ANALYSIS OF SAMPLES COLLECTED AT SPECIAL-STUDY SITES
SPECTRAL REFLECTANCE PROJECT

REMOTE ASSESSMENT OF THE LOCATION AND QUALITY OF MINE DRAINAGE USING SPECTRAL REFLECTANCE, SOUTHERN ANTHRACITE COALFIELD, PENNSYLVANIA

Contaminated mine drainage (CMD) from abandoned coal mines typically contains high concentrations of iron and other metals, which degrade water supplies and aquatic ecosystems and which ultimately can precipitate as rust-colored coatings on streambeds. Locating CMD and characterizing the chemistry of discharges and receiving streams can be difficult, time consuming, and costly because CMD originates from numerous nonpoint sources and access can be restricted in areas having few roads, steep terrain, and private ownership. A remote-sensing technique for locating and characterizing the chemical quality of discharges and affected streams could provide an efficient and cost-effective means of obtaining data on the sources and effects of CMD in a watershed.

The purpose of the Spectral Reflectance project is to demonstrate a remote-sensing method for identifying and characterizing surface waters affected by coal-mine drainage. Our goal is to use Digital Multispectral Video (DMSV) technology for aerial spectral-reflectance measurements to distinguish between acidic (pH <4) and near-neutral (pH 6 - 6.5) water that is affected by CMD. Spectral data from both ground and aerially-mounted imagers were collected during different seasons at 15-20 sites in the Southern Anthracite Coalfield. As part of this evaluation of the DMSV technology, water-quality and streambed precipitate samples at six sites in the Schuylkill River Basin (fig. 8) were collected during the water year. The water-quality data are being used to verify that spectral-reflectance imaging is capable of differentiating acidic and near-neutral water. Specific research objectives are (1) to verify that the aerial spectral-reflectance images and data are comparable to ground spectral-reflectance images and data; (2) to quantify the relation between key water-quality measures and both ground-collected and aerially collected spectral-reflectance data; and (3) to explain the sources of variability by analyzing microbial populations and the mineralogy and chemistry of streambed precipitates.

For additional information, contact Charles Cravotta at the U.S. Geological Survey, 215 Limekiln Road, New Cumberland, PA 17070; 717-730-6963 (email: cravotta@usgs.gov).

ANALYSIS OF SAMPLES COLLECTED AT SPECIAL-STUDY SITES
SPECTRAL REFLECTANCE PROJECT--Continued

TABLE 4.--SPECTRAL REFLECTANCE PROJECT STATION LIST.

REMARKS.--All samples collected by the U.S. Geological Survey.

LOCAL ID	STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE	DRAINAGE AREA
		MISCELLANEOUS-RECORD STATIONS			
Bell-121	404512076025501	BELL WATER LEVEL TUNNEL NEAR MIDDLEPORT, PA	40°45′12"	76°02′55"	n.a.
Bell-1	0146742496	BELL WATER LEVEL TUNNEL 400 FT DOWNSTREAM, NEAR MIDDLEPORT, PA	40°45′12"	76°02′58"	.02
SCr-149	404403076072401	SILVER CREEK MINE TUNNEL NEAR NEW PHILADELPHIA	40°44′03"	76°07′24"	n.a.
SCr-2	01467456	SILVER CREEK MINE TUNNEL, 700 FT DOWNSTREAM, AT NEW PHILADELPHIA, PA	40°43′43"	76°07′28"	.02
Otto-190	403958076191401	OTTO AIR SHAFT NEAR LLEWELLYN, PA	40°39′58"	76°19′14"	n.a.
Otto-2	0146784350	OTTO AIR SHAFT, 1,100 FT DOWNSTREAM, NEAR LLEWELYN, PA	40°40′07"	76°19′07"	.09

ANALYSIS OF SAMPLES COLLECTED AT SPECIAL-STUDY SITES
SPECTRAL REFLECTANCE PROJECT--Continued

WATER-QUALITY DATA, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000
MISCELLANEOUS STATION ANALYSES

DATE	TIME	AGENCY ANALYZING SAMPLE (CODE NUMBER) (00028)	AGENCY COLLECTING SAMPLE (CODE NUMBER) (00027)	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	OXYGEN, DISSOLVED (PERCENT SATURATION) (00301)	OXYGEN, DISSOLVED (MG/L) (00300)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	PH WATER WHOLE LAB (STANDARD UNITS) (00403)	SPECIFIC CONDUCTANCE (µS/CM) (00095)	TEMPERATURE WATER (DEG C) (00010)	CALCIUM DISSOLVED (MG/L AS CA) (00915)
404512076025501 BELL WATER LEVEL TUNNEL (LAT 40 45 10N LONG 076 02 53W)											
NOV 1999											
15...	0930	80020	1028	.96	24	2.5	4.0	3.6	275	9.7	15.0
FEB 2000											
15...	1015	80020	1028	.96	25	2.8	3.8	3.7	249	9.7	15.0
MAY											
17...	1215	80020	1028	1.7	50	5.7	3.9	--	229	9.6	--
0146742496 BELL WATER LEVEL TUNNEL NEAR MIDDLEPORT, PA (LAT 40 45 12N LONG 076 02 58W)											
NOV 1999											
15...	0945	80020	1028	.96	88	9.8	4.0	3.5	280	9.4	14.0
FEB 2000											
15...	1030	80020	1028	.96	88	9.9	3.8	3.7	247	9.1	15.0
404403076072401 SILVER CREEK MINE TUNNEL (LAT 40 43 48N LONG 076 07 26W)											
NOV 1999											
15...	1045	80020	1028	2.4	9	.9	5.5	5.4	554	12.0	51.0
FEB 2000											
15...	1130	80020	1028	3.0	14	1.5	5.6	5.1	506	12.0	51.0
MAY											
17...	1115	80020	1028	6.3	11	1.2	5.7	--	554	12.0	--
01467456 SILVER CR MINE TUNNEL AT NEW PHILADELPHIA, PA (LAT 40 43 42N LONG 076 07 28W)											
NOV 1999											
15...	1030	80020	1028	2.4	61	6.5	5.9	5.7	578	12.0	50.0
FEB 2000											
15...	1145	80020	1028	3.0	63	6.8	5.7	4.4	488	11.0	50.0
403958076191401 OTTO AIR SHAFT (LAT 40 39 58N LONG 076 19 14W)											
NOV 1999											
15...	1230	80020	1028	4.2	3	.3	5.9	6.0	561	12.0	41.0
FEB 2000											
15...	1400	80020	1028	2.9	6	.6	5.8	5.9	471	12.0	39.0
MAY											
17...	1015	80020	1028	5.2	20	2.2	5.8	--	460	12.1	--
0146784350 OTTO AIR SHAFT, 400 M DS, NEAR LLEWELLYN, PA (LAT 40 40 07N LONG 076 19 07W)											
NOV 1999											
15...	1200	80020	1028	4.2	84	8.8	6.4	6.1	560	12.0	42.0
FEB 2000											
15...	1330	80020	1028	2.9	--	--	--	6.0	--	--	38.0

ANALYSIS OF SAMPLES COLLECTED AT SPECIAL-STUDY SITES
SPECTRAL REFLECTANCE PROJECT--Continued

WATER-QUALITY DATA, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000
MISCELLANEOUS STATION ANALYSES

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	ACIDITY (MG/L AS CACO3) (00435)	ANC WATER UNFLTRD FET FIELD MG/L AS CACO3 (00410)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	COLOR (PLAT-INUM-COBALT UNITS) (00080)	OXID-ATION RED-UCTION POTEN-TIAL (MV) (00090)	ALUM-INUM, DIS-SOLVED (µG/L AS AL) (01106)	IRON, DIS-SOLVED (µG/L AS FE) (01046)	MANGA-NESE, DIS-SOLVED (µG/L AS MN) (01056)
404512076025501 BELL WATER LEVEL TUNNEL (LAT 40 45 10N LONG 076 02 53W)											
NOV 1999											
15...	12.0	2.2	--	0	2.6	110	40	504	900	7700	1500
FEB 2000											
15...	12.0	2.1	59	0	2.3	100	25	--	860	2500	1400
MAY											
17...	--	--	--	--	--	--	--	637	--	--	--
0146742496 BELL WATER LEVEL TUNNEL NEAR MIDDLEPORT, PA (LAT 40 45 12N LONG 076 02 58W)											
NOV 1999											
15...	12.0	2.1	--	0	2.5	120	55	508	870	6300	1500
FEB 2000											
15...	12.0	2.1	--	0	2.4	100	60	--	920	2400	1400
404403076072401 SILVER CREEK MINE TUNNEL (LAT 40 43 48N LONG 076 07 26W)											
NOV 1999											
15...	32.0	2.4	--	--	1.2	270	50	367	470	26000	3600
FEB 2000											
15...	31.0	2.6	91	18	1.4	260	60	--	500	25000	3600
MAY											
17...	--	--	--	--	--	--	--	309	--	--	--
01467456 SILVER CR MINE TUNNEL AT NEW PHILADELPHIA, PA (LAT 40 43 42N LONG 076 07 28W)											
NOV 1999											
15...	30.0	2.5	--	--	1.2	270	45	362	380	24000	3500
FEB 2000											
15...	30.0	2.5	68	22	1.3	270	250	--	380	23000	3500
403958076191401 OTTO AIR SHAFT (LAT 40 39 58N LONG 076 19 14W)											
NOV 1999											
15...	36.0	8.2	--	--	2.0	230	12	267	150	16000	2500
FEB 2000											
15...	34.0	8.3	32	42	2.3	230	25	--	150	14000	2500
MAY											
17...	--	--	--	--	--	--	--	329	--	--	--
0146784350 OTTO AIR SHAFT, 400 M DS, NEAR LLEWELLYN, PA (LAT 40 40 07N LONG 076 19 07W)											
NOV 1999											
15...	37.0	8.3	--	--	2.2	230	15	264	20	15000	2500
FEB 2000											
15...	33.0	8.4	41	34	2.5	220	220	--	910	19000	2400