraulic conductivities were calibrated to represent the observed head distribution (Table D-3).

D2.1.8 Recharge, Evaporation, and Evapotranspiration

Recharge to ground water was calculated from average precipitation values for the area following the Maxey-Eakin (1949) method which assigns recharge to elevation zones, with the higher elevation zones receiving

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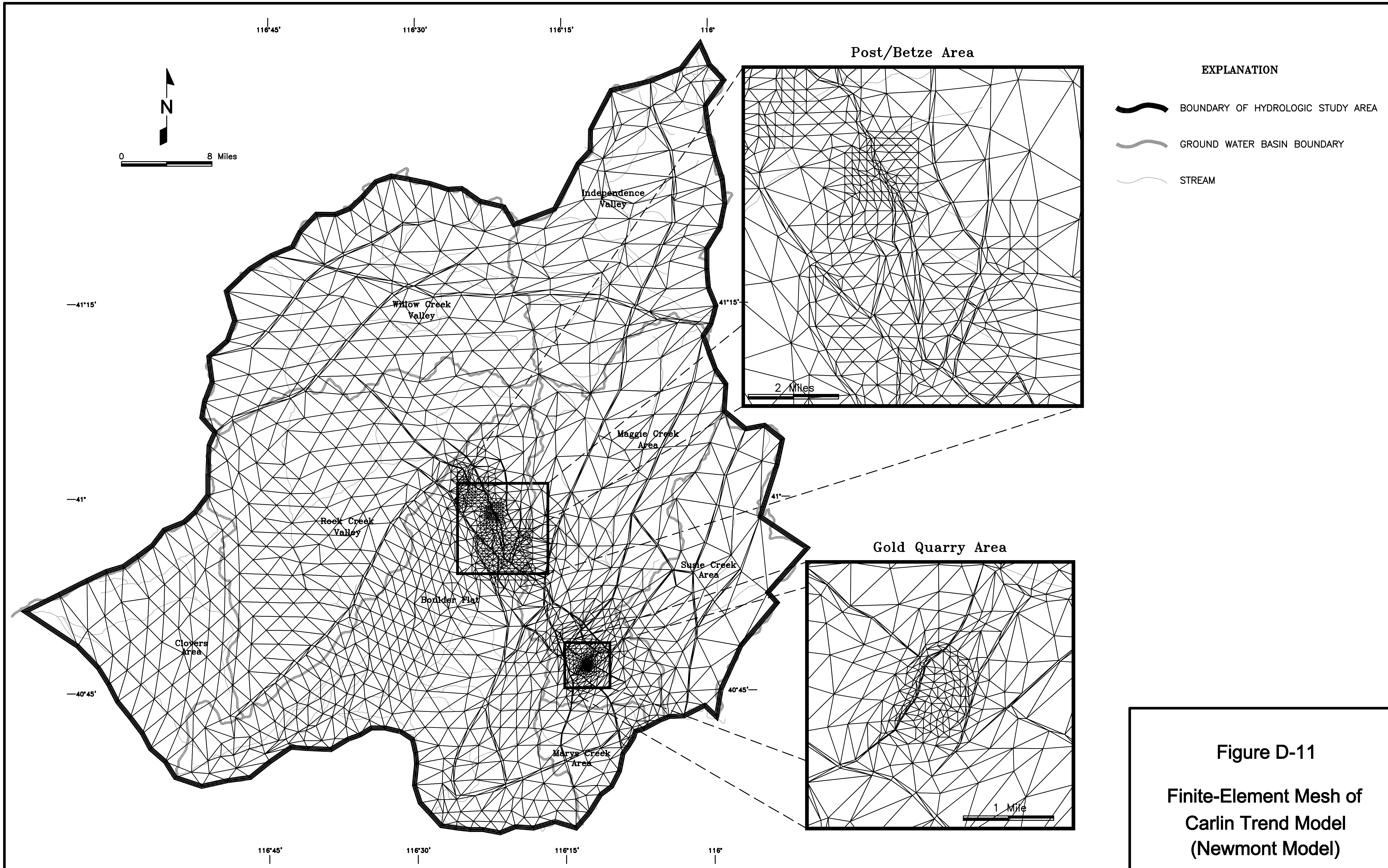

Figure D-11

Finite-Element Mesh of Carlin Trend Model (Newmont Model)

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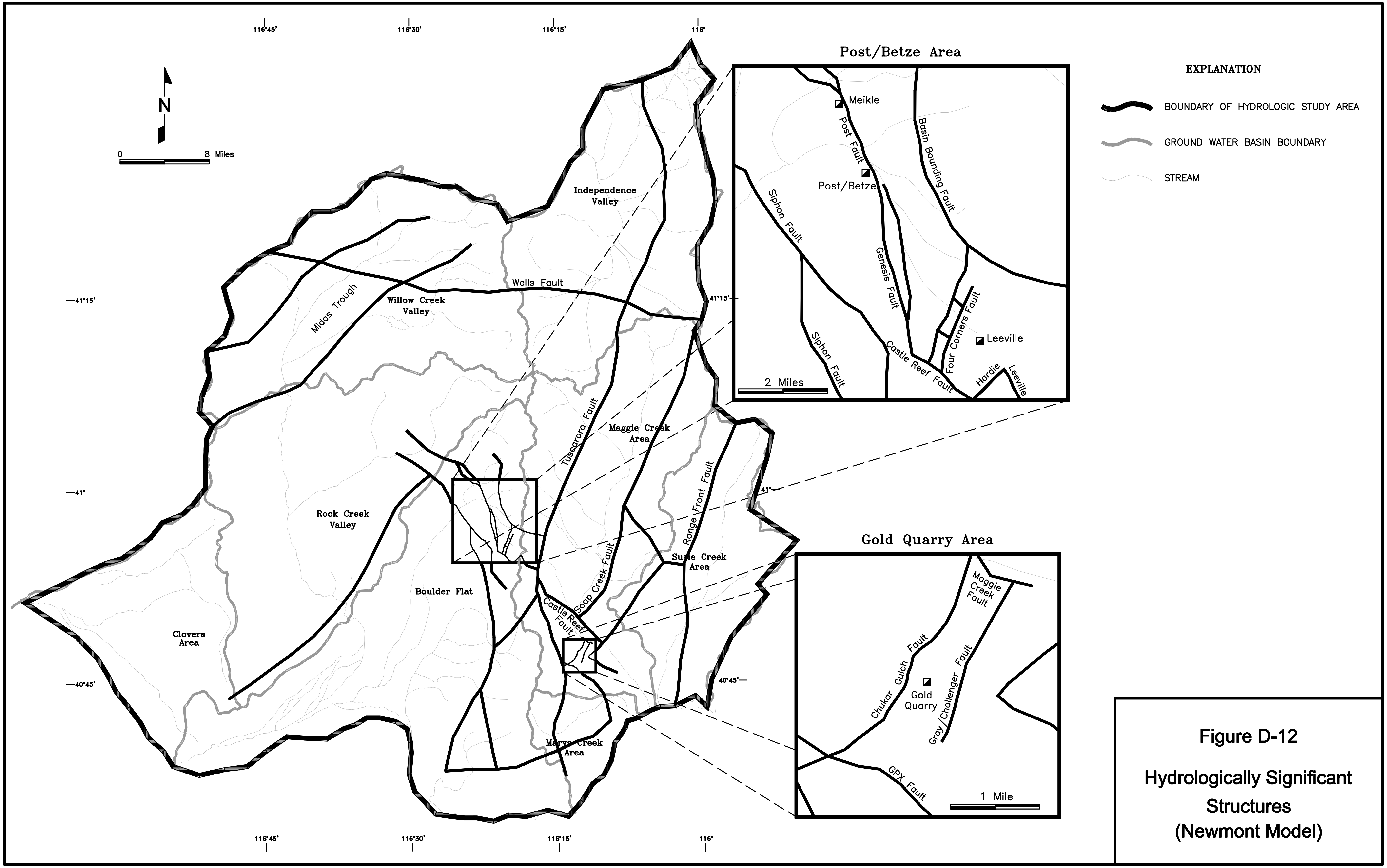


Figure D-12

Hydrologically Significant Structures (Newmont Model)

Table D-2
Hydraulic Parameters Used in the Model

Hydrogeologic Zones	Horizontal Hydraulic Conductivity K_x (feet/day)	Horizontal Hydraulic Conductivity K_y (feet/day)	Vertical Hydraulic Conductivity K_z (feet/day)	Specific Yield S_y	Specific Storage S_s ($x\ 10^{-6}\ ft^{-1}$)
Alluvium	1.0 -10.0	1.0 –10.0	0.1 – 1.0	0.05	5.0
Carlin Formation	0.05 – 10.0	0.05 – 10.0	0.0025 – 0.1	0.01 - 0.07	1.0 - 5.0
Basal clay of Carlin Formation	0.00001	0.00001	0.00001	0.005	5.0
Volcanics with high hydraulic conductivity (Boulder Valley)	130.0	130.0	13.0	0.07	5.0
Tertiary volcanics	1.0 - 35.0	1.0 - 35.0	0.05 – 7.0	0.05	1.0 - 5.0
Siltstones in Gold Quarry pit area	45.0 - 65.0	45.0 - 65.0	45.0 - 65.0	0.015 - 0.025	0.2
Regional siltstones	0.025 – 0.05	0.025 – 0.05	0.0002 – 0.001	0.01	2.0
Carbonates in Gold Quarry pit area	10.0 - 40.0	1.0 - 10.0	0.05 - 40.0	0.0035 - 0.005	0.2 - 5.0
Calcite shell (Gold Quarry pit area)	50.0	50.0	50.0	0.01	10.0
Carbonates with high hydraulic conductivity (North Boulder Flat)	100.0	50.0	0.5	0.002 - 0.007	0.01 - 2.0
Regional carbonates	1.0	1.0	0.05	0.005 - 0.008	0.5
Mesozoic intrusive	0.005	0.005	0.00025	0.008	0.2
Fractured Mesozoic intrusive	1.2	1.2	1.2	0.005	3.5
Paleozoic quartzite (Eureka)	1.0	1.0	0.1	0.005	0.5
Paleozoic Pogonip Group	0.5	0.5	0.005	0.005	0.5

Table D-3
Fault Hydraulic Conductivities Used in the Model

Hydrogeologic Unit	Horizontal Hydraulic Conductivity K_x, K_y (feet/day)	Vertical Hydraulic Conductivity K_z (feet/day)	Specific Yield S_y	Specific Storage S_s (x 10^{-6} ft^{-1})
Chukar Gulch fault	0.01	0.01	0.005	5.0
Castle Reef fault	0.0025	0.0025	0.005	5.0
Gen fault	0.00001	0.00001	0.005	5.0
Post and Tuscarora fault	0.001	0.0001	0.005	5.0
Roberts Mountains thrust fault	0.00001	0.00001	0.005	5.0
Regional faults	0.01	0.0001	0.005	5.0

the greatest recharge. Recharge was applied at a constant rate, across the model domain, equivalent to the mean annual recharge without considering seasonal variation. The net evaporation (evaporation minus direct precipitation) from the pit lake surface is treated as negative recharge in the model. Two nodes representing Willow Creek Reservoir and Hot Lake also have a negative recharge to represent evaporation from their surface. Evapotranspiration is simulated for areas in the Boulder Flat, the Clovers area, the Independence Valley, and along some streams.

D2.1.9 Streams

Discharge or recharge of ground water from streams is calculated depending on the hydraulic gradient between the stream and the water table. The Humboldt River is the only source of surface water inflow to the model domain. Carlin and Niagara springs are associated with streamflow and are simulated as streams. The three new springs created by Barrick's mine water discharge are simulated as drain nodes.

D2.1.10 Dewatering Wells, Injection Wells, Infilatration Ponds, and Irrigation

The pumping schedules for dewatering wells in the Gold Quarry, Post/Betze, Genesis, and Leeville/Four Corners areas were simulated in the transient calibration of the model from January 1988 through June 1998. Only pumping related to mining was simulated.

Injection, infiltration, and irrigation were modeled for mine water disposal only. Other agricultural irrigation was not modeled. Infiltration of Barrick's mine water was modeled at the TS Ranch Reservoir, injection wells and infiltration ponds. Irrigation was modeled to occur in the Boulder Flats area at pivots and a flood irrigation system. Irrigation was simulated by injecting 30 percent of the water discharged. Infiltration of Newmont's mine water at Maggie Creek reservoir is not simulated; however, discharge of mine water to Maggie Creek is simulated.

D2.1.11 Pit Lakes

Pit lakes are represented in the model based on an analytical routine that describes the mass balance between calculated inflows and volumetric changes associated with the water level changes in the pit. Dee, Bootstrap, Tara, Post/Betze, Genesis, and Gold Quarry pits are included in the model. Pit lake filling predictions were created with the 1996 Gold Quarry Model (HCI 1997b).

D2.1.12 Model Calibration and Sensitivity Analysis

Calibration is the final step in preparing the numerical ground water flow model for use in developing predictive simulations. Heads calculated in the steady-state calibration are used as the initial heads for subsequent transient simulations with the model, both for transient calibration and predictive simulations. The goal of steady-state calibration is to match heads and fluxes calculated by the numerical model to actual conditions. Calibration is achieved by adjusting the hydraulic parameters of the model, primarily the hydraulic conductivities. Water levels measured in 161 wells in the study area are used as specific calibration points, as are the baseflows of Susie Creek, Maggie Creek, Marys Creek, and Rock Creek. Steady state was assumed to be represented by water levels measured prior to the fourth quarter of 1990.

Once a satisfactory steady-state calibration is achieved, transient calibration is conducted to demonstrate the capability of the numerical model to replicate the response of the ground water flow system to historical hydraulic stresses. Some additional refinement of the hydraulic parameters is conducted during transient calibration. Transient calibrations are completed by simulating stresses from pumping on the aquifer. Historic records for mine dewatering for all mines within the model domain for the time period from 1988 through the second quarter of 1998 were used for the transient calibration. Data from 189 monitoring wells were used to evaluate the transient calibration.

A sensitivity analysis was conducted to assess which of the model input parameters might have the greatest effect on model predictions. The primary purpose of such an analysis is to identify those parameters that should be the focus of continuing investigations in order to minimize the uncertainty associated with model predictions. The predicted drawdown at the Gold Quarry pit was most sensitive to changes in the hydraulic conductivity of the regional carbonates and changes in recharge, while drawdown at the Post/Betze pits was most sensitive to changes in the high hydraulic conductivity unit. Drawdown in both pits was not sensitive to changes in vertical hydraulic conductivity.

D2.2 Predictive Model Simulations

The calibrated model was used for two different predictive simulations. The first simulation was used to estimate the possible impacts of the Gold Quarry pit dewatering, assuming no other mining operations are present. This hypothetical scenario was used to evaluate the direct and indirect impacts from the Gold Quarry Mine operations alone. The second predictive simulation addressed dewatering from several other mines in the hydrologic study area to estimate the cumulative impacts of mine dewatering operations.

D2.2.1 Predicted Cumulative Drawdown: End of Mining and Postmining

The Newmont hydrologic model described above was used to provide a separate prediction of the cumulative drawdown of the ground water surface at the end of mining and in the postmining period. As stated previously, it is important to understand that the hydrogeologic conditions in the vicinity of the mine and surrounding region are complex. Regional ground water flow models are based on a simplified conceptual model of the hydrostratigraphic and hydrostructural conditions and ground water flow patterns. It is important to understand that unknown conditions may exist that could influence the future drawdown patterns. For long-term predictions there is also the uncertainty of future climatic conditions.

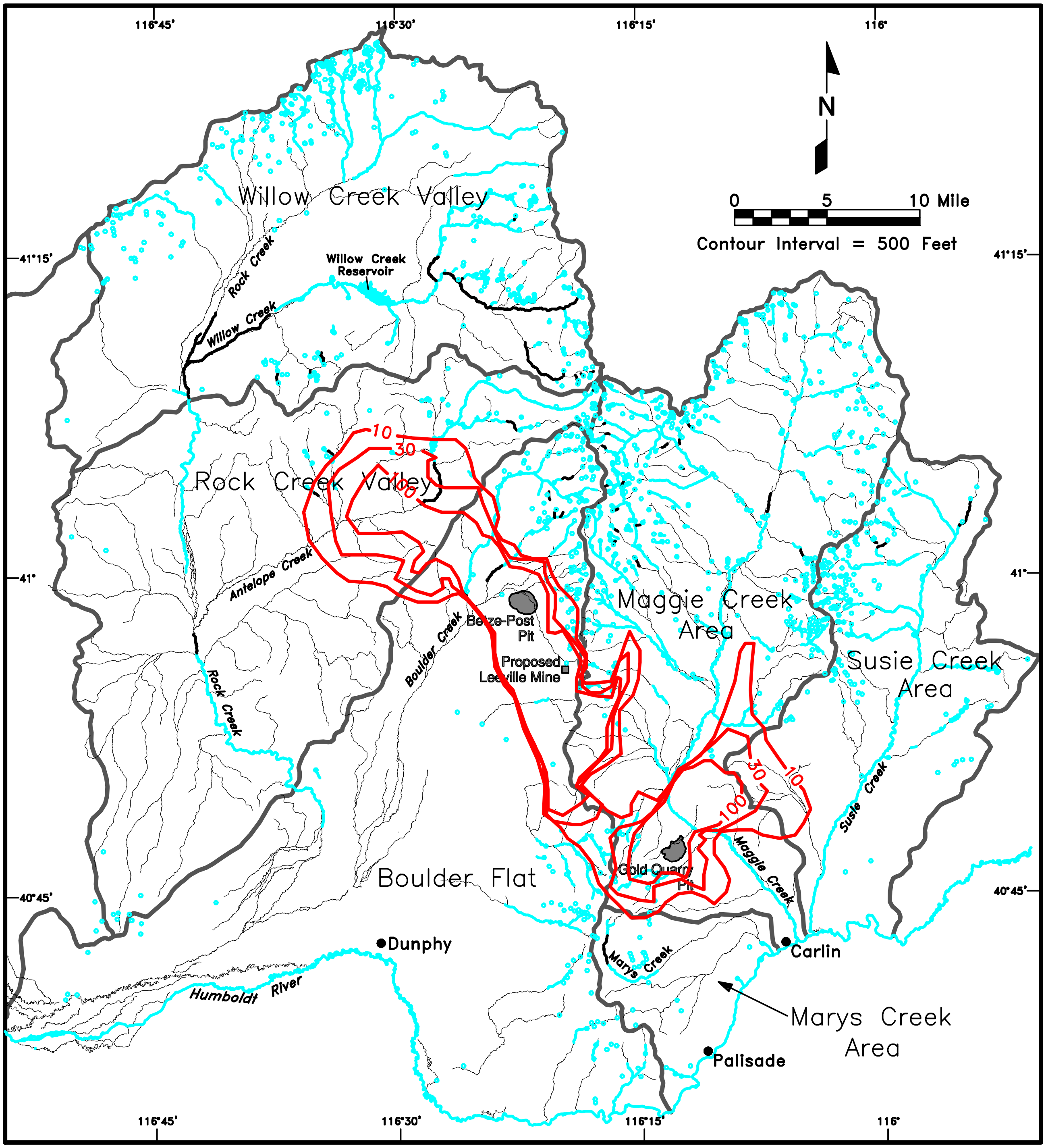
The model predicts that the areal extent and magnitude of the cone of drawdown will vary over time and persist for an extended period postmining. To illustrate these predicted variations in the cone of depression over time, model predictions corresponding to the years 2012 (end of mining), 2061 (50 years postmining), and 2111 (100 years postmining) are presented in Figures D-13, D-14, and D-15 (Newmont Gold Company 1999a). The end of mining as defined here refers to the currently planned cessation of mine dewatering efforts at the Goldstrike Mine and Gold Quarry Mine. (It should be noted the proposed Leeville Mine would extend mine dewatering an additional 5 years.) As shown in Figure D-13, at the end of mining the model predicts that cumulative mine dewatering would result in the development of a single elongated cone of drawdown extending from the east side of Susie Creek in the southeast to Antelope Creek in the northeast, a distance of approximately 32 miles, with a width of up to 12 miles southwest-northeast. Comparison of the predictions for the end of mining, 50 years postmining (Figure D-14), and 100 years postmining (Figure D-15) indicates that the maximum areal extent of the 10-foot contour would continue to expand after mine dewatering ceases. At 100 years postmining, the 10-foot drawdown contour is predicted to encompass an area centered between the Goldstrike and Leeville mines, extending up to a maximum of approximately 40 miles in a northwest-southeast direction and 25 miles in a northeast-southwest direction. The model simulations predict that in the northern and western portions of the model, the area of drawdown will continue to expand until it reaches its maximum extent (in these areas) at approximately 100 years postmining (HCI 1999a).

D2.2.2 Predicted Maximum Extent of the 10-Foot Drawdown Contour

For the cumulative analysis, the area that is predicted to experience a change in ground water elevation of 10 feet or more due to pit dewatering and mine water management activities was selected as the area of potential concern regarding impacts to water resources. Newmont's calibrated model was used to estimate the change in ground water levels over regular time intervals throughout the future mining and postmining period up to final recovery. These results were then used to determine the maximum extent of drawdown irrespective of time as presented in Figure D-16 (Newmont Gold Company 1999a). Comparison between the predicted maximum drawdown (Figure D-16), and the previously presented drawdowns for selected postmining periods indicates that in the northern and western portions of the modeled area, the maximum areal extent of drawdown (as defined by the 10-foot contour) is predicted to occur in most areas at approximately 100 years postmining.

D2.2.3 Predicted Cumulative Drawdown at Recovery

After the pit lake levels reaches equilibrium, the numerical ground water model predicts there will be a long-term drawdown cone that will persist for the foreseeable future. The predicted area of cumulative, long-term residual drawdown (shown in Figure D-17 [Newmont Gold Company 1999a]) is predicted to result in an elongated drawdown cone centered between the Goldstrike Mine and Leeville Mine that will extend a maximum of length of approximately 22 miles in a northwest-southeast direction with a width of up to 13 miles. This permanent drawdown will be maintained by continuous inflow of ground water into the lake to replace water lost through evaporation.



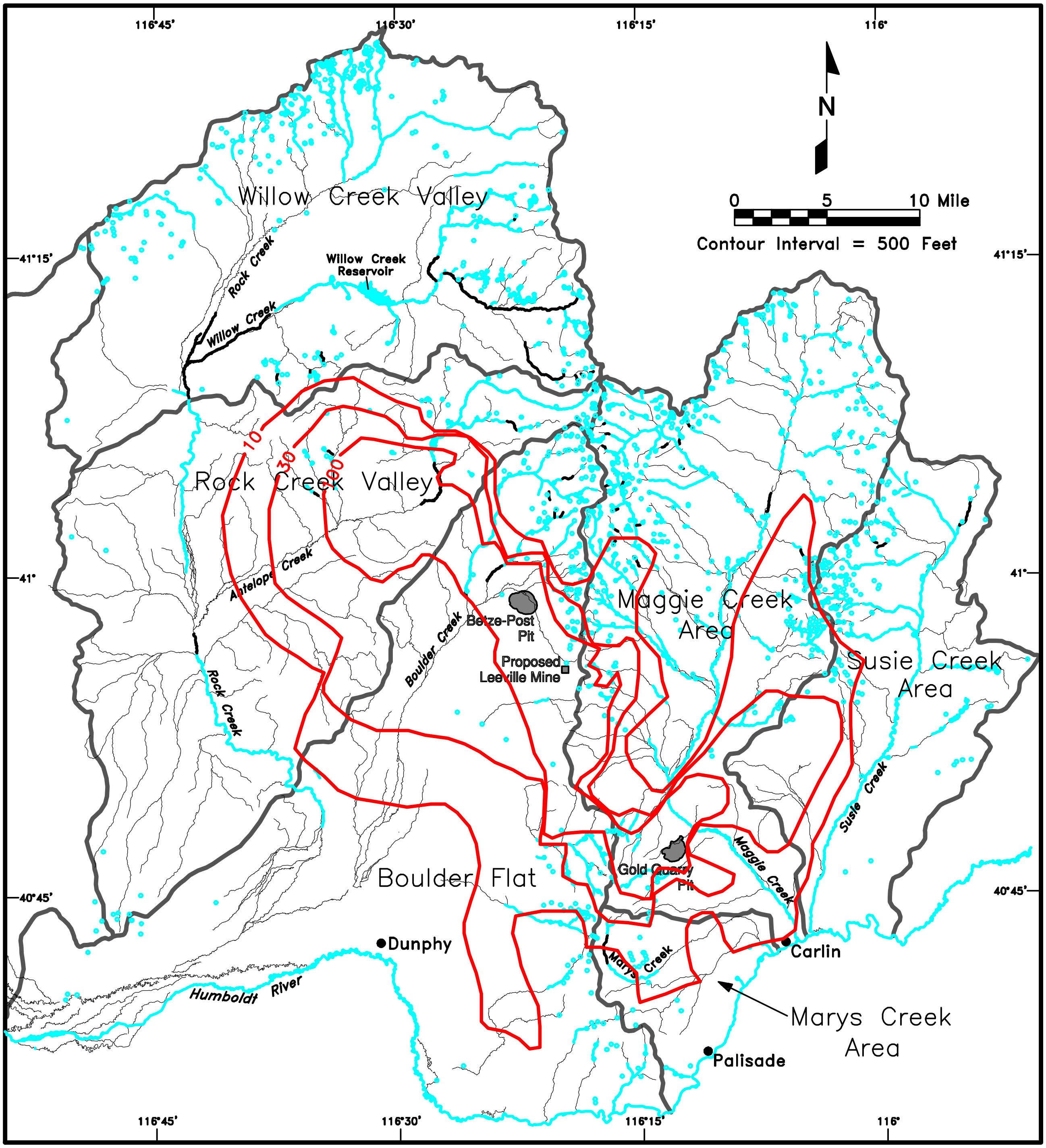
Legend

- Ground Water Basin Boundary
- Contour of Drawdown in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-13

Predicted Cumulative Drawdown at End of Mining (Newmont Model)

\A305C\DWG\305c.dwg [layer on: ddngc_2061-*] REVISION: 2/12/2000 [305cn2.plt]



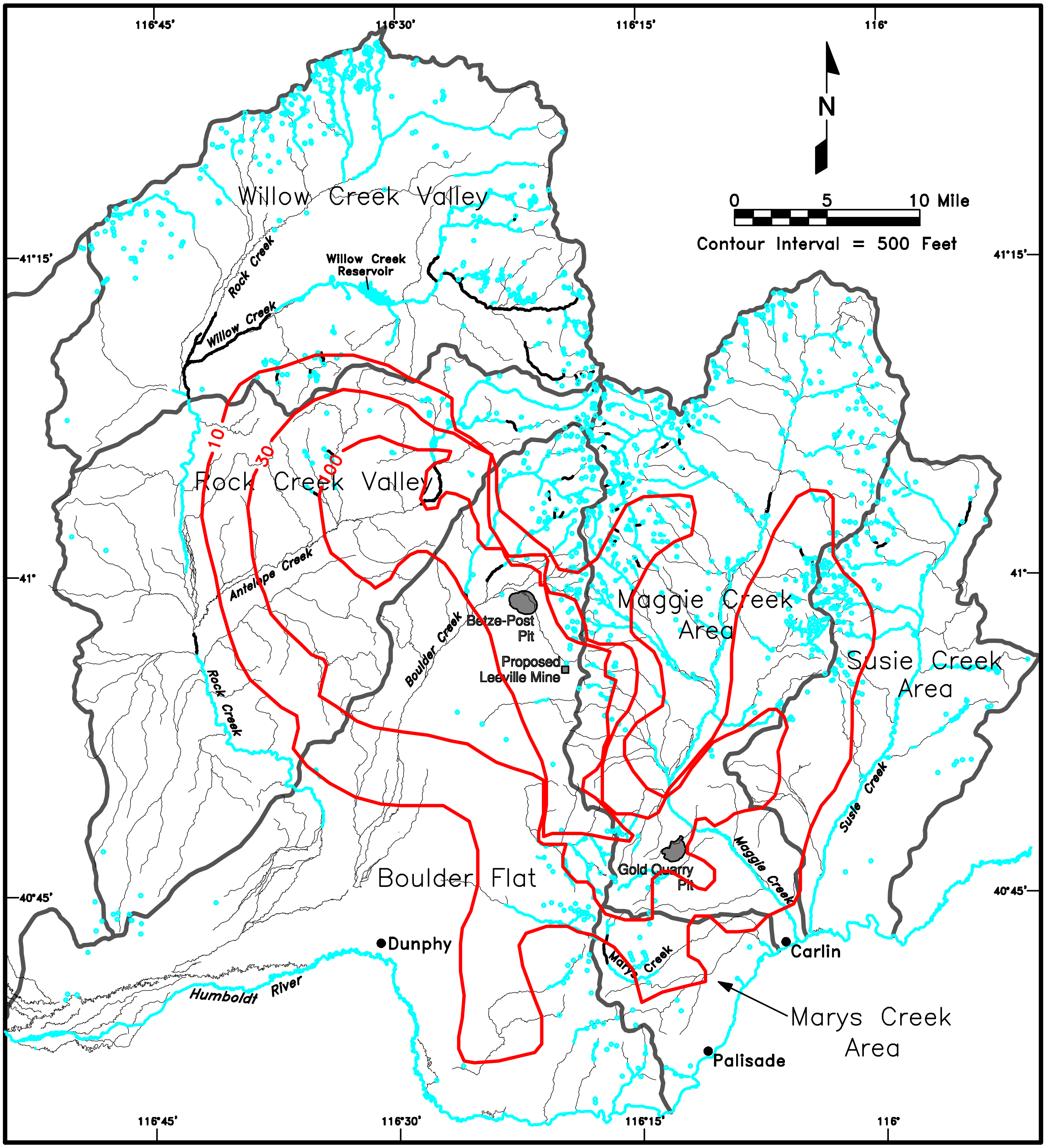
Legend

- Ground Water Basin Boundary
- Contour of Drawdown in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-14

Predicted Cumulative Drawdown at 50 Years Post Mining (Newmont Model)

\A305C\DWG\305c.dwg [layer on: ddngc_2111-*] REVISION: 2/12/2000 [305cn3.plt]



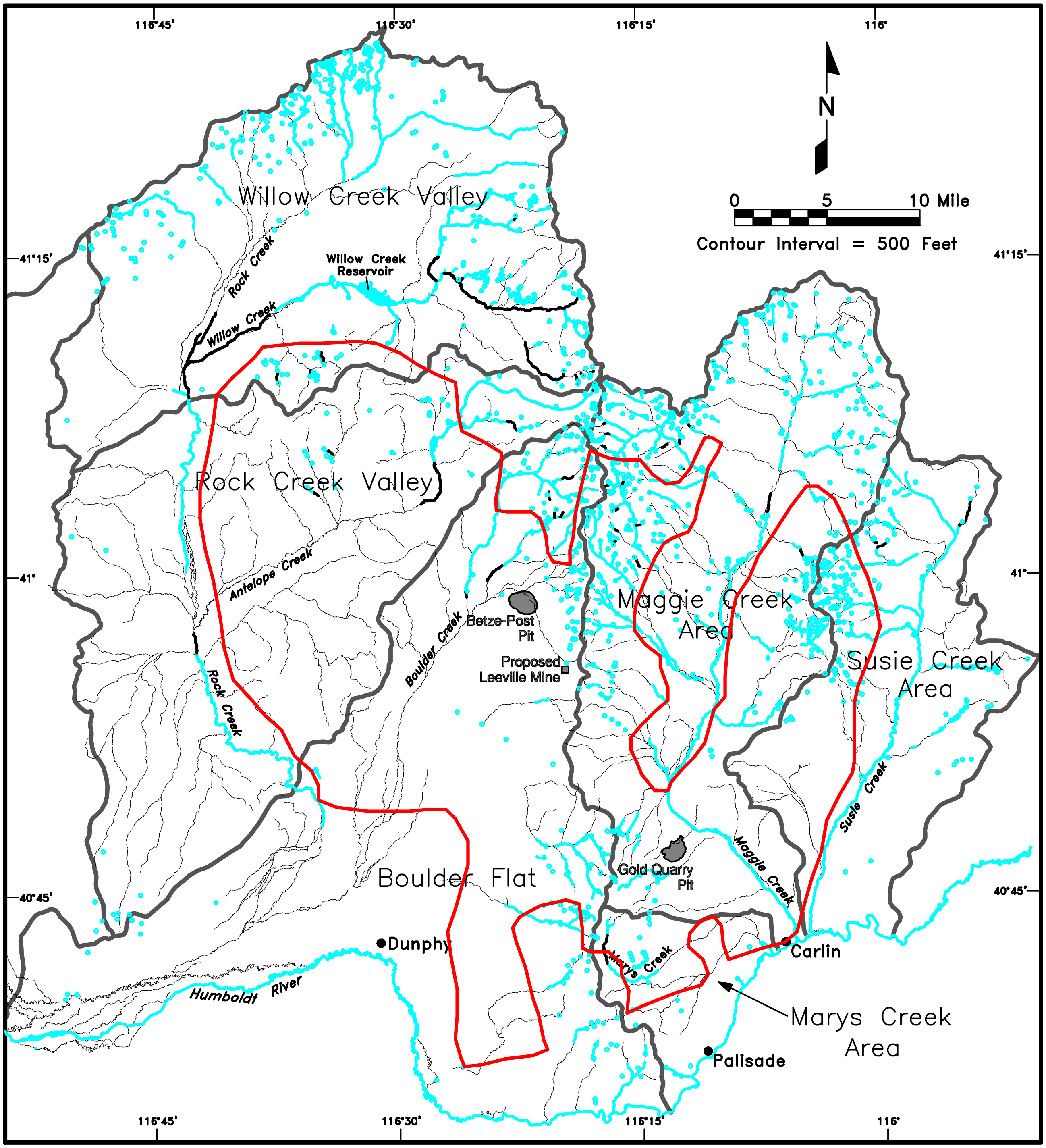
Legend

- Ground Water Basin Boundary
- Contour of Drawdown in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-15

Predicted Cumulative Drawdown at 100 Years Post Mining (Newmont Model)

\A305C\DWG\305c.dwg [layer on: ddngc_max-*] REVISION: 2/12/2000 [305cnmax.plt]



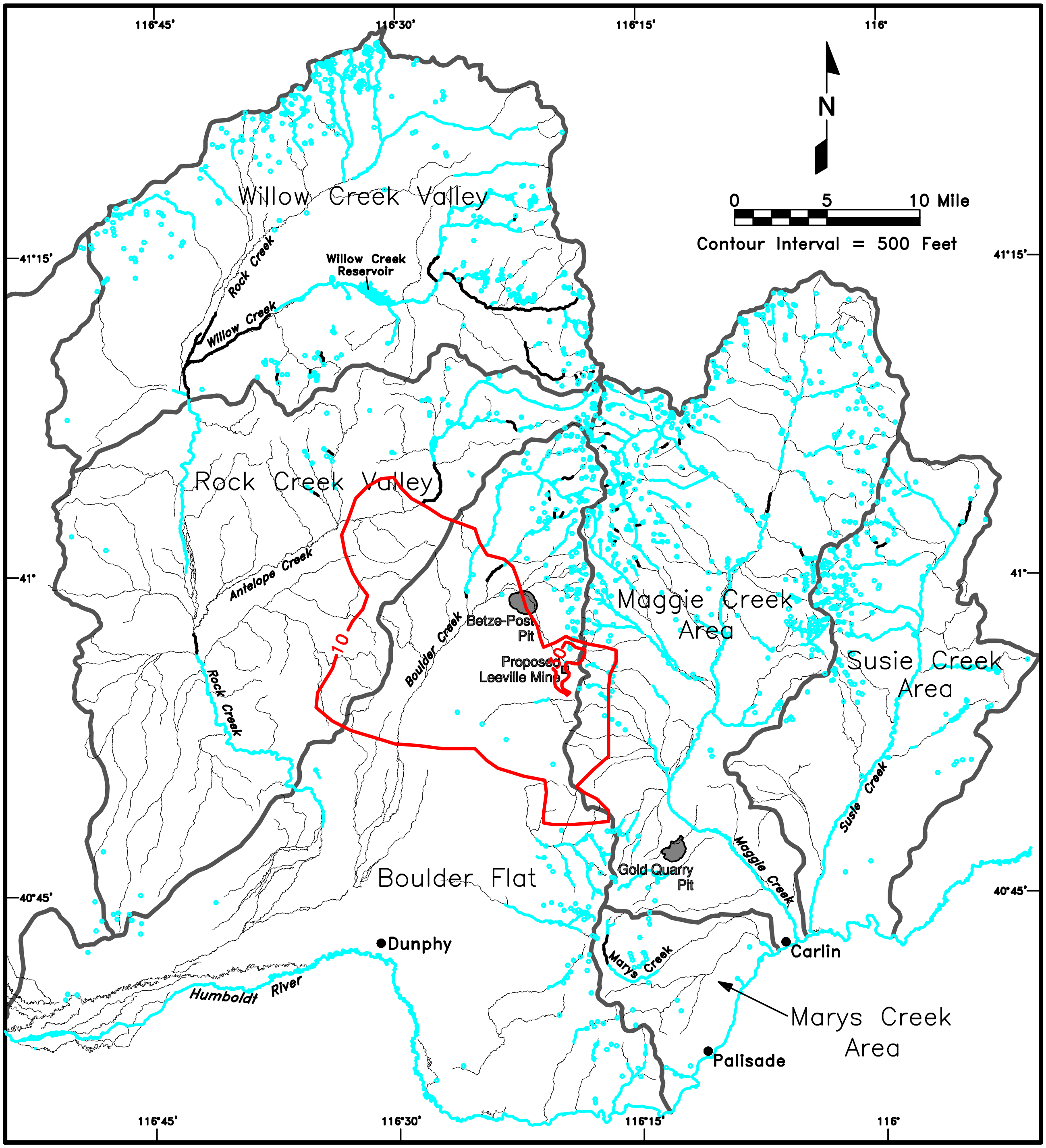
Legend

- Ground Water Basin Boundary
- Maximum Extend of Drawdown Contour in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-16

Predicted Maximum Extent of the 10-foot Drawdown Contour (Newmont Model)

\A305C\DWG\305c.dwg [layer on: ddngc_post-*] REVISION: 2/12/2000 [305cn4.plt]



Legend

- Ground Water Basin Boundary
- Contour of Drawdown in Feet
- Stream (Intermittent or Ephemeral)
- Perennial Steam
- Discontinuous Flowing Stream Reach
- Spring and Seeps

Figure D-17

Predicted Cumulative Drawdown at Recovery (Newmont Model)

APPENDIX E

WATERFOWL DATA

Table E-1
Aerial Duck Breeding Pair Survey
Average Number of Breeding Pairs Recorded Annually in Region 1
(1959 – 1998)

Area	1959 – 1966	1967 – 1979	1978 – 1987	1980 – 1989	1990 – 1998	1959 – 1998	High	Low
Humboldt River	299	154	324	365	260	266	658	40
Humboldt WMA	312	472	388	398	161	357	1,049	0
Stillwater WMA	2,621	1,678	1,590	1,687	1,194	1,760	4,829	122
Carson Lake	985	908	1,235	1,362	1,006	1,059	2,251	63

Source: Saake 1998.

Table E-2
Annual Waterfowl Occurrence from August 15 to January 30
(1968 – 1997)
(x 1,000)

Area	1968 – 1977		1978 – 1987		1988 – 1997		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Humboldt WMA[1]								
Ducks	2,803.83	1,433.80	2,256.48	1,487.29	1,442,04	1,951,94	2,145.51	1,686.26
Geese	65.97	24.82	94.69	53.90	28.82	33.28	63.06	47.38
Swans	22.44	27.18	34.04	51.14	14.79	27.66	23.80	36.94
Stillwater WMA								
Ducks	7,536.92	4,021.94	9,121.53	7,172.44	5,381.32	4,826.21	7,346.59	5,535.77
Geese	197.36	73.75	260.93	72.71	266.35	129.81	241.55	97.84
Swans	126.74	63.65	185.51	120.88	93.43	79.87	135.23	96.29
Carson Lake								
Ducks	5,384.15	2,649.05	4,587.44	1,611.03	2,635.89	1,934.21	4,202.49	2,350.16
Geese	270.79	146.11	218.28	72.32	142.54	134.72	210.54	129.41
Swans	3.17	2.71	24.77	41.85	18.25	35.69	15.40	32.03

[1]No data were obtained for the Humboldt WMA in 1968.
SD = standard deviation.
Source: Saake 1998.

Table E-3
Humboldt Wildlife Management Area
Annual Peak Population by Species
August 15 – January 30
(1969 – 1998)

Species	Average (Aug 15 – Jan 30)	Average Yearlong	1969 - 1998	
			High	Low
Mallard	3,074	6,148	12,880	1
Gadwall	1,994	3,988	10,530	0
Northern pintail	10,019	20,038	33,130	0
Green-winged teal	6,531	13,062	23,760	0
Cinnamon teal	700	1,400	3,260	0
American wigeon	4,455	8,910	14,850	0
Northern shoveler	2,581	5,162	13,500	0
Redhead	1,222	2,444	10,330	0
Ring-necked duck	98	196	2,050	0
Canvasback	1,162	2,324	15,880	0
Lesser scaup	7	14	30	0
Common goldeneye	3	6	20	0
Bufflehead	11	22	50	0
Ruddy duck	726	1,452	5,635	0
Other duck species	0	0	0	0
Total Ducks	**32,583**	**65,166**	**76,625**	**1**
Common merganser	706	1,412	6,800	0
Dark goose	729	1,458	2,640	0
White goose	20	40	300	0
Total Geese	**749**	**1,498**	**2,940**	**0**
Tundra swan	525	1,050	3,890	0
American coot	39,434	78,868	235,651	0
Total Waterfowl	**73,997**	**147,994**	**315,468**	**1**

Source: Saake 1998.

APPENDIX F

AQUATIC RESOURCES TABLES

Table F-1

Mean Fish Abundance[1] (number/mile) in the Maggie Creek Subbasin, 1992

Stream	Location No.	Speckled Dace	Redside Shiner	Mountain Sucker	Brook Trout	Lahontan Cutthroat	Total
Buck Rake Jack Creek	BRJ-004	10	0	0	0	0	**10**
West Cottonwood Creek	COW-001	1,070	0	0	0	0	**1,070**
Coyote Creek	COY-002	0	0	0	10	0	**10**
Indian Creek	IND-001	380	0	0	0	0	**380**
Jack Creek	JAC-003	60	0	0	0	0	**60**
	JAC-004	10	0	0	0	0	**10**
Little Jack Creek	LTL-007	20	0	0	0	150	**170**
Maggie Creek	MAG-007	12,890	270	20	0	0[2]	**13,180**
	MAG-102	3,180	680	0	0	0	**3,860**
Susie Creek	SUS-010	13,410	190	280	0	0	**13,880**

[1]Number of fish/sampling segment (in feet) was extrapolated to number/mile.
[2]Five LCT were electroshocked by JBR (1992e) during a qualitative survey.
Source: JBR 1992a.

Table F-2

Mean Fish Abundance[1] (number/mile) in the Beaver Creek Drainage, 1994

Stream	Location	LCT		Tahoe Sucker	Speckled Dace	Lahontan Redside
		Juvenile	Adult	All Stages	All Stages	All Stages
Beaver Creek	1	0	10	10	578	0
	2	0	0	429	992	107
	3	0	0	116	2,988	0
	4	44	0	0	0	0
	5	0	0	0	112	0
	6	28	28	28	428	0
	7	15	15	0	47	0
	8	43	43	0	1,056	0
	9	128	0	0	0	0
	10	15	0	0	0	0
	11	0	0	0	0	0
Williams Canyon	1	0	0	0	70	0
	2	81	0	0	0	0
	3	132	0	0	0	0
Toro Canyon	1	0	0	0	0	0
	2	170	34	0	0	0
	3	270	0	0	0	0
	4	114	0	0	28	0
	5	103	26	0	118	0
Toro Tributary A	1	128	64	0	0	0
Toro Tributary B	1	313	0	0	0	0
Toro Tributary C	1	328	0	0	73	0
Barber Canyon	1	0	0	0	0	0
Unnamed Trib.	1	0	0	0	0	0
	2	0	0	0	0	0
Little Beaver Ck.	1	0	0	0	0	0
	2	634	70	0	0	0

[1]Number of fish/sampling segment (in feet) was extrapolated to number/mile.
Source: Valdez et al. 1994.

Table F-3

Mean Fish Abundance[1] (number/mile) in the Rock Creek Subbasin, 1996

Stream	No. of Locations	Speckled Dace	Redside Shiner	Mountain Sucker	Tahoe Sucker	Lahontan Cutthroat	Total
Upper Rock Creek	4	53	0	0	0	70	**123**
Lewis Creek	5	348	0	0	0	290	**638**
Willow Creek	9	2,823	396	211	92	0	**3,522**
Nelson Creek	6	1,571	53	106	0	79	**1,809**
Toe Jam Creek	5	334	0	88	0	106	**528**
Frazer Creek	4	3,590	0	0	0	853	**4,443**

[1]Number of fish/sampling segment (in feet) was extrapolated to number/mile.

Source: NDOW 1996b.

Table F-4
Location Descriptions of the Humboldt River Sampling Stations

Station I.D.	Location Description
BG-HUM-01	This station is located approximately 1/2 mile upstream of the mine at Barth.
BG-HUM-02	This station is located approximately 1 mile below Cluro or approximately 5.5 miles downstream of BG-HUM-01.
BG-HUM-03	This station is located approximately 5 river miles above Beowawe.
BG-HUM-04	This station is located approximately 2 miles upstream from Dunphy.
BG-HUM-05	This station is just downstream of Dunphy. It was the most upstream station in the initial August/September 1995 sampling.
BG-HUM-06	This station is immediately downstream from Shoshone. It is in Eureka County near the Lander County line and above the confluence of Blue Horse Slough.
BG-HUM-07	This station is located 2 miles below where Blue House Slough enters the river. It is in Lander County just west of the Eureka County line.
BG-HUM-08	This station is situated near the gaging station north of Mosel.
BG-HUM-08a	This station is located at the levees in Lander County.
BG-HUM-09	This station is downstream from Argenta at Argenta Siding.
BG-HUM-10	This station is located approximately 2 miles above the confluence of Rock Creek.
BG-HUM-11	This station is only a short distance downstream from the confluence of Rock Creek.
BG-HUM-12	This station is located 2 miles below the Rock Creek confluence. It is situate immediately adjacent to the structures and buildings at Tomera Ranch.

Source: JBR 1997.

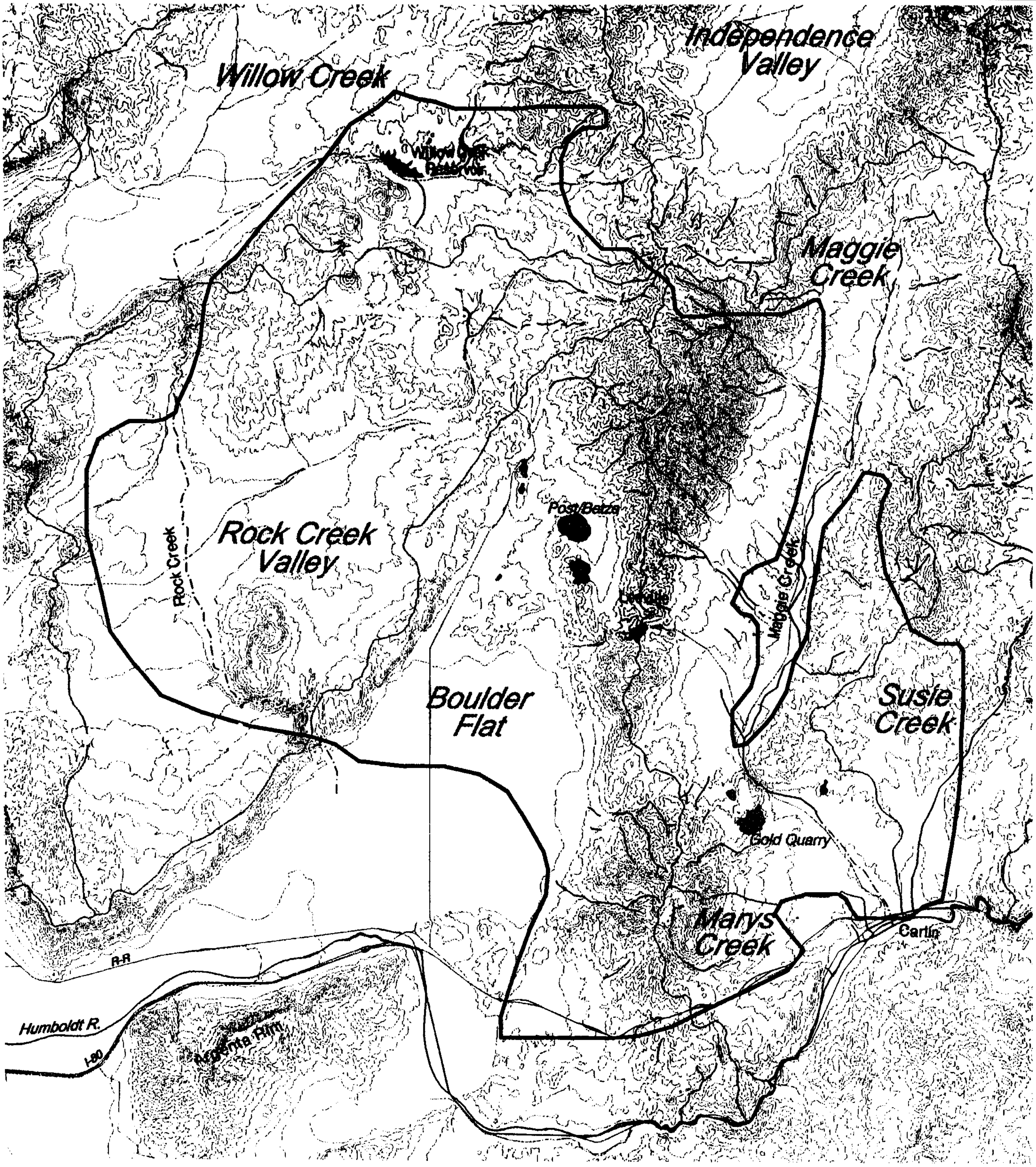
Table F-5
Fish Species Collected in the Humboldt River

Common Name	Scientific Name	Status	
		Game Species	Nongame Species
Suckers	**Family Catostomidae**		
Lahontan mountain sucker[1]	*Catostomus platyrhynchus*		X
Tahoe sucker[1]	*Catostomus tahoensis*		X
Minnows and Carp	**Family Cyprinidae**		
Goldfish[2]	*Carassius auratus*		X
Carp[2]	*Cyprinus carpio*		X
Lahontan tui chub[1]	*Gila bicolor*		X
Sacramento blackfish[2]	*Orthodon microlepidotus*		X
Redside shiner[1]	*Rhichardsonius balteatus*		X
Lahontan redside[1]	*Richardsonius egregius*		X
Lahontan speckled dace[1]	*Rhinichthys osculus robustus*		X
Catfishes	**Family Ictaluridae**		
White catfish[2]	*Ictalurus catus*	X	
Black bullhead[2]	*Ictalurus melas*	X	
Brown bullhead[2]	*Ictalurus nebulosus*	X	
Channel catfish[2]	*Ictalurus punctatus*	X	
Livebearers	**Family Poeciliidae**		
Mosquitofish[2]	*Gambusia affinis*		X
Perches	**Family Percidae**		
Yellow perch[2]	*Perca flavescens*	X	
Walleye[2]	*Stizostedion vitreum vitreum*	X	
Temperate Basses	**Family Percichthyidae**		
White bass[2]	*Morone americana*	X	
Sunfishes	**Family Centrarchidae**		
Green sunfish[2]	*Lepomis cyanellus*	X	
Bluegill[2]	*Lepomis macrochirus*	X	
Smallmouth bass[2]	*Micropterus dolomieui*	X	
Largemouth bass[2]	*Micropterus salmoides*	X	
White crappie[2]	*Pomoxis annularis*	X	
Black crappie[2]	*Pomoxis nigromaculatus*	X	

[1] Native species.
[2] Introduced species.
Sources: Sevon 1994; JBR 1992a; French 1994, as cited in BLM 1996c; Emerson 1975; La Rivers 1962.

APPENDIX G

NATIVE AMERICAN CONSULTATION



Note: The projected area of cumulative impacts to water resources (Figure 3-14) is smaller than this APE.

Figure G-1

Area of Potential Effect (APE) for Native American Consultation

10/1/98

10/1/98

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ELKO DISTRICT OFFICE
3900 E. IDAHO STREET
ELKO, Nevada 89801

In Reply Refer To:
N-47793
8100 (NV-010)/1-1738
8100 (NV-010)/1-1651
8100 (NV-010)/1-1652

OCT - 1 1998

Certified Mail No. P 213 903 590
Return Receipt Requested

ED 10/1/98

Mr. Elwood Mose, Chair
Te-Moak Tribe of the Western Shoshone
525 Sunset Street
Elko, NV 89801

Dear Mr. Mose,

The Bureau of Land Management has received Plans of Operations from:

Barrick Goldstrike Mines to amend Barrick's Betze project;

Newmont to amend its Gold Quarry project (South Operations Plan Amendment or SOPA); and

Newmont/Barrick HD Venture's Leeville underground mining Plan of Operation.

Consultation was initiated in May, 1997, with the Te-Moak Tribe, the Western Shoshone Historic Preservation Society (WSHPS), and the Elko, Battle Mountain, Wells and South Fork Bands for both Gold Quarry and Leeville. No sacred/religious areas were identified within the actual mining area. For these two projects consultation is continuing and expanding because of the potential effects to surface waters as a result of dewatering associated with those mining operations.

At this time, BLM is initiating consultation to amend Barrick's Betze project. The major surface disturbance from the amendment (other than from the potential effects of dewatering) is a pipeline which is part of this consultation effort.

All three of these mines are in close geographic proximity within the Carlin Trend. Because each of these mining projects would require dewatering, and this component has additional cumulative effects to the regional aquifer and to the Humboldt River system, BLM is expanding consultation on these three projects.

These individual projects could have overlapping, additive and cumulative effects as a result of dewatering. BLM has asked both Barrick-Goldstrike and Newmont Gold Company to present models to the BLM that show the combined effects of their dewatering. The effects are projected to occur within the isopleth border displayed in map 1 over the next 100 years at various times in different locations. In some locations, likely close to the Post/Betze and Gold Quarry pits and the Leeville underground mine, near-surface groundwater, springs and streams have a high probability of being affected.

The BLM is not the permitting agency for dewatering. The state controls water resources, and therefore whether dewatering is to occur and to what extent is in the hands of the Nevada state engineer. The BLM is involved because dewatering may affect surface resources.

This information was first informally presented in a meeting held on Tuesday, September 22, 1998, at the Bureau of Land Management. Representatives from Barrick, Newmont and the BLM presented maps and described the projects' effects to representatives of various Te-Moak bands, the WSHPS, the Shoshone-Paiute cultural and historic program (Duck Valley) and the Western Shoshone Defense Project.

The BLM is notifying you of these projects early in our environmental process so that tribal members may begin their discussion. At this time, in accordance with the National Historic Preservation Act (P.L. 89-665), the National Environmental Policy Act (P.L. 91-190), the Federal Land Policy and Management Act (P.L. 94-579), the American Indian Religious Freedom Act (P.L. 95-341), the Native American Graves Protection and Repatriation Act (P.L.101-601) and Executive Order 13007, the BLM is initiating the consultation process with the Te-Moak Tribe and providing the Tribe an opportunity to comment and consult on the proposed project.

We are soliciting your help in identifying locations within the project area that could have religious, traditional or cultural importance to the Shoshone people.

PROJECT LOCATION AND DESCRIPTION - Barrick-Goldstrike's Post/Betze Supplemental Environmental Impact Statement (Betze SEIS)

The project is located in the Carlin Trend (see the attached map), and direct effects of this project may interact with the other projects described in this letter. Pumping for dewatering is already permitted to 70,000 gallons per minute (gpm) but averages about 68,500 gpm. The project includes plans to continue to pump deep groundwater (dewatering) and discharge the water to infiltration ponds, re-injection wells, irrigated fields, and (with treatment) to the Humboldt River. The amount of water to be pumped will reach the target of 70,000 gpm by 1999 and afterward decline. By 2011 5,000 gpm will be pumped and by 2016, dewatering will cease. It is unknown to what degree the project will actually affect surface groundwater but some springs in the area could dry up or have reduced discharge for a number of years.

The Post/Betze pit is located approximately in T36N R50E, Sections 19 and 30: the area surrounding this location is likely to have the greatest effects.

This project was mostly reviewed in 1994 (Barrick's Betze Project) but the discharge to the Humboldt River was added in 1997 and even more recently, BLM has received an application from Barrick to add a freshwater 48" pipeline to the project. The 3,936 foot-long pipeline would extend the width of an existing right-of-way by 40 feet and would cross public lands (see the attached map 2).

PROJECT LOCATION AND DESCRIPTION - Newmont's Gold Quarry (SOPA)

As stated on page 1 of this letter, BLM concluded consultation efforts for the actual Gold Quarry mining area but is revisiting consultation to include effects of dewatering. Newmont has a permit to dewater its Gold Quarry operation. However, the mining plan of operation is being expanded, requiring an Environmental Impact Statement. Currently, water is pumped to a reservoir east of Maggie Creek and then the water is released to Maggie Creek and the Humboldt River except during high water periods. With the pit expansion, a greater amount of water will need to be pumped from the pit area, centered in sections 2 and 3, T33N, R51E and sections 34 and 35, T34N, R51E. The peak de-watering is 30,000 gpm with pumping expected to end in the year 2011.

PROJECT LOCATION AND DESCRIPTION - Newmont/Barrick's HD Venture - Leeville Plan of Operation

Similarly to Newmont's Gold Quarry, BLM is revisiting consultation efforts for the Leeville Plan of Operation. Up to 35,000 gallons per minute would be pumped out of the proposed Leeville underground mine, centered at T35N, R50E, Sections 10 and 11. The Leeville underground mine is a joint venture between Newmont and Barrick-Goldstrike. Dewatering and mining would occur through the year 2017. As the project lies between Barrick's Betze/Post Mine and the Newmont's South Operations Area, groundwater levels from both those projects would affect this project.

RESULTS OF CULTURAL RESOURCE INVENTORY - Barrick-Goldstrike Betze pipeline

Most of the length of the pipeline is on private land. Survey of the public land was done previously so that no new archaeological survey was required (the proposed pipeline follows an existing pipeline corridor). Results of those earlier surveys showed that there are no eligible sites on public lands that will be affected by this project.

TRADITIONAL CULTURAL PROPERTIES

For much of the project area, we are unaware of Traditional Cultural Properties (TCP's) or other locations having religious or cultural importance to the Shoshone within or near the proposed project. As stated above we are soliciting your help in identifying any such locations.

Additionally, if the ceremonial locations in Rock Creek Valley or Tosawihi Quarries are to be identified as Traditional Cultural Properties, we need any specific information showing that the ceremonial use spans back, at least occasionally, fifty years or more. Showing that there are locations in Rock Creek Valley that are currently important to the Shoshone people is fairly easy to document (for example, through Corbin Harney's book and other sources). However, we do need to demonstrate that there is continued use (this is a requirement for all TCP's). BLM also has information regarding Tosawihi Quarries and Big Butte suggesting that these may be TCP's as well. Again, more information is needed.

Please provide or refer us to any available information that would help us to understand the nature, significance and location(s) of Traditional Cultural Properties or other important areas that might be affected by the proposed Betze, Gold Quarry and Leeville dewatering projects, including the pipeline area for the Betze project.

Information about the location, use, character or ownership of traditional properties shall be withheld from the public if the tribe so requests, and if release of such information might: 1) cause a significant invasion of privacy, 2) risk harm to the traditional property, 3) impede the use of a traditional religious site by practitioners, or 4) constitute a risk to traditional activities.

We are also requesting the Tribe's input and participation in developing methods or alternatives that could reduce or eliminate effects to identified traditional cultural properties. Your views will be incorporated into the decision making process.

Please note that two ethnographic surveys have been completed in the area which may aid discussion within members of the Tribe. BLM could provide a copy of each to a tribal library or office at your request.

If you have comments which concern possible adverse effects to the environment, please address these separately to the BLM (these comments are also welcome and will be included in the NEPA process). This letter specifically seeks comments regarding the location shown on the attached map which relate to ways to avoid destroying or affecting potential Traditional Cultural Properties or areas of religious or cultural concern as a result of dewatering.

For your convenience you may respond by marking the appropriate space below and returning a copy of this cover letter to me. You may also contact Bryan Hockett and Eric Dillingham of my staff at (702) 753-0261 to discuss the project or to arrange a meeting. If you are not the appropriate person to receive this request, please advise whom we should contact.

Sincerely yours,

David J. Vandenberg

DAVID J. VANDENBERG, Manager
Non-Renewable Resources

____ We have no concerns or comments.

____ Our comments are attached.

____ Additional review time is requested. We will respond by ____________ (please specify date)

____ We wish to consult further with the BLM. Please contact ____________________ (tribal representative) at ___________________________ (address or phone number).

________________________________ Signature of Tribal Representative __________ Date
(regarding Barrick's Betze SEIS, Newmont's Gold Quarry and Newmont/Barrick's Leeville - letter of October, 1998)

Dec 16, 1998

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Elko District Office
3900 East Idaho Street
Elko, Nevada 89801

In Reply Refer To:
8100/1-1738

12/16/98
ED 12/16/98

Certified Mail No. P 213 903 665
Return Receipt Requested

Mr. Elwood Mose, Chair
Te-Moak Tribe of the Western Shoshone
525 Sunset Street
Elko, NV 89801

Dear Mr. Mose,

The BLM is continuing to evaluate three mining EIS's. These include the following: Barrick's Betze SEIS, Newmont's Gold Quarry Project, and Newmont/Barrick's HD Venture's Leeville underground mine. These operations involve surface impacts around the immediate area of the mines and potential impacts resulting from draw down of the water table in the dewatering operations.

Consultation for these three projects was initiated with the Te Moak Tribe, and bands of the Te Moak Tribe by letter on October 1, 1998. Subsequently, phone calls have been made on November 12 and 16, requesting information about potential impact to sites deemed sacred or important to the Shoshone people. The Bureau has received very limited response. To date, the BLM has only received a response from the Elko and Wells Band councils, which expressed general concerns about environmental contamination to ground and surface waters. This letter is to inform you that the BLM is continuing the consultation process, and we are again asking for your participation in this process.

The BLM has considerable information regarding traditional use by the Western Shoshone of Tosawihi Quarry area and the Rock Creek area. Both of these lie within the area of potential cumulative impact where there may be a temporary drop in regional groundwater tables. The information about traditional use is drawn from ethnographic studies, video tapes of Corbin Harney and others talking about the importance of these areas, books, and archaeological surveys. Although we do not believe it is likely either area will be impacted by the proposed dewatering, we are considering nominating these sites as eligible to the National Register of Historic Places as Traditional Cultural Properties. We feel this may be appropriate because these sites are very important and deemed sacred to the Western Shoshone people and this designation will help emphasize the cultural importance of these sites.

Nominating these localities to the National Register as Traditional Cultural Properties will not fully protect these sites, nor will it preclude mineral exploration and development which is already allowed because of mining claims located under the 1872 Mining Law. However, such a nomination will give the BLM additional leverage to minimize the impacts to these areas despite mining actions which may occur. It will also support the need for mitigation when appropriate.

I would like to meet with members of the Te Moak Tribal Council and elders January 5th to propose our ideas for nominating these areas as Traditional Cultural Properties which are eligible for the National Register, and to request from you additional information regarding concerns you have about sacred areas which may be unknown to the BLM but within the area of potential effect due to mine dewatering. I propose that we meet January 5, 1999, at 9:00am, at the Elko BLM Office. This meeting is not limited to information gathering: it is intended to be an official government-to-government consultation between the BLM and the Te-Moak Tribe.

If you choose not to attend, you may submit written comments to the BLM.

I look forward to your comments.

Sincerely,

Helen Hankins

HELEN M. HANKINS
Field Office Manager

2/9/99

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ELKO FIELD OFFICE
3900 EAST IDAHO STREET
ELKO, Nevada 89801

In Reply Refer To:
BLM1-1738(P)
8100 (NV-010)

KBH 2/9/99

FEB - 9 1999

Certified Mail No. P 213 903 761
Return Receipt Requested

Chairman
Duck Valley Tribal Council
PO Box 219
Owyhee, Nevada 89832

Dear Mr. Chairman:

The Bureau of Land Management is continuing its consultation efforts with the Duck Valley Tribe for mine dewatering associated with Barrick's Betze Pit, and Newmont's South Operations and Leeville Projects. The BLM initiated consultation with the Duck Valley Tribe for these projects via certified letter on October 1, 1998. We requested any information you may have on the effects of the mining operations on sites or places of religious or cultural importance to the Shoshone people. By mid-November, the BLM had not received a response from your tribe. The BLM called your office twice in November, once on November 12 and again on November 16, requesting a response to our letter of October 1. The BLM received no response from your office. The BLM sent you a second letter via certified mail on December 16, 1998. In this letter, we stated that the BLM was continuing its consultation efforts with your tribe, and asked for your participation in consulting with the BLM. In addition, the December 16, 1998 letter stated that the BLM held information about the sacred nature of the Rock Creek and Tosawihi Quarries areas, and we indicated that these areas may qualify for the National Register of Historic Places as Traditional Cultural Properties (TCP's). The letter also invited the Duck Valley Tribal Council and elders to a government-to-government consultation meeting on January 5, 1999, at the Elko Field Office.

At the January 5, 1999 consultation meeting, members of the Duck Valley Tribe, Battle Mountain Band, Wells Band, Elko Band, South Fork Band, Western Shoshone Defense Project, and Western Shoshone Historic Preservation Society were present. The meeting notes were faxed to the tribe on January 6, 1999. It was decided at the January 5, 1999 consultation meeting that the BLM would proceed as expeditiously as possible to formally determine the eligibility of areas near Rock Creek and Tosawihi as TCP's. The BLM disclosed to the group all of the information we had on file regarding the important or sacred nature of these areas to the Western Shoshone people. Representatives of the Western Shoshone present at the meeting agreed to discuss the matter with their tribal councils and elders, and then continue the discussions at the next consultation meeting, which was scheduled for February 2, 1999.

One week prior to the February 2 meeting, the BLM faxed a memo reminding all participants of the February 2 meeting. The memo stated that the February 2 meeting was a consultation meeting for mine dewatering, and outlined the information that the Western Shoshone agreed to discuss at the meeting.

The BLM is committed to protecting cultural resources and areas of cultural and religious significance to the Western Shoshone to the extent possible. The BLM considers the protection of areas important to the Western Shoshone to be a very important component of our mission, but we must also manage public lands in response to other laws and regulations, such as those associated with the rights under the 1872 mining law. During the four month period since initiating consultation, the BLM has received very limited information from the Western Shoshone regarding the importance of the Rock Creek and Tosawihi areas. Since we have received such limited information, the BLM intends to make a determination of eligibility on Rock Creek and Tosawihi as TCP's, and then consult with the Nevada State Historic Preservation Office on our determination by March 30, 1999. Specifically, the BLM intends to determine both Rock Creek and Tosawihi eligible for the National Register as TCP's. Any information you offer before March 30 will be used to strengthen our determination of eligibility.

The BLM is open to working with tribes, bands, and organizations in the future to formally nominate the Rock Creek and Tosawihi areas to the National Register. In addition, we continue to look forward to future consultations on the potential effects of the Barrick and Newmont dewatering operations on these two areas and any other sites or locations which are important to Western Shoshone culture.

We would like to propose that the next consultation meeting on mine dewatering be held March 15, 1999, beginning at 9:00am at the BLM office here in Elko. We look forward to our next consultation meeting on these matters on March 15.

Sincerely,

/S/ David Stout

HELEN HANKINS,
District Manager

cc: Ted Howard
Terry Gibson
Nevada SHPO