ENVIROCARE OF UTAH, LLC
SAFE AND SECURE

CD05-0487

October 13, 2005

Dane L. Finefrock
Executive Secretary
Division of Radiation Control
168 North 1950 West
P.O. Box 144850
Salt Lake City, UT 84114-4850

Subject: Envirocare's Cover Test Cell Evaporative Zone Depth (EZD) Report

Dear Mr. Finerfrock,

Envirocare of Utah, LLC (Envirocare) is hereby submitting a Cover Test Cell Data Report in order to justify an Evaporative Zone Depth (EZD) change from 18-inches to 24-inches.

This report is provided as a response to EZD related Interrogatories that Envirocare received on September 19, 2005, in regards to the Class A Combined License Amendment Request.

Envirocare is submitting this report as a separate attachment from the main body of interrogatory responses in order to expedite the review on this important matter.

Envirocare has attached a copy of the report to this letter and also sent three copies to URS. Please call me at (801) 532-1330 with any questions regarding this issue.

Sincerely,

Daniel B. Shrum
Director of Safety and Compliance

Enclosure

cc:
Robert Baird, URS: 3 copies

Envirocare of Utah, LLC

Cover Test Cell Data Report Addendum:
Justification to Change EZD from 18-inches to 24-inches

1.0 INTRODUCTION

The Cover Test Cell (CTC) began collecting calibrated data on January 22, 2002. During this time, trends have been developing that justify an evaporative zone depth (EZD) for the Envirocare site of at least 30 inches. Previous infiltration and transport modeling has assumed an EZD of 18 inches; Envirocare proposes to increase this to 24 inches for future modeling efforts.

This report consists of a discussion of the instrumentation used to develop the EZD as well as a discussion of the data acquired to analyze EZD. This data spans from January 22, 2002 to September 26, 2005. Detailed construction and instrument location drawings of the CTC can be found in the Cover Test Cell As-Built Report submitted as part of an informational request to the Division of Radiation Control (DRC) and URS on July 8, 2004 under cover letter CD04-0329. The analysis presented in this report is a continuation of information provided in the *Cover Test Cell Monitoring Report*, dated June 20, 2003.

2.0 INSTRUMENTATION

2.1 HEAT DISSIPATION UNITS (HDUs)

HDUs are small, fragile instruments comprised of a ceramic cylinder approximately 1.5 cm in diameter and 3.2 cm long. Internally, the unit consists of a heating element needle and a thermocouple surrounded by the ceramic material. During data collection, a constant power source applies a 50-milliamp current to the heating element for 30 seconds while the thermocouple measures the temperature change in the area. This temperature increase can be correlated to the matric potential through fitted calibration curves.

HDUs are also known as Matric Potential Probes or Soil Water Potential Probes, and are capable of measuring the matric potential of the media within which they are placed. 'Matric potential' is defined as the amount of tension retained in the soil due to small amounts of water retained in the soil matrix; it corresponds to the pressure work required per unit quantity of water to move water within the system to a neighboring point at the same elevation (pressure head or pressure potential). The greater the pressure, the more dry the matrix: conversely, as conditions become more wet, a lower amount of pressure will be required to 'move water' as described above. Gradients in matric potential are important because they measure movement of water within the system.

2.2 TEMPERATURE PROBES

Temperature probes installed throughout the CTC are rugged instruments consisting of a thermister housed within an epoxy-filled aluminum case.

2.3 DOSING SIPHON BASINS

A Dosing siphon basin is used to measure lateral drainage from the lower, Type-B filter layer (runoff from the CTC). They are completely enclosed, fixed volume cylindrical vessels with the dosing siphon mounted to the base. A dosing siphon is a device with no mechanical components, consisting of a trap with a vent pipe on one end and a "bell" covering the other end of the trap. When the fluid within the basin rises above the open end of the snifter pipe, air is sealed in the bell and trap. Once the fluid builds up to a level where the fluid pressure exceeds the pressure of the air in the trap, the air is forced through the trap and the siphon is "tripped", releasing fluid until the fluid level is equal to the open end of the snifter pipe. Therefore, a known quantity of liquid is released each time the siphon is "tripped". A mercury float switch is installed within the basin to provide a signal that counts each dose of the instrument.

2.4 RAIN GAUGEM (LYSIMETER)

In order to measure the smaller flows associated with water infiltration through the lysimeter constructed at the base of the CTC, a 0.1-inch tipping bucket rain gauge has been installed in-line between the lysimeter collection pipe and the dosing siphon basin. Based on the area of the rain gauge collection pan, the tipping bucket volume has been calculated at 0.289 inches^3 (4.7 cm^3).

3.0 OBSERVATIONS

3.1 TEST CELL DRAINAGE

Based on data obtained from the amount of flow measured through the lysimeter, water flow rate through the bottom of the CTC was measured to be 0.018 in/yr (0.045 cm/yr) in 2003 and 0.007 in/yr (0.018 cm/yr) in 2004. This illustrates that drainage through the CTC is slowly decreasing. Figure 1 has been provided to graphically present the data. Precipitation has been overlaid on this figure in order to illustrate the environmental conditions that have existed over the course of the CTC's operational life.

3.2 SACRIFICIAL SOIL: MOISTURE & TEMPERATURE MEASUREMENTS

HDU Matric Potential and Temperature Probes are located at the midpoint of the sacrificial soil layer of the CTC (approximately 30 inches below the surface of the rock cover).

Figure 2 is a comparison of the temperatures measured at the midpoint of the sacrificial soil and the 2-meter temperature values obtained from Envirocare's Meteorological Station. As illustrated, temperature patterns correlate closely with atmospheric conditions. This direct correlation suggests that atmospheric interactions occur in the midpoint of the sacrificial soil at least 30 inches beneath the surface of the cover.

Figure 3 has been provided to help determine to what degree evaporation occurs in the sacrificial soil. Figure 4 compares the precipitation recorded by Envirocare's Meteorological Station with the matric potential measured at the midpoint of the sacrificial soil (~30 inches below the top of the cover). It should be noted that precipitation data gathered from November 9, 2002 through April 28, 2003 is not valid due to a blocked tipping bucket and therefore not included in this graph.

Figure 3 shows that moisture conditions at the mid point of the sacrificial soil layer were subject to changes. Reduction in the overall moisture content of this layer can only be attributed to evaporation (release to the atmosphere), drainage (release at the interface of the Type-B filter and radon barrier into the dosing siphon), or a combination of the two.

During January 22, 2002 through February 24, 2004 (Period 1 on Figure 3), no flow was measured from the Type-B filter by the dosing siphon. The matric potential during

Period 1 fluctuates, showing both wetting and drying trends closely correlated to atmospheric conditions.

Envirocare was able to measure flow through the Type-B filter during February 24, 2004 through June 6, 2005 (Period 2 on Figure 3). Table 1 provides a summary of precipitation for January 2002 through September 2005. The information provided in this table along with Figures 1 and 3 suggest that runoff from the Type-B filter – Radon Barrier interface began to occur at the period of highest precipitation. Moisture conditions in the sacrificial soil were also high during the period of time runoff occurred (as discussed above, low pressure equals wet conditions, high pressure equals dry conditions).

Table 1. Precipitation Summary for Clive, Utah

Monthly Precipitation Measured at Envirocare Weather Facility (inches)					
	2002	2003	2004	2005	12-Yr Avg
January	0.5	**0.87**	0.06	1.15	0.79
February	0.07	**0.88**	1.3	1.09	0.92
March	0.44	**0.89**	0.43	0.93	0.85
April	1.36	**1.18**	1.98	1.41	1.25
May	0.57	0.91	0.6	2.94	0.94
June	0.08	0.12	0.19	0.76	0.9
July	0.24	0.03	0.35	0.01	0.34
August	0.01	0.45	0.57	0.6	0.32
September	0.52	0.21	0.99	0.09	0.34
October	0.95	0.17	1.72	No Data	0.75
November	**0.58**	0.62	0.91	No Data	0.58
December	**0.53**	1.27	0.18	No Data	0.6
Totals	5.85	7.6	9.28	8.98	8.58

Bolded monthly means are based on 10-year climatological average.

4.0 ANALYSIS

The following discussion defines at what point evaporation is the sole mechanism of water removal from the sacrificial soil.

During Period 1 the matric potential exerted by the sacrificial soil layer not only decreased (became more wet) in response to atmospheric conditions, but increased as well (dried out). Wetting occurs in response to precipitation; as no runoff was measured during this time, drying is the result of evaporation, making it the sole mechanism for water removal during Period 1.

Period 2 of Figure 3 illustrates that the Type-B filter zone receives water under high moisture conditions. This makes it difficult to determine whether water is being released through a combination of evaporation and runoff from the Type-B filter, or solely from runoff. The lack of runoff from the Type-B filter associated with the data in Period 1, however, supports the conclusion that an EZD of at least 30 inches exists in the CTC.

5.0 CONCLUSIONS

Drainage from the CTC is slowing down over time. Moisture conditions in the sacrificial soil layer (30 inches beneath the CTC surface) are in an atmospherically driven state of flux. Drainage from the cover filter zone illustrates that runoff occurs in response to high precipitation conditions. Data obtained prior to measurable runoff suggest that under normal weather conditions, water in the sacrificial soil, approximately 30 inches beneath the top of the cover, is removed via evaporation during the summer months. Evaporative forces may also be manipulating moisture content greater than 30 inches below the top of the cover; however, more data will need to be acquired to determine if the EZD extends beyond the sacrificial soil.

While the data would support a revised EZD of 30 inches, at this time Envirocare proposes to account for only the top 24 inches of evaporative zone in the infiltration and transport model. This approach maintains conservatism in the inputs to the infiltration and transport model.

Figure 1. Collection in the Lysimeter vs Precipitation

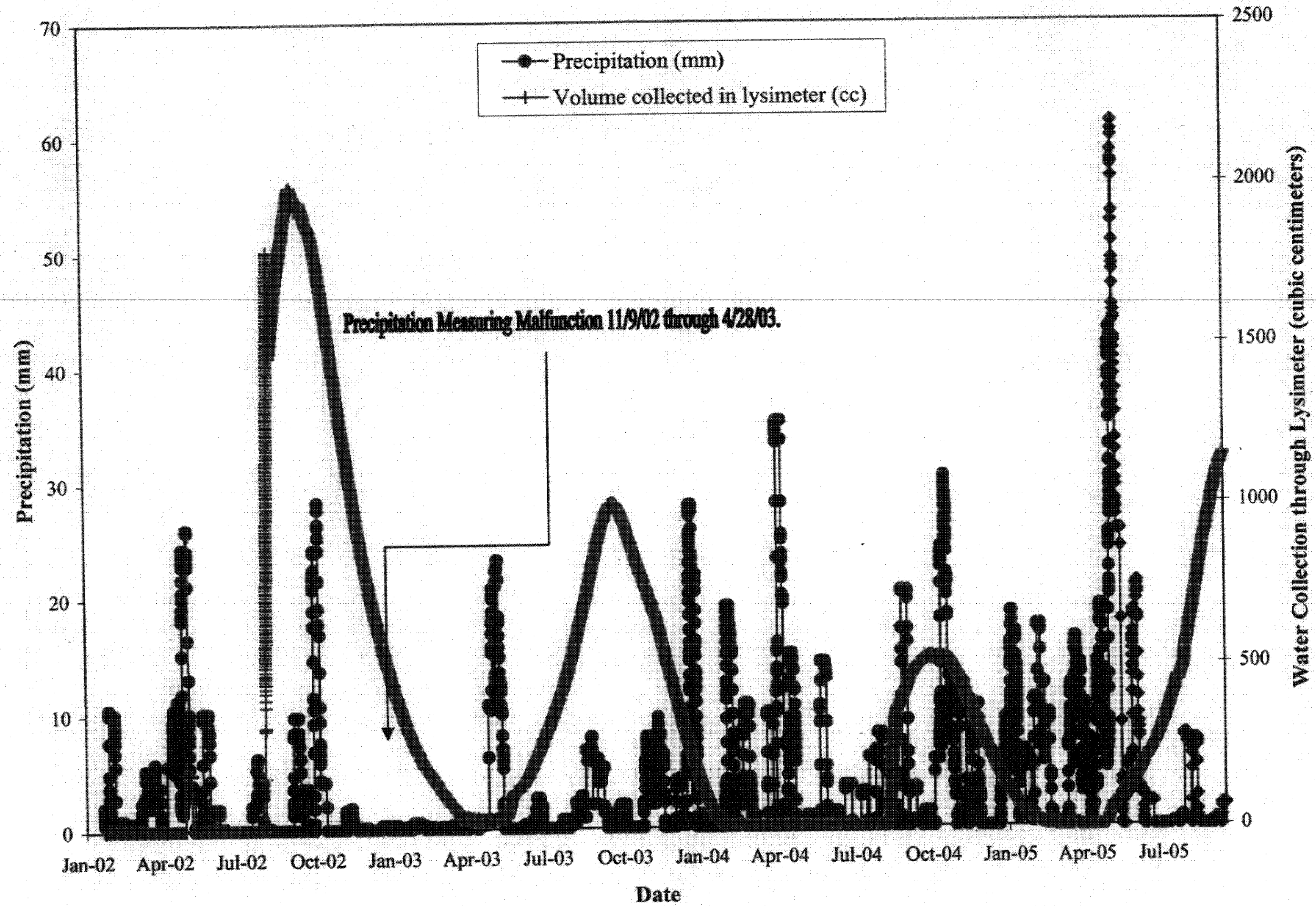

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Figure 2. Sac. Soil and Ambient Weather Temperature Comparison

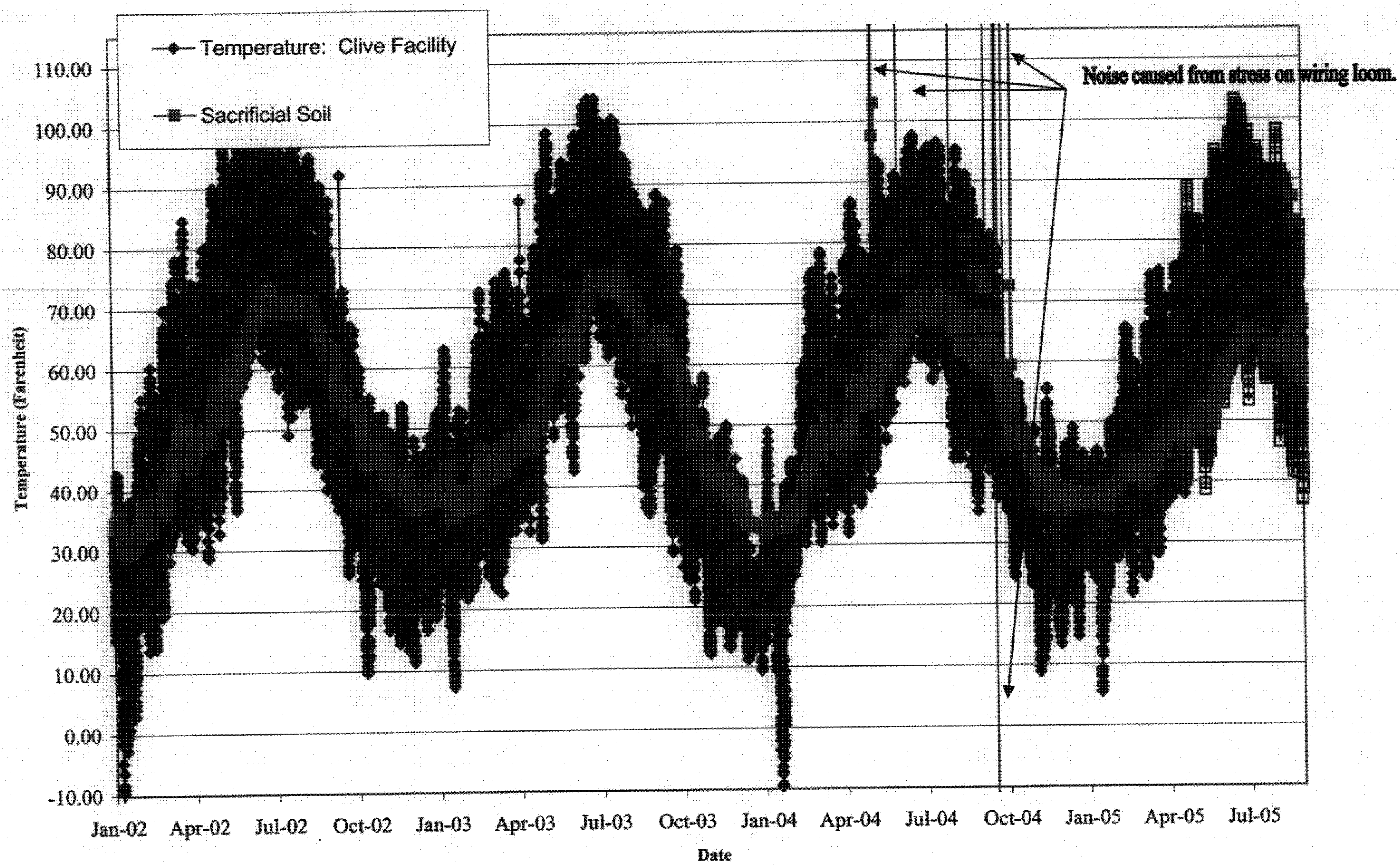

Figure 3. Matric Potential of Sacrificial Soil and Runoff From Type-B Filter

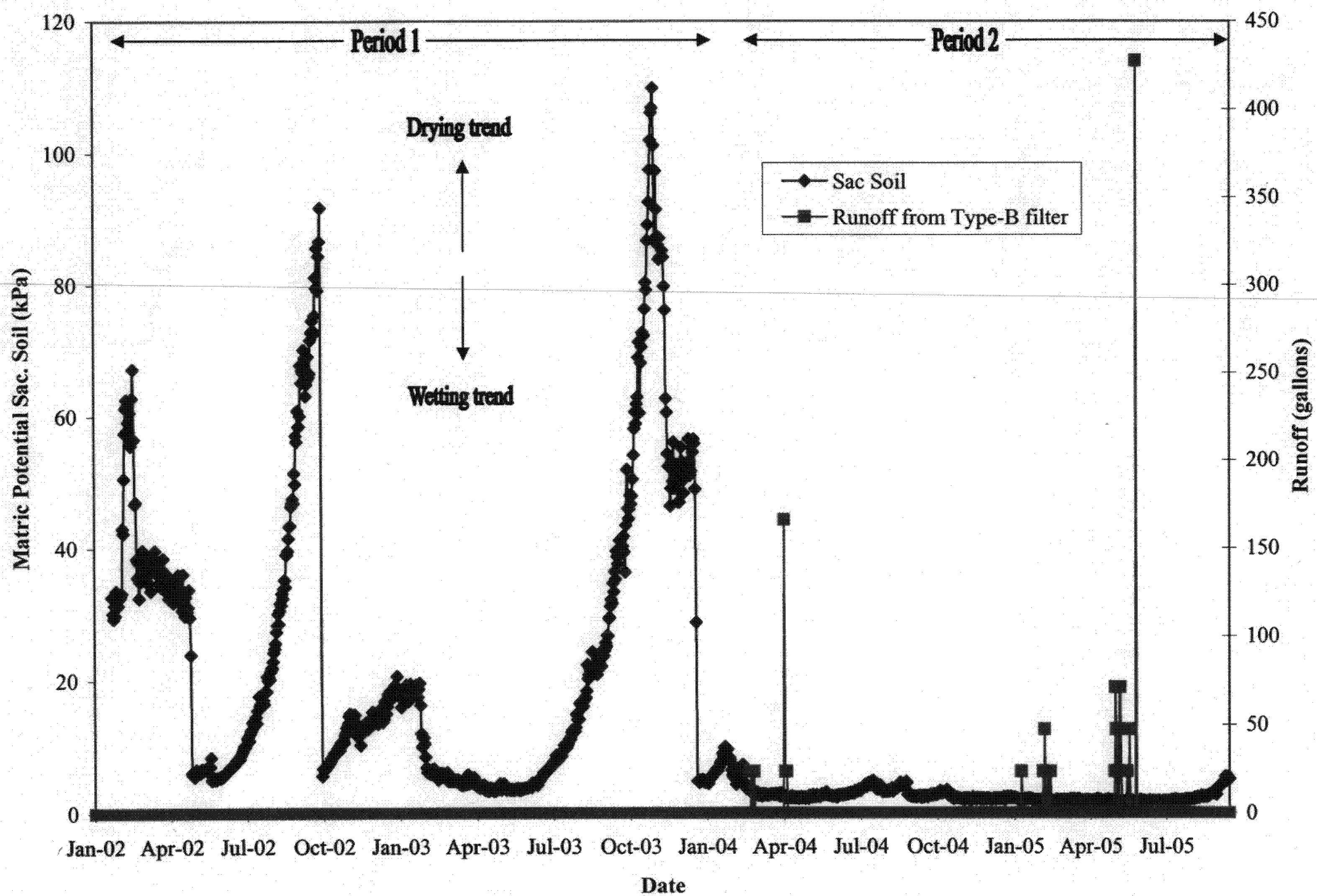

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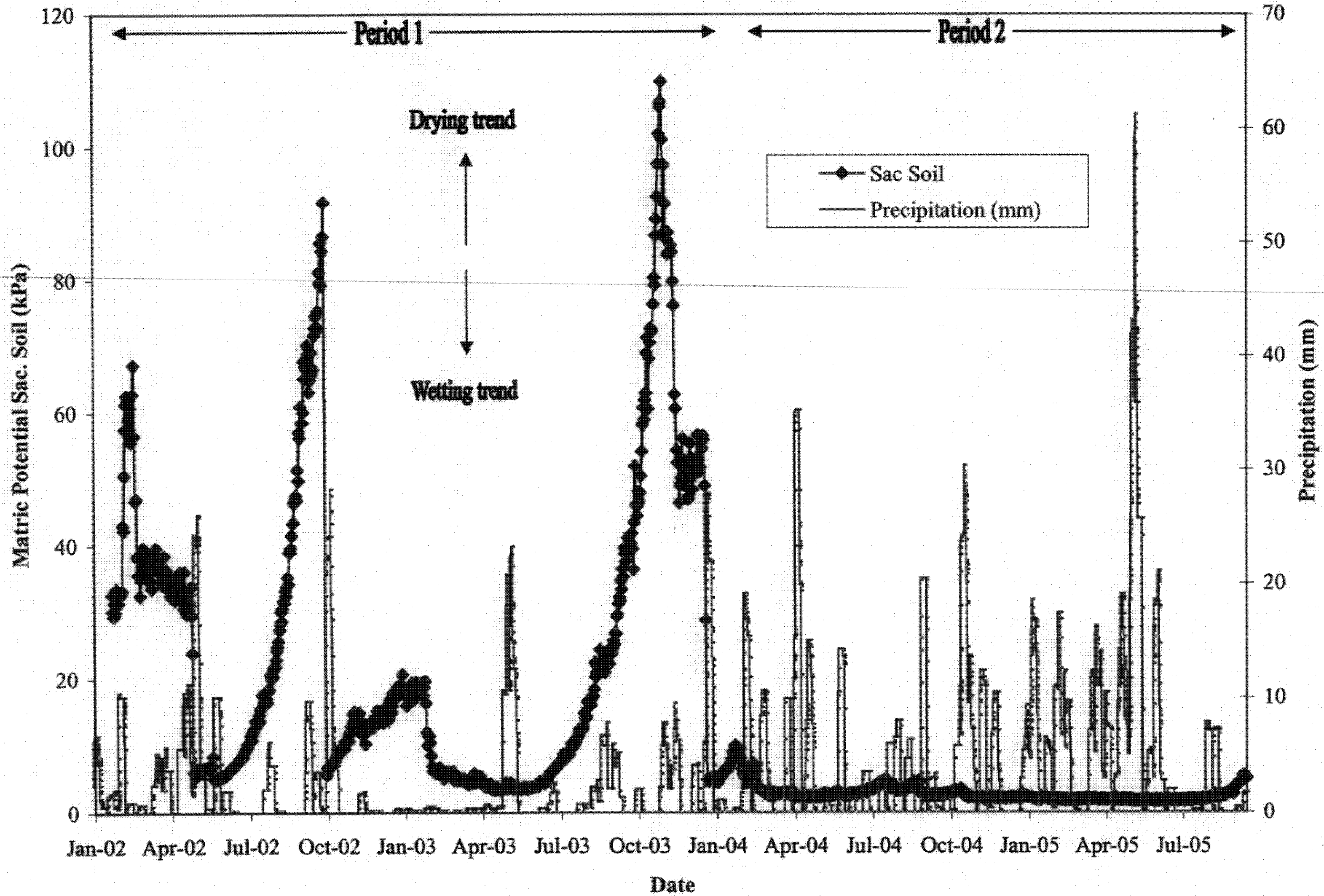
Figure 4. Matric Potential of Sacrificial Soil verses Precipitation



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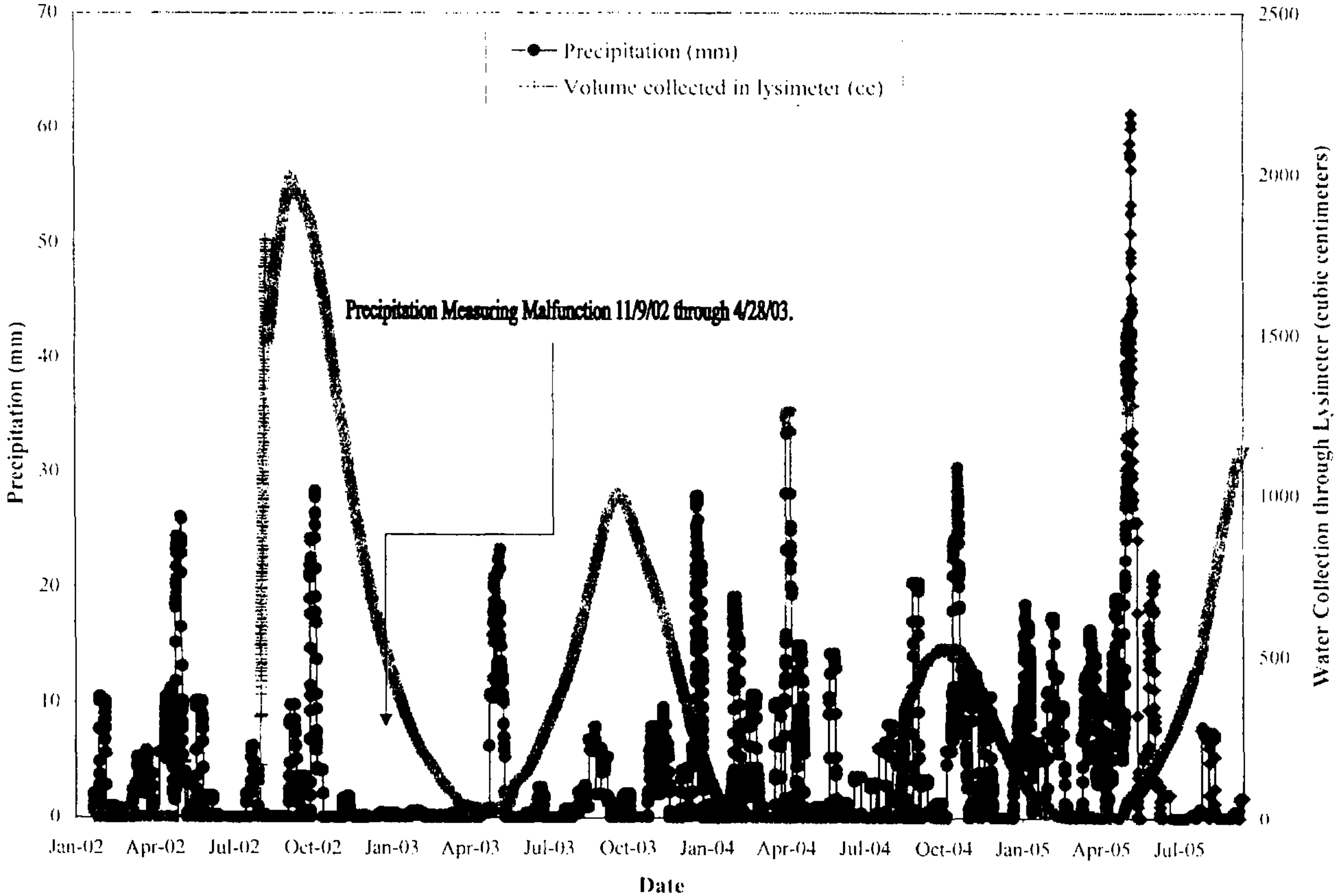

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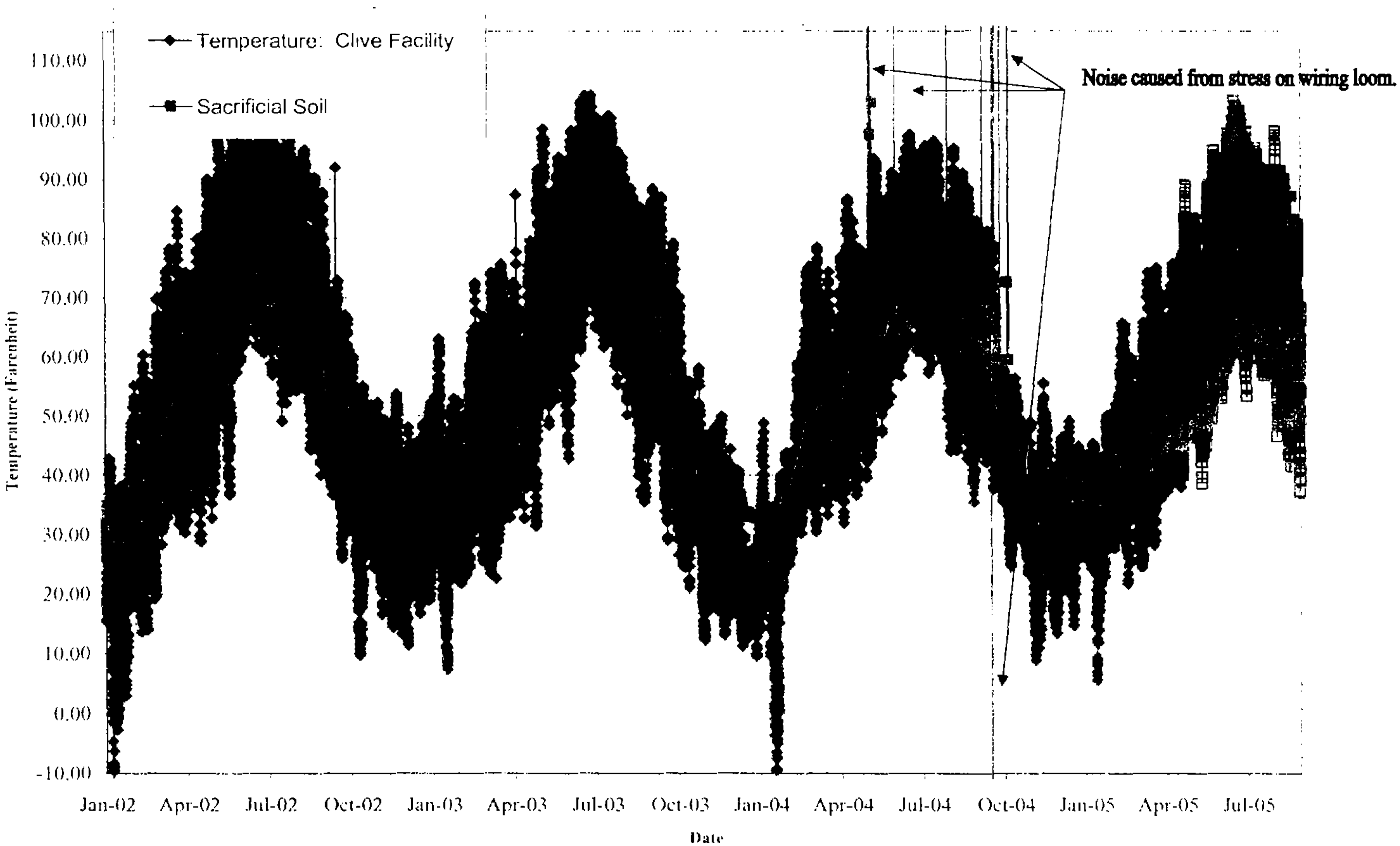

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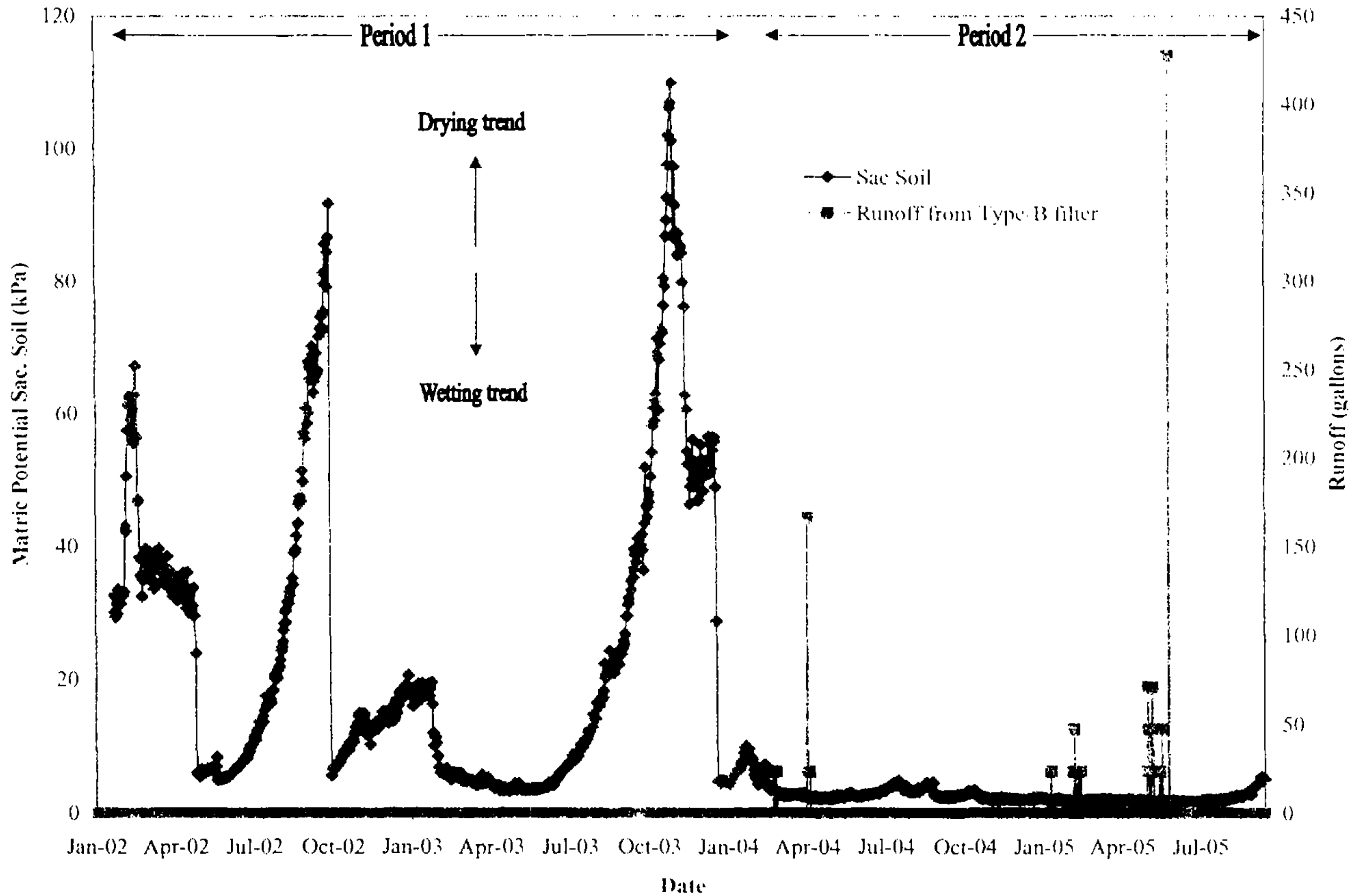

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