

0023

*Outgoing
c/015/0025*

From: April Abate
To: Melissa
CC: Jim Smith; OGMCOAL@utah.gov
Date: 2/19/2009 1:07 PM
Subject: Re: Bear Canyon 4th Quarter Water Monitoring
Place: OGMCOAL@utah.gov
Attachments: Bear Cyn MRP Water Monitoring Plan.pdf; April Abate.vcf

&

Hi Melissa,

I will be working on preparing your 4th quarter water quality report for Bear Canyon this time around. A couple of things:

1. Sample CK-2 is still in the pipeline and is just awaiting your quality control check off in the database. Once you check it off, that will enable us to download the data.
2. Based on your email to Jim below, I think there is some confusion about when to sample for baseline. I looked up your water monitoring requirements in the Bear Canyon MRP (refer to the attached document). According to the text on page 7-57, three years of baseline sampling is to be completed on all newly added sample locations. According to Tables 7-14A and 7-14B, there are several surface and groundwater sample locations added in May 2007 that would fall under that 3 year requirement for baseline sampling; hopefully you are doing sampling them for baseline now. You'll note that the CK-1 and CK-2 were added in 1994, so those are NOT required samples for baseline at the present time.
3. We do require that baseline parameters are resampled in August of year 5 of your permit term prior to renewal. This means that you are due to resample baseline parameters for all samples in August 2010, since your current permit expires November 2, 2010.

I'm happy to discuss this with you further if you have additional questions. Just out of curiosity, have you considered hiring an outside consultant to do your water monitoring?

Regards,
April

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>>> Melissa <melissa.reynolds@hiawathacoal.com> 2/11/2009 2:12 PM >>>

Jim,
Bear Canyon 4th Quarter Water Monitoring is in the pipeline and ready to be uploaded. I have double checked all parameters and all sites that required baseline have the base line done except CK-1 and CK-2. It was an error on the person who filled out the chain of custody forms. I have been told that the MRP states that we will do baseline for 3 years prior to mining in that area and it will be a while before we are in that area but we will make sure we have the chain of custody forms for CK-1 and CK-2 sites filled out will the baseline parameters.

Thanks,
Melissa Reynolds

(PS: Any thing that you have been sending or talking to lori Voorhees about will need to go to myself or Shawn Baker)

As discussed in Appendix 7-J, section 9-1, hydrocarbons in the form of oil and fuel are stored at the mine site. A spill prevention control and counter measures plan is maintained onsite-outlining controls to prevent and mitigate any hydrocarbon spills. Within six months of the implementation of the Wild Horse Ridge facilities construction, this plan will be updated to reflect the controls for the new facilities. If any state appropriated water rights are impacted in the future C. W. Mining will meet with the water right holder and the Division and develop a site specific water replacement plan.

Water Monitoring

Groundwater Monitoring Plan

Monitoring activities are designed to determine water levels, discharge and water quality fluctuations in relevant aquifers or groundwater occurrences in the mine area. Data is collected from mine sumps, from monitoring wells within the mine, observation wells on the surface, and springs. The objectives are to identify potential impacts during and after mining and, provide continuing data on the areas aquifer characteristics and groundwater occurrences. A recommended water-monitoring program is included in Appendix 7-J, section 10.0. The current approved water monitoring program is shown in Table 7-14.

Springs below the mine will be sampled to determine discharge and water quality parameters and their possible variation with time. These springs include SBC-14, Big Bear Springs, COP Development Springs, and Birch Springs (Plate 7-4). Periodic checks will be made of the mine area to determine any impact not currently expressed at the surface. This data

will be used to estimate seasonal fluctuations, aquifer recharge and consistent long-term changes and to ensure that no impacts occur. Springs above the mine will be monitored for field parameters, since the potential for impact to these springs is quantity rather than quality. SBC-9A and SBC-4 will be monitored for lead quality.

Groundwater monitoring will follow the ground water sampling guidelines as shown in Table 7-12 using the water quality parameter list in Table 7-13. These tables follow the recommendations presented in Appendix 7-J. New significant occurrences within the present permit area will be promptly included in the sampling program, as specified by state requirements. Operational ground water monitoring will continue through reclamation to Bond Release.

The sampling matrix for each of the existing monitoring stations during the operational phase of mining is included in Table 7-14. Baseline samples were collected for SBC-14, SBC-15, SBC-16, SBC-17, MW-114 and MW-117 in 2001.

Three years of baseline will be collected on all additional sites added after 2001.

Temporary Drill Hole Seals. Within 30 days of completion, drill holes utilized for groundwater monitoring will be sealed in a nonpermanent fashion by installing PVC surface casing with a threaded cap for access.

Annual Report. An Annual Report evaluating all data collected for the year will be submitted to DOGM as required.

Quarterly Data Submission. All water monitoring data will be submitted to DOGM on a quarterly basis within 90 days or less of quarterly sampling collection.

DH-1A, DH-2, DH-3. Three observation wells, DH-1A, DH-2, DH-3, were installed in 1992 (Plate 7-4). These wells are for the collection of piezometric surface and water quality data from the Spring Canyon tongue of the Star Point Sandstone, and are located such as to determine the extent or occurrence of groundwater within the depths of potential impact of the mining activities on the groundwater regime. Construction and Development of these wells are discussed in Appendix 7-N. In 1993 DH-3 was abandoned and was replaced by DH-4, shown on Plate 7-4.

Groundwater encountered in these wells will be sampled as specified above along with the other locations and used to correlate with the water quality data from Bear Springs, COP Development Springs, Huntington Spring, and Birch Springs to provide a check on estimates of groundwater contamination. These springs were selected since their flow is the sole use of groundwater to be possibly affected by mining activities in the permit area. Discussion of initial data gathered in 1992 from the wells is found in Appendix 7-J (PHC) and Appendix 7-N.

Table 7-12 Ground Water Sampling

	Baseline Monitoring	Operational Monitoring	Post-mining Monitoring
Type of Sampling site	Springs, In-Mine Flows, Boreholes, Observation Wells.	Springs, In-Mine Flows, Boreholes, Observation Wells.	Springs, Observation Wells, Mine discharge points.
Field Measurements and Parameters (Table 7.1-7)	Water levels and/or flow and water quality	Water levels and/or flow and water quality	Water levels and/or flow and water quality
Sample Frequency Each site	<u>Quarterly</u> Adequate to describe seasonal variation. <u>Monthly</u> recommended for more accurate description of seasonal variation.	<u>Quarterly</u> samples springs and wells; In-mine flows <u>at initial interception, quarterly after 1st 30 days until diminished.</u> From sumps and/or mine discharge points <u>quarterly or as required by UPDES.</u>	<u>Quarterly</u> based on potential impact; or <u>once per annum</u> (spring sampling at low flow).
Sampling Duration	<u>Three</u> years (Prior to mining in the area).	<u>Every</u> year until two years after surface reclamation activities have ceased. Sites will be monitored 4 times a year.	Until termination of bonding.
Type of Data Collected and Reported	Wells and Boreholes: Water quality, water level of flow logs, collar elevation; ground elevations; screened interval; formation where completed; depth. Springs: Water quality, location, and flow.	Wells and boreholes: Water quality, water level or flow. Springs: Flow and water quality with one sample taken at low flow.	Wells and Boreholes: Water quality, water level or flow. Springs: Flow, water quality with one sample taken at low flow. <u>Phase I:</u> Whether pollution of surface and subsurface water is occurring, the probability of future occurrence, and estimated cost of abatement. <u>Phase II:</u> After revegetation has been established and contributing suspended solids to streamflow or runoff outside the permit area is not excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751. <u>Phase III:</u> Until reclamation requirements of the Act and the permit are fully met.
Comments	Springs and seeps should be measured from source at high and low flow periods.	During the year preceding re-permitting. Springs, one water quality sample at low flow for baseline parameters. Other sites, one sample for baseline parameter.	

Table 7-13 Ground Water Quality Parameter List

Field Measurements:

- 1 * ✓ - Water Levels or Flow ✓
- 2 * ✓ - pH ✓
- 3 * ✓ - Specific Conductivity (umhos/cm) ✓
- 4 * - Temperature (C) ✓

Laboratory Measurements: (mg/l) (Major, minor ions and trace elements are to be analyzed in dissolved form only.)

- 5 * ✓ - Total Dissolved Solids ✓
- 6 * ✓ - Total Hardness (as CaCO₃) ✓
- - Aluminum (Al) ✓
- - Arsenic (As) ✓
- 7 * ✓ - Carbonate (CO₃²⁻)
- 8 * - Cation-anion balance ✓
- - Boron (B) ✓
- 9 * ✓ - Bicarbonate (HCO₃⁻)
- - Cadmium (Cd) ✓
- 10 * ✓ - Calcium (Ca)
- 11 * ✓ - Chloride (Cl⁻)
- - Copper (Cu) ✓
- 12 & 13 * ✓ ✓ - Iron (Fe) ✓ (Total and Dissolved)
- 21 - † - Lead (Pb) ✓
- 14 * ✓ - Magnesium (Mg)
- 15 & 16 * ✓ ✓ - Manganese (Mn) ✓ (Total and Dissolved)
- - Molybdenum (Mo) ✓
- - Nitrogen: Ammonia (NH₃) ✓
- - Nitrite (NO₂) ✓
- - Nitrate (NO₃⁻) ✓
- 17 * ✓ - Potassium (K) ✓
- - Phosphate (PO₄³⁻) ✓
- - Selenium (Se) ✓
- 18 * ✓ - Sodium (Na) ✓
- 19 * ✓ - Specific Conductivity (umhos/cm) ✓
- 20 * ✓ - Sulfate (SO₄²⁻) ✓
- - Zinc (Zn) ✓

Sampling Period:

- Baseline

*Operational, Post-mining

†Quarterly for site SBC-9A and SBC-4

Table 7-14 Water Monitoring Matrix: Operational Phase of Mining

Location	Jan	Feb	Mar	Apr	May	June	July	Aug ³	Sept	Oct	Nov	Dec
Streams												
4 i BC-1 (Upper Bear Creek)		oper			oper	field	field	oper.	field	oper		
#2 BC-2 (Lower Bear Creek)		oper			oper	field	field	oper.	field	oper		
#3 BC-3 (Lower Rt Fork Bear Creek)		oper			oper	field	field	oper.	field	oper		
#72 BC-4 (Upper Rt Fk. Bear Creek)		oper			oper.	field	field	oper.	field	oper		
#53 CK-1 (Upper Cedar Creek)		oper			oper.	field	field	oper.	field	oper		
#54 CK-2 (Lower Cedar Creek)		oper			oper.	field	field	oper.	field	oper		
MH-1 (Lower McCadden Hollow Creek)					field ⁵		field	field		field		
#90 MH-2 (Upper McCadden Hollow Creek)					field ⁵		field	field		field		
FC-1 (Lower Left Fork Fish Creek)					field ⁵		field	field		field		
#40 FC-2 (Lower Right Fork Fish Creek)					field ⁵		field	field		field		
91 FC-3 (Right Fork Fish Creek Property Line)					field ⁵		field	field		field		
92 FC-4 (Upper Right Fork Fish Creek)					field ⁵		field	field		field		
93 FC-5 (Mud Spring)					field ⁵		field	field		field		
94 FC-6 (Upper Left Fork Fish Creek)					field ⁵		field	field		field		
95 FC-7 (Water Right Upper LF FC)					field ⁵		field	field		field		
96 FC-8 (Water Right Upper LF FC)					field ⁵		field	field		field		
Springs												
4 SBC-3 (Creek Well)		oper			oper			oper.		oper		
5 SBC-4 (Big Bear Springs)		oper			oper			oper.		oper		
6 SBC-5 (Birch Spring)		oper			oper.			oper.		oper		
#5 SBC-9A (Hiawatha Seam)		oper			oper			oper		oper		
SBC-12 (16-7-13-1)					field ⁵		field	field		field		
#2 SBC-14 (WHR-6)		oper			oper.			oper.		oper		
SBC-15 (WHR-5)					field ⁵		field	field		field		
SBC-16 (WHR-4)					field ⁵		field	field		field		
91 SBC-16A					field ⁵		field	field		field		
82 SBC-16B					field ⁵		field	field		field		
45 SBC-17 (16-7-24-4)					oper.			oper.		oper		
#51 SBC-18 (WHR-2)					field ⁵		field	field		field		
83 SBC-20 (16-8-16-4)					field ⁵		field	field		field		
84 SBC-21 (16-8-18-16)					field ⁵		field	field		field		
85 SBC-22 (Stockwater Trough)					field ⁵		field	field		field		
58 SBC-23 (FBC-12)					field ⁵		field	field		field		
41 SCC-1 (16-8-20-1)					field ⁵		field	field		field		
88 SCC-2 (16-8-15-5)					field ⁵		field	field		field		
46 SCC-3 (Mohrland Portal)					field ⁵		field	field		field		
60 SCC-5 (16-8-7-3)					field ⁵		field	field		field		
SMH-1 (FBC-6)					field ⁵		field	field		field		
SMH-2 (FBC-5)					field ⁵		field	field		field		
SMH-3 (FBC-13)					field ⁵		field	field		field		
SMH-4 (FBC-4)					field ⁵		field	field		field		
87 86 SMH-5 (Stockwater Trough)		x			field ⁵		field	field		field		
Wells												
SDH-2 (Well, Sec. 11, T16S, R7E)					level ⁵		level	level	level	level		
SDH-3 (Well, Sec. 10, T16S, R7E)					level ⁵		level	level	level	level		
MW-114 (Well, Sec 18, T16S, R8E)					level ⁵		level	level	level	level		
MW-117 (Well, Sec 12, T16S, R8E)					level ⁵		level	level	level	level		

- Notes:
1. See Tables 7-13 and 7-17 for listing of water quality monitoring parameters.
 2. oper. = operational base. = baseline
 3. Baseline parameters taken in August of year 5 prior to each permit renewal.
 4. SBC-4 and SBC-5 shall also be tested for oil and grease.
 5. First sample to be taken in May or June, when Gentry Mountain is accessible.
 6. A comment will be made regarding the level of the pond feeding the spring
 7. Weekly monitoring to begin one month prior to mining in area and continue until one month after. Monthly monitoring will then be done for an additional six months.

Table 7-14 Water Monitoring Matrix: Operational Phase of Mining

Location	Jan	Feb	Mar	Apr	May	June	July	Aug ³	Sept	Oct	Nov	Dec
Streams												
BC-1 (Upper Bear Creek)		oper			oper	field	field	oper.	field	oper		
BC-2 (Lower Bear Creek)		oper			oper	field	field	oper.	field	oper		
BC-3 (Lower Rt Fork Bear Creek)		oper			oper	field	field	oper.	field	oper		
BC-4 (Upper Rt Fk. Bear Creek)		oper			oper.	field	field	oper.	field	oper		
CK-1 (Upper Cedar Creek)		oper			oper.	field	field	oper.	field	oper		
CK-2 (Lower Cedar Creek)		oper			oper.	field	field	oper.	field	oper		
MH-1 (Lower McCadden Hollow Creek)					field ⁵		field	field		field		
MH-2 (Upper McCadden Hollow Creek)					field ⁵		field	field		field		
FC-1 (Lower Left Fork Fish Creek) ⁷					field ⁵		field	field		field		
FC-2 (Lower Right Fork Fish Creek) ⁷					field ⁵		field	field		field		
FC-3 (Right Fork Fish Creek Property Line) ⁷					field ⁵		field	field		field		
FC-4 (Upper Right Fork Fish Creek) ⁷					field ⁵		field	field		field		
FC-5 (Mud Spring) ⁷					field ⁵		field	field		field		
FC-6 (Upper Left Fork Fish Creek) ⁷					field ⁵		field	field		field		
FC-7 (Water Right Upper LF FC)					field ⁵		field	field		field		
FC-8 (Water Right Upper LF FC)					field ⁵		field	field		field		
Springs												
SBC-3 (Creek Well)		oper			oper			oper.		oper		
SBC-4 (Big Bear Springs) ⁴		oper			oper			oper.		oper		
SBC-5 (Birch Spring) ⁴		oper			oper.			oper.		oper		
SBC-9A (Hiawatha Seam)		oper			oper			oper		oper		
SBC-12 (16-7-13-1)					field. ⁵		field	field		field		
SBC-14 (WHR-6)		oper			oper.			oper.		oper		
SBC-15 (WHR-5)					field ⁵		field	field		field		
SBC-16 (WHR-4) ^{6,7}					field ⁵		field	field		field		
SBC-16A ⁷					field ⁵		field	field		field		
SBC-16B ⁷					field ⁵		field	field		field		
SBC-17 (16-7-24-4)		oper			oper.			oper.		oper		
SBC-18 (WHR-2) ⁷					field ⁵		field	field		field		
SBC-20 (16-8-16-4 16-8-18-4) ⁷					field ⁵		field	field		field		
SBC-21 (16-8-18-1) ⁷					field ⁵		field	field		field		
SBC-22 (Stockwater Trough)					field ⁵		field	field		field		
SBC-23 (FBC-12)					field ⁵		field	field		field		
SCC-1 (16-8-20-1)					field ⁵		field	field		field		
SCC-2 (16-8-15-5 16-8-18-5) ⁷					field ⁵		field	field		field		
SCC-3 (Mohrland Portal)					field ⁵		field	field		field		
SCC-5 (16-8-7-3)					field ⁵		field	field		field		
SMH-1 (FBC-6)					field. ⁵		field	field		field		
SMH-2 (FBC-5)					field ⁵		field	field		field		
SMH-3 (FBC-13)					field. ⁵		field	field		field		
SMH-4 (FBC-4)					field ⁵		field	field		field		
SMH-5 (Stockwater Trough)					field ⁵		field	field		field		
Wells												
SDH-2 (Well, Sec. 11, T16S, R7E)					level ⁵		level	level	level	level		
SDH-3 (Well, Sec. 10, T16S, R7E)					level ⁵		level	level	level	level		
MW-114 (Well, Sec 18, T16S, R8E)					level ⁵		level	level	level	level		
MW-117 (Well, Sec 12, T16S, R8E)					level ⁵		level	level	level	level		

- Notes:
1. See Tables 7-13 and 7-17 for listing of water quality monitoring parameters.
 2. oper. = operational base. = baseline
 3. Baseline parameters taken in August of year 5 prior to each permit renewal.
 4. SBC-4 and SBC-5 shall also be tested for oil and grease.
 5. First sample to be taken in May or June, when Gentry Mountain is accessible.
 6. A comment will be made regarding the level of the pond feeding the spring
 7. Weekly monitoring to begin one month prior to mining in area and continue until one month after. Monthly monitoring Will then be done for and additional six months.

Table 7-14A Surface Water Monitoring Matrix: Baseline Collection

Site Name	Site Description	Baseline Monitoring Start Date
BC-1	Upper Bear Creek	September 2, 1980
BC-2	Lower Bear Creek	September 2, 1980
BC-3	Lower Right Fork Bear Creek	January 5, 1987
BC-4	Upper Right Fork Bear Creek	February 29, 2000
♀ CK-1	Upper Cedar Creek	June 9, 1994
* CK-2	Lower Cedar Creek	June 9, 1994
MH-1	Lower McCadden Hollow Creek	July 31, 1991
MH-2 ✓	Upper McCadden Hollow Creek	May, 2007
FC-1	Lower Left Fork Fish Creek	June 9, 1994
* FC-2	Lower Right Fork fish Creek	July 31, 1991
FC-3 ✓	Right Fork Fish Creek Property	May, 2007
FC-4 ✓	Upper Right Fork Fish Creek	May, 2007
FC-5 ✓	Right Fork Fish Creek Below Mud	May, 2007
FC-6 ✓	Upper Left Fork Fish Creek	May, 2007 ✓
FC-7 ✓	Water Right Upper LF Fish Creek	May, 2007
FC-8 ✓	Water Right Upper LF Fish Creek	May, 2007

- Notes: 1. See Tables 7-13 and 7-17 for listing of water quality monitoring parameters.
 2. See Table 7-14 for specific months that the sites will be monitored in.

Table 7-14B Ground Water Monitoring Matrix: Baseline Collection

Site Name	Site Description	Baseline Monitoring Start Date
SBC-3	Bear Creek Well	January 5, 1987
SBC-4	Big Bear Spring	January 5, 1987
SBC-5	Birch Spring	July 24, 1986
SBC-9A	Bear Canyon #1 Mine Portal	September 25, 2002
SBC-12	16-7-16-1	June 8, 1994
SBC-14	WHR-6	October 26, 1993
SBC-15	WHR-5	October 27, 1992
SBC-16	WHR-4	March 22, 1993
SBC-16A ✓		May, 2007
SBC-16B ✓		May, 2007
SBC-17	16-7-24-4	May 22, 2000
* SBC-18	WHR-2	March 22, 1993
SBC-20	16-8-16-4 16-8-18-4	June 8, 1994
* SBC-21	16-8-18-1	June 8, 1994
SBC-22 ✓	Stock Watering Trough	May, 2007
SBC-23	FBC-12	March 22, 1993
SCC-1	16-8-20-1	June 8, 1994
* SCC-1 2	16-8-15-5 16-8-18-5	June 8, 1994
* SCC-3	Mohrland Portal 16-8-8-10	January 19, 1979
SCC-5	16-8-7-3	June 8, 1994
SMH-1	FBC-6	October 13, 1992
SMH-2	FBC-5	October 13, 1992
SMH-3	FBC-13	August 29, 1993
SMH-4	FBC-4	October 13, 1992
SMH-5 ✓	Stock Watering Trough	May, 2007

- Notes: 1. See Tables 7-13 and 7-17 for listing of water quality monitoring parameters.
 2. See Table 7-14 for specific months that the sites will be monitored in.

Table 7-15 Past monitoring sites

Site ID	Description	Status
Springs		
SBC-1	Under Ground Seep ¹	Dried up early 1988, and monitoring was discontinued.
SBC-2	Portal Well ²	Dry from 1987. Caved in, lost (2) quarters and relocated in 1991.
SBC-6	COP Development Spring ³	Dried up in 1987, with no flow through 2000. Monitoring discontinued in 2000.
In-Mine Sources		
SBC-7	Sump #1	Dried up and discontinued in 2000.
SBC-8	Sump #2	Dried up and discontinued in 2000.
SBC-9	Sump #3 ⁴⁶	Abandoned in 1999 due to retreat mining and replaced by SBC-13.
SBC-10	Sump #4	Flow first measured Dec. 1991. Monitoring initiated Jan. 1992. In July, 1995, retreat mining progressed passed this sump, making it inaccessible. Monitoring was discontinued in August 1995. Flows from this area have subsequently flowed through the pillared area and out of the 1 st East pillared section.
SBC-11	Hiawatha Seam 1 st North	Abandoned in January 2003
SBC-13	1 st East Pillared Section ⁵	Abandoned in April 2002 due to retreat mining and replaced by SBC-9A
Wells		
DH-1A	2nd W. Monitor Well	Abandoned in 2001 due to retreat mining.
DH-2	3rd W. Monitor Well6	Abandoned in 1999 due to retreat mining.
DH-3	1st E. Monitor Well6	Abandoned in 1993 due to retreat mining and was replaced by DH-4.
DH-4	3rd W. Bleeder Monitor Well6	Abandoned in 1999 due to retreat mining.
MW-116	Gentry Mtn. Monitor Well	The side caved in and the well was lost

SDH-1, SDH-2, SDH-3. These three monitoring wells were installed in 1995 from the surface (Plate 7-4). These wells are completed in the Spring Canyon tongue of the Star Point Sandstone, with SDH-1 and SDH-2 located to monitor the potentiometric surface in conjunction with the DH wells discussed previously. SDH-3 was installed West of the Blind Canyon fault (western boundary of the permit area) in order to observe the relationship of the Spring Canyon aquifer on each side of the fault. Completion diagrams of these wells are included in Appendix 7-A. The initial baseline data is included in Appendix 7J-A. Based on these baseline levels, a potentiometric surface for the Spring Canyon aquifer was developed. This is shown in Appendix 7-J, Figure 13b, and on Plate 7J-2.

In 1996, SDH-1 well plugged and was lost while attempting to unplug the well. SDH-2 and SDH-3 are monitored for water levels as shown in Table 7-14.

MW-114, MW-117. These Two wells were drilled in 1991 by Cyprus/Plateau, and are located North of the Wild Horse Ridge expansion area. Both wells are located East of the Bear Canyon fault. MW-114 is located immediately North of and adjacent to the permit area. These wells were also completed in the Spring Canyon member of the Starpoint Sandstone. Baseline water levels for these wells are included in Appendix 7J-A, and well completion diagrams are included in Appendix 7-A. Water age dating and chemical information will be collected from these wells to verify that the hydrologic patterns in the Wild Horse Ridge area are consistent with the patterns discussed in the PHC which have been found in the existing permit area. This information will also be collected from any new wells installed within or adjacent to the Wild Horse Ridge area.

Additional Monitor Wells. A minimum of one additional drillhole will be installed in the northern portion of the Wild Horse Ridge area, shown as DH-5 on Plate 5-1C. If necessary, additional wells may be installed following the installation and evaluation of DH-5 in order to adequately characterize the groundwater aquifers of the lower Blackhawk and upper Star point formations. DH-5 and any additional drillholes will be tested using the same methodology, which was used in the previous in-mine wells, described in Appendix 7-N. The holes will then be completed as monitor wells in the same manner as described in Appendix 7-N.

Springs above the mine have also been selected based on the conclusion of Appendix 7J and 2006 field investigations that included regulating agencies and interested parties. Because these springs are above the coal seam water quality impacts are not a major concern, however flow quantity impacts are. Sites were selected because they were either major contributors to surface water systems, or they were springs that have been developed for beneficial use or have water rights on them. The major contributors to surface water systems are SMH-3, SMH-4, SBC-12, SBC-18, SBC-20, SBC-21, SCC-1, SCC-3, and SCC-5. Perennial portions of the streams feed by sites SCC-5, SCC-2, SBC-16, SBC-16A, SBC-16B, SBC-20, and SBC-21 will be undermined. Because of this these sites will be monitored for flow weekly starting one month prior to undermining and continuing until one month after undermining at which time they will be monitored monthly for six months before returning back to their normal monitoring schedule. The actual start time will be determined based on continual underground surveying that is required by MSHA. During the monitoring weekly reports will be sent to the Division via email. The ground water sites selected because they were developed or had water rights are SMH-1, SMH-2, SMH-5, SBC-15, SBC-16, SBC-16A, SBC-16B, and SBC-22.

Measuring the flow from springs and seeps is almost always difficult because flows tend to be dispersed and rarely concentrate into well-defined channels amenable to discharge measurement.

The most accurate method of measuring small discharges, and the method that will be used, is by observing the time required to fill a container of known capacity, or the time required to partly fill a calibrated container. The basic equipment is a stopwatch and a calibrated container.

Purchased pre-calibrated containers may be used or containers will be calibrated by either adding known volumes of water by increments and measuring the depth of water in the container, or by weighing the container with varying amounts of water in it, noting the depth in the container, and using the formula: $V = (W2 - W1) / w$; where: V = volume of water in the container, $W2$ = weight of container with water, $W1$ = weight of empty container, and w = unit weight of water.

The basic field procedure will consist of interrupting the flow and collecting the water. Temporary earth dams may be constructed to divert the water through a small diameter pipe for capture. Or it may be possible to place a trough or half of a stove pipe against the spring or seep to carry the water to the calibrated container. Cloths, clay, or other materials will be used to temporarily seal cracks and force the water to go into the calibrated container. Where flows come out of the ground in a number of distinct sources or if they are scattered over a broad area, the results of several different measurements will be added together.

731.220 Surface Water Monitoring

In the past, C. W. Mining has monitored three stations on Bear Creek, one above (north) the mine plan area, one at the right-hand tributary (center) and one below the mine area (southwest). The monitoring location above the mining area is approx 3000 ft upstream from where the mine road crosses Bear Creek in the mine plan area. The monitoring location at the right-hand tributary of Bear Creek is located just above its confluence with the main Bear Creek. Two additional monitoring locations will be added to this tributary for mining in Wild Horse Ridge, one above the disturbed area (northeast), as well as a spring located in the drainage (SBC-14, see section 7.1). The monitoring location downstream is near the Ballpark topsoil storage pile. Monitoring stations are shown on Plate 7_4 and listed below. Monitoring points have also been added to the Fish Creek and McCadden Hollow drainages to monitor for water quantity impacts.

Streams

1. Upper Bear Creek	-	BC-1
2. Lower Bear Creek	-	BC-2
3. Lower Right Fork Bear Creek	-	BC-3
4. Upper Right Fork Bear Creek	-	BC-4
5. Lower McCadden Hollow Creek	-	MH-1
6. Fish Creek Left Fork	-	FC-1
7. Fish Creek Right Fork	-	FC-2
8. Fish Creek RF Property Line	-	FC-3
9. Upper Fish Creek Right Fork	-	FC-4
10. Fish Creek Past Mud Spring	-	FC-5
11. Upper Fish Creek Left Fork	-	FC-6
12. Upper Fish Creek LF Water Right-	-	FC-7
13. Upper Fish Creek LF Water Right-	-	FC-8
14. Upper Cedar Creek	-	CK-1
15. Lower Cedar Creek	-	CK-2
16. Upper McCadden Hollow Creek	-	MH-2

Surface monitoring will follow the surface water sampling guidelines as shown in Table 7-16, using the water quality parameter list in Table -16. Monthly sampling matrix for each of the existing monitoring stations are included in Table 7-14. Operational surface water monitoring will continue through reclamation to bond release. Three years of baseline will be collected on all new sites.

Table 7-16 Surface Water Sampling

	Baseline Monitoring	Operational Monitoring	Post-mining Monitoring
Type of Sampling Site	Surface Water Bodies.	Surface Water Bodies.	Surface Water Bodies.
Field Measurements and Parameters (Table 7.1-7)	Performed during water level/flow measurements.	Performed during water level/flow measurements.	Performed during water level/flow measurements.
Sample Frequency	Quarterly for lakes, reservoirs and impoundments (water level and quality); monthly flow measurements and quarterly water quality measurements (one sample at low flow and high flow each) for perennial streams. Monthly flow and water quality measurements during period of flow for intermittent streams. Sampling for ephemeral streams determined at pre-design conference.	Quarterly for lakes, reservoirs and impoundments (water level and quality); monthly flow measurements and quarterly water quality measurements (one sample at low flow and high flow each) for perennial streams. Monthly flow and water quality measurements during period of flow for intermittent streams. Sampling for ephemeral streams determined at pre-design conference.	<u>Two</u> per annum for perennial streams (high & low flow); two per annum during snowmelt and rainfall for intermittent streams.
Sampling Duration	<u>Three</u> years (Prior to mining in the area).	<u>Every</u> year until two years after surface reclamation activities have ceased. Sites will be monitored 4 times a year.	<u>Every</u> year until termination of bonding.
Type of Data Collected and Reported	Flow and/or water levels and water quality.	Flow and/or water levels and water quality.	Flow and/or water levels and water quality per operational parameters.
Comments	All field measurements should be performed concurrently with water level/flow measurements.	All field measurements should be performed concurrently with water level/flow measurements.	All field measurements should be performed concurrently with water level/flow measurements.
Additional Comments		For every fifth year preceding re-permitting, one sample at low flow and high flow each should be taken for baseline water quality parameters. The construction monitoring program will be conducted on a site-specific basis in addition to the operational monitoring.	

Table 7-17 Surface Water Quality Parameter List

Field Measurements:

1 *	-	Water Levels or Flow	11
2 *	-	pH	2
3 *	-	Specific Conductivity (umhos/cm)	4
4 *	-	Temperature (C)	1
5 *	-	Dissolved Oxygen (ppm) (perennial streams only)	3

Bear Canyon

Laboratory Measurements: (mg/l) (Major, minor ions and trace elements are to be analyzed in dissolved form only.)

# 6 *	-	× Total Settleable Solids	99		
# 7 *	-	× Total Suspended Solids	16		
8 *	-	× Total Dissolved Solids	68		
9 *	-	× Total Hardness (as CaCO ₃)	63		
	-	× Aluminum (Al)	113		
	-	× Arsenic (As)	37		
	-	× Boron (B)	34		
10 *	-	× Carbonate (CO ₃ ²⁻)	52		
11 *	-	× Bicarbonate (HCO ₃ ⁻)	50		
	-	× Cadmium (Cd)	35		
12 *	-	× Calcium (Ca)	36		
13 *	-	× Chloride (Cl)	53		
	-	× Copper (Cu)	39		
14 & 15 *	-	✓ × Iron (Fe)		(Total and Dissolved)	145 40
	-	× Lead (Pb)	41		
16 *	-	× Magnesium (Mg)	42		
17 & 18 *	-	× × Manganese (Mn)		(Total and Dissolved)	149 43
	-	✓ Molybdenum (Mo)	129		
	-	× Nitrogen: Ammonia (NH ₃)	31		
	-	× Nitrite (NO ₂)	52		
	-	× Nitrate (NO ₃)	56		
19 *	-	× Potassium (K)	45		
	-	× Phosphate (PO ₄ ³⁻)	58		
	-	× Selenium (Se)	46		
20 *	-	× Sodium (Na)	48		
21 *	-	✓ Specific Conductivity (umhos/cm)	67		
22 *	-	× Sulfate (SO ₄ ²⁻)	60		
	-	× Zinc (Zn)	49		
23 *	-	Oil and Grease	19		
24 *	-	× Cation-Anion Balance	135		

Sampling Period:

- Baseline
- *Operational, Postmining
- #Construction

Flows will be determined by direct measurement (depth times width times 2/3 velocity), by use of portable or stationary weirs or flumes, or, whenever feasible, by timed filling of a unit volume container. Measurements will be taken by qualified personnel following standard procedures with calibrated instruments.

Stream monitoring sites were selected based on the conclusion of Appendix 7J and 2006 field investigations that included regulating agencies and interested parties.

Annual Report. An Annual Report evaluating all data collected for the year will be submitted to DOGM as required.

Quarterly Data Submission. All water monitoring data will be submitted to DOGM on a quarterly basis within 30 days following the end of the quarter.

Discharge Permit and Reporting. All discharge report forms filed to meet Government requirements will be submitted to DOGM in the quarterly Water Monitoring Report. A copy of the mine discharge permit is included in Appendix 7-B.

Post-Mining Portal Discharge. No gravity discharges are expected from the Bear Canyon No. 3 or No. 4 mines during or following reclamation. Any post-mining portal discharge that occurs will be monitored quarterly for operational parameters shown on Table 7-16. No water will be discharged into the mine during or following reclamation.