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DEPARTMENT OF ENVIRONMENTAL QUALITY
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288 NORTH 1460 WEST
SALT LAKE CITY, UTAH 84114-4870
Main Phone # (801) 538-6146 Fax # (801) 538-6016

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12/17/02
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MAIL:
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TO: Pam Grubaugh-Littig
PHONE #:

DATE: 12/17/02
FROM: Mike Herkimer
PHONE #:

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No. of pages including cover sheet: 60	
For your information	
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Per previous conversation on?	
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MESSAGE: This is what I sent to Harry Austin

Pam,
This did not go in the mail
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Mike Herkimer
12/17/02

Canyon Fuel Company, LLC
Skyline Mines
HC 35 Box 380
Helper, Utah 84526
(435) 448-6463 Fax: (435) 448-2632

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DEC 13 2001
DIVISION OF
WATER QUALITY

December 12, 2001

Mr. Don Ostler, P.E.
Executive Secretary
Department of Environmental Quality
Division of Water Quality
288 North 1460 West
Salt Lake City, Utah 84114-4870

RE: Response Notice of Violation and Order, Docket No. I01-05, Canyon Fuel Company, LLC., Skyline Mines, UPDES Permit UT0023540

Dear Mr. Ostler:

Canyon Fuel Company, LLC, Skyline Mine is providing this required response to the Utah Division of Water Quality's Notice of Violation (NOV) and Order, Docket No. I01-05. This NOV was issued as a result of a discharge of water from the mine on August 28, 2001 that contained coal fines as total suspended solids (TSS) at a measured concentration of 171 mg/l and total iron at 2.6 mg/l. The mine's UPDES permit limitation for TSS is 70 mg/l as a daily maximum and a total concentration of 1.0 mg/l of total iron. The NOV was received by Skyline Mine on November 13, 2001.

This letter report has been organized following the format presented in the Order Section of the NOV. This response includes: A) The chronology of events leading up to, during, and following the discharge of coal fines and a discussion of the cause of the discharge; B) Water quality data collected between August 1 and October 2, 2001 are presented in tabular form and the supporting data sheets are attached to this report as Attachment 2; C) A determination regarding the erosional effects of the present rate of flow on Eccles and Mud Creeks is discussed; D) The actions that have been taken and will be implemented to prevent coal fines from being discharged to Eccles Creek, and; E) The actions the mine has taken or plans to take to mitigate any damage to the stream caused by the release.

A) Chronology of Events

Prior to January 2000, Skyline Mine discharged less than one million gallons of water per day from the mine site (Figure 1 in Attachment 1). By January 2001, the discharge rate has steadily increased to approximately 3 million gallons per day (mgd) as new sources of ground water were encountered during mining. By August 1, 2001, the discharge rate had steadily climbed to 6 mgd. On August 16, 2001, substantial ground water inflows were encountered and the discharge rate from the mine has increased significantly. The mine was not capable of discharging all of the water to the surface,

therefore; large areas of active and inactive workings in the mine were flooded as temporary storage areas. Over several weeks, new pipeline was laid and pumps were installed to remove water from the mine workings. To remove the water from the active portions of the mine, pumps were advanced into the receding bodies of water. On Tuesday, August 28, 2001 at approximately 5:30 a.m., pumps operating in the 9 Left area of the mine were advanced and received a slug of water containing an estimated 150 pounds of coal fines and silt. The coal fines and silt were then discharged directly to Eccles Creek through the mine's dewatering system.

The slug of fines consisted of material that had initially been deposited during mine flooding. These deposits were exposed as the water receded and the pumps were moved down gradient with the receding water level. The sediments were saturated with water and had very little structural strength. Early on the morning of the August 28th, the sediments suddenly began to flow and mixed with the water in the are of the 9 Left pumps. Underground personnel were servicing pumps not in 9 Left and did not immediately observe the flood of sediments.

At approximately 9:00 a.m. on August 28th, surface personnel noticed Eccles Creek was carrying dark sediment. Mine management was notified of the dark color of the water and the pumps that were picking up the sediment were shut off. Samples of the mine discharge water were immediately obtained. Also, all of the underground pumps were systematically inspected and shutdown if it was determined they were not pumping clear water. By 2:30 p.m., the mine discharge water had cleared significantly. However, clearing the sediment completely out of the system took several more hours.

Dewatering activities continued after all of the pumps were inspected to determine the visual quality of the water discharged. Mine personnel have been assigned to each pump where water was picked up underground and discharged to the surface. They were instructed to shut down pumps if the water coming to the pumps was not clear. Plans were made to immediately begin installing sand filters to remove suspended solids from the discharge water. Samples of the mine discharge water were obtained on an hourly basis until and for some time after sand filters were installed for visual inspection of water quality. Several samples were sent to Commercial Testing and Engineering for UPDES discharge limits analysis. The results of these analyses are discussed in Section C of this letter. Written notification to the Division of Water Quality of the upset conditions was made in a letter dated August 31, 2001 and signed by Stan Christensen, the Acting General Mine Manager. A copy of the letter is attached to this report as Attachment 2.

Since August 28th, the mine has been able to reclaim most of the flooded active workings and returned to mining. Water is currently pumped from the mine at a rate between 5.8 mgd and 12.9 mgd. Much of the water discharged from the mine is routed through a system of sand filters that remove coal fines and sediment. The remainder of the water discharged from the site consists of sediment pond water or water discharged from Mine #3, a multi-million gallon underground sump. The total suspended solids and total iron concentrations in the discharge water have been below permit limits since August 28th (Section B of this report).

B) Water Quality Data Collected Between August 1 and October 2, 2001

Numerous samples of the mine water discharge were obtained on the day of the release and in the weeks following, and analyzed for Total Suspended Solids and Total Dissolved Solids (TDS). Most of the samples were also analyzed for total iron and oil and grease concentrations. Table 1 below provides a compilation of the water quality data collected between August 1 and October 2, 2001.

TABLE 1

UPDES EFFLUENT QUALITY
AUGUST 1 THROUGH OCTOBER 2, 2001

Date	Total Iron (mg/l)	Oil & Grease (mg/l)	TDS (mg/l)	TSS (mg/l)	Flow (gpm)
August 1, 2001	0.2	<2	523	<5	4567
August 8, 2001	NA	<2	501	6	4412
August 16, 2001	0.2	<2	420	<5	3659
August 23, 2001	NA	<2	437	18	5081
August 28, 2001 9:30 am	2.6	<2	276	171	6000
August 28, 2001 2:50 pm	0.6	<2	375	40	3860
August 30, 2001	0.3	<2	435	17	4800
September 2, 2001	0.5	<2	403	13	7200
September 4, 2001	0.3	<2	397	11	6900
September 5, 2001	0.2	<2	394	12	7600
September 6, 2001	0.4	<2	373	24	7848
September 7, 2001	0.3	<2	402	13	7166
September 11, 2001	0.4	<2	486	12	9800
September 12, 2001	0.3	<2	456	12	11,700
September 13, 2001	0.3	<2	416	15	8008
September 14, 2001	0.4	<2	447	14	9381
September 17, 2001	NA	NA	479	11	9380
September 19, 2001	0.4	<2	541	25	9091
September 20, 2001	NA	NA	493	16	8154
September 24, 2001	NA	NA	471	17	6121
September 26, 2001	0.4	<2	420	17	5360
October 2, 2001	NA	NA	502	17	9200

NA: Not Analyzed.
Copies of the lab data sheets from which the information in this table was derived are found in Attachment 3 of this report.

The data in the preceding table demonstrate the release of fines on August 28, 2001 was short-lived. The sample obtained at 2:50 pm on August 28th demonstrates the TSS concentration in the discharge water was decreasing. TSS appears to have generally stabilized in the discharge water at a concentration of 17 mg/l or less. Total iron concentration was already below the 1 mg/l UPDES limit by 2:50 pm on August 28th. Since the release, no further TSS or total iron limit violations have occurred.

C) A Determination Regarding the Erosional Effects of the Present Rate of Flow on Eccles and Mud Creeks

Skyline Mine has been concerned with the potential for increased erosion on Eccles and Mud Creeks due to the increased discharge from the mine. EarthFax Engineering, Inc. (EarthFax) of Salt Lake City, Utah was contracted to perform a study of the potential effects on the Eccles Creek stream channel based on the current and projected mine discharge volumes. This study was completed and delivered to the Manti-La Sal National Forest as part of the Environmental Impact Study for the Flat Canyon Tract coal lease. A copy of this study is included as Attachment 4 of this report. Changes to Eccles Creek are discussed in detail on pages 9 through 14 of the EarthFax report. The conclusion presented in the report generally states the current discharge volume from the mine is not causing significant erosion to the Eccles Creek channel.

EarthFax has also been contracted to study the effects on the channels, wildlife, and vegetation in Eccles and Mud Creeks of discharging 25,000 to 30,000 gpm of water from the mine. The mine does not anticipate this volume of flow being discharged from the mine at any one time to the Price River drainage. A very conservative approach was taken to analyze the worst-case scenerio. This report has not yet been completed. A copy of the report can be forwarded to your office once it is available if you so desire.

D) Actions Taken and to be Implemented to Prevent Coal Fines Discharging to Eccles Creek

Skyline Mine took immediate action to stop the release of coal fines to Eccles Creek as stated in Section A of this report. As stated previously, mine personnel are stationed at each pump that discharges water directly to the surface to ensure water containing suspended solids, or any other visible contaminant, is not pumped to Eccles Creek. These personnel have been instructed to shut down the pumps and investigate the source of the contaminant if the water becomes visually cloudy. The pumps are not restarted until the problem is solved.

In addition to the individuals stationed at the pumps, Skyline Mine installed sand filters on all of the water lines where water discharged from the mine might contain sediment. The sand filters remove all particles 25 microns or larger in size from the water stream. Skyline Mine will continue to employ sand filters to remove suspended solids as long as the water cannot be treated with underground sumps. Water stored in Mine #3 is not filtered since it is pumped from an abandoned area of the mine that has several million gallons of storage capacity and several months of detention time. Skyline Mine is also

investigating the possibility of constructing a new sediment pond(s) that would have enough storage volume to treat as much as 43 million gallons of water per day to the Price River Drainage. This would require the mine to obtain property of sufficient size and suitable topography to build the pond(s). Pipelines would need to be constructed from the mine to the ponds and a new discharge point would need to be permitted. The mine is currently pursuing properties for the pond(s) and contracting with an engineering firm to design the entire water treatment system.

Skyline Mine anticipates the current sand filter system will be in place for at least six more months. After that water will either be treated in large underground sumps, collected directly at its source (thus not allowing it to become contaminated), and/or treated in a new, larger sedimentation pond(s).

E) Actions the Mine has Taken, or Plans to Take, to Mitigate any Damage to the Stream Caused by the Release.

As described in Section A, an estimated 150 pounds of coal fines and silt were discharged to Eccles Creek. Most of this material was carried as suspended load to Scofield Reservoir. Minor volumes of the material adhered to bank side vegetation, submerged stream vegetation, deposited in low flow velocity areas of Mud and Eccles Creek. The coal fines and silt are chemically non-toxic and no fish kills were noted in the two creeks or in Scofield Reservoir. The damage to the streams that would result in attempting to remove coal fines from the channels would far out-weigh any benefit realized through their removal. Therefore, Skyline Mine does not anticipate making an attempt to remove any remaining coal fines from the creeks. Mitigation plans associated with damages, if any, to Eccles or Mud Creeks as a result of increased mine discharge cannot be made until the current EarthFax study is complete. If the conclusion of the report is that no significant damage has occurred to either stream to date, no mitigation will be proposed. However, if the report indicates erosion or other quantifiable stream damage is occurring, mitigation plans will be made at that time. Skyline Mine anticipates the EarthFax report will be completed by January 2, 2002.

Skyline Mine appreciates the cooperation and aid the Division of Water Quality has provided during this time. If you have any questions regarding this response to Notice of Violation and Order, Docket No. I01-05, please give me a call at (435) 448-2669.

Sincerely,

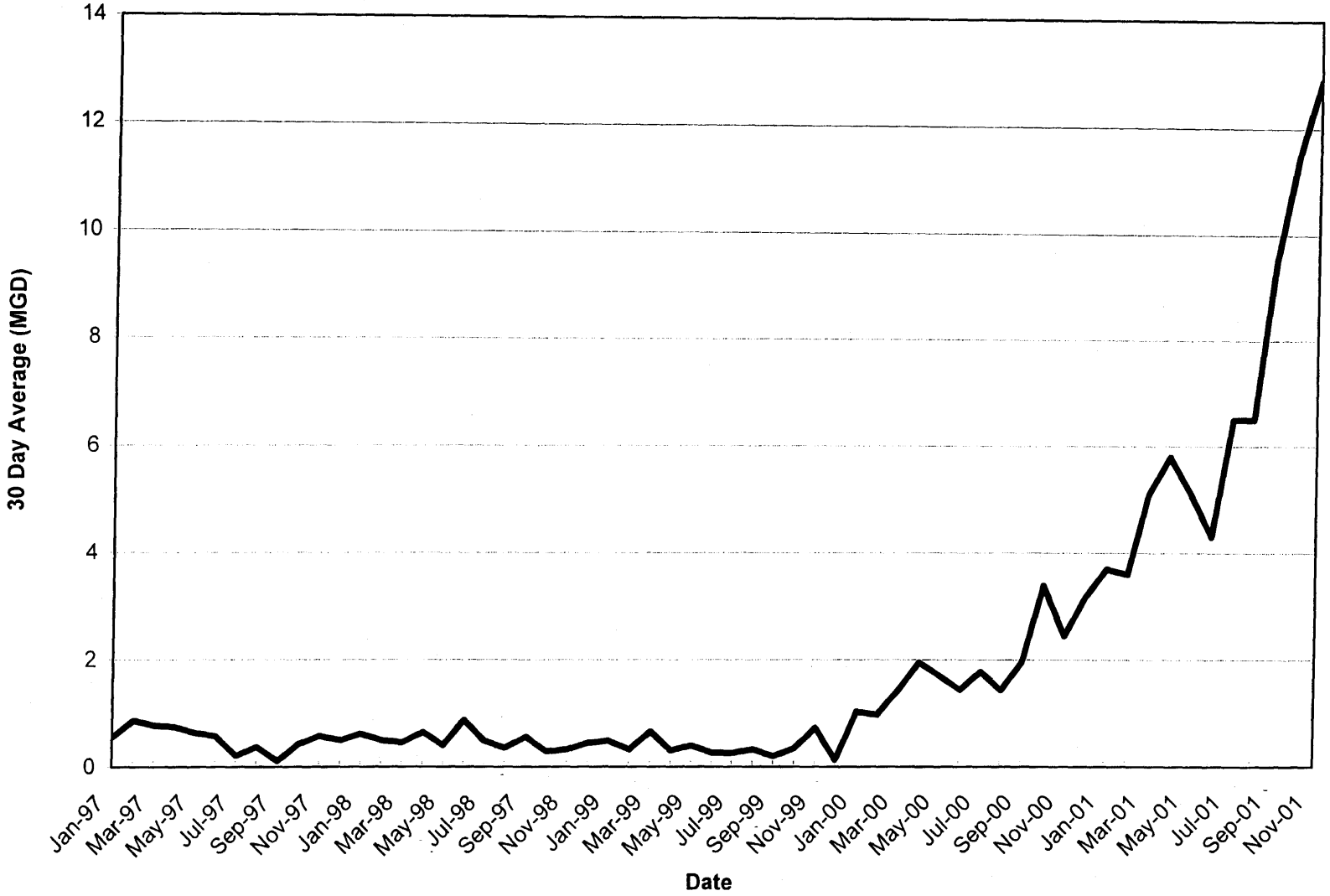
Chris D. Hansen
Environmental Coordinator
Canyon Fuel Company, LLC

attachments

ATTACHMENT 1

FIGURE 1
SKYLINE MINE DISCHARGE

FIGURE 1
SKYLINE MINE DISCHARGE



ATTACHMENT 2

WRITTEN NOTIFICATION OF UPSET CONDITIONS AT THE CANYON FUEL COMPANY, LLC., SKYLINE MINE
AUGUST 31, 2001

Canyon Fuel Company, LLC
Skyline Mines
HC 35 Box 380
Helper, Utah 84526
(435) 448-6463 Fax: (435) 448-2632

August 31, 2001

Mr. Mike Herkimer
Department of Environmental Quality
Division of Water Quality
288 North 1460 West
Salt Lake City, Utah 84114-4870

RE: Written Notification of Upset Conditions at the Canyon Fuel Company, LLC., Skyline Mines, UPDES Permit UT0023540

Dear Mr. Herkimer:

As required by Part II. I of Skyline Mine's UPDES permit, we are hereby giving the Utah Division of Water Quality written notification of an upset that occurred at the mine that resulted in the discharge of water to Eccles Creek that did not meet the mine's UPDES discharge limitations. A brief description of the upset, following the outline provided in the mine's permit, is provided below.

A. Description of the noncompliance and its cause.

As you are aware, Skyline Mine has been involved in an ongoing battle to save the mine from flooding that began on August 16, 2001. Since the 16th, water has been pumped from the mine at a rate that varies between 4,500 and 6,000 gpm. Water has been removed from the active portions of the mine by advancing pumps into the receding body of water located in 9 Left. On Tuesday, August 28, 2001 at approximately 5:30 a.m., pumps operating in the 9 Left area of the mine received an unknown quantity of coal fines and silt. The coal fines and silt were then discharged directly to Eccles Creek through the mine's dewatering system. Prior to the discharge, the water originating from the mine was in compliance with the UPDES permit.

The fine grained materials that were pumped to Eccles Creek were located in areas that were up gradient of the pumps and remained in place as the water receded. However, the sediments were saturated with water and had very little structural strength. Early on the morning of the 28th, the sediments suddenly began to flow and inundated the pumps operating in the affected area of 9 Left. Due to the ever increasing number of pumps operating within the mine, underground personnel were servicing pumps in another area and did not immediately observe the flood of sediments.

B. Period of noncompliance

At approximately 9:00 a.m. on the 28th, surface personnel noticed Eccles Creek was carrying a dark sediment. Mine management was notified of the dark color of the water in the creek and samples of the mine discharge were immediately taken. Also, underground pumps were systematically inspected and shutdown if it was determined they were not pumping clear water. By 10:30 a.m., noncompliant water was no longer being discharged.

C. Estimated time noncompliance is expected to continue

The cause of the noncompliance was discovered, the situation corrected, and the noncompliant discharge was terminated approximately five hours after it began.

D. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance

The pumps in the 9 Left area of the mine were removed and placed in areas where silt would not flood in to the water intake area. Additionally, water containing visible sediment will be routed through sand filters before discharge or through underground settling basins. Soon after the flooded area of the mine is reclaimed and the water system for handling the recently encountered heavy inflows of ground water is in place, the mine anticipates installing instrumentation to analyze oil and grease content, turbidity, and pH in-line in the discharge system. The analytical equipment will be calibrated to alarm when one or more of the discharge limits are exceeded. Additionally, valving that is activated when noncompliant water is detected will be in place to redirect the water to storage areas within the mine so that discharge to Eccles Creek will not occur. The feasibility of this plan is still in the investigative stages. Finally, Skyline is currently drilling and constructing wells in the water source below the mine workings in an attempt to stem the flow of ground water into the mine. The wells will discharge uncontaminated water to the Huntington Creek drainage thereby reducing the amount of water handled underground and discharged to Eccles Creek.

E. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period

Upon discovery of the noncompliant discharge, the appropriate regulatory agencies, including the Utah Division of Water Quality, were notified. Information regarding the release was quickly disseminated to the affected public either by the mine or the different state agencies. In addition, local land owners observed the upset condition of Eccles and Mud Creeks and notified several state and federal government agencies.

Mine personnel most familiar with the conditions of the water underground were questioned as to the nature of the material that would be expected to be in the water discharged to Eccles Creek. No oil and grease, hydraulic fluids, emulsion, lubricants, fuels or any other potential hydrocarbon pollutants were expected to occur in the water. Mine personnel were confident that only coal fines and silt were discharged to Eccles Creek. Water samples were taken of the mine water discharge at the time the upset conditions were observed and analyzed for oil and grease, total iron, Total Suspended Solids, Total Dissolved Solids, pH, and conductivity. The results of the oil and grease

analyses were received the afternoon of August 31st. No oil or grease was detected in the discharged water at or above 2.0 mg/L. A sample of the water in Mud Creek at an irrigation diversion below the Lodestar Coal Loadout facility was taken and analyzed for oil and grease content. The results of the analysis indicated oil and grease was present at 3.0 mg/l. However, the source of this oil and grease could be attributed to numerous sources unrelated to mining.

Potential mitigation to Eccles and Mud Creek has been discussed briefly with the Utah Division of Wildlife Resources (DWR) but no definite remedial projects have been identified. DWR has suggested that the impacts of the release of coal fines and silt to Eccles and Mud Creek, if any, may not be identified until next summer.

Other than obtaining samples of water in Eccles Creek for analysis for oil and grease concentrations, no other remedial actions to protect human health have been taken at this time and are not considered necessary. Eccles Creek and Mud Creek are not drinking water sources for persons living upstream of Scofield Reservoir. Since the coal mined at Skyline is inert and does not contain metals or other pollutants at concentrations great enough to be considered threats to human health, actions to remove the coal fines from the stream beds are not planned at this time. Removal of the coal fines would undoubtedly cause greater harm to the environment than leaving them in place.

Canyon Fuel Company appreciates the help and cooperation you have given the mine during this difficult time. If you desire additional information regarding the upset that occurred at the mine, please call Chris Hansen at (435) 448-2669.

Sincerely:

Stan Christensen
Acting General Mine Manager, Skyline Mine
Canyon Fuel Company, LLC

ATTACHMENT 3

LABORATORY DATA SHEETS
UPDES DISCHARGE
AUGUST 1 THORUGH OCTOBER 2, 2001

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306

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P.O. BOX 1020
HUNTINGTON, UT 84528
TEL: (435) 653-2311
FAX: (435) 653-2436

August 8, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1724
SAMPLED 1305

FIELD MEASUREMENTS

FLOW 4567 GPM TEMP 16°c
COND. 528 pH 8.47

Sample taken at SKYLINE

Sample taken by GARY TAYLOR

Date sampled August 1, 2001

Date received August 1, 2001

Analysis report no. 59-22996

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst	
Iron, Total	0.2	0.1	mg/l	EPA 236.1	08-07-2001 1254	MK
Oil & Grease	<2	2	mg/l	EPA 413.1	08-06-2001 0800	SC
Solids, Total Dissolved	523	10	mg/l	EPA 160.1	08-02-2001 1000	CB
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	08-02-2001 1000	CB

FAXED 8-9-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Esequiel Jaco

Huntington Laboratory

MEMBER ACIL

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August 21, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

RECEIVED
AUG 27 2001
ACCOUNTS PAYABLE

Sample identification by Skyline

ID:UPDES 001
RECEIVED 1615
SAMPLED 1355

FIELD MEASUREMENTS

FLOW 4412 GPM TEMP 15 C
COND. 612 pH 7.22

Kind of sample reported to us Water

Sample taken at SKYLINE

Sample taken by Gary Taylor

Date sampled August 8, 2001

Date received August 8, 2001

Analysis report no. 59-23003

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Oil & Grease	<2	2	mg/l	EPA 413.1	08-15-2001 0830 SC
Solids, Total Dissolved	501	10	mg/l	EPA 160.1	08-13-2001 1430 MK
Solids, Total Suspended	6	5	mg/l	EPA 160.2	08-13-2001 1430 MK

FAXED 8-22-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Zeke Jarvis

Huntington Laboratory

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August 30, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1750
SAMPLED 1315

FIELD MEASUREMENTS
FLOW 3659 GPM TEMP 16 C
COND. 526 pH 7.51

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled August 16, 2001

Date received August 16, 2001

Analysis report no. 59-23034

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.2	0.01	mg/l	EPA 236.1	08-24-2001 0718 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	02-28-2001 0900 SC
Solids, Total Dissolved	420	10	mg/l	EPA 160.1	08-21-2001 1300 SC
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	08-21-2001 1300 SC

FAXED 8-30-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

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COMMERCIAL TESTING & ENGINEERING CO.

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September 18, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled August 23, 2001

Date received August 23, 2001

RECEIVED 1630
SAMPLED 1358

FIELD MEASUREMENTS

FLOW	5081 GPM	TEMP	15 C
COND.	475	pH	7.40

Page 1 of 1

Analysis report no. 59-23095

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst	
Oil & Grease	<2	2	mg/l	EPA 413.1	09-04-2001 0800	SC
Solids, Total Dissolved	437	10	mg/l	EPA 160.1	08-27-2001 0830	CB
Solids, Total Suspended	18	5	mg/l	EPA 160.2	08-27-2001 0830	CB

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

MEMBER ACIL

COMMERCIAL TESTING & ENGINEERING CO.

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September 11, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

RECEIVED 1615
SAMPLED 0930

FIELD MEASUREMENTS

FLOW 6000 GPM	TEMP 15 C
COND. 317	pH 7.14

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by C.Hansen

Date sampled August 28, 2001

Date received August 29, 2001

Analysis report no. 59-23127

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	2.6	0.1	mg/l	EPA 236.1	09-06-2001 1040 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	08-31-2001 0900 SC
Solids, Total Dissolved	276	10	mg/l	EPA 160.1	08-30-2001 0900 CB
Solids, Total Suspended	171	5	mg/l	EPA 160.2	08-30-2001 0900 CB

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Lud Berg

Huntington Laboratory

MEMBER ACIL

COMMERCIAL TESTING & ENGINEERING CO.

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TEL: (435) 653-2311
FAX: (435) 653-2436
www.comteco.com

September 11, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1615
SAMPLED 1450

FIELD MEASUREMENTS

FLOW 3860 GPM TEMP 15 C
COND. 410 pH 7.20

Sample taken at Skyline

Sample taken by C.Hansen

Date sampled August 28, 2001

Date received August 29, 2001

Analysis report no. 59-23128

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.6	0.1	mg/l	EPA 236.1	09-06-2001 1040 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	08-31-2001 0900 SC
Solids, Total Dissolved	375	10	mg/l	EPA 160.1	08-30-2001 0900 CB
Solids, Total Suspended	40	5	mg/l	EPA 160.2	08-30-2001 0900 CB

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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www.comteco.com

September 11, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1600
SAMPLED 1700

FIELD MEASUREMENTS

FLOW 4800 GPM TEMP 14
COND. 540 pH 7.1

Sample taken at Skyline

Sample taken by C.Hansen

Date sampled August 30, 2001

Date received August 31, 2001

Analysis report no. 59-23159

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst	
Iron, Total	0.3	0.1	mg/l	EPA 236.1	09-06-2001 1040	MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-06-2001 1000	SC
Solids, Total Dissolved	435	10	mg/l	EPA 160.1	09-04-2001 0955	CB
Solids, Total Suspended	17	5	mg/l	EPA 160.2	09-04-2001 0955	CB

Respectfully submitted,
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September 13, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by C. Hansen

Date sampled September 2, 2001

Date received September 4, 2001

RECEIVED 1730
SAMPLED 1720
FIELD MEASUREMENTS
FLOW 7200 GPM TEMP 15 C
COND. 519 pH 7.3

NOTES:
DIS.METALS
FILTERED @ LAB

Analysis report no. 59-23182

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.5	0.1	mg/l	EPA 236.1	09-06-2001 1040 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-06-2001 1000 SC
Solids, Total Dissolved	403	10	mg/l	EPA 160.1	09-06-2001 0830 CB
Solids, Total Suspended	13	5	mg/l	EPA 160.2	09-06-2001 0830 CB

9-13-01

Respectfully submitted,
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September 13, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by C. Hansen

Date sampled September 4, 2001

Date received September 4, 2001

RECEIVED 1730
SAMPLED 1550
FIELD MEASUREMENTS
FLOW 6900 GPM TEMP 15 C
COND. 613 pH 7.30

NOTES:
DIS.METALS
FILTERED @ LAB

Page 1 of 1

Analysis report no. 59-23183

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.3	0.1	mg/l	EPA 236.1	09-06-2001 1040 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-06-2001 1000 SC
Solids, Total Dissolved	397	10	mg/l	EPA 160.1	09-06-2001 0830 CB
Solids, Total Suspended	11	5	mg/l	EPA 160.2	09-06-2001 0830 CB

FAXED 9-13-01

Respectfully submitted,
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September 20, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1630
SAMPLED 1900
FIELD MEASUREMENTS
FLOW 7600 TEMP 15
COND. 426 pH 7.92

Sample taken at Skyline

Sample taken by Chris Hansen

Date sampled September 5, 2001

Date received September 6, 2001

Page 1 of 1

Analysis report no. 59-23214

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.2	0.1	mg/l	EPA 236.1	09-14-2001 0831 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-18-2001 0730 SC
Solids, Total Dissolved	394	10	mg/l	EPA 160.1	09-10-2001 0900 TS
Solids, Total Suspended	12	5	mg/l	EPA 160.2	09-10-2001 1330 TS

RECEIVED
SEP 27 2001
ACCOUNTS PAYABLE

SKYLINE MINES
APPROVAL _____
CODE _____

FAXED 9-20-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

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September 20, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1630
SAMPLED 1354

FIELD MEASUREMENTS

FLOW 7848 GPM TEMP 14 C
COND. 430 pH 7.38

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 6, 2001

Date received September 6, 2001

Analysis report no. 59-23215

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.4	0.1	mg/l	EPA 236.1	09-14-2001 0831 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-18-2001 0730 SC
Solids, Total Dissolved	373	10	mg/l	EPA 160.1	09-10-2001 0900 TS
Solids, Total Suspended	24	5	mg/l	EPA 160.2	09-10-2001 1330 TS

FAXED 9-20-01

Respectfully submitted,
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September 20, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1640
SAMPLED 1503

FIELD MEASUREMENTS
FLOW 7.166 GPM TEMP 14 C
COND. 417 pH 7.64

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 7, 2001

Page 1 of 1

Date received September 10, 2001

Analysis report no. 59-23266

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.3	0.1	mg/l	EPA 236.1	09-14-2001 0831 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-20-2001 0715 SC
Solids, Total Dissolved	402	10	mg/l	EPA 160.1	09-12-2001 0830 CB
Solids, Total Suspended	13	5	mg/l	EPA 160.2	09-12-2001 0830 CB

Respectfully submitted,
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September 25, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by Chris Hansen

Date sampled September 11, 2001

Date received September 12, 2001

RECEIVED 1430
SAMPLED 1620
FIELD MEASUREMENTS
FLOW 9800 TEMP 15.5
COND. 540 pH 7.67

Page 1 of 1

Analysis report no. 59-23273

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.4	0.1	mg/l	EPA 236.1	09-14-2001 0831 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-24-2001 0940 SC
Solids, Total Dissolved	486	10	mg/l	EPA 160.1	09-17-2001 0800 CB
Solids, Total Suspended	12	5	mg/l	EPA 160.2	09-17-2001 0800 CB

FAXED 9-25-01

Respectfully submitted,
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September 24, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by Chris Hansen

Date sampled September 12, 2001

Date received September 13, 2001

RECEIVED 1100
SAMPLED 1610
FIELD MEASUREMENTS
FLOW 11700 GPM TEMP 16 C
COND. 556 pH 7.8

Page 1 of 1

Analysis report no. 59-23285

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.3	0.1	mg/l	EPA 236.1	09-14-2001 0831 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-24-2001 0940 SC
Solids, Total Dissolved	456	10	mg/l	EPA 160.1	09-17-2001 0800 CB
Solids, Total Suspended	12	5	mg/l	EPA 160.2	09-17-2001 0800 CB

FAXED 9-25-01

Respectfully submitted,
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October 4, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1630
SAMPLED 1450

FIELD MEASUREMENTS

FLOW	8008 GPM	TEMP	14 C
COND	443	pH	8.10

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 13, 2001

Page 1 of 1

Date received September 13, 2001

Analysis report no. 59-23287

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.3	0.1	mg/l	EPA 236.1	10-02-2001 1538 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-24-2001 0940 SC
Solids, Total Dissolved	416	10	mg/l	EPA 160.1	09-17-2001 0800 CB
Solids, Total Suspended	15	5	mg/l	EPA 160.2	09-17-2001 0800 CB

FAXED 10-5-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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October 4, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1655
SAMPLED 1505

FIELD MEASUREMENTS

FLOW 9381 GPM TEMP 14 C
COND 573 pH 7.98

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 14, 2001

Page 1 of 1

Date received September 14, 2001

Analysis report no. 59-23290

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.4	0.1	mg/l	EPA 236.1	10-02-2001 1538 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-24-2001 0940 SC
Solids, Total Dissolved	447	10	mg/l	EPA 160.1	09-17-2001 0800 CB
Solids, Total Suspended	14	5	mg/l	EPA 160.2	09-17-2001 0800 CB

FAXED 10-5-01

Respectfully submitted,
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September 24, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

RECEIVED 1645
SAMPLED 1625

FIELD MEASUREMENTS

FLOW	9380 GPM	TEMP	15 C
COND	515	pH	8.08

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 17, 2001

Date received September 18, 2001

Analysis report no. 59-23309

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Solids, Total Dissolved	479	10	mg/l	EPA 160.1	09-20-2001 0815 CB
Solids, Total Suspended	11	5	mg/l	EPA 160.2	09-20-2001 0815 CB

FAXED 9-24-01

Respectfully submitted,
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October 4, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1400
SAMPLED 1300

FIELD MEASUREMENTS

FLOW 9091 GPM TEMP 15 C
COND 573 pH 8.05

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 19, 2001

Page 1 of 1

Date received September 20, 2001

Analysis report no. 59-23325

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.4	0.1	mg/l	EPA 236.1	10-02-2001 1538 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	09-26-2001 0800 SC
Solids, Total Dissolved	541	10	mg/l	EPA 160.1	09-24-2001 0730 CB
Solids, Total Suspended	25	5	mg/l	EPA 160.2	09-24-2001 0730 CB

FAXED 10-5-01

Respectfully submitted,
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September 26, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1650
SAMPLED 1530

FIELD MEASUREMENTS
FLOW 8154 GPM TEMP 15 C
COND. 586 pH 7.83

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 20, 2001

Date received September 20, 2001

Analysis report no. 59-23347

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Solids, Total Dissolved	493	10	mg/l	EPA 160.1	09-24-2001 0730 CB
Solids, Total Suspended	16	5	mg/l	EPA 160.2	09-24-2001 0730 CB

FAXED 9-26-01

Respectfully submitted,
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September 26, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1512
SAMPLED 1330

FIELD MEASUREMENTS

FLOW 6121 GPM TEMP 14 C
COND. 571 pH 7.61

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 24, 2001

Date received September 24, 2001

Analysis report no. 59-23363

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Solids, Total Dissolved	471	10	mg/l	EPA 160.1	09-24-2001 1515 CB
Solids, Total Suspended	17	5	mg/l	EPA 160.2	09-24-2001 1515 CB

FAXED 9-26-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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October 4, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UPDES 001

Kind of sample reported to us Water

RECEIVED 1520
SAMPLED 1330
FIELD MEASUREMENTS
FLOW 5360 GPM
COND 537 pH 7.77

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled September 26, 2001

Date received September 26, 2001

Page 1 of 1

Analysis report no. 59-23387

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Iron, Total	0.4	0.1	mg/l	EPA 236.1	10-02-2001 1538 MK
Oil & Grease	<2	2	mg/l	EPA 413.1	10-03-2001 0815 SC
Solids, Total Dissolved	420	10	mg/l	EPA 160.1	09-27-2001 0645 CB
Solids, Total Suspended	17	5	mg/l	EPA 160.2	09-27-2001 0645 CB

FAXED 10-5-01

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

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SGS Member of the SGS Group (Société Génén le de Surveillance)
Committed To Excellence

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020
HUNTINGTON, UT 84528
TEL: (435) 653-231:
FAX: (435) 653-2436

October 5, 2001

CANYON FUEL CO., SKYLINE MINES
P.O. Box 719
Helper, Utah 84526

Sample identification by
Skyline

ID:UIDES 001

RECEIVED 0730
SAMPLED 1415

FIELD MEASUREMENTS

FLOW	9200 GPM	TEMP	14 C
COND	565	pH	7.66

Kind of sample reported to us Water

Sample taken at Skyline

Sample taken by Gary Taylor

Date sampled October 2, 2001

Date received October 3, 2001

Page 1 of 1

Analysis report no. 59-23408

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Solids, Total Dissolved	502	10	mg/l	EPA 160.1	10-04-2001 0650 CB
Solids, Total Suspended	17	5	mg/l	EPA 160.2	10-04-2001 0650 CB

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

MEMBER ACIL

ATTACHMENT 4

EARTHFAX ENGINEERING, INC. REPORT
SKYLINE MINE DISCHARGE EVALUATION

October 24, 2001

EarthFax

EarthFax
Engineering Inc.
Engineers/Scientists
7324 So. Union Park Ave.
Suite 100
Midvale, Utah 84047
Telephone 801-561-1555
Fax 801-561-1861

Mr. Chris Hansen
Canyon Fuel Company
Skyline Mine
HC 35, Box 380
Helper, Utah 84526

Re: Skyline Mine Discharge Evaluation

Dear Chris:

At your request, EarthFax Engineering, Inc. ("EarthFax") has completed the discharge evaluation for the Skyline Mine. The scope for this evaluation is based on comments provided by Mr. Carter Reed of the Manti-LaSal National Forest. The concerns that have been addressed include:

- Discharge Projections. Determine discharges under three conditions: current emergency conditions; stabilized conditions (after the emergency pumping is over, but prior to mining in the Flat Canyon area); and expansion conditions (with Flat Canyon). For each of these conditions, provide estimates of the waters produced from the mine which will be discharged to Eccles Creek and Electric Lake. Where possible, segregate the water produced by the Flat Canyon tract and where it will be discharged.

- Water Quality Evaluation of Impacted Streams and Reservoirs. Determine the water quality of the combined discharges of natural flow and mine water downstream of the mine, both to streams and reservoirs, under all three discharge projections. The downstream water quality should be a function of discharge and water quality from each source. Additionally, the resultant water quality estimates should be compared to the applicable standards (i.e., state water quality standards, RCRA metals, emulsions, DOGM standards, UPDES standards, etc.).

- Impact on Stream Morphology and Reservoir Operations. Based on the various projected discharges, determine the long-term impact of each discharge on either stream morphology or reservoir operations. Consider long-term plans for discharges to both Electric Lake and Scofield.

DISCHARGE PROJECTIONS

Based on information provided by Skyline Mine personnel, the anticipated discharges from the mine are presented in Table 1. The discharge projections are divided into four conditions: historic, emergency, stabilized, and expansion conditions. These projections are felt to be representative of the discharge values that may occur; however, due to the uncertainty of the conditions which may be encountered it should be recognized that additional discharges may be required.

Historic Conditions

Prior to January 2000, the combined mine water discharge from Mine 1 and Mine 3 portals was generally less than 1000 gpm. The water discharged from the Mine 1 portal consisted principally of water captured in mine Level 1 and mixed with a small portion of water from mine Level 2. After January 2000 and until August 2001, the average discharge to Eccles Creek from Mine 1 portals (water from both Levels 1 and 2) has been approximately 2500 gpm. Approximately 1600 gpm have been pumped from Mine 3 (Level 3) on average. These rates varied slightly based on the amount of water encountered underground and the water handling operations within the mine.

Emergency Conditions

The emergency conditions have existed since the increased water inflow was encountered in the mine Level 2 in early August 2001. Due to efforts by the mine to minimize impacts to the environment and to meet effluent limitations, much of the water encountered has been pumped to abandoned and currently unused sections of the mine for temporary storage. It was initially assumed that the water encountered would have a high inflow for a short duration and then decrease with time. Under these circumstances, the underground areas which temporarily stored water would have acted as a reservoir and allowed the initial inflow surge to be discharged at a lower rate over time once the inflow decreased.

However, the inflow has not decreased significantly with time, but has remained fairly constant. The mine has consumed all available storage and needs to pump out both the inflow water and the stored water to prevent mine flooding and allow continued operation. To achieve this, a discharge rate higher than the inflow to the mine will be required temporarily.

Discharges from the mine to Eccles Creek have and will range between 10,000 and 15,000 gpm under emergency conditions. At a rate of approximately 10,000 gpm all water encountered in the mine can be pumped from the mine; however, pumping at this rate does not allow the discharge of a significant amount of previously stored water. Therefore, a higher discharge rate is temporarily needed to dewater the mine. It is estimated that a rate of 15,000 gpm for several weeks would be able to handle both the inflow and stored water.

Under emergency conditions, the discharge to Electric Lake will consist of water from the James Canyon wells. These wells were drilled into the Starpoint Sandstone, in the area of the mine inflow, to collect groundwater before it reached the mine. The purpose of the James Canyon wells is to reduce the pressure within the formation and thereby reduce the inflow rate to the mine. Approximately 2,000 to 4,000 gpm are planned to be discharged from this source.

Under emergency conditions, all water intercepted by the mine will be discharged to Eccles Creek. Water pumped from the James Canyon Wells will discharge to Electric Lake within the Huntington Creek Drainage.

Stabilized Conditions

Once the initial surge of inflow water is handled, the mine will only need to discharge the normal inflow to the mine. CFC estimates that the maximum discharge rate could be 15,000 gpm. Eccles Creek will receive an estimated discharge of approximately 10,000 gpm, while Electric Lake will receive a discharge of about 5,000 gpm, assuming an UPDES permit to Electric Lake can be obtained.

These discharges represent a maximum expected discharge rate. The actual rate of discharge from the mine will be dependent on mine water handling, the amount of water encountered, and what volume of water can be stored underground. The Electric Lake discharge assumes that a new UPDES permit is allowed for discharges of mine water to Electric Lake and that the classification for Electric Lake is modified to a Class 2 water.

Expansion Conditions

Regarding mining of the Flat Canyon tract, it is estimated that dewatering resulting from this mining will result in a maximum discharge of 7,000 gpm plus the discharges from stabilized conditions. The discharges to Eccles Creek will remain the same at 10,000 gpm. The discharge to Electric Lake will increase to about 12,000 gpm. Similar to the stabilized conditions, these discharges represent a maximum expected discharge rate. The actual rate of discharge from the mine will be dependent on mine water handling, the amount of water encountered, and what volume of water can be stored underground.

WATER QUALITY EVALUATION

Based on the quality of natural runoff and water intercepted by the mine, evaluations of the expected quality of the combined waters in the downstream reaches of Eccles Creek and Electric Lake were conducted.

Eccles Creek

Using known values of the various water quality parameters and flows from the mine and upstream waters, the anticipated combined water quality at monitoring point CS-2 (immediately downstream from the mine) was estimated using a flow-weighted linear mixing model. For the natural waters and the Mine 3 Portal (Level 3) discharges, historic water quality averages were used as inputs to the model. However, due to variations in mine water quality with time and inflow occurrence locations, historic values were determined not to be appropriate for Mine 1 Portal discharges. As an example, the historic average for TDS from Mine 1 Portal, (mainly water from Level 1), is 1104 mg/l. Samples of the September 2001 discharge indicate that TDS for the current Mine 1 Portal discharge (mainly water from Level 2) is 241 mg/l. The historic flow rate has ranged from 150 to 500 gpm from Mine 1 Portal (Level 1). The current flow rate from the Mine 1 portal (the majority originating in Level 2) ranges from 3300 to 5500

gpm. Based on these conditions and differences, the historic average values are not representative of the flows currently being discharged from the mine.

While current emergency conditions are not representative of the normal operation of the mine, future operations under stabilized and expansion conditions will not return to historic conditions either. Under current conditions, the waters within the mine are being collected and discharged as soon as possible. Therefore, there is little residence time underground, resulting in very little degradation of the water quality. Thus, the water quality values from September will be used for input to the flow-weighted linear mixing model for emergency conditions.

Under stabilized and expansion conditions, it is likely that the residence time for intercepted water will be greater than it is at present. For example, the water will need to be detained to allow time for reduction of TSS values. This will result in additional time for water to interact with materials within the mine, resulting in elevated TDS values. Therefore, the projected water quality values were increased to account for these conditions. To be conservative, it is assumed that concentrations of the modeled parameters will be degraded by 100 percent beyond that measured in the September sample. Therefore, a 100 percent adjusted value for each water quality parameter was used as inputs to the flow-weighted linear mixing model to determine the quality of the anticipated flows.

The anticipated water quality was evaluated for the flow conditions of historic, emergency, stabilized and expansion. Tables 2, 3, and 4 present the results of the flow-weighted linear mixing model for each of these conditions, respectively.

Based on these projections of the anticipated water quality, the increased inflows will result in an improvement in the water quality to be discharged to Eccles Creek. Under emergency conditions, the TDS concentration is approximately 40 percent lower than the historic average value. Under both stabilized and expansion conditions, the TDS concentration in Eccles Creek will be approximately 65 percent greater than the current emergency discharge value, but 1 percent lower than the historic average value. Most other solute parameters would have similar concentration adjustments.

As discussed previously, these estimates are based on the assumption of continuous mine discharges at the specified maximum rates. It is likely that discharge rates will fluctuate due to water encountered and water handling operations. Therefore, these discharge rates and water quality values should be considered worst-case estimates. The magnitude of change may be less than estimated.

Table 5 presents a comparison of the emergency discharge water quality versus State of Utah Beneficial Use standards (UAC R317-2). For these samples, no exceedance of the state standards was identified.

Additionally, the water quality data collected from the emergency discharges were compared to Utah DOGM and UPDES standards. For the parameters sampled, no exceedances were

identified. Based on the worst-case projections of future water quality degradation, it also does not appear that these standards would be exceeded at the increased flow rates projected.

NorWest (2000a) prepared an Addendum to the Technical Report which addressed impacts to the receiving water quality by comparing the beneficial use standards against the historic data. Exceedances were identified for four parameters - BOD, dissolved mercury, phenol, and total phosphorous. No data have been collected on emergency discharges for BOD, dissolved mercury, and total phosphorous. Phenol samples were collected for both mine discharges and were not detected. The discussion of impacts to the receiving waters presented by NorWest are also applicable to the anticipated discharges from the projected discharges for stabilized and expansion conditions. Due to the increased inflow of higher quality water to the mine and the planned improved water handling procedures, it is likely that the future discharges will be lower than the historic values.

For the worst-case sustained discharge condition, the expansion conditions will result in the largest sustained discharge. Therefore, this discharge rate has the highest potential for impact to operation of the downstream Scofield Reservoir. Based on a sustained discharge of 10,000 gpm to Eccles Creek, this represents an increased annual discharge volume of 16,130 ac-ft of water. This is approximately 21 percent of the available storage capacity of the reservoir. Over the long-term, it is unknown whether the inflows to the mine will continue. However, a discharge of this volume will result in some minor changes in the operation of the reservoir. CFC will need to work with the reservoir operator to determine how the operations will need to change.

The following potential impacts to Eccles Creek were presented by Norwest (2000b) in the Technical Report for Surface and Groundwater Resources in the Flat Canyon Area. These impacts are also a concern for the proposed discharges covered in this report. These concerns are:

> "Scofield Reservoir and the Price River and its tributaries have been designated as protected by the Utah Division of Drinking Water (UAC R317-2) for 1) domestic purposes with prior treatment by treatment processes, 2) secondary contact recreation such as boating, wading, or similar uses, 3) cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain, and 4) agricultural uses including irrigation of crops and stock watering.
>
> "Before any mine water could be discharged into these waters, the current UPDES discharge permit may need to be modified. In order to receive a new or modify an existing UPDES permit, it must be demonstrated that beneficial use standards would not be exceeded in the receiving water. When a UPDES discharge permit is issued or modified, the water quality of the proposed discharge water is evaluated by the Utah Division of Water Quality (Personal Communication, Mike Herkimer, 2000). WET testing is performed to ensure that the water is not toxic (either chronic or acute) to aquatic organisms. If harmful constituents are identified in the proposed discharge water, then an approved water treatment plan must be implemented before any water may be discharged.

If constituents are found in the water that are regulated under TMDL or which may cause the receiving water to not meet the quality standards for the designated beneficial uses, then specific discharge limits are placed on these constituents. Routine water quality monitoring of the discharge water is required for all parameters requested by the Division of Water Quality to demonstrate compliance with the UPDES permit.

"As demonstrated by many years of continuous water quality monitoring, the quality of raw mine discharge water from the Skyline Mine, in terms of TDS, sulfate and pH, is acceptable for all of the protected beneficial uses and is within the drinking water standards set fourth by the Utah Division of Drinking Water (UAC 317-2). Limited chemical data are available for most other chemical parameters controlled by the designated beneficial use standards.

"With a few exceptions discussed below, the quality of the mine discharge water has generally been acceptable for all of the designated beneficial uses of the receiving water (in terms of the chemical constituents for which water quality data are available). Concentrations of total boron, cyanide, dissolved lead, total phosphorous, and TDS have on at least one occasion exceeded the concentration limits specified by one or more of its beneficial use standards. Concentrations of cyanide from CS-12 on one occasion exceeded the beneficial use standard for aquatic wildlife. On each of the other 12 monitoring events, no cyanide was detected. During the single cyanide-monitoring event from the UPDES outfall, the concentration of cyanide also slightly exceeded the standard. The concentration of total phosphorous has occasionally been exceeded in discharge from CS-12 and CS-14, and was exceeded in the single phosphorous-monitoring event from the UPDES outfall. The average concentration of total phosphorous from CS-12 discharge is within the beneficial use standards, while those standards are somewhat exceeded in the average CS-14 discharge. The concentration of total mercury also exceeded the beneficial use standards during the single mercury-monitoring event from the UPDES outfall. "Concentrations of phenol, an organic compound, have exceeded the beneficial use standards on a few occasions at both CS-12 and CS-14, while on all other occasions, there was no phenol detected in the discharge water. The causes of the occasional elevated phenol concentrations in the mine discharge water are not known. "It is important to note that for each of the chemical parameters discussed above, (with the exception of phenol and possibly total phosphorous) although certain beneficial use standards have occasionally been exceeded in the discharge water from either CS-12 or CS-14, the average concentration of mine discharge water, which is a combination of water from these two sources, is generally suitable for each of the beneficial uses. As discussed above, important chemical parameters of potential mine discharge water would be strictly controlled through the UPDES permitting process and would be monitored by several Utah State regulatory agencies. Additionally, continuous, automated monitoring equipment has been installed in the Skyline Mine discharge system that ensures that water that is excessively elevated in TDS, ph, turbidity, or oil and grease concentrations would not be discharged. If poor quality mine discharge water is detected by this system, it is automatically rerouted to underground storage areas within the Skyline Mine and is not discharged." (NorWest, 2000b)

Electric Lake

Under emergency conditions the discharges to Electric Lake come from the James Canyon wells. This water is natural groundwater that has not been affected by the mine. The historic values for flow and quality from upper Huntington Creek at Electric Lake are used to represent the existing water in the lake. Samples of the water taken from the wells were averaged to determine the representative quality of the well water. Table 6 presents the results of the flow-weighted linear mixing of the two waters.

As noted in Table 6, the TDS concentration of combined water in Electric Lake, is estimated to raise approximately 1 percent as a result of the emergency discharge. The other solute parameters show changes ranging from -17 to 56 percent. Most of these changes are the result of slight variations in the mixing waters.

For stabilization and expansion conditions, the discharge waters are planned to be mine water rather than water from the James Canyon wells. Based on the anticipated effluent limits, the TDS of this water will be limited to 200 mg/l. Therefore, CFC plans that the waters encountered within the mine will be collected as soon as possible and piped to the pumping station for discharge. This will minimize contact of the waters with the rocks, rock dust, longwall emulsion, and other mine activities, thereby minimizing degradation of the water quality. It is assumed that the waters entering the mine will have a quality similar to the James Canyon Well water. Based on the allowable limit, a degradation of 8.1 percent can occur within the mine before the limit is exceeded. Assuming this degradation for all constituents in the discharge water, Tables 7 and 8 present the anticipated mixed water quality for the stabilized and expansion conditions, respectively.

For the stabilized conditions, the TDS concentration is estimated to raise approximately 6 percent as a result of the mine water discharge. The other solute parameters show changes ranging from -25 to 100 percent. Most of these changes are the result of slightly different waters mixing.

For expansion conditions, the TDS concentration is estimated to raise approximately 8 percent as a result of the mine water discharge. The other solute parameters show changes ranging from -33 to 133 percent.

The water quality data collected from the emergency discharges were compared to Utah State Beneficial Use, DOGM, and UPDES standards. For the parameters sampled, no exceedances were identified. Based on the worst-case projections of future water quality degradation, it also does not appear that these standards would be exceeded at the increased flow rates projected.

NorWest (2000a) prepared an Addendum to the Technical Report which addressed that impacts to the receiving water quality by comparing the beneficial use standards against the historic data. Exceedances were identified for four parameters - BOD, dissolved mercury, phenol, and total phosphorous. No data have been collected on emergency discharges for

these parameters. The discussion of impacts to the receiving waters presented by NorWest are also applicable to the anticipated discharges from the projected discharges for stabilized and expansion conditions. Due to the increased inflow of higher quality water to the mine and the planned improved water handling procedures, it is likely that the future discharges will be lower than the historic values.

For the worst-case discharge condition, the expansion conditions will result in the largest sustained discharge. Therefore, this discharge rate has the highest potential for impact to operation of the reservoir. Based on a sustained discharge of 12,000 gpm to Electric Lake, this represents an annual discharge volume of 19,360 ac-ft of water. This is approximately 61 percent of the available storage capacity of the reservoir. Over the long-term, it is unknown whether the inflows to the mine will continue. However, a discharge of this volume will result in some changes in the operation of the reservoir. CFC will need to work with Utah Power and Light to determine how the operations will need to change.

The following potential impacts to Electric Lake were presented by Norwest (2000b) in the Technical Report for Surface and Groundwater Resources in the Flat Canyon Area. These impacts are also a concern for the proposed discharges covered in this report. These concerns are:

> "Huntington Creek and Electric Lake are protected for secondary contact recreation such as boating, wading, or similar uses. These waters are also protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain. The waters are also protected for agricultural uses including irrigation of crops and stock watering. Huntington Creek has been designated as protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
>
> "Before any mine water could be discharged into these waters, a UPDES discharge permit would be required. In order to receive this permit, it would need to be demonstrated that the beneficial use standards for these waters would not be exceeded. Water quality analyses for the Skyline Mine discharge for important parameters regulated under the beneficial use standards are included in Appendix D [NorWest Report]. As discussed in Section 5.1.3, the quality of mine discharge water for all parameters regulated under beneficial use standards (with the exception of phenol and possibly total phosphorous) for which data are available is generally acceptable for the designated beneficial uses. As discussed above, all important water quality parameters would be controlled through the UPDES permitting process and are regulated by several Utah State regulatory agencies. Additionally, continuous, automated monitoring equipment has been installed in the Skyline Mine discharge system that ensures that water that is excessively elevated in TDS, pH, turbidity, or oil and grease concentrations would not be discharged. If poor quality mine discharge water is detected by this system, it is automatically rerouted to underground storage areas within the Skyline Mine and is not discharged.
>
> "Because the mine discharge water is generally of sufficient quality to meet drinking water standards and all of the designated beneficial uses of the receiving waters (for the chemical parameters for which data are available and with the exception of phenol and possibly total

phosphorous), it is unlikely that there would be adverse impacts to ecosystems in downstream water courses or that there would be adverse water quality impacts to downstream water users.

"The temperature of groundwater from the Skyline Mine has averaged between about 11 and 16 C (Mayo and Associates, 1994). If this water is discharged directly into Electric Lake during the winter months when temperatures of the lake water are near 0 C, there would be an alteration of the thermal regime of the lake. This may locally result in the melting or thinning of the surface ice in the vicinity of the discharge point and may also impact ecosystems in the immediate vicinity of the discharge point.

"In the event that mine water is discharged near the high water line of Electric Lake, there is potential for appreciable erosion of lake bed sediments during times of the year when Electric Lake is not at high water. When the lake is not at high water, mine water discharge would first mix with Upper Huntington Creek discharge before flowing in the lake. When the lake is not at high water, Huntington Creek flows in a channel carved into unvegetated lake bed sediments. The addition of approximately 3,000 gpm (6.68 cfs) of mine discharge water to Upper Huntington Creek would constitute a considerable increase in the discharge in the creek. During low-flow periods, discharge from Upper Huntington Creek to Electric Lake is commonly between about 1 and 3 cfs (Mayo and Associates, 1996). Thus, an addition of 6.68 cfs would result in a baseflow discharge that is between about 2.2 and 6.7 times current levels.

"The potential for disturbance of lake-bottom sediments would be greatly diminished if discharge water were conveyed via pipeline to a point further out into the lake. Because the mine water discharged into the lake would be essentially sediment free, there would likely not be any perceptible deposition of sediment at the mine discharge point.

"During dry years and during the late summer months, the addition of 6.68 cfs of water to Electric Lake may be seen as a beneficial impact. This would be particularly true during drought years, because as discussed in Section 3.2.3 [NorWest Report], the inflow of deep, perched groundwater into the mine workings is not related to climate. During extremely wet years, when water is spilling from the reservoir, the addition of this amount of water would be a meager amount relative to the 2,300 cfs capacity of the spillway. During extremely wet years, when there is no available storage capacity in the reservoir, the mine discharge water would increase the high-flow discharge rate in Huntington Creek below the dam by 6.68 cfs. This would constitute a small percentage of the high-flow discharge of Huntington Creek below the reservoir." (NorWest, 2000b)

ECCLES CREEK GEOMORPHIC EVALUATION

Stream Classification

The Eccles Creek stream channel is cut into alluvial deposits throughout its length downstream from the Skyline Mine. From the mine surface facilities to a point approximately 0.6 mile upstream from its confluence with Mud Creek, these alluvial deposits are relatively shallow,

with channel sinuosity, slope, and the depth to which downcutting can occur ultimately being controlled by underlying bedrock. Near the confluence with Mud Creek, decreased channel and valley slopes have resulted in deposition of greater depths of alluvial material into which the channel has been cut. Sinuosity of the stream increases in this reach, as does the depth to which the channel is downcut.

For a distance of approximately 0.3 mile downstream from the Skyline Mine surface facilities, Eccles Creek is classified as a B3a stream, using the method of Rosgen (1996). The channel is steep (typically >7%), with a low sinuosity and a bed material consisting predominantly of cobbles. The v-shaped bedrock valley that holds the channel controls its lateral movement. The channel is characterized by a series of rapids with irregularly-spaced scour pools. The bed and bank materials appear stable, and the channel contains occasional woody debris from the adjacent hillslopes. Vegetation along the banks consists predominantly of firs, with an understory of willows and grasses.

The channel reach from 0.3 mile downstream of the mine to 0.6 mile upstream from Mud Creek is classified as a B4a stream. The channel in this reach is steep (typically 4.5 to 5.5%), with a bed material consisting predominantly of gravel. Several beaver ponds have been constructed in this reach, many of which appear to be currently abandoned. Pools and riffles are frequent, but irregularly spaced. The channel is approximately twice as wide in this reach compared with the upstream reach, both because of a slightly wider valley and bedrock near the bottom of the channel that forces widening of the channel by preventing significant downcutting. The channel banks and bed appear to be stable, and woody debris is common in the channel. Vegetation along the banks is predominantly willows and grasses, with nearby firs.

The lower portion of Eccles Creek is classified as an E6b channel. The channel slope is relatively steep (about 3.8%). This channel is cut into alluvial material and has moderate sinuosity. The channel banks appear stable, with a good vegetative cover of riparian grasses that form a dense sod mat, willows, and some fir. The channel banks are predominantly fine-grained materials, with the bed containing gravel and cobbles.

Hydrology

The mean annual streamflow of Eccles Creek was calculated using the channel geometry methods of Fields (1975) and Hedman and Osterkamp (1982). Since the channel width in the upper reaches may be controlled by underlying bedrock (that forces lateral cutting instead of downcutting), this calculation was performed only for Eccles Creek immediately above its confluence with Mud Creek.

According to Fields (1975), the mean annual streamflow of perennial steams in the Colorado River basin can be estimated using the equation:

$$Q_a = 80W^{1.79} \quad (1)$$

where Q_a = mean annual streamflow (acre-feet per year)
W = channel width at channel bar cross section (ft)

Based on an average channel width of 5.5 ft immediately above the confluence with Mud Creek, the mean annual streamflow of Eccles Creek is estimated to be 1,690 acre-feet per year (2.3 cubic feet per second [cfs]).

According to Hedman and Osterkamp (1982), the mean annual streamflow of perennial streams in the western United State can be estimated from the equation:

$$Q_a = 64W^{1.88} \quad (2)$$

where all terms have been previously defined. Using this equation, the mean annual streamflow of Eccles Creek above its confluence with Mud Creek is estimated to be 1,580 acre-feet per year (2.2 cfs). This is in close agreement with the estimate using the Fields (1975) method.

It has been estimated in Table 1 that the long-term maximum discharge of water from the Skyline Mine to Eccles Creek will be approximately 10,000 gallons per minute (22.3 cfs). This quantity exceeds the mean annual streamflow of the creek at its mouth by a factor of approximately 10. For periods of a few weeks, as accumulated water is pumped from the underground workings, this discharge to Eccles Creek may reach 15,000 gallons per minute (33.4 cfs). This quantity exceeds the mean annual streamflow of the creek by a factor of about 15.

The magnitudes of peak flows in Eccles Creek were estimated using the predictive equations of Thomas and Lindskov (1983). These researchers developed a series of regression equations, based on watershed area and mean watershed elevation, for estimating peak flows in Utah streams with various return periods. For the high plateaus region in which Eccles Canyon occurs, the equations are as follows:

$$Q_2 = 10.8\ A^{0.800} \quad (3)$$

$$Q_5 = 25.1\ A^{0.740} \quad (4)$$

$$Q_{10} = 680\ A^{0.706}\ E^{-1.30} \quad (5)$$

$$Q_{25} = 10{,}300\ A^{0.672}\ E^{-2.33} \quad (6)$$

$$Q_{50} = 64{,}200\ A^{0.651}\ E^{-3.03} \quad (7)$$

$$Q_{100} = 347{,}000\ A^{0.631}\ E^{-3.68} \quad (8)$$

where Q_n = peak discharge at a return period of "n" years (cfs)
A = watershed area (mi^2)
E = mean watershed elevation (thousands of feet)

These equations are based on data obtained from stream locations throughout Utah and are accompanied by average standard errors of estimate ranging from 53 to 68%. Even though the standard error is relatively large, the equations are considered a reasonable approximation of conditions in Eccles Canyon.

Flood peaks were calculated using Equations 3 through 8 for Eccles Creek above South Fork (i.e., the upper portion of the watershed where the mine surface facilities are constructed) and Eccles Creek above Mud Creek (i.e., the entire watershed). Based on drainage areas of 1.77 mi^2 and 7.10 mi^2 and mean watershed elevations of 9,110 feet and 9,000 feet for the upper and entire watersheds, respectively, the peak discharges presented in Figure 1 were estimated. Based on these estimates, the return period of the long-term maximum mine-water discharge (22.3 cfs) is estimated to be equivalent to 2.5 years for Eccles Creek above South Fork and 1.2 years for Eccles Creek above Mud Creek. The short-term maximum mine-water discharge (33.4 cfs) is estimated to be equivalent to a return period of 4.2 years for Eccles Creek above South Fork and 1.4 years for Eccles Creek above Mud Creek.

Observed Stability

An assessment was made of the existing stability of Eccles Creek throughout its length downstream from the Skyline Mine surface facilities. These observations were made on October 11, 2001, approximately 10 weeks after discharge of the increased mine-water inflow began. During this period, the rate of mine-water discharged had typically varied from 20.1 to 23.4 cfs.

Even though the channel had been subjected, for a period of several weeks, to flows approximately equal to or in excess of the anticipated long-term maximum discharge, the channel banks appear to be stable. Only limited signs of mass wasting were observed, and these appeared to be typical of stream channels under natural conditions. Some recent movement in bed materials appeared to have occurred, resulting in minor movement of depositional bars and minor aggradation behind beaver dams. This type of movement occurs frequently under natural conditions and did not appear to be abnormal.

The stability of the channel is greatly enhanced by thick vegetative growth of willows, mat-forming grasses, and firs. Although the streamflow in the channel on October 11, 2001 was near bankfull stage, no abnormal cutting of the bank was noted.

Only one location was observed below the mine surface facilities where the stream flowed out of its normal bank. At this location, approximately 0.5 mile downstream from South Fork, debris plugged the channel several years ago (as evidenced by the growth of large willows on the blockage), thereby restricting the natural channel cross section. This occurs at a location immediately adjacent to an old sediment trap formerly used by the operators of the Belina Mine

to capture sediment from their access road. A portion of the water flows out of the Eccles Creek channel at this point, into the well-vegetated sediment trap, and down the vegetated channel at the outlet of the trap. No signs of erosion were observed.

Potential Impacts

Rosgen (1996) indicates that bankfull discharge is that discharge which is most effective in channel maintenance. As noted above, the discharge observed on October 11, 2001, which was approximately equivalent to the long-term maximum discharge expected from the mine (22.3 cfs), was at about bankfull stage. Hence, the rate at which mine water will be discharged for the long term should not significantly affect channel stability and maintenance.

Based on field observations and reviews of research by others, Rosgen (1996) also indicates that bankfull discharge typically has a return period which, although variable, on average approximates 1.5 years. This corresponds well with the return periods estimated above for the long-term maximum discharge rate (i.e., with return periods of 1.2 to 2.5 years, depending on location within the watershed). This further suggests that the increased mine-water discharge should not significantly affect channel stability and maintenance.

As noted above, the average annual streamflow in Eccles Creek is anticipated to significantly increase as a result of the mine-water discharge. This increase will define a new baseflow (i.e., the sustained low flow of the stream) which will likely saturate the stream banks at higher levels than would occur without the mine-water discharge. While this may result in localized areas of instability as the bank soils saturate, the thick vegetative growth along the stream banks appears to be sufficient to avoid extensive stability problems. Given the additional water likely to be held by the stream banks, it is probable that willows will extend into new areas along the channel. This should provide additional channel-bank stability, based on observations along the existing channel.

During short periods, as accumulated water is pumped from the underground workings, discharge rates from the mine to Eccles Creek are anticipated to reach 15,000 gallons per minute (33.4 cfs). With an equivalent return period of 1.4 years, this increased flow should not adversely affect conditions near the mouth of Eccles Creek (since this is approximately equivalent to the return period of discharge rate considered most effective at channel maintenance [see Rosgen, 1996]). In the upper watershed, with an equivalent return period of approximately 4.2 years for this increased discharge, it is anticipated that water will flow out of the channel banks and onto the adjacent floodplain. Some erosion is anticipated during this period, but the magnitude of this erosion should be minimal, given the extensive vegetative cover on the floodplains and the fact that events of this magnitude have naturally occurred frequently during formation of the channel (every 4 to 5 years).

By increasing the baseflow of Eccles Creek, peak flows of a given magnitude will occur more frequently than under pre-mine conditions. For example, the 25-year peak discharge for Eccles Creek above South Fork is estimated from Figure 1 to be 88 cfs. With the additional 22.3 cfs of baseflow, however, a flow of this magnitude (88 cfs) will occur in the future

approximately every 13 years (i.e., it will have a return period associated with a current peak flow of about 66 cfs). Thus, the magnitude of runoff events at a given frequency will increase and the frequency of given magnitudes will decrease. Likewise, spring snowmelt runoff events that may have been contained within the stream banks in the past will now overflow the banks onto the adjacent floodplain. This will likely result in some increased erosion of the channel and floodplain during these infrequent events. However, as pointed out by Rosgen (1996), it is the more frequent events associated with bankfull stage (at a return period of about 1.5 years) that tend to have the greatest influence on channel morphology. Thus, on a long-term basis, the annual quantity of increased erosion resulting from the high-magnitude events should be minimal.

Additionally, CFC will have the capacity to divert inflow water from underground to either Eccles Creek or Electric Lake. For example, during periods of high flow in Eccles Creek, CFC will be able to divert high quality water to the Electric Lake discharge point to minimize impacts.

I hope this description of the potential impacts provides you with the information that you need. If you have any questions, please give me a call.

Sincerely,

Tom

Thomas J. Suchoski
Hydrologist

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TABLE 1

MINE DISCHARGE PROJECTIONS

Water Source	Discharge Rate	Discharge Drainage
Historic Conditions		
Mine 1 Discharge	500	Eccles
Mine 3 Discharge	2,500	Eccles
Total	3,000	
Emergency Conditions		
Mine 1 Portal (Level 1)	7,500	Eccles
Mine 1 Portal (Level 2)	5,000	Eccles
Mine 3 Portal (Level 3)	2,500	Eccles
Subtotal	15,000	
James Canyon Wells	4,000	Huntington
Subtotal	4,000	
Total	19,000	
Stabilized Conditions*		
Mine 1 Portal (Levels 1 & 2)	7,500	Eccles
Mine 3 Portal (Level 3)	2,500	Eccles
Subtotal	10,000	
Level 2	5,000	Huntington
Subtotal	5,000	
Total	15,000	
Expansion Conditions*		
Mine 1 Portal (Levels 1 & 2)	7,500	Eccles
Mine 3 Portal (Level 3)	2,500	Eccles
Subtotal	10,000	
Level 2	5,000	Huntington
Flat Canyon Tract	7,000	Huntington
Subtotal	12,000	
Total	22,000	

* Based on Reclassification of Electric Lake to Class 2 Water & Approval of new UPDES Permit to discharge to Electirc Lake

TABLE 2

ECCLES CREEK-Historic Conditions

Monitoring Point:	Flows (gpm)
CS-4 - Upper Eccles	190
CS-14 - Mine 1 Discharge	153
CS-12 - Mine 3 Discharge	242

	INPUT						OUTPUT			
Parameter	X_{cs4} Upstream Concentration (mg/l)	Q_{cs4} Upstream Discharge (gpm)	X_{cs14} Mine Concentration (mg/l)	Q_{cs14} Mine Discharge (gpm)	X_{cs12} Mine Concentration (mg/l)	Q_{cs12} Mine Discharge (gpm)	X_{ds} Downstream Concentration (mg/l)	Q_{ds} Downstream Discharge (gpm)	Historic Downstream Concentration (mg/l)	Percentage of Historic %
Alkalinity, Bicarbonate	266	190	310	153	280	242	283.30	585	321	-11.74
Calcium	74	190	141	153	74.9	242	91.90	585	88	4.43
Chloride	12	190	14.8	153	11	242	12.32	585	14	-12.01
Magnesium	14	190	85.3	153	49.7	242	47.42	585	35	35.47
Phenol	0	190	0	153	0	242	0.00	585	0	0.00
Potassium	1	190	13.1	153	7.5	242	6.85	585	6.1	12.35
Sodium	6	190	62.9	153	52.5	242	40.12	585	52	-22.85
TDS	269	190	1104	153	797	242	705.81	585	554	27.40
TOC	1.65	190	0.36	153	0.7	242	0.92	585	0.7	31.37
TSS	0	190	26	153	6	242	9.28	585	27	-65.62
Sulfate	15	190	525	153	361	242	291.52	585	193	51.04

TABLE 3

ECCLES CREEK-Emergency Conditions

Monitoring Point:	Flows (gpm)
CS-4 - Upper Eccles	190
CS-14 - Mine 1 Discharge	12500
CS-12 - Mine 3 Discharge	2500

	INPUT						OUTPUT					
Parameter	X_{cs4} Upstream Concentration (mg/l)	Q_{cs4} Upstream Discharge (gpm)	X_{cs14} Mine Concentration (mg/l)	Q_{cs14} Mine Discharge (gpm)	X_{cs12} Mine Concentration (mg/l)	Q_{cs12} Mine Discharge (gpm)	X_{ds} Downstream Concentration (mg/l)	Q_{ds} Downstream Discharge (gpm)	Historic Downstream Concentration (mg/l)	Percentage of Historic %	Current Downstream Concentration (mg/l)	Percentage of Current %
Alkalinity, Bicarbonate	266	190	243	12500	378	2500	265.51	15190	321	-17.29	264	0.57
Calcium	74	190	46	12500	97	2500	54.74	15190	88	-37.79	55	-0.47
Chloride	12	190	6	12500	2.5	2500	5.50	15190	14	-60.72	6.4	-14.08
Magnesium	14	190	20	12500	65	2500	27.33	15190	35	-21.91	27	1.23
Phenol	0	190	0	12500	0	2500	0.00	15190	0	0.00	0	0.00
Potassium	1	190	3	12500	12	2500	4.46	15190	6.1	-26.95	5	-10.88
Sodium	6	190	9	12500	43	2500	14.56	15190	52	-72.00	15	-2.94
TDS	269	190	241	12500	773	2500	328.91	15190	554	-40.63	333	-1.23
TOC	1.65	190	0.36	12500	0.7	2500	0.43	15190	0	0.00	0.7	-38.27
TSS	0	190	26	12500	6	2500	22.38	15190	0	0.00	27	-17.10
Sulfate	15	190	83	12500	31	2500	73.59	15190	193	-61.87	49	50.19

TABLE 4

ECCLES CREEK-Stabilized and Expansion Conditions

Monitoring Point:		Flows (gpm)
	CS-4 - Upper Eccles	190
	CS-14 - Mine 1 Discharge	7500
	CS-12 - Mine 3 Discharge	2500
	Mine 1 Adjustment Percent	100

	INPUT							OUTPUT					
Parameter	X_{cs4} Upstream Concentration (mg/l)	Q_{cs4} Upstream Discharge (gpm)	X_{cs14} Mine Concentration (mg/l)	X_{cs14} Adjusted Concentration (mg/l)	Q_{cs14} Mine Discharge (gpm)	X_{cs12} Mine Concentration (mg/l)	Q_{cs12} Mine Discharge (gpm)	X_{ds} Downstream Concentration (mg/l)	Q_{ds} Downstream Discharge (gpm)	Historic Downstream Concentration (mg/l)	Percentage of Historic %	Current Downstream Concentration (mg/l)	Percentage of Current %
Alkalinity, Bicarbonate	266	190	243	486	7500	378	2500	455.40	10190	321	41.87	264	72.50
Calcium	74	190	46	92	7500	97	2500	92.89	10190	88	5.56	55	68.89
Chloride	12	190	6	12	7500	2.5	2500	9.67	10190	14	-30.93	6.4	51.08
Magnesium	14	190	20	40	7500	65	2500	45.65	10190	35	30.42	27	69.07
Phenol	0	190	0	0	7500	0	2500	0.00	10190	0	0.00	0	0.00
Potassium	1	190	3	6	7500	12	2500	7.38	10190	6.1	20.96	5	47.58
Sodium	6	190	9	18	7500	43	2500	23.91	10190	52	-54.02	15	59.40
TDS	269	190	241	482	7500	773	2500	549.42	10190	554	-0.83	333	64.99
TOC	1.65	190	0.36	0.72	7500	0.7	2500	0.73	10190	0	0.00	0.7	4.63
TSS	0	190	26	52	7500	6	2500	39.74	10190	0	0.00	27	47.20
Sulfate	15	190	83	166	7500	31	2500	130.06	10190	193	-32.61	49	165.44

TABLE 5

Comparison of Skyline Mine Discharge Water Quality to State of Utah Beneficial Use Standards (UAC R317-2)

		Beneficial Use Standards					
Parameter	Unit	1C Domestic	2A, 2B Recreation	3A 4-Day Aquatic Wildlife	4 Agriculture	CS-12	CS-14
							n
226 Radium	pc/l	5				-	-
Alpha gros	pc/l	15			15	-	-
Ammonia N	mg/l			About 2		0.4	0.1
Arsenic-T*	mg/l	0.05		0.19	0.1	-	-
B.O.D. 5	mg/l		5	5	5	-	-
Barium-D	mg/l	1				<0.6	<0.6
Beta gross	pc/l	50		50	50	-	-
Boron-T	mg/l				0.75	<0.6	<0.6
Cadmium-T*	mg/l	0.01		0.0011	0.01	-	-
Chromium-T*	ug/l	0.05		0.011	0.1	-	-
Copper-D	mg/l			0.012	0.2	<0.1	<0.1
Cyanide	mg/l			0.0052		<0.02	<0.02
Fluoride	mg/l	2.4				0.15	0.16
Iron-D	mg/l			1 (Max)		<0.1	<0.1
Lead-D	mg/l	0.05		0.0032	0.1	<0.1	<0.1
Mercury-T*	ug/l	0.002		0.012		-	-
Nickel-T*	ug/l			0.16		-	-
Nitrate N	mg/l			4		0.19	0.36
NO2+NO3 N	mg/l	10				-	-
Phenol	ug/l			0.01		<0.04	<0.04
Phos.-T	mg/l		0.05	0.05		-	-
TDS @ 180C	mg/l				1200	773	241
Missing							
Selenium		X		X	X		
Silver		X		X			
Zinc				X			
Residual Chlorine				X			
H2S				X			
TSS			X	X			
Strontium-90		X					
Tritium		X					

TABLE 6

ELECTRIC LAKE - Emergency Conditions

Monitoring Point:	Flow (gpm)
UPL-10 - Upper Huntington Creek @ Lake Inflow	3857
JC-1 - James Canyon Wells	2200

Parameter	UPL-10 Average Concentration (mg/l)	UPL-10 Flow Rate (gpm)	JC-1 Average Concentration (mg/l)	JC-1 Flow Rate (gpm)	Average Concentration (mg/l)	Total Discharge (gpm)	Historic Concentration (mg/l)	Precentage of Historic %
Alkalinity, Bicarbonate	183	3857	226	2200	198.62	6057.00	183	8.53
Calcium	53	3857	45.03	2200	50.11	6057.00	53	-5.46
Chloride	6.5	3857	3.9	2200	5.56	6057.00	6.5	-14.53
Magnesium	9.9	3857	17.21	2200	12.56	6057.00	9.9	26.82
Potassium	1	3857	2.56	2200	1.57	6057.00	1	56.66
Sodium	3.7	3857	3.54	2200	3.64	6057.00	3.7	-1.57
TDS	182	3857	185	2200	183.09	6057.00	182	0.60
Sulfate	15.2	3857	7.89	2200	12.54	6057.00	15.2	-17.47

TABLE 7

ELECTRIC LAKE - Stabilized Conditions

Monitoring Point:	Flow (gpm)
UPL-10 - Upper Huntington Creek @ Lake Infl	3857
Mine 1	5000
Mine 1 Adjustment	8.1

Parameter	UPL-10 Average Concentration (mg/l)	UPL-10 Flow Rate (gpm)	Mine 1 Average Concentration (mg/l)	Mine 1 Adjusted Concentration (mg/l)	Mine 1 Flow Rate (gpm)	Estimated Concentration (mg/l)	Total Discharge (gpm)	Historic Concentration (mg/l)	Precentage of Historic %
Alkalinity, Bicarbonate	183	3857	226	244.306	5000	217.61	8857.00	183	18.91
Calcium	53	3857	45.03	48.67743	5000	50.56	8857.00	53	-4.60
Chloride	6.5	3857	3.9	4.2159	5000	5.21	8857.00	6.5	-19.84
Magnesium	9.9	3857	17.21	18.60401	5000	14.81	8857.00	9.9	49.63
Potassium	1	3857	2.56	2.76736	5000	2.00	8857.00	1	99.77
Sodium	3.7	3857	3.54	3.82674	5000	3.77	8857.00	3.7	1.93
TDS	182	3857	185	199.985	5000	192.15	8857.00	182	5.58
Sulfate	15.2	3857	7.89	8.52909	5000	11.43	8857.00	15.2	-24.78

TABLE 8

ELECTRIC LAKE - Expansion Conditions

Monitoring Point:	Flow (gpm)
UPL-10 - Upper Huntington Creek @ Lake Infl	3857
Mine 1	12000
Mine 1 Adjustment	8.1

Parameter	UPL-10 Average Concentration (mg/l)	UPL-10 Flow Rate (gpm)	Mine 1 Average Concentration (mg/l)	Mine 1 Adjusted Concentration (mg/l)	Mine 1 Flow Rate (gpm)	Estimated Concentration (mg/l)	Total Discharge (gpm)	Historic Concentration (mg/l)	Precentage of Historic %
Alkalinity, Bicarbonate	183	3857	226	244.306	12000	229.39	15857.00	183	25.35
Calcium	53	3857	45.03	48.67743	12000	49.73	15857.00	53	-6.17
Chloride	6.5	3857	3.9	4.2159	12000	4.77	15857.00	6.5	-26.59
Magnesium	9.9	3857	17.21	18.60401	12000	16.49	15857.00	9.9	66.53
Potassium	1	3857	2.56	2.76736	12000	2.34	15857.00	1	133.75
Sodium	3.7	3857	3.54	3.82674	12000	3.80	15857.00	3.7	2.59
TDS	182	3857	185	199.985	12000	195.61	15857.00	182	7.48
Sulfate	15.2	3857	7.89	8.52909	12000	10.15	15857.00	15.2	-33.21

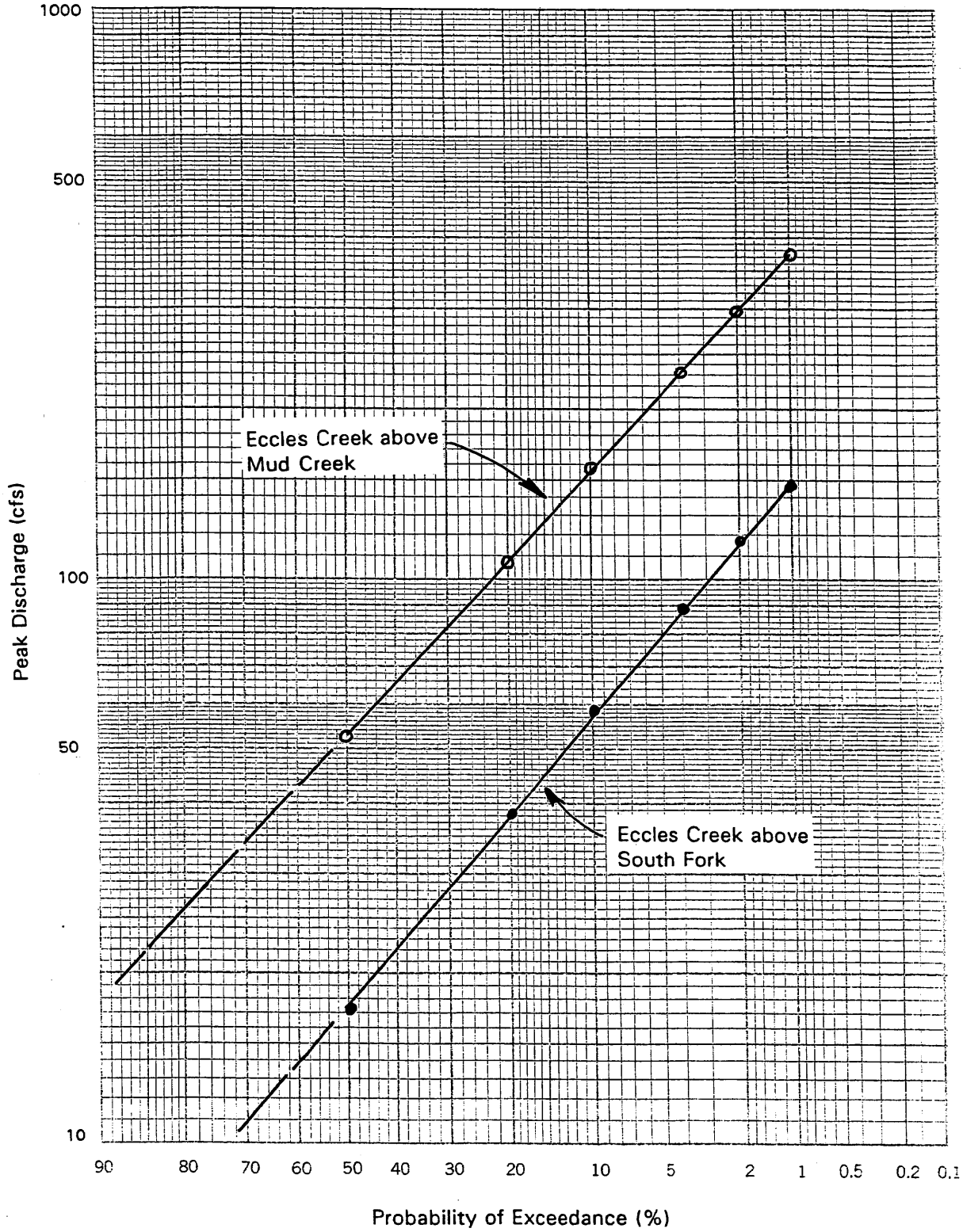

FIGURE 1. ESTIMATED PEAK FLOW FREQUENCIES FOR ECCLES CREEK.

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