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Canyon Fuel
Company, LLC.
Sufco Mine

A Subsidiary of Arch Western Bituminous Group, LLC.

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March 29, 2006

Coal Regulatory Program
Attn.: Pam Grubaugh-Littig
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P. O. Box 145801
Salt Lake City, Utah 84114-5801

*Opening
as per log
copy Steve
Alaska
S. P. to H.*

Re: Comparison of Weather Data and Stream Flows in Box Canyon, Canyon Fuel Company,
LLC, SUFCO Mine C/041/002

Dear Ms. ^{Pam} Grubaugh-Littig:

Please find attached a comparison of weather data and stream flows in Box Canyon during 2004
and 2005.

Sincerely,
CANYON FUEL COMPANY, LLC
SUFCO Mine

Michael L. Davis

Michael L. Davis,
Environmental Engineer

Encl.

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APR 03 2006
DIV. OF OIL, GAS & MINING

Comparison of weather data and stream discharge At the Sufco Mine during 2004 and 2005

Climate Data

A weather station was installed in the upper East Fork of Box Canyon in August 2004. The station is fully automated and records precipitation and temperature data hourly during the ice-free period of the year. During the winter season, the station is closed. Weather data from the East Fork weather station are available from mid August 2004 to early November 2004, and from mid May 2005 to late October 2005. These data have been used in the flow comparisons presented below.

The Palmer Hydrologic Drought Index has also been used in the flow comparisons presented below. A plot of the PHDI for Utah Region 4 for 2004 and 2005 is included in this analysis. The PHDI is a monthly numerical value generated by the National Climatic Data Center (NCDC) that indicates the severity of wet and dry spells. The PHDI is calculated from various hydrologic parameters including precipitation, temperature, evapotranspiration, soil water recharge, soil water loss, and runoff. Consequently, it is useful for evaluating the relationship between climatic conditions and groundwater and surface water discharge.

Pines 407

Pines 407 is a monitoring station on the Main Fork of Box Canyon Creek just above the confluence with the East Fork of Box Canyon. Discharge data are measured at Pines 407 using a 3-inch Parshall flume that is installed at the site. The station is equipped with a pressure transducer and a datalogger that continuously records flow data on the creek during the ice-free period of the year. Discharge data at Pines 407 for 2004 and 2005 are plotted together with precipitation data from the East Fork weather station on the attached sheets.

It is apparent that discharge in the stream responded during 2004 to the springtime snowmelt, with sustained flows on the order of 100 gpm occurring during April and May. Discharge at Pines 407 declined gradually through the summer months to approximately 50 gpm. Short-term spikes in the discharge rate during this period are likely due to torrential rainfall events in the Box Canyon Creek drainage. Beginning in September 2004, discharge in the stream increased gradually through October 2004, reaching a sustained discharge rate of approximately 100 gpm. During October 2004, the influences of torrential rainfall events are apparent as spikes in the discharge rate measured at Pines 407. It is typical in the Sufco Mine area for spring and stream discharges to occasionally increase in the fall months relative to discharge rates measured in the warm summer months. This condition is attributed to the decrease of losses to evapotranspiration resulting from cooler air temperatures and diminished plant activity. This phenomenon is likely in part responsible for the increase discharge at Pines 407 measured in the fall of 2004. It is also apparent in the plot of the PHDI that the region was rapidly entering into

a period of significantly wetter climatic conditions. Climatic variability is likely responsible for most of the increase in discharge at Pines 407 during the fall of 2004. Precipitation data from the East Fork weather station are limited during 2004. However, some precipitation events recorded at the weather station correspond with spikes in discharge measured at Pines 407. The muted response to the precipitation event recorded at the East Fork weather station in early September 2004 demonstrates that localized precipitation events near the weather station may not be representative of rainfall conditions over the entire Box Canyon drainage area (particularly with isolated summertime thunderstorms that can be very localized in nature).

During 2005 discharge at Pines 407 was similar to that measured during 2004, although discharge during spring runoff season was appreciably greater than that measured in 2004, with sustained discharge rates of about 175 gpm. Similarly, discharge rates during the mid-summer season in 2005 ranged from about 75 to 100 gpm. There was very good correlation between the numerous rainfall events recorded at the East Fork weather station and spikes in discharge measured at Pines 407.

Pines 408

Pines 408 is a monitoring station on the East Fork of Box Canyon just above the confluence with the Main Fork of Box Canyon Creek. Discharge data are measured at Pines 408 using a 3-inch Parshall flume that is installed at the site. The station is equipped with a pressure transducer and a datalogger that continuously records flow data on the creek during the ice-free period of the year. Discharge data at Pines 408 for 2004 and 2005 are plotted together with precipitation data from the East Fork weather station on the attached sheets.

Discharge in the East Fork of Box Canyon as monitored at Pines 408 is typically considerably less than that measured in the Main Fork of Box Canyon Creek monitored at Pines 407. During 2004 discharge at Pines 408 ranged from about 10 to 15 gpm during the spring runoff event. As the summer months progressed, discharge in the drainage declined gradually to less than 5 gpm. Beginning in September 2004, discharge in the drainage increased appreciably, with sustained flows of about 10 to 20 gpm. During this time, abrupt spikes in discharge rates were measured in the stream, which are typically indicative of torrential precipitation events. The increase in discharge during the fall of 2004 is likely primarily attributable to the transition to wetter climatic conditions the region experienced at that time. Decreased losses to evapotranspiration during the cooler fall months are also in part responsible for the increased discharge measured at Pines 408 during the fall of 2004.

During 2005, discharge in the stream channel increased significantly relative to rates measured in 2004. Discharge rates measured during the spring runoff season in 2005 commonly exceeded 150 gpm, which reflects the wet climatic conditions the region experienced during 2005. Beginning in late May 2005, as the spring runoff waned, discharge in the drainage gradually began to decline. By mid-July 2005, discharge in the

East Fork had declined to about 35-40 gpm. Similar discharges were recorded at Pines 408 until late October 2005 when data collection at Pines 408 stopped for the year.

There is good correlation between discharge spikes measured at Pines 408 and precipitation data recorded at the East Fork weather station upstream of Pines 408.

FP-1

FP-1 is a monitoring site on a specified reach of the stream channel in the upper west fork of the Main Fork of Box Canyon (located between monitoring sites SUFCO 089 and GW-20). Monitoring at FP-1 occurs on or near October 1 of each year. Monitoring at FP-1 consists of the identification of the location of the first (uppermost) discharge in the stream on that date. A discharge measurement is also performed at this location. During both 2004 and 2005 there was no flow in the FP-1 stream section during October.

The first occurrence of flow in Box Canyon Creek during October 2004 occurred at an approximate location of 469636, 4316158 (UTM, Zone 12 NAD 27 coordinates). A discharge of 0.05 gpm was measured at that time in the creek a short distance downstream. During October 2005, the first occurrence of stream flow in Box Canyon Creek occurred at an approximate location of 469471, 4316735 (UTM, Zone 12 NAD 27 coordinates) in the southwest $\frac{1}{4}$ section 10, T21S, R5E. A discharge of 0.41 gpm was measured a short distance downstream of this location. The higher discharge measured in 2005 was likely in response to the wetter climatic conditions the region experienced in 2005 relative to 2004.

FP-2

FP-2 is a monitoring site on a specified reach of stream in the east fork of the East Fork of Box Canyon Creek (between Pines 105 and the confluence with the East Fork of Box Canyon Creek). Monitoring at FP-2 occurs on or near October 1 of each year. Monitoring at FP-2 consists of the identification of the location of the perennial portion of the stream. There was no perennial stream flow at the confluence with the East Fork of Box Canyon Creek during October of 2004 or 2005.

Discharge from spring Pines 105 infiltrated entirely into the subsurface during both 2004 and 2005 at an approximate location of 471738, 4316900 (Zone 12, UTM NAD 27 coordinates). Approximately 1,100 feet below Pines 105, which is slightly more than half-way between Pines 105 and the confluence with the East Fork. The flow at that point during both 2004 and 2005 was 0.00 gpm.

Pines 106

Pines 106 is a regular monitoring location in Sufco's quarterly water monitoring plan. Pines 106 also corresponds to site EFB-6, which is a flow monitoring site associated with the undermining of the East Fork Drainage. The location of Pines 106 corresponds with the uppermost occurrence of perennial flow in the East Fork. Above this location, the

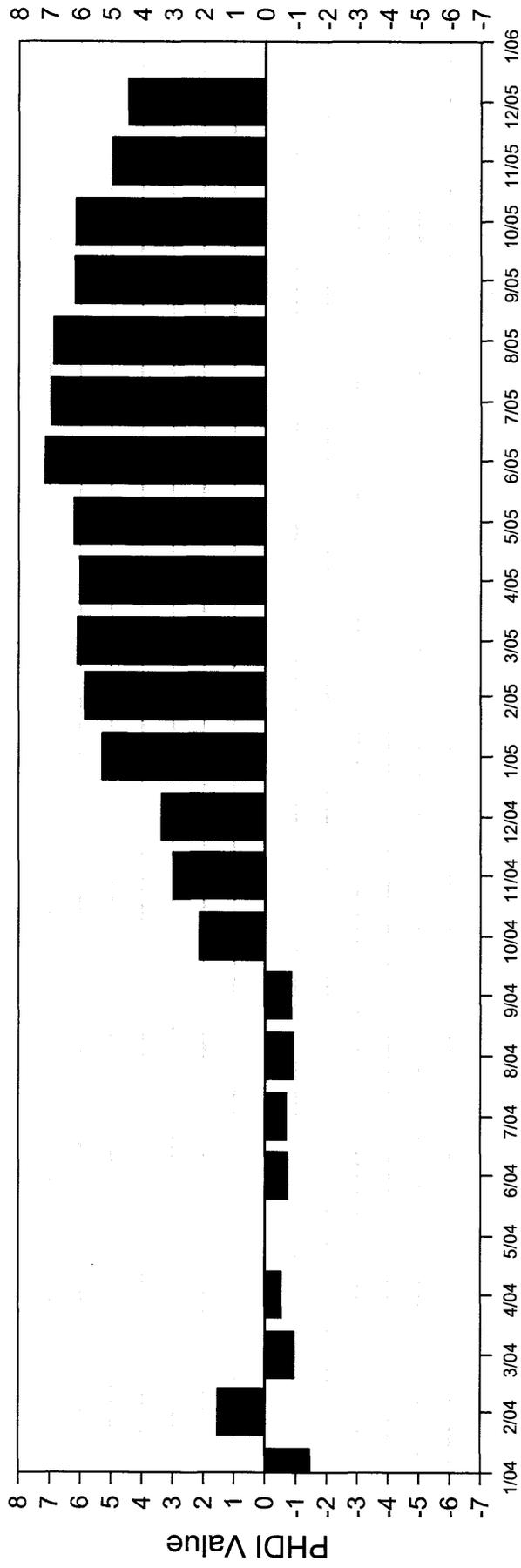
stream is usually dry. Discharge at Pines 106/EFB-6 is plotted on the attached sheet. Discharge at monitoring site EFB-7, which is located on the East Fork about 500 feet below Pines 106/EFB-6 is also plotted on the attached sheets. Typically, discharge in the East Fork increases rapidly through diffuse seepage from the underlying sandy substrate between Pines 106/EFB-6 and EFB-7.

It is apparent in the attached plot that discharge at Pines 106 is meager. In 2004, during the springtime runoff event, measured discharge peaked at 3.1 gpm in late April (the first measurement of the season). From mid-June through the rest of 2004 discharge at Pines 106/EFB-6 was less than 0.5 gpm.

During 2005 (a period of significant wetness) the springtime runoff event is not reflected in the discharge data for Pines 106/EFB-6. Discharge at the site during 2005 was less than 0.5 gpm throughout the year. However, it was noted in the field during 2005 by monitoring personnel that, while the discharge at the designated Pines 106/EFB-6 monitoring site was meager, discharge in the stream drainage about 30 feet below the normal monitoring point was considerably greater. It is unknown whether this slight shift in the first location of significant streamflow in the East Fork of Box Canyon is related to mining-activities or whether it is the result of other factors. In either event, the discharge measured a short distance below Pines 106/EFB-6 is considerably greater than that measured at the same location during 2004, which is a reflection of climatic trends in the region. Discharge measured at EFB-7 clearly reflects the influence of climatic conditions in the East Fork drainage, with typical mid-summer discharges of 3 or 4 gpm occurring during 2004, while mid-summer discharges on the order of 20 gpm occurred during 2005.

USFS 109

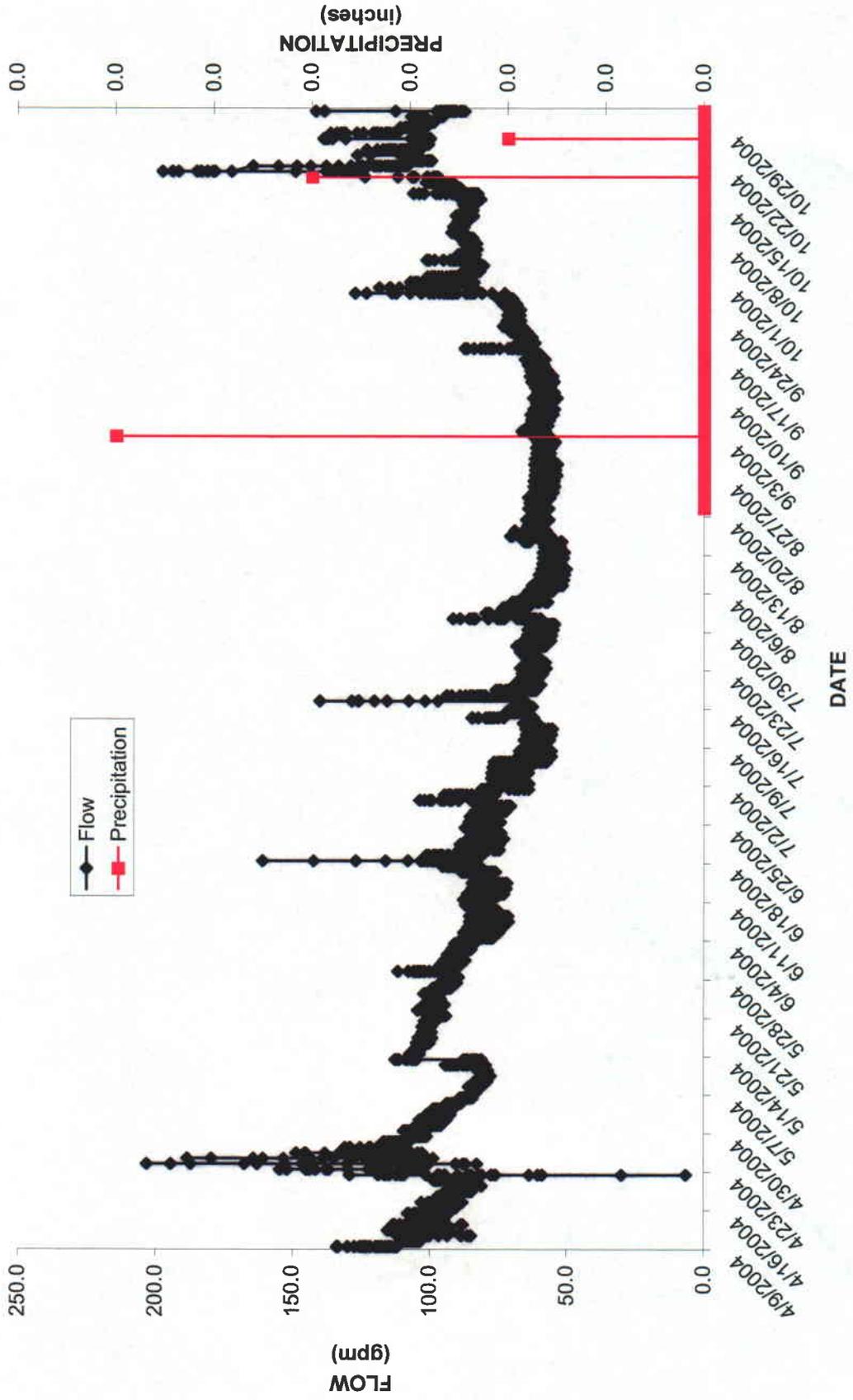
USFS 109 is routinely monitored as part of Sufco's quarterly water monitoring program. The site is located in the upper middle fork of the Main Fork of Box Canyon. There was no discharge measured during 2004 and 2005 at USFS 109.



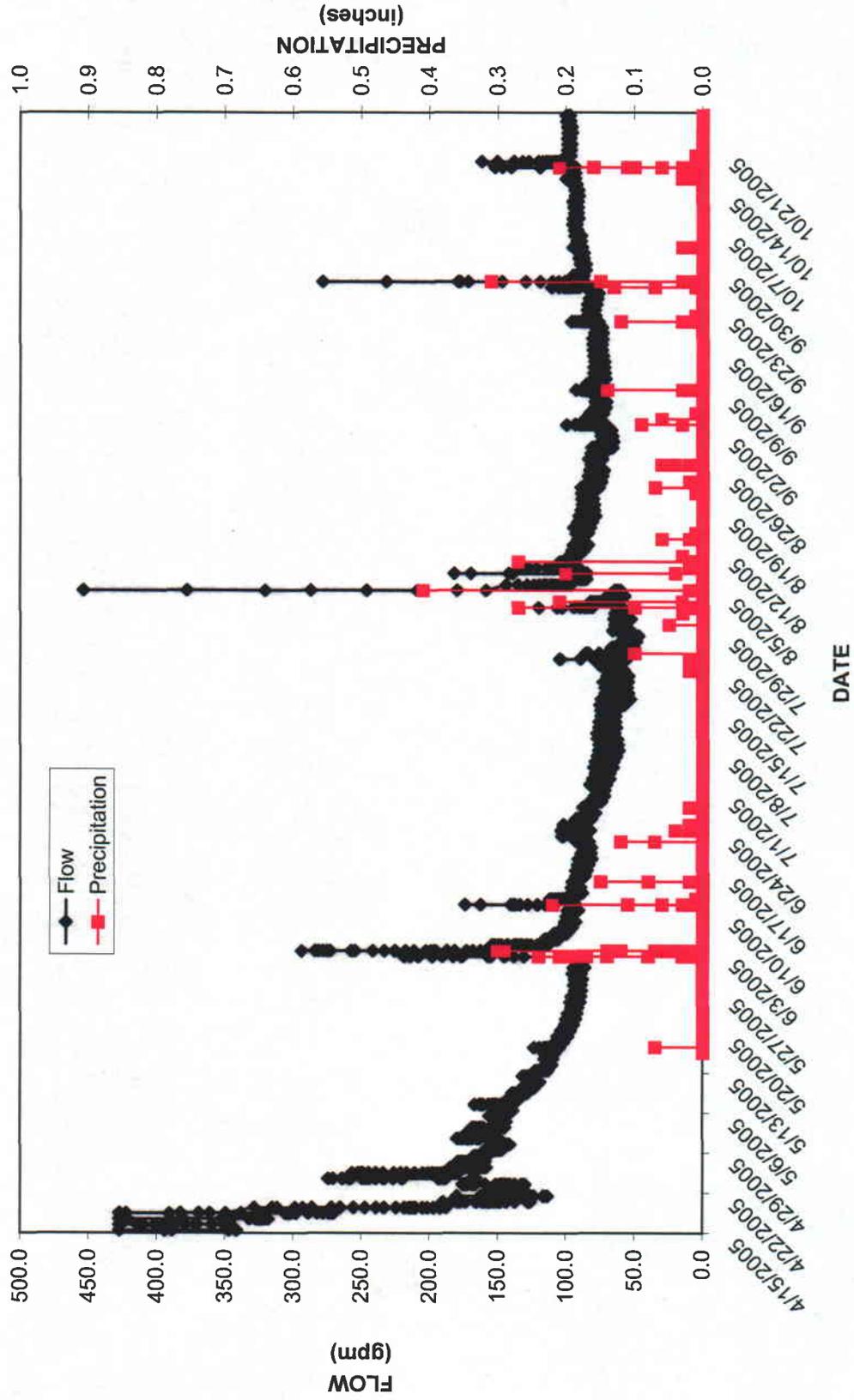
- 1 to -2 Mild Drought
- 2 to -3 Moderate Drought
- 3 to -4 Severe Drought
- 4 to -5 Extreme Drought
- 1 to 2 Mild Wet Spell
- 2 to 3 Moderate Wet Spell
- 3 to 4 Severe Wet Spell
- 4 to 5 Extreme Wet Spell

Plot of Palmer Hydrologic Drought Index for Utah Region 4.

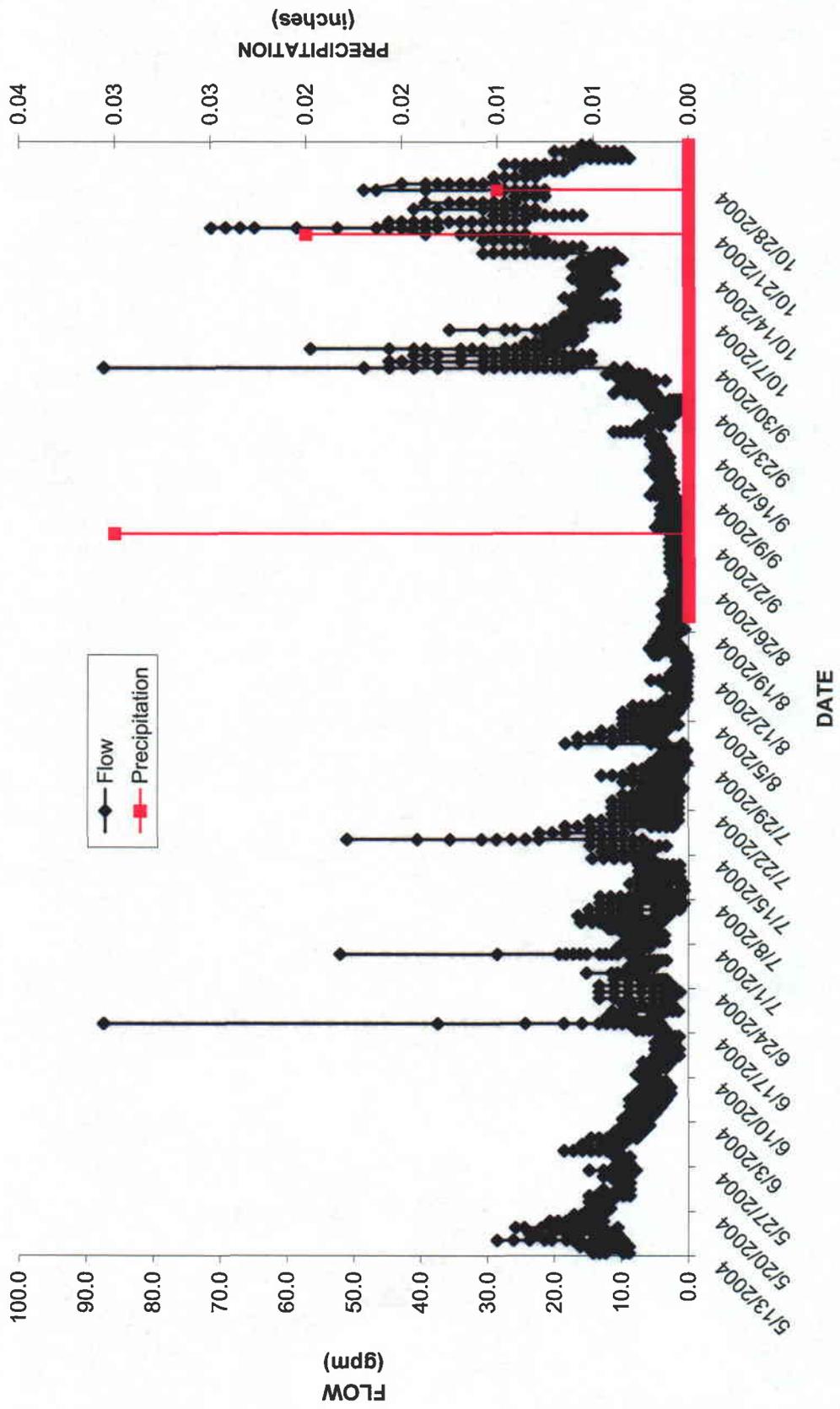
PINES 407
2004



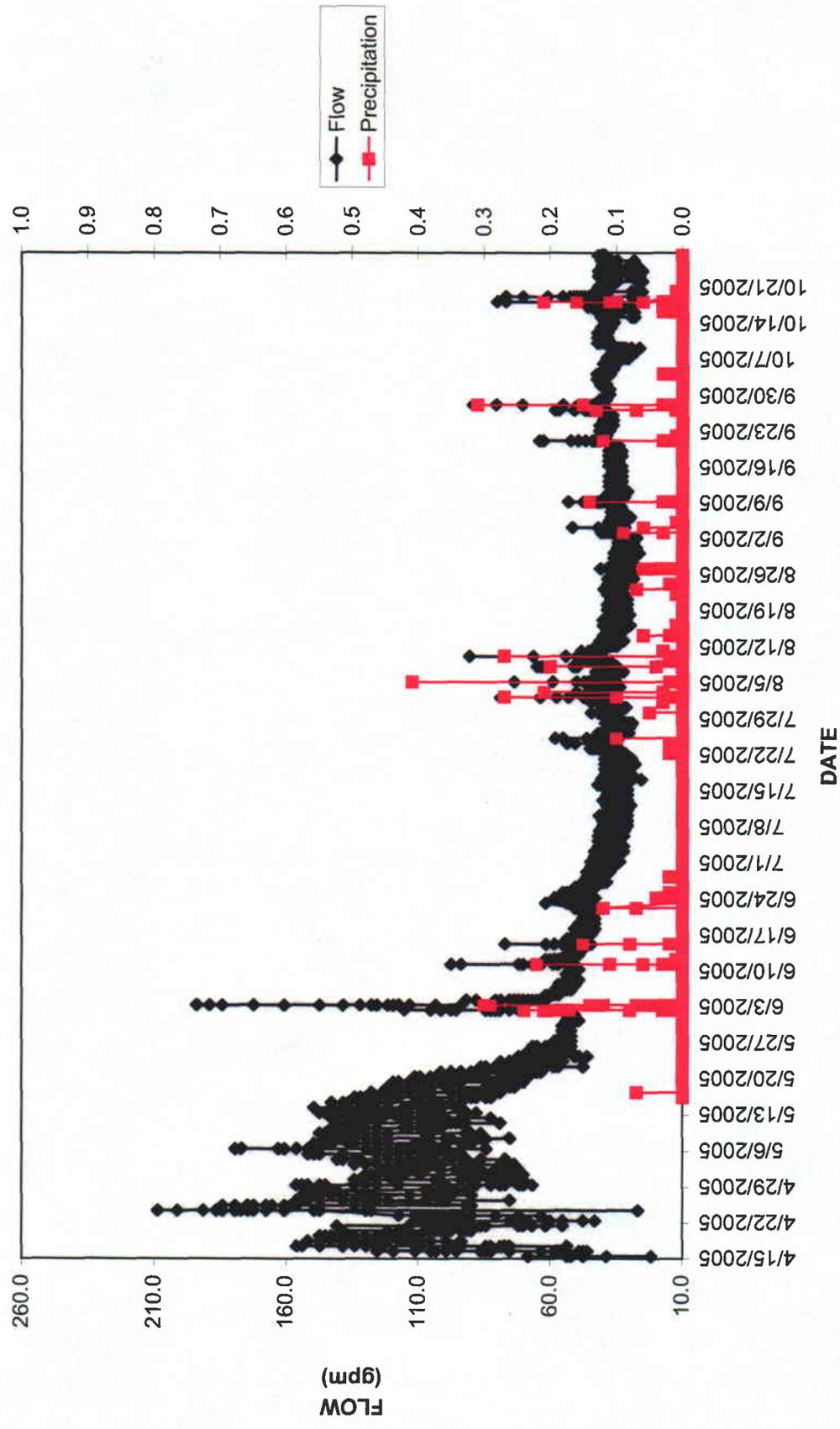
**PINES 407
2005**



PINES 408
2004



PINES 408
2005



EFB-6 and EFB-7 discharge

