The Effect of Plastic Liner on Acid Loads/DLM Site, W.V.

by

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Everyone familiar with the acid mine drainage problem recognizes the equations that relate pyrite, oxygen and water to the formation of acidity. Many of the predictive models integrate the occurrence of pyrite and carbonate to reactivity rates and levels of acid production. Similarly, many of the reclamation techniques, designed to mitigate acid generation, are structured to manipulate the gas and water systems that form an integral part of the equation. Given the three factors, pyrite, gas (oxygen) and water, the removal or complete isolation of any one of these factors checks the acid reaction and eliminates the acid producing mechanism.

This, in essence, was the strategy employed in reducing the acid loads associated with the DLM Coal Company mine complex near Alton, W.V. The principle being to eliminate infiltrating water, thereby reducing the seepage and acid loads emanating from the backfilled area of the mine.

Several possible mechanisms that could be used as a surface sealant were evaluated. From a variety of considerations, the decision was made to use a 20 mil PVC liner to cover a portion of the DLM property. For a detailed discussion of the background of the problem, the theory behind the approach to this solution and the manner in which the liner was installed, refer to "The Application of Surface Sealant Technology for the Prevention of Acid Mine Drainage" by E. Foree , Commonwealth Technology, Inc., paper presented before the Third W.V. Surface Mine Drainage Task Force Symposium, May 17, 1982.

At the DLM property all acid seeps are channeled into treatment facilities and settling basins to neutralize the acidity and reduce the iron and manganese concentrations to acceptable levels. As part of a monitoring program the volumes and chemistries of the seeps are periodically measured and the total acid load emanating from this mine complex can be determined. Similarly, the percentages of the net acid load attributable to each seep can be calculated. These percentages may also be used to test the degree to which the plastic liner reduces acid and assess the reduction in treatment costs.

The data presented below are a part of a comprehensive monitor program designed to evaluate the effectiveness of using this technology to mitigate acid mine drainage. Other parameters include changes in ground water levels, reversals in hydraulic gradients, possible changes in geochemistries of seep and acid regimes, reductions in flows and shifts in drainage quality between various parts of the mine. To cover each of these aspects is beyond the purpose and scope of this paper. What we present is a synopsis of the preliminary set of data, dealing primarily with acid loads, which illustrate the effectiveness of the liner and the degree to which acid loads have been affected.

Within the DLM mined area eight major seeps emanate from various portions of the complex. The flows and acid concentrations for each of the seeps were used to calculate the total acid loads generated in the mine and the percentage contributions by each seep. These data are summarized in Table 1.

The data in Table 1 show that the total, net acid load emanating from this mine complex during December 2, 1980 (pre-dating the installation of the PVC liner) is on the order of 1904.5×10^{6} mg/day. Of this total, 1473.7×10^{6} mg/day, or 77.4% came from Seeps 6 and 7.

As part of an effort to reduce the acid load associated with the seeps, DLM covered the part of the mine complex which was identified with Seeps 6 and 7. This area of approximately 45 acres was graded, covered with a continuously sealed 20 mil PVC which was capped with approximately 18" of soil, and vegetated. The installation of the PVC liner was started in October, 1981 and was 40% completed by the end of November, 1981. The project area was completely lined during June, 1982.

The data in Table 1 show that through time, from December, 1980 to December, 1982, there was a substantial decrease in total acid loads. Significantly, the percentage of the net load, contributed by Seeps 6 and 7, fell from 77.4% of the total (before the installation of the liner) to 28.5% of the total (six months following completion of the lining).

In terms of net acid reduction which may be translated to a decrease in treatment costs, the liner effectively reduced the acid load by $[(299.5 \times 10^{6}) \times 77.4\% - (299.5 \times 10^{6}) \times 28.5\%] = 146 \times 10^{6}$ mg/day.

This trend is further demonstrated by comparing Figures 1 and 2, plots of the characteristics of Seep 2 which emanates from an unlined portion of the mine and is used as the control, to Figures 3 and 4, which plot the characteristics of Seep 7, affected by the PVC liner. Through time, Seep 2 shows a small decline in flow (Figure 1) but a significant increase in acid load (Figure 2). Seep 7, however, shows a substantial decrease in flow (Figure 3) and acid load (Figure 4) and is directly attributable to the effect of the plastic liner.

Although these are preliminary results, the data substantiate the effectiveness of the liner's ability to reduce acid loads through reductions in flows. Further evaluation of the liner's effect on other facets of the geochemistry of the acid regime, in terms of mitigating acid production, is continuing to take place. These results will be reported in a future issue of AMDTAC Newsletter.

Table 1

Acid Loads (mgs/day) Produced by each of the Major Seeps at the DLM Site

	2 Dec. 1980	Dec. 1981	Dec. 1982
Seep # 1	15.1×10^6	22.5×10^6	18.9×10^6
Seep # 2	115.8×10^6	61.4×10^6	72.4×10^6
Seep # 2A		12.6×10^6	7.9×10^6
Seep # 3	104.7×10^6	37.3×10^6	27.7×10^6
Seep # 4	0.04×10^6		
Seep # 5	195.2×10^6	89.1×10^6	87.3×10^6
Seep # 6	1153.7×10^6	195.1×10^6	80.4×10^6
Seep # 7	$> 320 \times 10^6$	31.0×10^6	4.9×10^6
Total Acid Load (mgs/day)	1904.5×10^6	449.0×10^6	299.5×10^6
% Acid Load Contributed by Seeps 6 & 7	$\frac{1473.7}{1904.5} = 77.4\%$	$\frac{226.1}{449.0} = 50.4\%$	$\frac{85.3}{299.5} = 28.5\%$

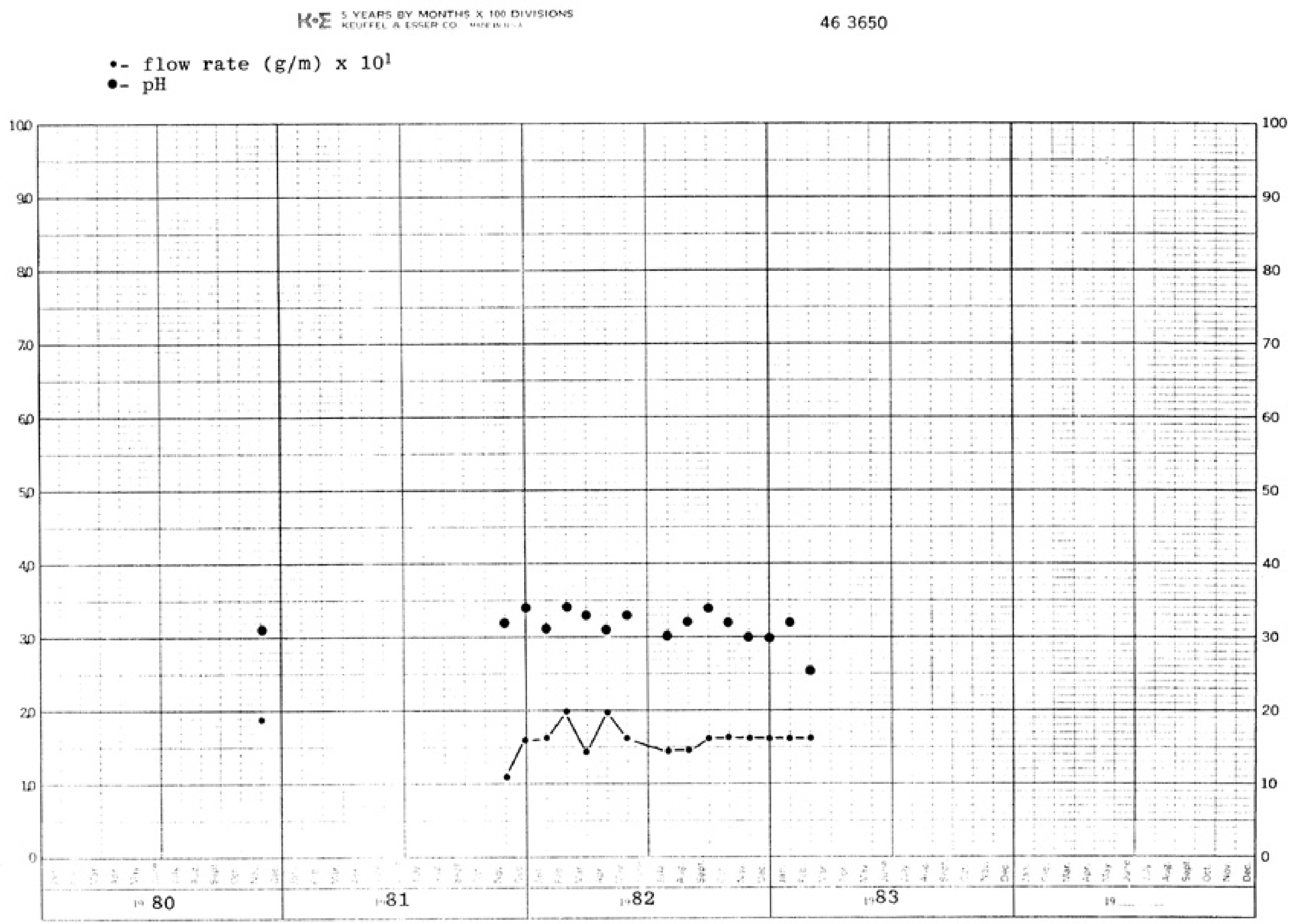

FIGURE 1- Flow Rate and pH for Seep 2 from the Unlined Portion of the Backfill (Control)

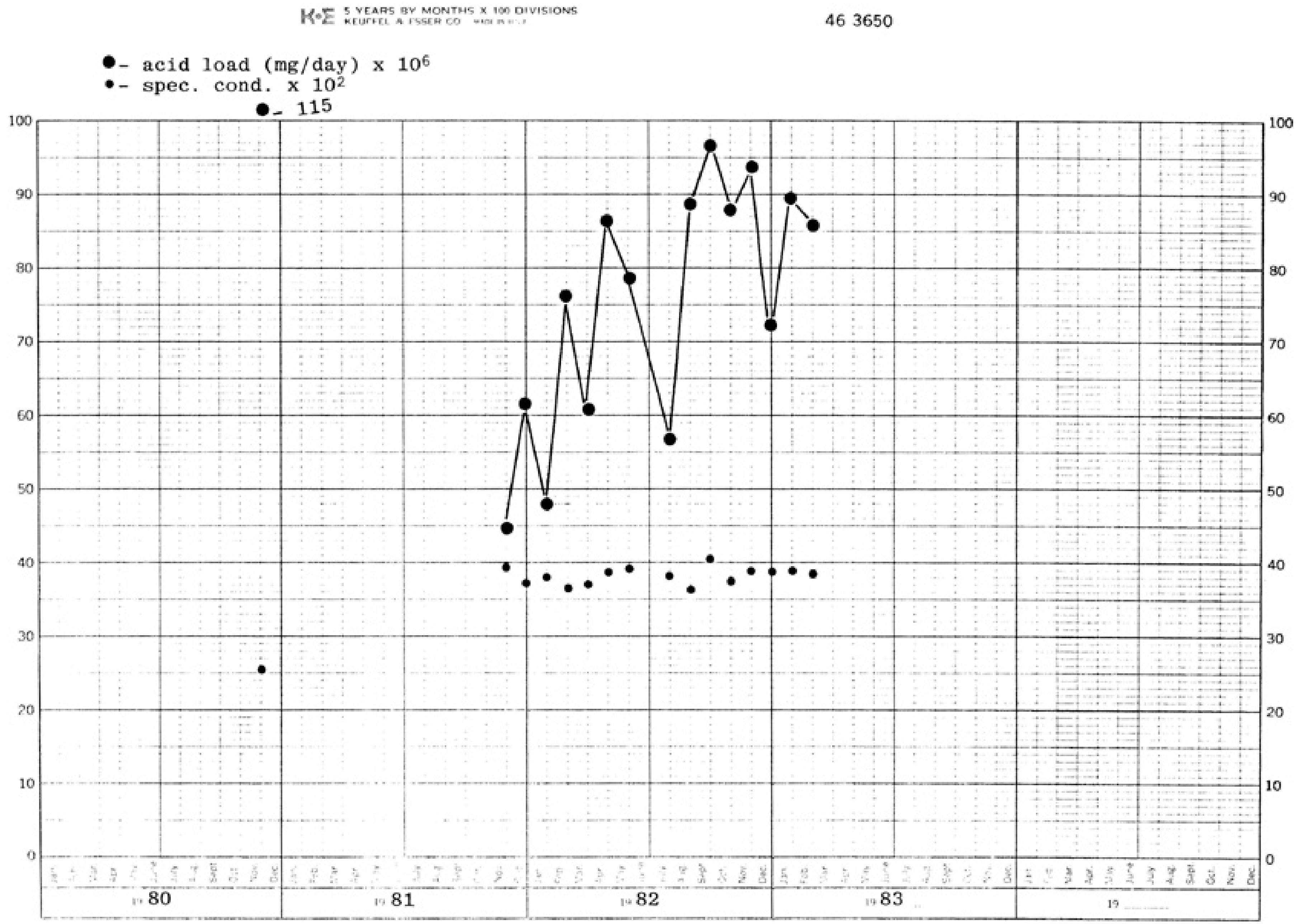

FIGURE 2- Acid Load and Specific Conductance for Seep 2 from the Unlined Portion (Control)

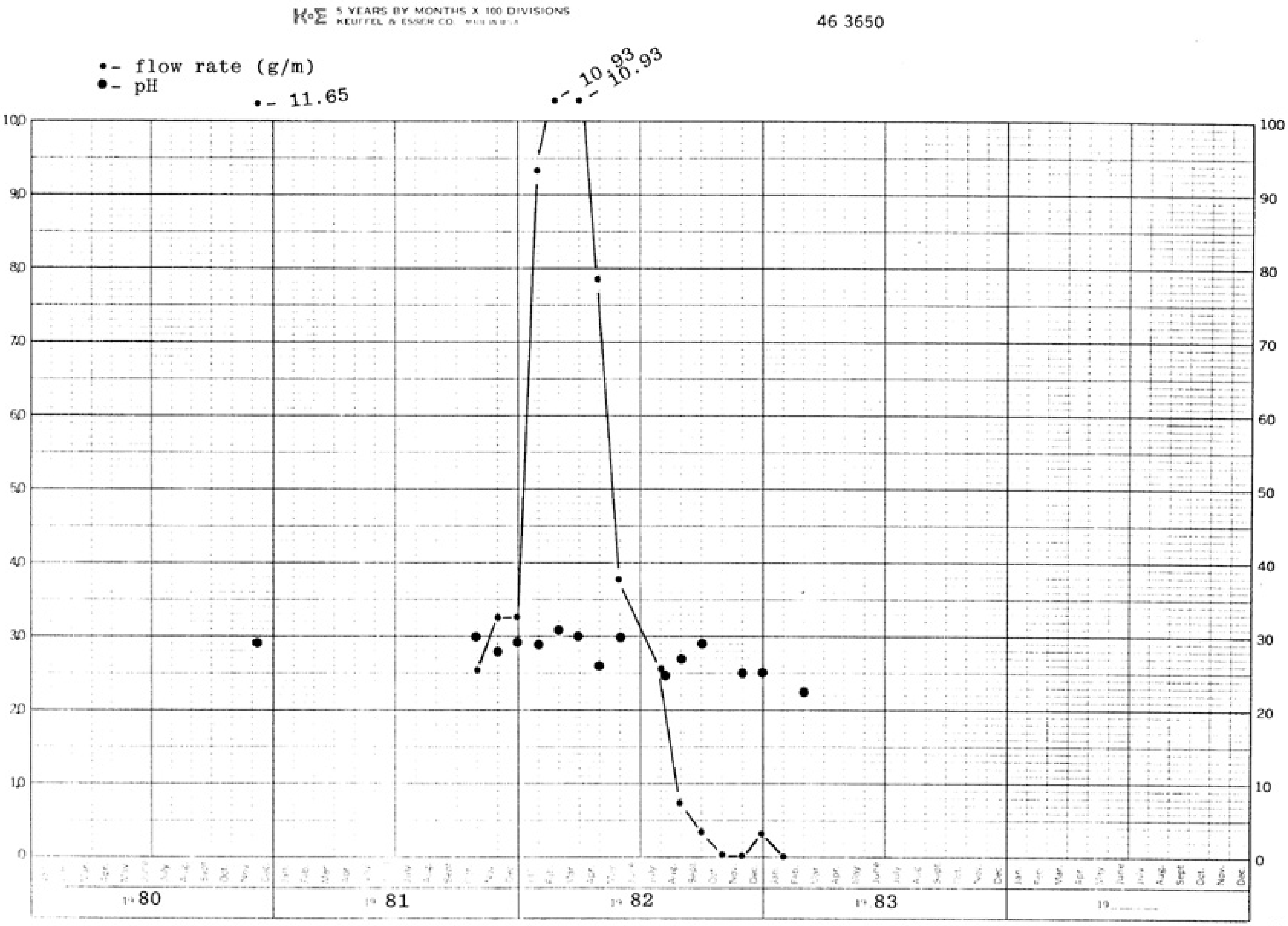

FIGURE 3- Flow Rate and pH for Seep 7 from the Lined Portion of the Backfill

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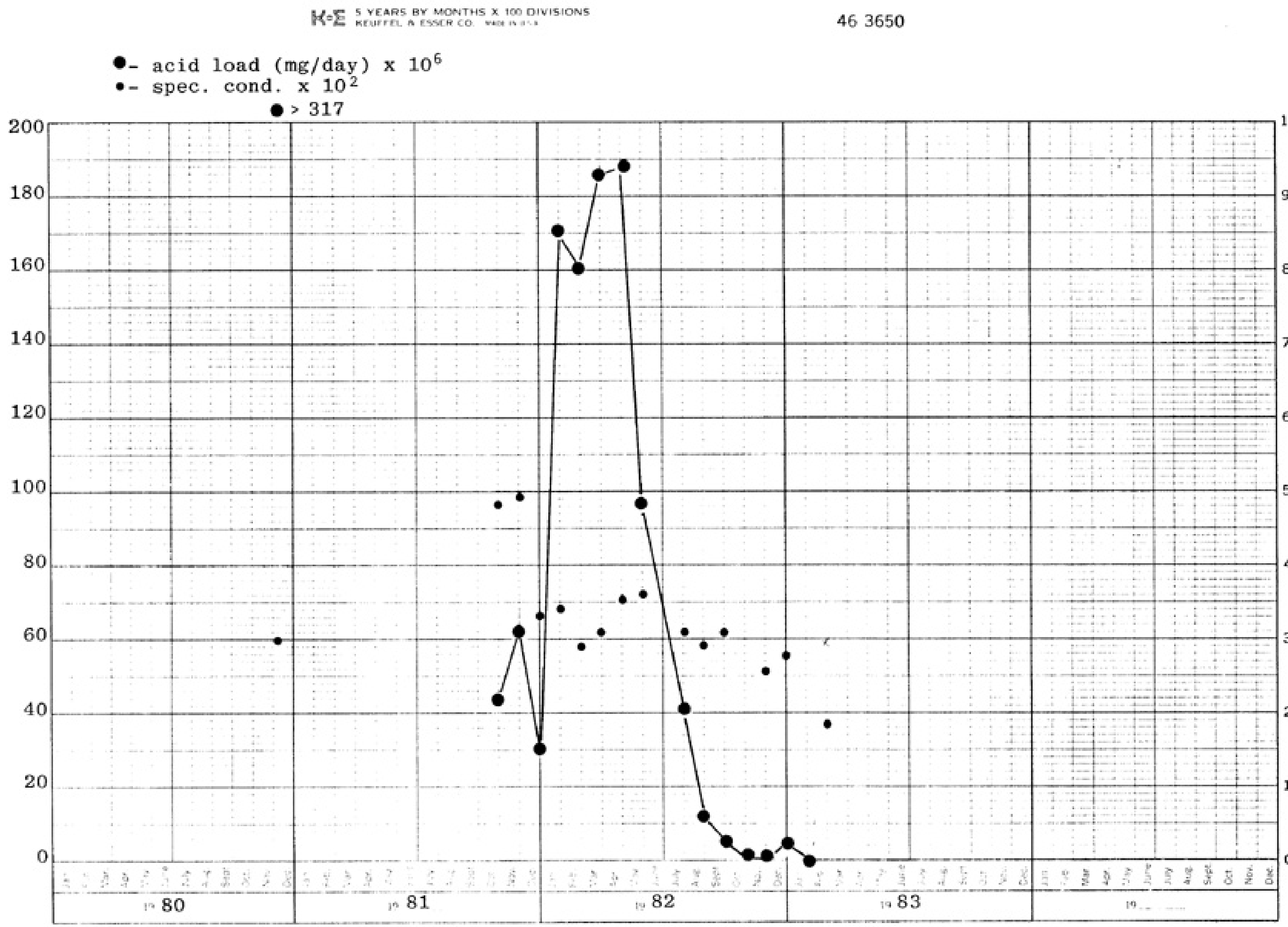

FIGURE 4- Acid Load and Specific Conductance for Seep 7 from the Lined Portion