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MINE ENGINEERING
MINE RECLAMATION
CIVIL ENGINEERING
CONST. MANAGEMENT

February 28, 2021

Rob Zuber
Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

Re: 2019 Annual Hydrology Report
Adequacy Review #1
Bowie Resources, LLC, Bowie No. 2 Mine
Permit No. C-1996-083

Dear Mr. Zuber:

On behalf of Bowie Resources, LLC, below are the responses to DRMS' adequacy review letter dated August 10, 2020;

1. **DRMS:** It is not clear to me why some parameters in the surface water list in the Hydrologic Monitoring Plan of the PAP are not included in the 2019 AHR data.

- In the data for SP-20 (Table 8), laboratory analysis was conducted for the May sample but not the August sample when flow was greater than 5 gpm. Please explain.
- Dissolved Oxygen was not analyzed for the Deer Trail, Fire Mountain Canal, or North Fork sites. Please explain or perform these analyses for these sites later this year.
- Oil and Grease and Phosphate were not analyzed for Deer Trail sites. Please explain or perform these analyses for these sites later this year.
- Dissolved iron and other parameters are missing from the dataset for SW-01. Please explain or perform these analyses for these sites later this year.

BRL:

- Please see attached **Table 8**, the laboratory data for August was inadvertently left off.
- A dissolved Oxygen meter was obtained and the Operator will begin taking readings in 2020.
- In March of 2019, Surface Water list 1 parameters were used for the laboratory analysis, and in August, Table 2 parameters were used for laboratory analysis. Surface Water list 2 parameter do not include Oil and Grease, or Phosphorus. It appears the <MDL input into the August column should have been input into the March 2019 column. Please see revised **Table 68.** In addition, Oil and Grease was inadvertently left off of Deer Trail

Upper, please see revised **Table 70.**

- Dissolved Iron, Calcium, Magnesium, Sodium and Hardness were added to the laboratory data for SW-01. Please see revised **Table 86.**

2. **DRMS: A dissolved arsenic value for AW-1, 0.05 mg/L, is above the standard of 0.01 mg/L.** Per the AW-1 data in Table 107 of the 2019 AHR, this is a common occurrence, as the average concentration during the period of operation of the mine is 0.09 mg/L. The baseline data in Table 107 shows much lower concentrations, with an average and maximum of 0.001 mg/L. Therefore, this is a potential water quality issue caused by operations at the Bowie No. 2 Mine. **Please provide a discussion of this parameter in the context of the data and the CDPHE standard.**

BRL: Arsenic levels in AW-1 have been sporadic since the well's inception in 1997, and, in comparison to the Regulation No. 41 standard for domestic drinking water appear to be very high. However, it is worth noting that the baseline levels of Arsenic for DH-67abv show a maximum value of 0.415 mg/L. Baseline levels for Arsenic in DH-67B show a maximum level of 0.55 mg/L. Baseline levels of Arsenic for DH 67D have a maximum arsenic level of 0.915 mg/L. These are wells that have never been impacted by mining and demonstrate an inherent level of Arsenic within them. So, these are either laboratory errors, or the soils within and around the mine site do contain Arsenic.

In evaluating AW-1, values between 1997 and 2019 varied between <MDL to a high value of 0.553 in 2009. However, the elevated Arsenic level is not a consistent upward trend within the well, and when graphed in excel, the values actually trend down, which demonstrates there is no long-term degradation of the groundwater. In the last ten years, there have only been two values of Arsenic which have exceeded the standard. And since this response is being written in 2022, I can add that laboratory data for the 2020 and 2021 AHR show no Arsenic in the well.

In the future, the Operator will pay close attention to the laboratory data on Arsenic and will note any exceedances in the Annual Hydrology Report.

Please feel free to contact me if you have any questions.

Sincerely,

Tamme Bishop

Tamme Bishop, P.E.
Project Engineer

SP20
Terror Creek - Pond Spring 20
Depth 4'
Elevation - 7840

Initiated	5/15/1983	5/15/1983	5/15/1983
Activated	6/30/2013	6/30/2013	6/30/2013
Date	11/19/2019	8/27/2019	5/14/2019

		Summary Information								
Field		Baseline			Operation					
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max			
Outflow	GPM	0.0	0.6	2.3	0.0	7.2	42.2	0.00	5.55	1.80
Inflow	GPM	0.0	3.5	37.5	0.6	11.8	45.0	1.8	5.15	2.3
Freeboard	Feet	0.0	0.0	0.8	0.0	0.0	0.0			
Temperature	Celsius	2.0	8.8	27.7	6.7	8.1	9.8	8.6	8.9	9.3
Conductivity	umhos/cm	250.0	471.2	674.0	460.0	587.4	649.0	649	619	601
pH	su	5.3	7.5	8.9	7.0	7.4	7.9	7.71	7.9	7.46
Field Comments										
Lab Parameters	UNITS									
Bicarbonate	mg/L	144.7	289.9	342.0	247.4	331.1	385.0		335	329
Chloride	mg/L	0.0	5.0	28.3	2.3	2.7	4.6		2.5	2.5
Conductivity	umhos/cm	311.5	513.5	714.0	465.0	517.1	591.0		465	513
Hardness	mg/L	108.0	207.6	511.9	197.0	223.6	243.0		226	226
Nitrate-Nitrite	mg/L	<MDL	0.3	0.3	<MDL	<MDL	0.1		<MDL	<MDL
Oil and Grease	mg/L	<MDL	<MDL	0.0	<MDL	<MDL	0.0		<MDL	<MDL
pH	su	6.7	7.4	8.5	7.0	7.5	8.0		7.7	7.82
Phosphate	mg/L	<MDL	<MDL	0.0	<MDL	0.0	0.0		0.034	0.023
ResidueFilterable-TDS	mg/L	240.0	318.8	460.0	337.0	357.5	438.0		349	352
ResidueNonFilterable-TSS	mg/L	<MDL	88.9	1800.0	<MDL	9.0	9.0		<MDL	<MDL
SAR		0.5	1.3	2.3	1.2	1.8	5.4		1.24	1.26
Sulfate	mg/L	0.8	12.5	60.0	0.0	28.8	34.2		31.4	34.2
Aluminum (TREC)	mg/L	<MDL	0.2	0.5	<MDL	93.1	186.0		<MDL	<MDL
Arsenic (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL
Cadmium (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL
Calcium (TREC)	mg/L	36.3	69.1	128.3	42.1	53.6	59.8		54.2	54.9
Copper (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL
Iron (TREC)	mg/L	0.0	0.1	0.2	0.0	0.1	0.3		<MDL	0.03
Lead (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL
Magnesium (TREC)	mg/L	17.2	28.6	46.5	20.2	21.8	22.9		22.1	21.5
Manganese (TREC)	mg/L	<MDL	0.0	0.0	<MDL	7.7	23.0		<MDL	<MDL
Mercury (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL
Molybdenum (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		0.0173	<MDL
Selenium (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL
Sodium (TREC)	mg/L	40.2	47.6	53.1	43.5	52.0	124.8		49.2	43.5
Zinc (TREC)	mg/L	<MDL	0.0	0.0	<MDL	0.0	0.0		<MDL	<MDL

Activated 6/30/2013

This spring and pond consists of an area of approximately 20' x 20' of diffuse flow which is collected in a pond of approximately 30' x 60'. (Hanna, 99)

Baseline Information Collection initieated on 5/15/83 and not yet considered complete.
Point SP20 has not been influenced by mining.

Deer-low
Canal - Deer Trail Ditch
Elevation - 5920

Initiated								6/14/1995	6/14/1995	6/14/1995	6/14/1995
Activated								3/30/1997	3/30/1997	3/30/1997	3/30/1997
Date								10/22/2019	8/8/2019	5/2/2019	3/26/2019
		Summary Information									
Field		Baseline			Operation						
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max				
Flow	GPM	0	8	32	0	6	83		0.23	0.08	
Water Level in Flume	Feet				0.00	0.12	0.40		0.1	0.05	
FieldComment								Dry			Dry
ph	su	6.8	8.3	9.0	7.1	8.4	9.2		8.4	7.9	
Conductivity	umhos/cm	80	276	638	60	222	720		262	131	
Temperature	Celsius	4.9	13.1	21.2	3.1	11.1	21.5		19.7	7.8	
DO	mg/L	0.0	3.7	10.7	0.0	6.6	12.1				
Lab Parameters	UNITS										
Bicarbonate	mg/L	41	70	118	39	92	127			61.6	
Chloride	mg/L	<MDL	1	2	<MDL	1.7	4.0		0.93	1	
Chromium III CrIII	mg/L				<MDL	<MDL	<MDL		<MDL		
Chromium VI CrIV	mg/L				<MDL	<MDL	<MDL		<MDL		
Cyanide, Total	mg/L				<MDL	<MDL	<MDL		<MDL		
Conductivity	umhos/cm	97	148	238	98	190	308			109	
Hardness	mg/L	48	67	96	33	83	119		113	55.4	
Nitrate-Nitrite	mg/L	<MDL	0.07	0.17	<MDL	0.01	0.04		<MDL	<MDL	
Nitrate	mg/L	<MDL	0.08	0.17	<MDL	0.47	2.69		<MDL	0.1	
Nitrite	mg/L	<MDL	0.01	0.02	<MDL	0.00	0.01		<MDL	<MDL	
Dissolved Oxygen		0	0	0	<MDL	7.93	7.95		7.9	7.95	
Ammonia	mg/L				0.10	0.18	0.25		<MDL		
Oil and Grease	mg/L	<MDL	<MDL	<MDL	<MDL	2	2			<MDL	
pH	su	7.5	7.8	8.0	7.7	8.1	8.6		8.35	7.89	
Phosphate	mg/L	<MDL	0.03	0.08	<MDL	0.03	0.08			0.057	
ResidueFilterable-TDS	mg/L	30	93	150	70	167	302		156	146	
ResidueNonFilterable-TSS	mg/L	6	101	286	<MDL	16	41			16	
SAR		0.21	0.38	0.68	<MDL	0.86	6.50			0.289	
Sulfate	mg/L	<MDL	7	10	<MDL	10	20		8.8	6.2	
Sulfide S	mg/L				<MDL	<MDL	<MDL		<MDL		
Aluminum (TREC)	mg/L	0.25	3.03	7.68	0.14	0.61	1.58			1.58	
Arsenic (TREC)	mg/L	<MDL	0.001	0.002	<MDL	0.0024	0.0150		<MDL	<MDL	
Boron	mg/L				0.78	0.78	0.78		<MDL		
Cadmium (TREC)	mg/L	<MDL	0.001	0.003	<MDL	0.01	0.05		<MDL	<MDL	
Calcium (TREC)	mg/L	13.4	18.8	26.9	9.1	22.9	33.8		32.3	16	
Copper (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.004	0.017		<MDL	<MDL	
Iron (Dissolved)	mg/L	<MDL	<MDL	<MDL	<MDL	0.06	0.15		0.0537	0.122	
Iron (TREC)	mg/L	0.45	3.83	9.79	0.10	0.80	5.29		5.29	1.69	
Lead (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.0074	0.0400		<MDL	<MDL	
Magnesium (TREC)	mg/L	3.4	4.9	6.9	2.5	6.1	8.6		7.85	3.74	
Manganese (Dissolved)	mg/L	<MDL	<MDL	<MDL	<MDL	1.6	6.2		<MDL		
Manganese (TREC)	mg/L	0.012	0.075	0.193	0.001	0.041	0.166		0.166	0.031	
Mercury (TREC)	mg/L	<MDL	0.00007	0.0002	<MDL	0.00005	0.0002		<MDL	<MDL	
Molyebdenum (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.0003	0.0010			<MDL	
Nickel	mg/L				<MDL	<MDL	<MDL		<MDL		
Selenium (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.002	0.010		<MDL	<MDL	
Silver	mg/L				<MDL	<MDL	<MDL		<MDL		
Sodium (TREC)	mg/L	3.7	7.6	15.3	3.9	10.9	31.5			5.0	
Zinc (TREC)	mg/L	0.03	0.03	0.04	<MDL	0.02	0.05		0.0337	<MDL	

The lower end of Deer Trail Ditch is monitored at a point where the ditch empties into the Fire Mountain Canal.

Baseline Information for Point Deer-low is derived from events beginning on 6/14/95 through 3/30/97.
Point influenced by mining on 3/30/97.

Deer-up
Canal - Deer Trail Ditch
Elevation - 5960

Initiated	6/14/1995	6/14/1995	6/14/1995	6/14/1995
Activated	3/30/1997	3/30/1997	3/30/1997	3/30/1997
Date	10/22/2019	8/8/2019	5/2/2019	3/26/2019

		Summary Information									
Field		Baseline			Operation						
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max				
Flow	CFS	0.8	1.8	3.5	0.1	1.6	4.8	0.23	1.24	1.93	
Water Level in Flume	Feet	0.23	0.37	0.59	0.05	0.35	0.72	0.1	0.3	0.4	
FieldComment											Dry
ph	su	6.4	8.5	9.1	7.4	8.4	9.1	7.9	8.6	8.0	
Conductivity	umhos/cm	70	286	668	50	213	440	272	263	133	
Temperature	Celsius	0.8	11.4	20.3	0.2	9.6	22.1	1.5	17.4	3.9	
DO	mg/L	0.0	3.5	7.7	0.0	9.1	12.0				
Lab											
Parameters	UNITS										
Bicarbonate	mg/L	51.0	73.0	117.0	-42.5	104.9	176.0			-42.5	
Hydroxide	mg/L	0	0	0	0	0	0				
Chloride	mg/L	<MDL	1.67	3.00	<MDL	20.73	190.50		1.1	1.1	
Chromium III CrIII	mg/L				<MDL	<MDL	<MDL		<MDL		
Chromium VI CrIV	mg/L				<MDL	0.01	0.01		<MDL		
Cyanide, Total	mg/L				<MDL	<MDL	<MDL		<MDL		
Conductivity	umhos/cm	100	148	235	85	251	573			105	
Hardness	mg/L	42	61	94	<MDL	97	168		106	52.6	
Nitrate-Nitrite	mg/L	<MDL	0.02	0.07	<MDL	0.20	1.25			<MDL	
Nitrate	mg/L	<MDL	0.02	0.07	<MDL	0.33	2.87		0.011	0.1	
Nitrite	mg/L	<MDL	0.01	0.02	<MDL	0.003	0.016		<MDL	<MDL	
Dissolved Oxygen	mg/L	0	0.00	0.00	<MDL	9.375	10.850		7.9	10.85	
Ammonia	mg/L				<MDL	0.149	0.290		<MDL		
Oil and Grease	mg/L				<MDL	4.3	5.5			<MDL	
pH	su	7.6	7.8	8.1	6.4	8.0	8.7		8.4		
Phosphate	mg/L	<MDL	0.01	0.03	<MDL	7.07	141.00			0.052	
ResidueFilterable-TDS	mg/L	50	100	150	60	187	475		160	116	
ResidueNonFilterable-TSS	mg/L	<MDL	25	52	<MDL	12	40			19	
SAR		0.24	0.37	0.62	<MDL	0.74	2.29			0.31	
Sulfate	mg/L	<MDL	10	20	<MDL	12.4	37.5		9.1	5.9	
Sulfide S	mg/L				<MDL	0.13	0.13		<MDL		
Aluminum (TREC)	mg/L	0.24	1.09	1.77	<MDL	0.35	2.03			0.742	
Arsenic (TREC)	mg/L	<MDL	0.0003	0.0010	<MDL	0.0054	0.0300		<MDL	<MDL	
Boron	mg/L				<MDL	0.82	1.40		<MDL		
Cadmium (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.006	0.040		<MDL	<MDL	
Calcium (TREC)	mg/L	11.8	17.2	26.5	8.29	28.92	134.00		30.6	15	
Copper (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.004	0.019		<MDL	<MDL	
Iron (Dissolved)	mg/L	<MDL	<MDL	<MDL	<MDL	0.07	0.25		0.0493	0.193	
Iron (TREC)	mg/L	0.38	1.19	1.85	0.03	11.62	618.00		<MDL	0.76	
Lead (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.0104	0.1000		<MDL	<MDL	
Magnesium (TREC)	mg/L	3.0	4.4	6.7	2.5	7.8	17.6		7.1	3.9	
Manganese (Dissolved)	mg/L	<MDL	<MDL	<MDL	<MDL	0.8	6.7		<MDL		
Manganese (TREC)	mg/L	0.02	0.03	0.03	0.002	0.926	26.700		0.0223	0.0281	
Mercury (TREC)	mg/L	<MDL	0.0001	0.0002	<MDL	0.00007	0.0004		<MDL	<MDL	
Molyebdenum (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.003	0.011			<MDL	
Nickel	mg/L				<MDL	0.0088	0.0120		<MDL		
Selenium (TREC)	mg/L	<MDL	<MDL	<MDL	<MDL	0.0039	0.0230		<MDL	<MDL	
Silver	mg/L				<MDL	0.0030	0.0030		<MDL		
Sodium (TREC)	mg/L	3.6	7.1	13.8	3.8	19.0	66.5			5.4	
Zinc (TREC)	mg/L	0.01	0.02	0.03	<MDL	0.01	0.04		<MDL	<MDL	

The upper end of Deer Trail Ditch is monitored at the headgate located on Hubbard Creek. This monitoring point is fitted with a 2' Parshall Flume.

Negative Acidity value indicates equivalent value of alkalinity

Baseline Information for Point Deer-up is derived from events beginning on 6/14/95 through 3/30/97.
Point influenced by mining on 3/30/97.

SW-01
West Terror Creek - Downstream
Elevation - 7140

Initiated								10/24/2013	10/24/2013	10/24/2013
Activated										
Date								10/22/2019	8/7/2019	5/14/2019
		Summary Information								
Field		Baseline			Operation					
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max			
Flow	CFS	0.29	4.17	52.00				0.99	2.74	10.62
Water Level in Flume	Feet	0.100	0.632	2.000				0.4	0.78	1.9
Temperature	Celsius	0	6.5	20.2				0.2	17.5	7.0
Conductivity	umhos/cm	81.3	137	190				161.5	111.5	81.3
pH	su	7.56	8.2	8.9				8.15	8.32	8.12
Field Comments										
Lab Parameters	UNITS									
Bicarbonate	mg/L	41.6	73.2	90.6						41.6
Chloride	mg/L	0.56	0.85	1.30						0.58
Conductivity	umhos/cm	65.4	109	139						65.4
Hardness	mg/L	33.2	54.48	69.90						33.2
Acidity	mg/L	-76	-54.44	-25.00						-25
Nitrate-Nitrite	mg/L	<MDL	<MDL	<MDL						<MDL
Oil and Grease	mg/L	<MDL	<MDL	<MDL						<MDL
Phosphate	mg/L	0.017	0.06	0.23						0.049
ResidueFilterable-TDS	mg/L	86.7	104	144						92
ResidueNonFilterable-TSS	mg/L	<MDL	15	34						23.8
SAR		0.226	0.330	0.505						0.23
Sulfate	mg/L	1.8	3.2	4.7						1.8
Aluminum (TREC)	mg/L	<MDL	9.036	101.000						1.76
Arsenic (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Cadmium (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Calcium (TREC)	mg/L	8.6	14.1	18.0						8.57
Calcium (Dissolved)	mg/L	8.4	14.8	18.2						8.41
Copper (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Iron (Dissolved)	mg/L	0.0310	3.5906	41.6000						0.32
Iron (TREC)	mg/L	0.074	0.458	1.430						1.43
Lead (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Magnesium (TREC)	mg/L	2.87	4.68	6.07						2.87
Magnesium (Dissolved)	mg/L	3.02	4.91	6.09						3.02
Manganese (TREC)	mg/L	0.0058	0.0147	0.0334						0.0334
Mercury (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Molybdenum (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Selenium (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL
Sodium (TREC)	mg/L	3.37	5.69	8.50						3.37
Sodium (Dissolved)	mg/L	3.06	5.53	8.66						3.06
Zinc (TREC)	mg/L	<MDL	<MDL	<MDL						<MDL

The area of concern for monitoring point SW-01 has not been affected by the mining operation. Therefore, all recorded monitoring events are considered Baseline.
Negative acidity value indicates equivalent value of alkalinity