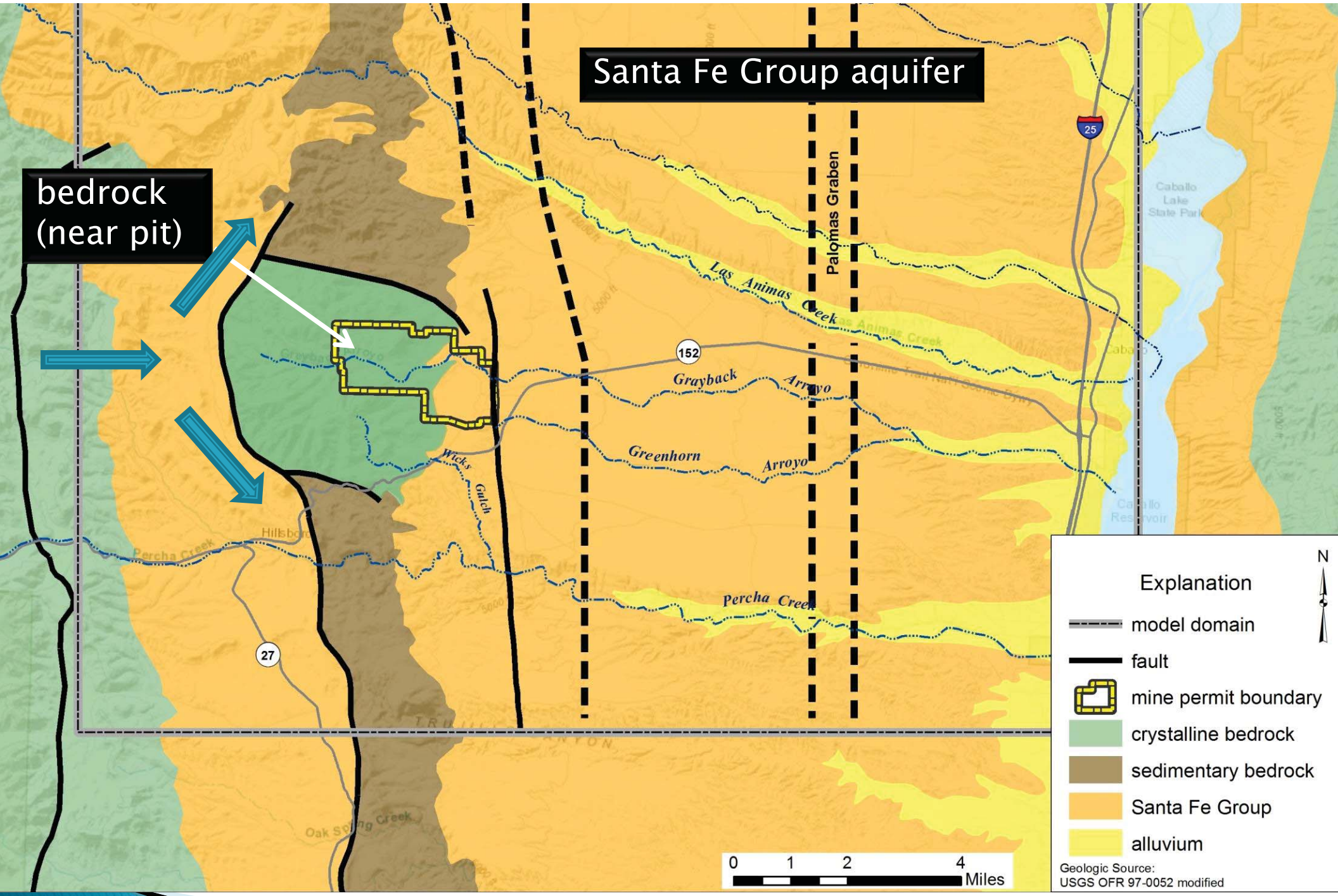
Copper Flat Mine
Discharge Permit DP-1840 Application Rebuttal

Steven T. Finch, Jr., CPG, PG
Principal Hydrogeologist-Geochemist
John Shomaker & Associates, Inc.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS

September 28, 2018

Low Permeability of Andesite

1. Shomaker (1993)
2. Adrian Brown (1996)
3. SRK (1997)
4. JSAI (2011) Stage 1 Abatement Plan Amend
5. INTERA (2012)
6. JSAI (2014) – Stage 1 Abatement report
7. Jones et al. (2014) and NMOSE Review



Regional Groundwater flow (Shomaker, 1993)

JSAI (2011)

Table 2. Summary of wells and well data for the Stage 1 Abatement Plan area of investigation, Copper Flat Mine, Sierra County, New Mexico

well name	well type	facility area	year drilled	casing diameter (inches)	total depth (ft bmp)	screen interval (ft bgl)	measuring-point elevation (2011 survey) (ft amsl)	geologic unit	depth to water measurement date	depth to water (ft bmp)	water-level elevation (ft amsl)
GWQ-1	supply	background region	1972	12 + 14	401	na	5,195.24	Santa Fe Group	6/15/1981	72.00	5,123.24
GWQ-2	supply	background region	1932	8	500	na	5,227.44	Santa Fe Group	11/15/1982	60.00	5,167.44
GWQ-3	supply	waste rock pile	1932	40 x 43	33	na	5,252.60	alluvium/andesite	9/29/2011	18.71	5,233.89
GWQ-4	supply	background region	1948	5	150	na	5,565.85	andesite	11/10/1982	35.00	5,530.85
GWQ-5R	monitoring	waste rock pile	2011	4	120	in progress	*5,410.00*	andesite	9/29/2011	98.91	*5,311.09*
GWQ-6(N)	supply	background region			85		5,395.36	andesite	6/9/1981	26.95	5,368.41
GWQ-6(S)	supply	background region					5,382.77	andesite			
GWQ-7	supply	tailings impoundment	1932	8	500	na	5,181.60	Santa Fe Group	6/15/1981	77.00	5,104.60
GWQ-8	supply	background region	1931	8	157	na	5,216.94	Santa Fe Group	11/15/1982	68.00	5,148.94
GWQ-9	supply	tailings impoundment	1971	14 + 16	767	na	5,208.13	Santa Fe Group	4/15/1972	60.00	5,148.13
GWQ-10	monitoring	tailings impoundment	1981	3	120	na	5,213.29	Santa Fe Group	9/27/2010	23.19	5,190.10
GWQ-11	monitoring	tailings impoundment	1981	3	70	na	5,196.44	alluvium/Santa Fe Group	5/4/2011	20.02	5,176.42
GWQ-12	monitoring	tailings impoundment	1981	3	137	na	5,237.28	Santa Fe Group	5/4/2011	79.71	5,157.57
GWQ94-13	monitoring	tailings impoundment	1994	5	106	74 to 104.5	5,200.47	Santa Fe Group	5/4/2011	13.02	5,187.45
GWQ94-14	monitoring	tailings impoundment	1994	5	159	127.5 to 157.5	5,192.69	Santa Fe Group	5/4/2011	6.42	5,186.27
GWQ94-15	monitoring	tailings impoundment	1994	5	149	112 to 142	5,183.07	Santa Fe Group	5/4/2011	4.92	5,178.15
GWQ94-16	monitoring	tailings impoundment	1994	5	46	25 to 45	5,197.41	alluvium	5/4/2011	21.76	5,175.65
GWQ94-17	monitoring	tailings impoundment	1994	5	151	120 to 150	5,198.13	Santa Fe Group	9/27/2010	10.11	5,188.02
GWQ94-18	monitoring	tailings impoundment	1994	4	51	10 to 50	5,194.83	alluvium	10/15/1994	dry	
GWQ94-19	monitoring	tailings impoundment	1994	4	53	10 to 50	5,203.36	alluvium	9/27/2010	52.22	5,151.14
GWQ94-20	monitoring	tailings impoundment	1994	4	338	288 to 338	5,203.49	Santa Fe Group	1/27/2010	18.05	5,185.44
GWQ94-21A	monitoring	tailings impoundment	1996	[illegible]	263	213 to 263	5,192.71	Santa Fe Group	11/7/1994	4.58	5,188.13
GWQ94-21B	monitoring	tailings impoundment	1996	[illegible]	315	285 to 315	5,192.22	Santa Fe Group	11/7/1994	3.95	5,188.27
GWQ96-22A	monitoring	pit/waste rock pile	1996	[illegible]	244	174 to 244	5,596.17	andesite	8/28/2011	54.63	5,541.54
GWQ96-22B	monitoring	pit/waste rock pile	1996	[illegible]	380	340 to 380	5,595.95	andesite	8/28/2011	54.59	5,541.36
GWQ96-23A	monitoring	pit/waste rock pile	1996	[illegible]	101	50 to 100	5,489.84	monzonite	8/28/2011	40.71	5,449.13
GWQ96-23B	monitoring	pit/waste rock pile	1996	[illegible]	251	150 to 250	5,489.70	monzonite	8/28/2011	40.87	5,448.83
GWQ11-24A	monitoring	pit/waste rock pile	2011	[illegible]	90	60 to 90	*5,514.80*	andesite	8/28/2011	49.86	*5,464.94*
GWQ11-24B	monitoring	pit/waste rock pile	2011	[illegible]	250	230 to 250	*5,514.80*	andesite	8/28/2011	56.69	*5,458.11*
GWQ11-25A	monitoring	pit/waste rock pile	2011	[illegible]	100	70 to 100	*5,532.00*	monzonite	8/28/2011	50.91	*5,481.09*
GWQ11-25B	monitoring	pit/waste rock pile	2011	[illegible]	242	222 to 242	*5,532.00*	monzonite	8/28/2011	62.90	*5,469.10*
IW-1	monitoring	tailings impoundment	1982	4	49	to 49	5,198.99	alluvium	6/24/2010	dry	
IW-2	monitoring	tailings impoundment	1982	4	46	to 45	5,208.01	alluvium	5/4/2011	39.01	5,169.00
IW-3	monitoring	tailings impoundment	1982	4	45	to 45	5,213.17	alluvium	6/24/2010	dry	
NP-1	monitoring	tailings impoundment	1981	4	106	to 106	5,188.75	Santa Fe Group	5/4/2011	30.8	5,157.95
NP-2	monitoring	tailings impoundment	1981	4	110	to 110	5,192.54	Santa Fe Group	5/4/2011	32.92	5,159.62
NP-3	monitoring	tailings impoundment	1981	4	100	to 100	5,199.73	Santa Fe Group	5/4/2011	12.02	5,187.71
NP-4	monitoring	tailings impoundment	1981	4	117	to 117	5,225.73	Santa Fe Group	5/4/2011	35.22	5,190.51
NP-5	monitoring	tailings impoundment	1981	4	39	24 to 39	5,198.81	basalt	5/4/2011	22.63	5,176.18
MW-4	supply	background region	1975	6	1,500	123 to 1,500	*5,125.00*	Santa Fe Group	6/9/1981	123.27	5,001.73
Pague	supply	background region			26		5,550.81	andesite	5/4/2011	11.69	5,539.12
Dolores	supply	background region			56		5,397.51	andesite	11/10/1982	29.7	5,367.81
Paxton Well	supply	background region	1932	40 x 40	30		5,500.00	andesite	11/10/1982	7.6	5,492.40
LRG-4156	supply	background region	1956	6	150		5,431.06	andesite	1956	60	5,371.06
LRG-4158	supply	background region	1955	6	150	na	5,533.03	limestone	11/11/2010	47.01	5,486.02
McCravey-G	supply	background region	1931	8	500	na	5,201.53	Santa Fe Group	11/15/1982	40	5,161.53
LRG-4159	supply	background region	2002	6	200	5 to 200	5,719.70	andesite	11/4/2010	13.56	5,706.14

ft bmp - feet below measuring point
ft bgl - feet below ground level
ft amsl - feet above mean sea level
italic measuring-point elevations are estimated
na - not available

JSAI (2011)

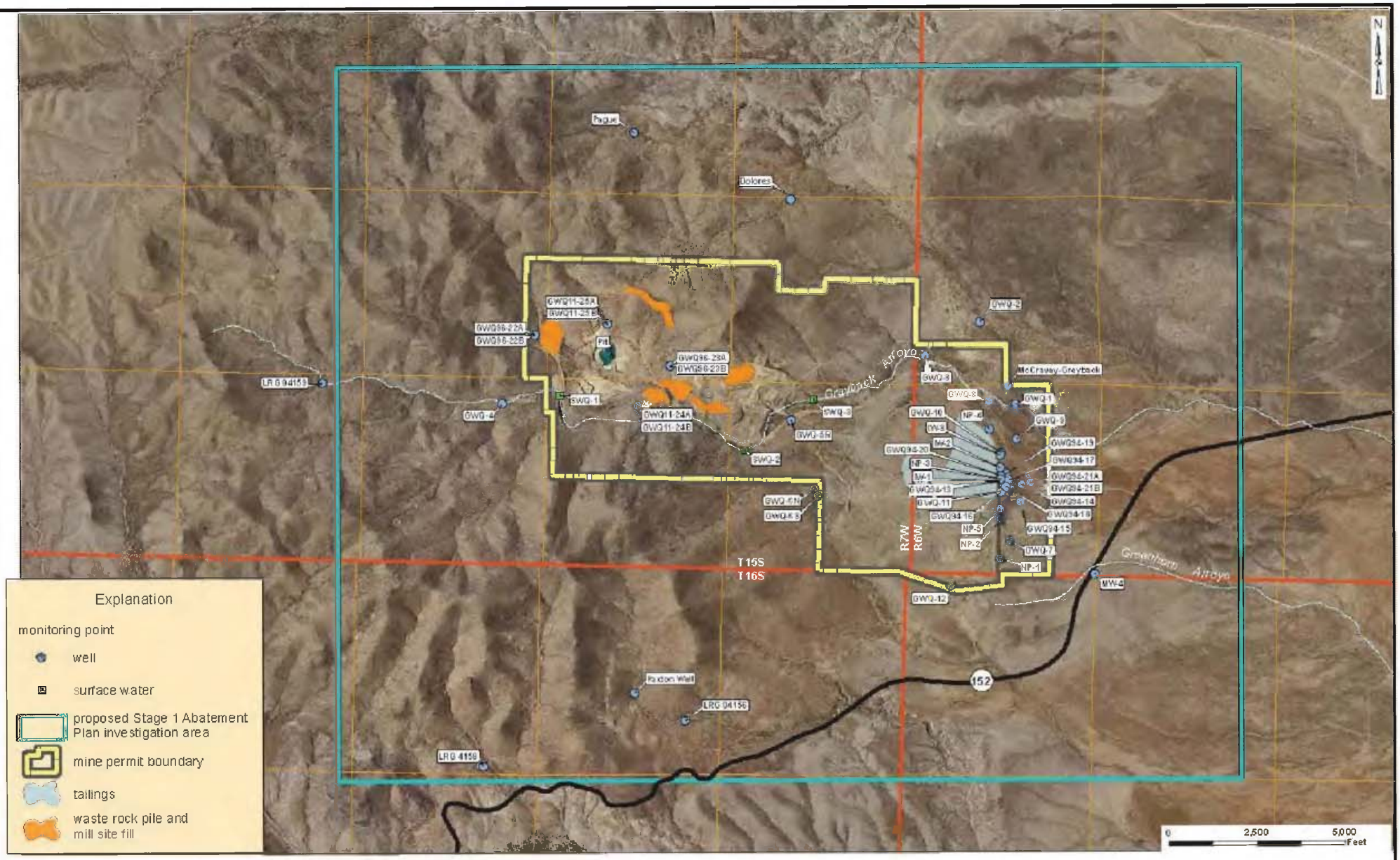


Figure 2. Map of proposed Stage 1 Abatement Plan area of investigation, Copper Flat Mine facilities, and monitoring point locations, Copper Flat Mine, Sierra County, New Mexico.

JSAI (2013)

Table 3. Summary of 1st Quarter 2013 field data and sample collection methods

monitoring point	sample list	casing diameter (in.)	date sampled	temp. (°C)	pH	conductivity (µS/cm)	depth to water (ft)	volume purged (gal)	comments
pit area									
GWQ96-22A	A	2	1/9/2013	15.5	7.41	679	54.31	17	pumped off, micropurge sample in screen
GWQ96-22B	A	2	1/9/2013	19.1	6.85	1,038	53.96	6	pumped off, sampled w/ bailer after recovered
GWQ96-23A	A	2	1/11/2013	17.1	7.46	878	41.14	5	pumped off, sampled w/ bailer after recovered
GWQ96-23B	A	2	1/11/2013	16.2	7.16	737	41.16	13	pumped off, sampled w/ sample pump after recovered
GWQ11-24A	A	2	1/8/2013	18.0	4.08	2,807	57.62	20	
GWQ11-24B	A	2	1/9/2013	18.0	6.72	1,904	61.30	30	parameters stable-sampled after 1 well vol.
GWQ11-25A	A	2	1/9/2013	16.5	3.63	6,410	70.00	8	pumped off, sampled w/ bailer after recovered
GWQ11-25B	A	2	1/9/2013	19.8	6.28	2,390	72.06	84	
GWQ11-26	A	4	1/8/2013	17.4	6.81	735	41.30	8	
pit water	A	-	1/9/2013	4.3	7.32	10,510	surface water	grab sample	
pit wall seep	A	-	1/9/2013	-	-	-	-	-	no seep observed

µS/cm - microSiemens per centimeter

East Animas Fault As Barrier
– Hydraulic Response to 1982 unlined TSF Jones et al (2014)

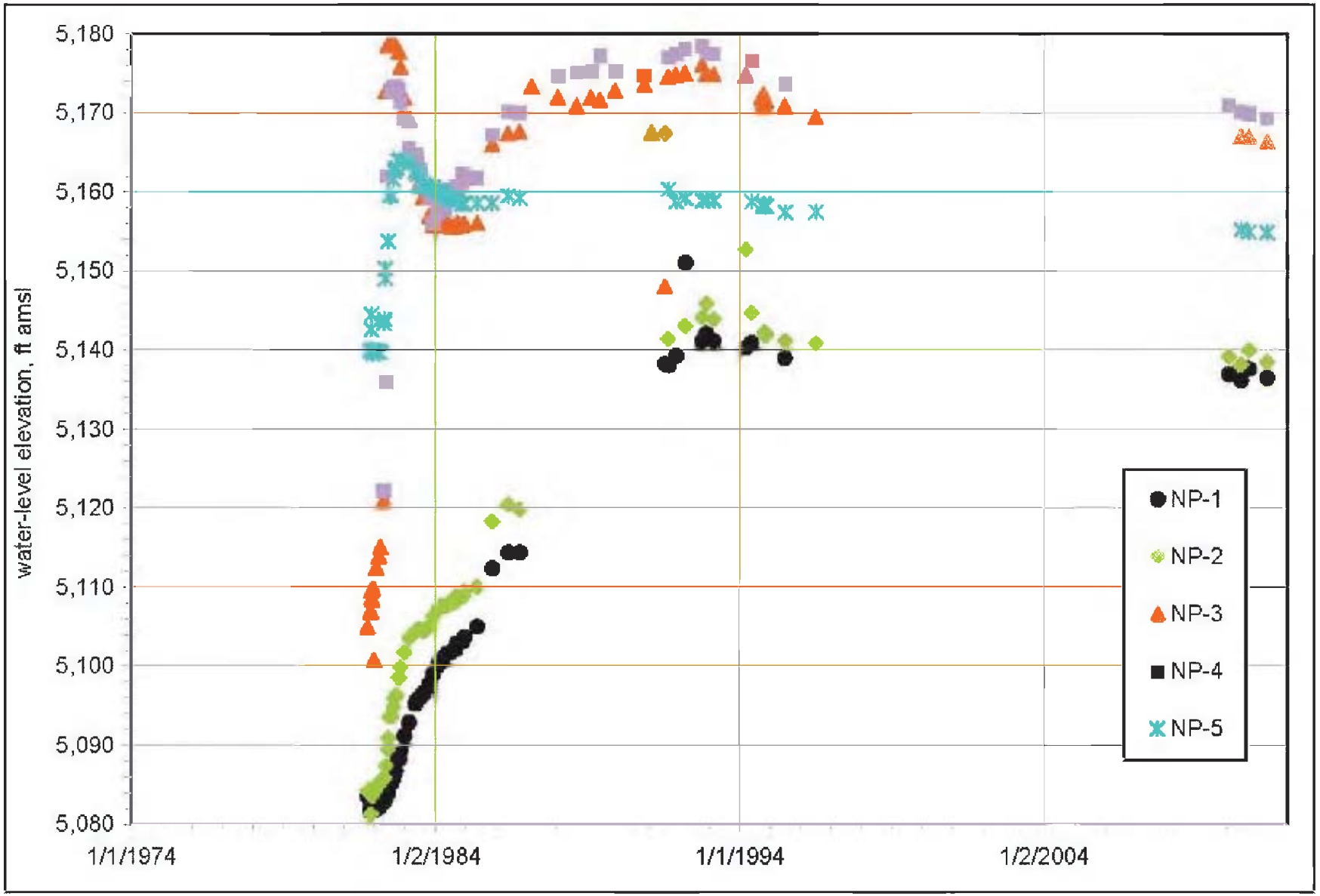


Figure 5.16. Tailings-area water levels.

TSF Hydrogeologic Cross-Section
JSAI (2014) Stage 1 Abatement Report Fig 9

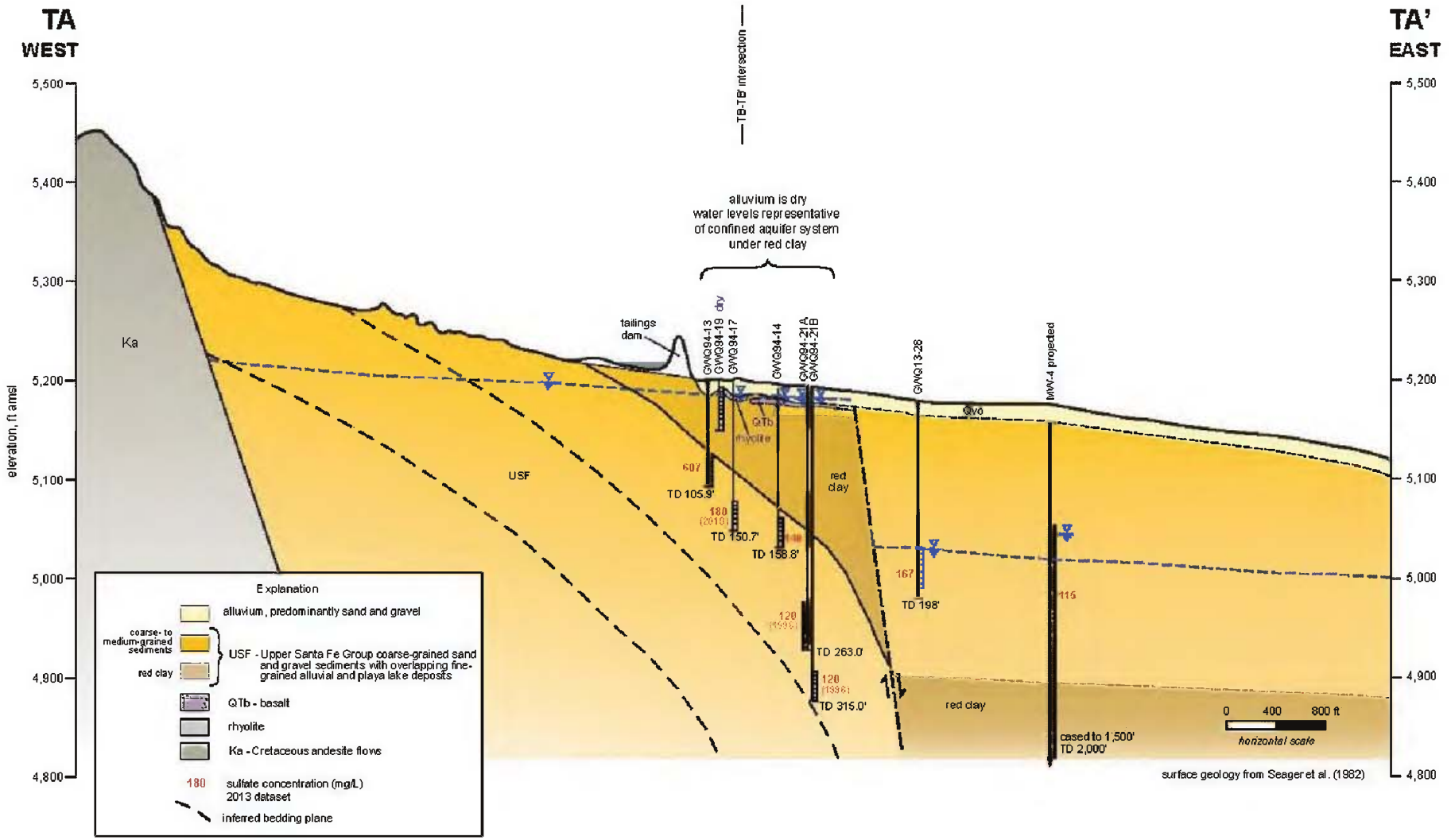


Figure 9. West to east hydrogeologic cross-section TA-TA' through the tailings storage facility (TSF) area, Copper Flat Mine, Sierra County, New Mexico.

TSF Hydrogeologic Cross-Section
JSAI (2014) Stage 1 Abatement Report Fig 9