Wastewater Treatment in Soil: Effect of Residence Time

by

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TABLE OF CONTENTS

Appendix

page

LIST OF TABLES

LIST OF FIGURES

Chapter I

INTRODUCTION

Land application of wastes is not a new concept. Animal and human wastes have been applied to the land as fertilizer amendments for at least as long as man has recorded agricultural history (Einarson and Link, 1976). However, since revision of the Federal Clean Water Act in 1972, land application has received renewed interest as a waste treatment alternative, particularly for wastewater. Stimulus for this interest was provided by establishment of a national goal to eliminate, by 1985, all discharges of pollutants to the navigable waters of the United States. This implied that the waterways of the Nation would no longer serve as receivers for wastes, and prompted investigation of alternative treatment methods.

Congress reaffirmed its confidence in land treatment as a viable waste management alternative in 1977 when it again amended the Federal Water Pollution Control Act. The resulting legislation appropriated funds specifically for research on land application, as well as wastewater recycle and reuse. Also in 1977, the Environmental Protection Agency (EPA) issued a policy statement saying the Agency would "press vigorously for publicly owned treatment works to utilize land treatment processes to reclaim and recycle municipal wastewater" (Costle, 1977).

Despite this legislative and administrative impetus, land application has not become a widely accepted wastewater treatment alternative. Jorling (1977) attributed the public's reaction to using waste as the biggest impediment to implementing land treatment. Pollock (1979), assessing the lack of municipal land application projects in Virginia, also cited public awareness as one problem, but listed factors such as cost, groundwater quality standards, and limited availability of suitable application sites as other deterrents to the use of land application. Most significantly though, Pollock observed that ". . land application of wastewater is a highly complex field . . ." with which ". . . design engineers [in Virginia] have little or no first hand experience."

The research reported herein was initiated on the premise that the unfamiliarity with land application and the consequent limited acceptance of this process is chiefly due to a lack of adequate, easily-used design criteria. This is not to say that design criteria do not exist. Extensive treatises on methods for designing municipal and industrial land treatment systems are available (e.g. U.S. Environmental Protection Agency, 1977; Overcash and Pal, 1979), but these ignore the influence of process dynamics and do not promote *a priori* prediction of effluent quality nor the development of "optimum" system designs.

One might contrast the situation just described for land treatment with that which exists for conventional wastewater treatment. In the latter case, engineers have at their disposal mathematical formulae which describe treatment processes and permit reliable prediction of final effluent quality. Similarly, because such formulae exist, an optimum system design can be achieved by "simulating" different process modifications to determine their effect on effluent quality. Until a similar degree of knowledge is achieved for land treatment and translated into a readily useable format, design engineers will be reluctant to risk their professional reputations by recommending the use of land treatment. Stated another way, "Until the assimilation capacities of the soil system are known to researchers, disseminated, and understood, the designs [of land treatment systems] will be subject to questions and used only under highly conservative conditions" (Jewell and Seabrook, 1979).

A land treatment system is actually an advanced wastewater treatment system in which physical, chemical, and biological reactions occur simultaneously in the same reactor (soil) rather than as separate unit processes in different reactors. Therefore it should be entirely possible to develop relationships that describe the various treatment processes just as has been done for more conventional wastewater treatment systems.

1.1 OVERVIEW OF RESEARCH AND PROJECT OBJECTIVES

The overall goal of this research was to develop an engineering criterion for routine and reliable design of land treatment systems. A laboratory study was conducted in which a synthetic wastewater was applied to undisturbed soil samples. The major purpose for conducting a laboratory investigation was to facilitate study of only certain key factors of interest. Even though a laboratory study was utilized, an overriding consideration was that the study approximate field conditions as closely as possible.

An artificial wastewater was used to eliminate potential problems caused by inherent variability associated with actual wastewaters. Initially a wastewater was developed which approximated anaerobic swine lagoon effluent. However, to approximate the strength of a wastewater which more realistically would be land-applied on a long-term basis, the original wastewater was diluted.

A soil was sought that would be suitable for use in an actual land treatment system and that would be prevalent in areas where land application would be feasible. A Cecil gravelly sandy loam was chosen for the study because it not only satisfied the two criteria above, but was also the subject of concurrent moisture movement studies being conducted by the Virginia Tech Department of Agronomy.

To incorporate the effects of process dynamics in the study, reaction time (i.e. the time available for treatment processes to take place) was selected as the system performance variable. This was a logical choice since all chemical, physical, and biological processes require some finite amount of time to occur. Reaction time for a land treatment system was arbitrarily defined as the length of time wastewater is in the root zone and is synonymous with the more traditional term "residence time" which is used in conventional wastewater treatment terminology. A "macro" approach was adopted in an effort to simplify the development and maximize the utility of an engineering design criterion for land treatment systems. Consequently, physical, chemical, and biological processes were grouped together rather than investigated separately.

In situations where wastewater is land-applied, nitrogen has been identified as the pollutant that usually controls the treatment system design (Loehr et al., 1977). Consequently, it was chosen as the dependent variable in this study. Because a "macro" approach was selected, however, the various transformations of nitrogen in the soil-plant-microbe system were not of particular interest; this study was concerned with mass removals but not the various pathways by which such removals were achieved.

Specific objectives of this study were:

1. To determine the effect of residence time in the root zone on the removal of nitrogen from a land-applied wastewater

2. To develop a simple, easily used predictive method for relating the removal of nitrogen from a land-applied wastewater to wastewater residence time in the root zone, and

3. To identify criteria which would permit application of the findings from this study to other situations.

Chapter II

REVIEW OF LITERATURE

2.1 LYSIMETERS

2.1.1 Applications

This research was conducted using columns of soil as "reactors" for the treatment of a surface-applied synthetic wastewater. This technique is not new since soil columns, or lysimeters, have been used for over a century to study various processes which occur in soil.

The earliest use of lysimeters involved research on soil moisture movement. Harmsen and Kolenbrander (1965) cite Dalton's (1802) work as the first lysimeter-based research. The use of lysimeters for soil moisture studies is still widespread, especially for making measurements of evapotranspiration (Hanks and Ashcroft, 1980).

Lysimeters also have been used extensively in various nutrient studies. Levin (1964); Corey, Nielsen and Kirkham (1967); Ardakani, Rehbrock and McLaren (1973); Wagenet, Biggar and Nielsen (1977); and Bauder and Schneider (1979) are among the many researchers who have used soil columns to investigate the movement and transformations of nitrogen in soil. Lysimeters also have been used to provide data to verify various mathematical models of soil processes (e.g. Iskandar and Nakano, 1978).

The resurgent interest in land application as an alternative wastewater treatment method has lead to the use of lysimeters in the study of wastewater treatment in soil. De Jong (1978) leached sewage effluent through soil columns to investigate the movement of various common ions. Lance (1977) and Lance, Rice, and Gilbert (1980) used lysimeters to investigate changes in the nitrogen content of secondary effluent as it moved rapidly through soil. Iskandar and Nakano (1978) studied soil renovation of secondary sewage effluent in laboratory lysimeters and Iskandar et al. (1976) used field lysimeters to conduct similar field studies. Bitton, Davidson and Farrah (1979) used soil columns to assess virus transport in soil. Ogilvie and Warkentin (1973) and Humenik et al. (1975) employed laboratory soil columns to study land treatment of swine manure.

2.1.2 Disturbed versus Undisturbed Columns

Wallihan (1940) defined a lysimeter as:

> "a column of soil which has been isolated from the surrounding soil either by removal to a new location and placing in tanks or by building a wall around a portion of soil in place."

Wallihan's definition separated lysimeters into two categories which Harmsen and Kolenbrander (1965) defined as "filled in" columns, constructed by carefully placing previously excavated soil in a container, and "monoliths", constructed _in situ_ by enclosing a volume of undisturbed soil in a container. Lysimeters of the first type can be constructed on site or in the laboratory, whereas those of the second type can only be constructed in the field.

Improved sampling techniques (Richards, 1971; Mielke, 1973; Robertson, Pope, and Tomlinson, 1974) fostered the development of a third type of column not envisoned in Wallihan's definition - the undisturbed laboratory lysimeter. Murphy, Grissinger and Little (1981) cited Hvorslev's (1949) definition of an undisturbed soil sample as one which exhibited

> ". . . no disturbance of the soil structure, no change in water content or void ratio, and no change in constituents or chemical composition. . . ."

The development of this type of lysimeter stemmed from a recognition that structure has a large effect on the moisture retention and transmission properties of soil. Cassel et al. (1974) demonstrated the importance of using undisturbed soil columns by showing that more liquid is required to move a given quantity of NO_3^--N and Cl^- in disturbed versus undisturbed soil profiles. This is particularly important if lysimeters are to accurately simulate natural conditions.

2.1.3 Operating Characteristics

Ogilvie and Warkentin (1973) described variables other than the method of lysimeter construction which may be controlled to attain a given level of simulation (Table 1).

2.1.3.1 Moisture Movement

One of the more important variables that Ogilvie and Warkentin (1973) discussed was the hydraulic flux maintained in a lysimeter, and implied a need to control the moisture regime in the soil column. In general, two moisture regimes are possible - saturated and unsaturated. Early lysimeters were gravity drained and thus developed artificial water tables. This posed no problem for studies involving saturated flow or a naturally occurring restrictive soil layer; however, it did create undesirable moisture conditions for the investigation of unsaturated flow. Wallihan (1940) solved this problem by placing a tensiometer cup at the base of a soil column and inducing drainage by applying a suction to the cup. As a result of Wallihan's early work, artificially drained lysimeters have become a standard technique for studying unsaturated flow (King and Morris, 1974).

TABLE 1

Levels of Simulation Using Soil Columns. (Ogilvie and Warkentin, 1973)

SIMULATION LEVEL		Light	Heat	Temperature	Rainfall	Relative Humidity	Plant Growth
	A	no	no	constant	constant	constant	no
	B	yes	no	constant	constant	constant	yes
	C	yes	yes	constant	constant	constant	yes
	D	yes	yes	variable	constant	constant	yes
	E	yes	yes	variable	variable	constant	yes
	F	yes	yes	variable	variable	variable	yes
	G	yes variable	yes	variable	variable	variable	yes

2.1.3.2 Moisture Flow

Soil moisture movement may occur as saturated or unsaturated flow depending on whether the soil is saturated or unsaturated. In addition, steady and unsteady flow is possible. Most soil column studies have involved steady state flow under either saturated or unsaturated conditions.

Cassel et al. (1974); Ogilvie and Warkentin (1973); Wagenet, Biggar and Nielsen (1972); Ardakani, Rehbrock and McLaren (1973); and Corey, Nielsen and Kirkham (1967) all studied nitrogen movement and transformations under steady-state flow conditions. Bauder and Schneider (1979), Colman (1946), Levin (1964) and Lance, Rice, and Gilbert (1980), however, studied unsteady moisture flow by applying wastewaters and nutrient solutions at intermittant intervals.

The rate at which moisture flows through lysimeters is important when studying the treatment of wastewater in soil. Ogilvie and Warkentin (1973) suggested biological processes are influenced by the effect of moisture flux on detention time. Several methods have been developed to control the rate at which moisture moves through soil columns. One of the simplest means has been to apply liquid at regular intervals (De Jong, 1978). Another has been to control the intensity of suction at the base of the columns. Colman (1946) discovered that the rate of moisture movement after irrigation of a 188-cm disturbed column doubled when the suction at the base of the column was increased from 0 to 50 cm H_2O (0-4 cm Hg). More elaborate (and expensive) systems have since been developed. Corey, Nielsen and Kirkham (1967) attached porous plates to each end of a small soil column and applied a unit suction across the column, thereby inducing steady state unsaturated flow. Mansell, Nielsen and Kirkham (1968) used a similar apparatus and added a means of inducing gas of a specific pressure and composition into the column. Wagenet and Starr (1977) further refined this technique. Unfortunately, these methods require relatively small samples (e.g. 7.6 cm diameter X 15 cm). Because these smaller columns have such high circumference-to-area ratios, they are much more subject to "edge effects", i.e. discontinuities in soil properties at the soil/casing interface. Studies which involve continuous, steady-state flow offer limited transferability for the examination of land treatment systems because liquid applications at land treatment sites are rarely frequent enough to establish truely steady-state flow conditions.

2.2 RESIDENCE TIME AS A CONCEPT

The concept of "residence time" (i.e., the time available for biological, physical, and chemical forces to interact with a waste) is basic to every form of wastewater treatment. It is well known that biological processes require a certain minimum reaction time to transform a waste, because of the activity of the microbial population, type of waste involved, and environmental conditions under which the transformation takes place. Continuous treatment systems such as activated sludge, express this period as mean cell residence time (Adams and Eckenfelder, 1974), while for liquid batch systems it may simply be expressed as the time in which the liquid remains in the reactor (Metcalf and Eddy, 1972). Even purely physical processes, such as sedimentation, require that the liquid remain in the reactor long enough for particles of a desired size to settle.

The common link among the different expressions for residence time is reaction rate. In a soil system, factors which affect reaction rates include temperature, pH, soil moisture, oxygen supply, available nutrients, soil structure and texture, physical and chemical nature of the waste, and nature of the indigenous microflora (Reddy, Khaleel and Overcash, 1980). However, few attempts have been made to define reaction rates for nitrogen in the context of wastewater treatment in soil.

Nevertheless, virtually every individual step in the nitrogen transformation process in soil is rate dependent. Bazin and Saunders (1972) showed that nitrification in a column containing glass beads and marble chips innoculated with nitrifying bacteria was inversely related to flow rate of ammonium sulfate through the column. Nitrate reduction (denitrification) was shown by Pilot and Patrick (1971) to be dependent upon moisture tensions in the loamy sand, very fine sandy loam, and silty clay loam which they investigated. Since moisture content and, therefore, moisture tension is related to moisture flow, it follows that denitrification is also dependent upon flow rate. Barber (1961) postulated that one of the two key processes that brought nutrients to the roots of plants for eventual uptake was the mass flow rate of soil water in the vicinity of the roots. It is, therefore, conceivable that a large enough concentration of nutrients can develop at the root surface that the plants cannot assimilate them as fast as they are being supplied. There remains a need, then, for a comprehensive procedure that quantitatively relates wastewater nitrogen transformations to the rate at which wastewater moves through the soil.

2.3 NITROGEN MODELS

Considerable effort has been expended in the last decade to satisfy the need for methods that predict the behavior of nitrogen in soil. In general, these efforts have taken the form of mathematical models developed from one of two approaches: deterministic and empirical. Deterministic approachs use physical laws and mathematical equations to describe natural processes. Empirical methods use regression equations fitted to existing data. Tables 2 and 3 outline the key features of several of these models.

TABLE 2

Summary of Model Considerations I

	Biological Transformations					
	Immobilization	Mineralization	Nitrification	Denitrification	Crop Growth Sub-model	Verification
Dutt, et. al. (1972)	yes	yes	yes	no	no	lab
Saxton, et. al. (1977)	no	yes	yes	no	corn	field
Hagin and Amberger (1974)	yes	yes	yes	yes	corn	none
Beek and Frissel (1973)	yes	yes	yes	no	no	none
Burns (1975, 1977)	no	no	no	no	no	literature data
Mehran and Tanji (1974)	yes	yes	yes	yes	no	literature data
Reuss and Innis (1977)	yes	yes	yes	no	grassland	none
Duffy, et. al. (1975)	yes	yes	yes	yes	corn/ soy beans	field
Addiscott (1977)	no	no	no	no	no	field
Cameron and Kowlenko (1976)						lab
Tanji, et. al. (1977, 1979)	no	no	no	yes	no	field

TABLE 3

Summary of Model Considerations II

	Layered Structure y=yes; n=no; (x)=#layers; var=variable	Approach E=empirical M=mechanistic	Nitrogen Inputs: Precipitation	Nitrogen Inputs: Fixation	Nitrogen Inputs: Crop Residues	Nitrogen Inputs: External: Organic Wastes	Nitrogen Inputs: External: Fertilizers	Exchange	Leaching	Runoff
Dutt, et. al. (1972)	y(var)	E	no	no	no	no	yes	yes	yes	no
Saxton, et. al. (1977)	n	M	yes	no	yes	no	yes	no	yes	no
Hagin and Amberger (1974)	y(var)	M	no	no	yes	yes	yes	no	yes	no
Beek and Frissel (1973)	y(20)	M	no	no	yes	yes	no	no	yes	no
Burns (1975, 1977)	y(var)	E	no	no	no	no	yes	no	yes	no
Mehran and Tanji (1974)	n	M	no	no	yes	no	no	yes	no	no
Reuss and Innis (1977)	y(4)	comb.	yes	yes	yes	no	no	no	no	no
Duffy, et. al. (1975)	y(11)	E	yes	no	no	no	yes	no	tile flow	no
Addiscott (1977)	y(var)	M	no	no	no	no	yes	no	yes	no
Cameron and Kowlenko (1976)	n	M	no	no	yes	no	no	yes	no	no
Tanji, et. al. (1977, 1979)	n	M	yes	yes	no	no	yes	no	yes	return flow

2.3.1 Mechanistic Models

Beek and Frissel (1973) have developed the most detailed of the mechanistic models. Using IBM's continuous simulation modeling program (CSMP) language, these researchers have included biochemical interactions such as production and decay of humus as well as microbial die-off which are often ignored in most models. Hagin and Amberger (1974) followed a similar approach in developing a slightly less complex model for use in the Mediterranean region. Other mechanistic models are listed in Table 2.

Assumptions regarding reaction rates, both microbiological and chemical, differentiate deterministic models. Mehran and Tanji (1974) assumed all reactions followed first-order kinetics. Beek and Frissel (1973) and Hagin and Amberger (1974) took a more realistic approach and assumed microbial transformations were functions of the type of substrate, the amount of substrate, soil moisture content, soil temperature, and the microbial population. Tanji, et al. (1977, 1979) assumed constant reaction coefficients. Likewise, Saxton et al. (1977) assumed constant nitrification and mineralization rates. Duffy, et al. (1975) assumed constant rate coefficients for nitrogen transformations but applied a different rate constant at different points in time of the computational sequence. Reuss and Innis (1977) assumed first-order kinetics and constant coefficients for mineralization and oxidation of ammonium to nitrite.

2.3.2 Empirical Models

Comparatively few researchers have adopted the empirical approach to model development. Dutt, et al. (1972) used this procedure in attempting to simulate the movement of nitrogen and several other ions. Burns (1975, 1977) also employed an empirical procedure to develop a simple leaching equation applicable to soils in the British Isles. His equation is suitable for direct field use and can be varied depending on the initial distribution of fertilizer in the soil profile (Burns, 1977). Duffy, et al. (1975) have developed a more complex model for application to tile-drained soils of the corn belt region of the United States which requires solution by means of a digital computer.

Although empirical models offer less insight into the actual processes which transform nitrogen in the soil environment, their inherent simplicity makes them more attractive as aids for the design of land-based wastewater treatment systems. Their main limitation is that they are usually extremely site specific and are difficult to use in situations other than those for which they were developed. Deterministic models, however, while very descriptive, are often so difficult to understand and operate that they are not routinely used by design engineers. A relationship is needed to describe nitrogen transformations in the terrestrial environment which combines both reliability, broad applicability, and ease of use.

2.4 CARBON MODELS

The investigation of organic carbon decomposition complements the study of nitrogen transformation in soils, especially when wastewater treatment is involved. Several detailed mathematical models have been formulated to describe the process.

Wallace (1976) reported on research of Costopoulos (1959) who studied the oxidation rate of a synthetic wastewater made from skim milk. He found decomposition of this waste to depend on rate of loading, interval between loadings, and elapsed time following waste applications. He developed time dependent equations describing biochemical oxygen demand (BOD) removal which were very similar to those of Streeter and Phelps (Nemerow, 1974) describing BOD reduction in aqueous environments.

Pirt (1973) developed a quantitative theory of organic decomposition in a packed column (trickling filter). He described the action in terms of the rate of diffusion of the substrate that was limiting metabolism of the biomass in the column. His equations apply to the continuous application of wastewater, and predict the length of column necessary for a desired treatment efficiency as a function of several factors involving wastewater residence time in the column.

Parnas (1974) also developed a theoretical model to describe decomposition of organic material by microorganisms but was concerned with the change in the carbon to nitrogen (C/N) ratio of solid organic matter (plant, animal or microbial tissue and humic matter) in soil. Her treatment did not include the concept of residence time per se. Similar independence from the residence time concept is characteristic of models developed recently to describe sludge decomposition in soil (Terry, Nelson and Somers, 1979; Gilmour and Gilmour, 1980; Hsieh, 1976).

Adams (1976) attempted to develop a mathematical description of BOD and chemical oxygen demand (COD) removal from a land-applied wastewater as a function of the distance it moved through the soil profile (Adams, 1978). Instead of soil columns, he used batch incubation experiments and assumed that the incubation duration was equivalent to the time it would take the wastewater to flow a particular distance in the soil. He concluded that batch incubation experiments could not be used to describe wastewater treatment versus depth in the soil profile because as the more readily degraded components of a waste are removed in the upper reaches of the soil profile, microbial populations with different metabolic rates develop in the lower reaches of the profile. Batch incubations cannot approximate these different populations.

As with nitrogen, engineering equations which describe carbon transformations in the soil, are unavailable to the design engineer.

Chapter III

MATERIALS AND METHODS

3.1 SOILS

A Cecil gravelly sandy loam (Typic Hapludult; clayey, kaolinitic, thermic) was selected for use in this study because it satisfied the criteria of being suitable for actual land application projects while occurring on a widespread basis. Cecil soils occur in three major soil associations in Virginia which account for 15 percent of the total land area of the Commonwealth and 41 percent of the area in the Piedmont Physiographic Province (U.S. Soil Conservation Service, 1979). A site was selected in a pasture approximately 2.4 km from the town of Blackstone in Nottoway County, Virginia (Figure 1). The site was the scene of moisture movement investigations by the Virginia Tech Department of Agronomy. However, a misunderstanding in locating the actual sampling site placed it approximately 105 m from a soil pit described for the moisture movement study. A new soil pit was dug as a consequence of the soil sampling procedure discussed below and the profile was described by a soil scientist (Appendix A).

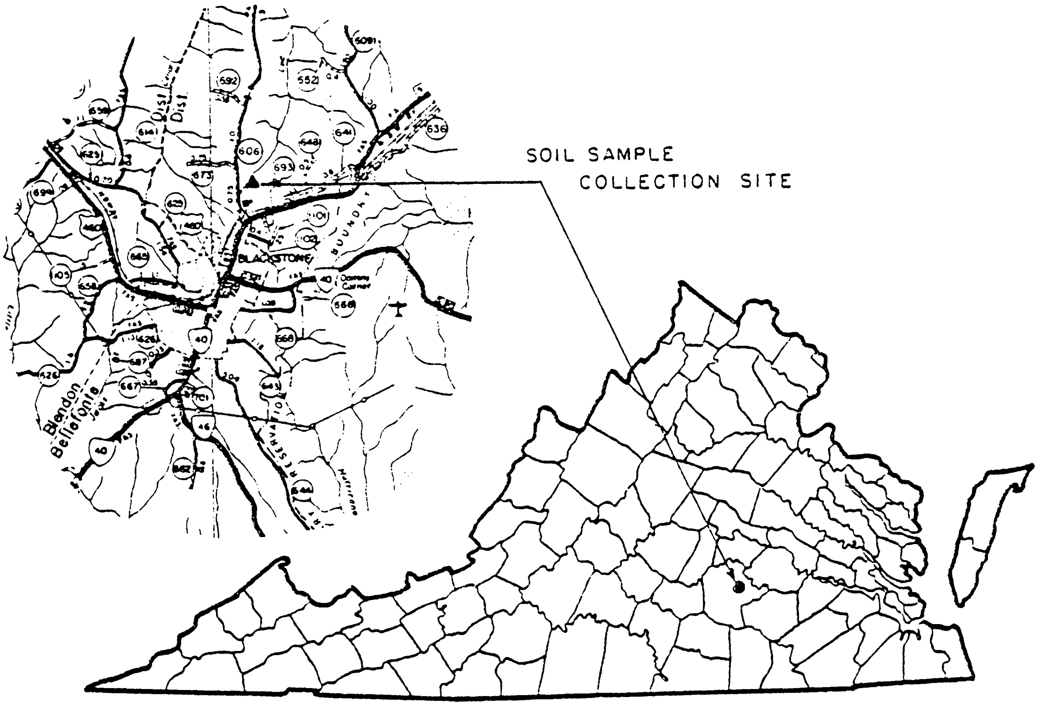

Figure 1: Sampling Site Location Map

3.2 SOIL SAMPLE COLLECTION

Research by Cassel et al. (1974) prompted a decision to use undisturbed soil samples for this study. Collection of these samples began in December 1979. Sixteen samples, each 15 cm in diameter and approximately 75 cm in length, were collected in polyvinylchloride (PVC) pipe (ASTM D-2665, Charlotte Pipe and Foundry Co., Charlotte, NC) using the method of Richards (1971). Richards' method was selected because of its low cost, portability, and demonstrated effectiveness in providing undisturbed soil samples. Richards had used steel pipe casings for soil samples in his study. However, because dual gamma radiation attenuation was originally planned as the method for determining soil moisture content in the laboratory, PVC pipe was selected for casing material in this study because steel casings would absorb too much radiation and prevent application of the dual gamma ray technique. The plastic pipe offered the advantages of being relatively inexpensive, readily available, and easily handled.

Richards' procedure involved slowly pushing the PVC pipes into the soil with a hydraulic pump and piston (Figure 2). To facilitate inserting the casings into the soil surface a cutting edge was formed at the base of the casing by beveling the outside edge of the pipe. Markings to gauge each foot of depth were added on the outside of the casings to permit an accurate determination of the depth to which the pipe had been driven. No lubricant was used on the inside of the casings for fear of lubricant interference with planned carbon analyses.

Samples were closely spaced in a 274-cm X 274-cm area to minimize effects of soil variability. The collection procedure involved first placing anchors with 10-cm diameter plates in the soil to a depth of approximately 107 cm. Anchors were located as far as possible from the soil sample to minimize disturbance of soil structure. However, the need for locating the anchors far from the sample had to be balanced with the need to have the anchors overcome the forces generated by pushing casings into the soil. Consequently, each anchor was positioned at the corner of a 91-cm X 91-cm square which enclosed the soil sample at the center.

The soil surface was cleared of natural vegetation and other debris before the casing was located to prevent surface trash and vegetation from being caught on the cutting edge of the casing and interfering with sample collection. To minimize destruction of surface soil structure, vegetation was carefully cut rather than removed with the roots.

The soil sampler was placed at the top of the casing while both were lying on the ground. The cutting edge of the casing was positioned and the entire apparatus then

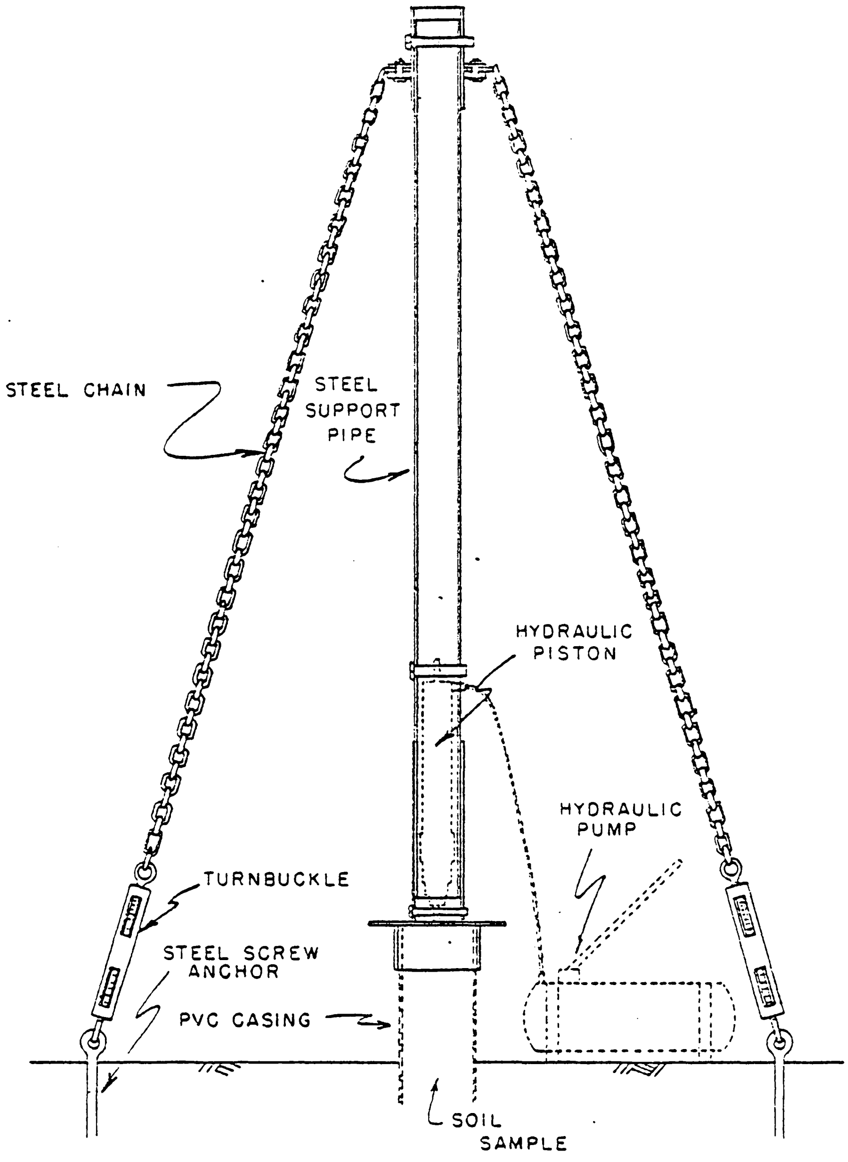

Figure 2: Soil sampler used to collect undisturbed samples (after Richards, 1971)

raised to a vertical position. Sample collection began after the guide chains were attached to the anchors.

The stroke of the hydraulic piston was approximately 30 cm, so pressure on the pump had to be released periodically and the sampler re-positioned so that the casing could be pushed another 30 cm into the soil. The process of pushing, relaxing, repositioning, and pushing again was continued until the casing reached the desired depth. After the casings had been embedded in the soil profile, the distance from the top of each casing to the soil surface was measured both inside and outside the casing. Distances were measured to the nearest 0.5 cm with a steel tape measure. The top of each casing was covered with a plastic bag to prevent the soil sample from drying and shrinking from the sides of the casing. Each sample was assigned a number to identify its location in the collection area.

Approximately one week after all casings had been embedded, samples were removed for transport back to the laboratory. A tractor-mounted back hoe with a narrow bucket was employed to remove soil surrounding the columns. Soil which remained adhered to the casings was removed by hand, and the vertical location of the soil horizons was marked on the outside of the casings. Grab samples of soil were collected beside each column for miscellaneous analyses.

Each sample was carefully removed from the excavated pit by hand and capped at both ends with two pieces of plywood tied together with steel wire. Before the top cap was installed, however, the space between the soil surface and top of the casing was filled with newspaper and a cube of foam rubber to help prevent expansion and destruction of the surface layer of soil during transport to the laboratory.

After the samples were capped, they were placed vertically on two box bed springs in the back of a pickup truck. A wooden framework was built around the columns to prevent lateral movement. Spaces between this framework and the samples were filled with foam rubber to cushion the columns. Samples were then transported approximately 240 km to the laboratory.

At the laboratory caps and bags were removed and distances between the tops of the casings and the surface of the soil samples inside the casings were measured as before. Plastic bag covers were replaced and the columns were recapped and placed in a cool dark location for storage.

3.2.1 Sample Collection Results

Soil cores 150 cm in length were originally desired for the study. However, the portable soil sampler, though designed to generate a vertical force of 3750 kg, was unable to embed the PVC casings deeper than 90 cm. This was probably because the cutting edge of the casings deformed and/or a change in soil structure was encountered as the casings were pushed into the profile.

Little compression of the cores occurred during the sampling procedure. Measurements of the elevation of the soil surface of each sample, compared to that of the original soil surface, indicated that each column was compressed an average of 1 cm. This amounted to only 1.5 percent of the total depth of the soil column.

Even less disturbance of the soil samples occurred during transport back to the laboratory. The average settlement for all columns was 0.2 cm although some soil columns expanded (i.e. the soil surface rose) approximately the same amount. The overall effect of sample collection and transport on the original soil structure was negligible (Table 4).

TABLE 4

Compression and Expansion of Soil Samples During Collection and Handling

COLUMN #	COMPRESSION DURING COLLECTION, cm	SETTLEMENT (S) OR EXPANSION (E) DURING TRANSPORT AND HANDLING, cm
2	1.12	0.51 (S)
3	2.62	0.19 (E)
4	1.66	0.25 (S)
5	1.11	0.25 (E)
6	0.56	0.13 (S)
7	1.11	0.25 (S)
8	1.03	0.19 (S)
9	0.72	0.32 (S)
10	0.40	0.06 (E)
11	0.48	0.13 (S)
12	1.83	0.44 (S)
13	1.35	0.38 (S)
14	1.03	0.00
15	1.19	0.13 (S)
16	0.08	0.19 (S)
	Mean 1.09	Mean (S) 0.27
	S.D. 0.63	Mean (E) 0.17

3.3 COLUMN INSTRUMENTATION

Instrumenting each soil column for this study involved grass seeding, installation of a ceramic plate to provide drainage, placement of tensiometers to sense moisture movement, and intallation of ceramic cups to facilitate collection of soil water samples for chemical analyses. Each of these processes is discussed in detail below.

3.3.1 Seeding

Approximately six months after collection, the columns were removed from storage. Excess casing above the soil surface was removed with a hand saw to within 7.5 cm of the soil surface. Each column was placed in an environmental chamber, and seeded to tall fescue (*Festuca elatior*, var. Redman) at the rate of 22.5 kg/ha allowing for 80 percent germination. This rate required approximately 18 seeds per column, which were planted by hand to assure uniform distribution of plants. Tops of the columns were covered with a perforated plastic mulch to promote germination.

Grass was permitted to grow for approximately 6 months prior to application of any wastewater so that a well established stand could be obtained. During this time only tap and distilled water was applied to the columns. Native nutsedge and/or crabgrass competed with the seeded fescue on two columns (13 and 15) and had to be removed. These two columns were completely reseeded and grass allowed to grow approximately two months before wastewater was applied.

3.3.2 Suction Plate Installation

After plants had reached a height of approximately 5 cm, all columns were removed from the growth chamber and placed in large tanks of tap water. This was done to optimize soil/casing contact by saturating the samples and inducing soil swelling. Samples were assumed to be saturated when the soil surface "glistened" with moisture.

After the columns had become saturated (approximately 2-3 days) they were removed from the water tank and each fitted with a 10.5-cm diameter, 1-bar, ceramic plate (604 D04-B1M1, Soilmoisture Equipment Corp. Santa Barbara, Ca.). Ceramic plates, rather than cups (King and Morris, 1974) or filter candles (Bauder and Schneider, 1979) were used to provide suction and induce drainage because plates had been reported to establish more uniform suction gradients than the other devices (van der Ploeg and Beese, 1971). For each plate to be successful in inducing drainage, however, intimate soil/plate contact had to be achieved, and a suction had to be applied and maintained on the plates.

Both criteria were achieved by carefully removing soil from inside the base of each column. This provided a uniform surface on which to place each plate, and also created a "chamber" between the plate and bottom edge of the casing which could be sealed and evacuated. To facilitate removal of soil, each column was inverted. A cube of foam rubber was placed at the top of column to prevent disruption of the soil surface while in the inverted position.

Because the cutting edge of the plastic casings had deformed during sample collection, original soil structure at the base of each column had been destroyed. This material was removed to satisfy the definition of an undisturbed soil sample. In addition, some undisturbed soil was removed to achieve a column length of 70 cm. Undisturbed soil was carefully removed with a knife point to minimize damage to the natural structure. Columns 70 cm long were achieved on all except one sample. The bottom of sample Column 8 had been more extensively deformed and removal of the damaged segment of this column left a sample 53 cm deep.

Approximately 0.64 cm of sand (<40 mesh) was spread evenly on the bottom of each column to provide a uniform surface for good plate contact and to filter whatever particulate matter might eventually make its way to the base of the column. Sand was wetted to prepare it for the ceramic plate.

A Plexiglas ring was constructed to provide complete coverage of the exposed soil and to provide a means of securing the ceramic plate in place. The ring was machined to a 15-cm outside diameter to fit tightly inside the PVC casings. Each plate was sealed to the ring with a silicone/ neoprene cement (Silaprene, Leech Products Co., Hutchinson, KA). The ceramic plate was supported with its face slightly higher than that of the ring so that good plate/sand contact could be assured (Figure 3). Plates were soaked in water prior to placement in the columns.

Each plate/ring assembly was secured tightly against the sand by a PVC retaining ring that was cemented to the inside of the casing with PVC cement (Figure 3). Joints between the Plexiglas ring and PVC retaining ring, and between the retaining ring and casing were sealed initially with silicone rubber (Dow Corning Chemical Co., Midland, MI). All surfaces to be glued were first cleaned with PVC cleaning solution.

When all cement joints had dried, a bottom plate made from 0.63-cm Plexiglas was sealed to the base of the casing with silicone rubber, forming an airtight/watertight chamber (Figure 3). A plastic fitting was threaded into the center of each Plexiglas plate to allow a vacuum to be developed and effluent samples to be collected. Columns were returned

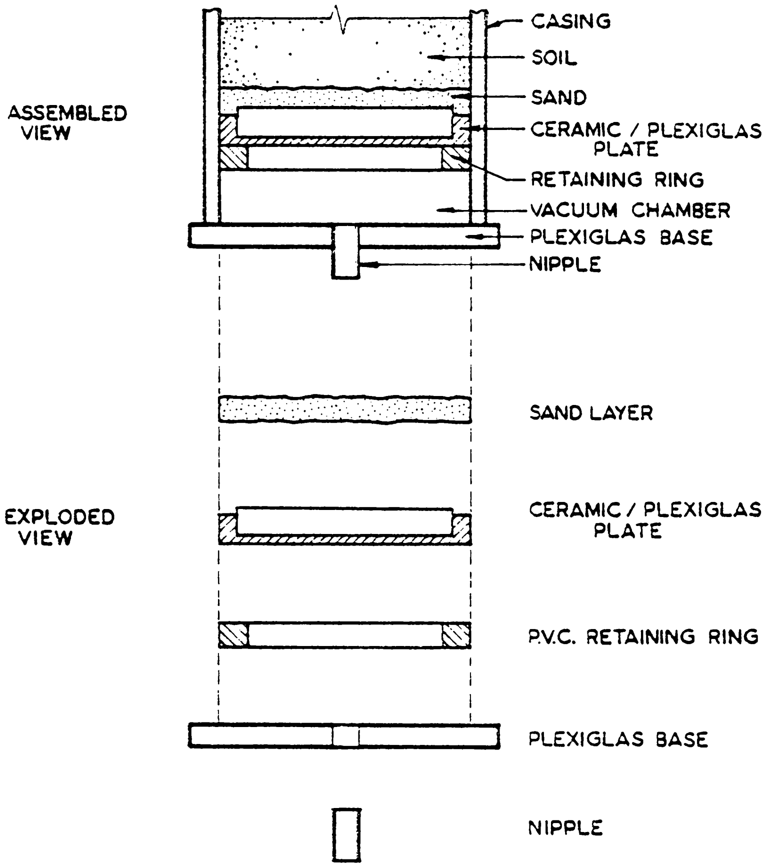

Figure 3: Cross Section of Suction Apparatus

to the growth chamber when the sealer around the base plate had dried.

3.3.3 Tensiometers

Micro-tensiometers were used in this project to determine soil moisture content and moisture movement since more sophisticated moisture sensing techniques were not available. Tensiometers were embedded in the columns at three depths (10.2 cm, 33.0 cm, and 61.0 cm) below the soil surface. These locations corresponded to the mid-points of each soil horizon. The tensiometers were constructed using 0.95-cm diameter X 2.86-cm, 1-bar, ceramic cups (652X7-B1M1, Soilmoisture Equipment Corp., Santa Barbara, CA) and nylon tubing (MYT009, Soilmoisture Equipment Corp., Santa Barbara, CA). A separate line for recharging the tensiometers was included (Figure 4). The tensiometers were placed 7 cm into the column at an angle of 20 degrees with the horizontal to minimize entrapment of air bubbles within the cups (Wierenga, et al., 1975) (Figure 5). The tensiometers were filled with deaerated, distilled water and connected to calibrated mercury manometer boards. The tensiometers were staggered in a spiralling pattern around the circumference of the soil sample to minimize short circuiting of soil water through the profile.

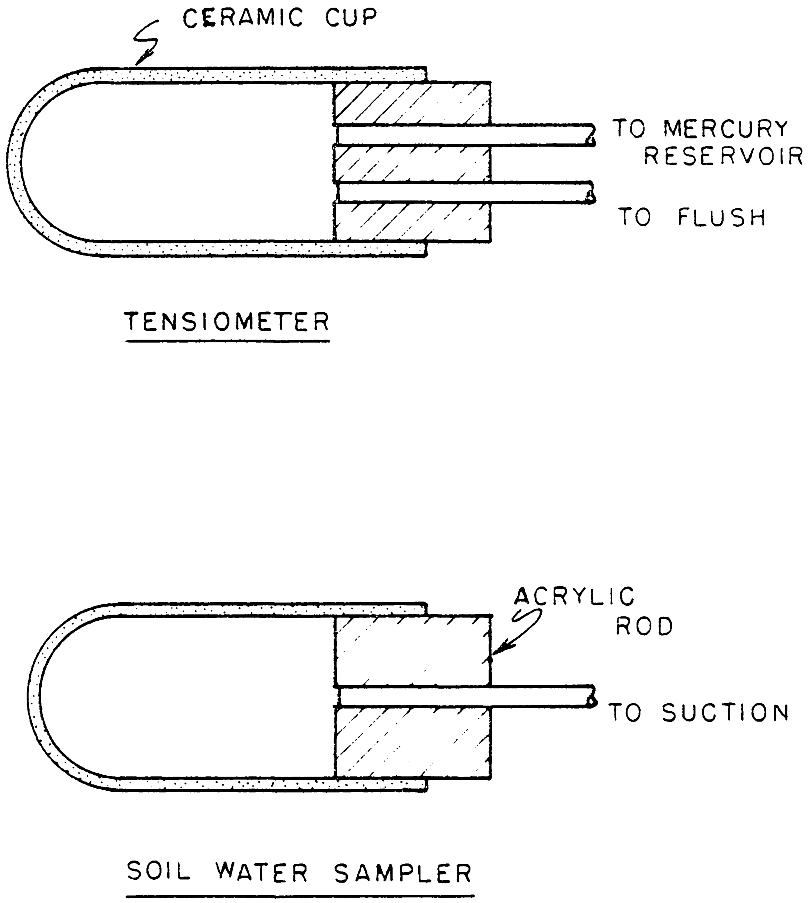

Figure 4: Tensiometer and Soil Water Sampler Construction

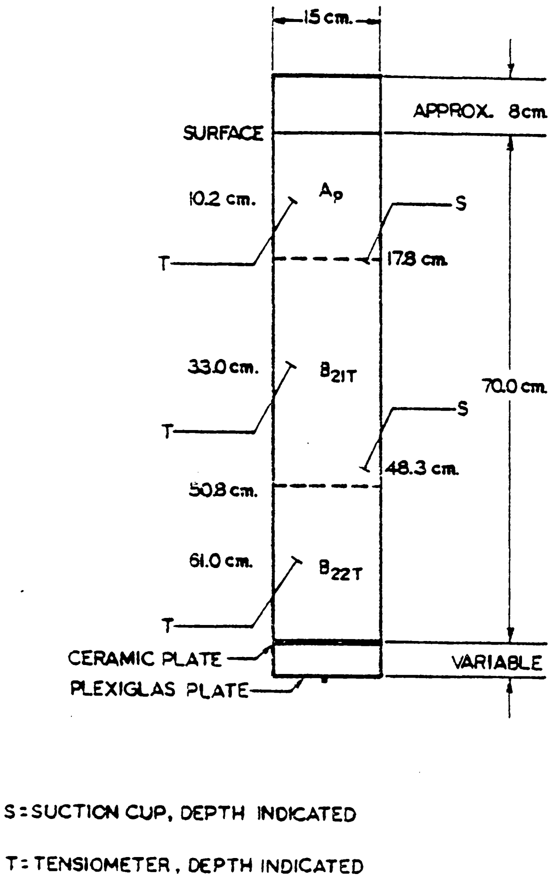

Figure 5: Cross Section of Typical Column.

3.3.4 Soil Water Samplers

Soil water samplers were constructed using 0.95-cm diameter X 2.86-cm, 1-bar, ceramic cups and nylon tubing similiar to the tensiometers previously described in Figure 4. However, high flow (i.e. 50 ml/hr/cm) ceramic was used (652X7-B1M3, Soilmoisture Equipment Corp., Santa Barbara, CA) to minimize the length of time necessary for sample collection. These devices were also embedded to a depth of 7 cm and located on a spiralling pattern (Figure 5). Samplers were located at two depths below the soil surface: 17.8 cm, which corresponded to the bottom of the Ap horizon, and 48.3 cm. Because the greatest proportion of the root system was assumed to occur in the upper 15 cm of the soil profile, the root zone was arbitrarily assumed to correspond to the Ap horizon. Thus, the soil water sampler at 17.8 cm was located immediately below the root zone. The porous ceramic plate at the base of each column also allowed soil water samples to be collected at a depth of 70 cm.

3.4 ENVIRONMENTAL CHAMBER

Environmental factors such as temperature and light intensity affect the performance of a land treatment system through the effect they exert over biological and chemical processes. An environmental chamber (growth chamber) was constructed to keep these factors relatively constant so that the influence of residence time on treatment could be isolated.

The chamber was constructed in an unused storage room which placed certain constraints, particularly regarding size, on the design. Procedures for the proper design of environmental chambers (Downs, 1975) were followed.

All walls were wood-framed, and insulated with R-14 fiberglass. Masonite panelling 0.3 cm thick was used on all interior walls; gypsum wall board 1.6 cm thick was used on the two exterior walls. All interior walls and the ceiling were painted with high gloss white paint to maximize reflectance.

A design lighting intensity of 16,146 lx was selected as the maximum economically achievable intensity. Monetary considerations also dictated that conventional fluorescent lighting be used rather than specialized "grow lights". To attain the proper mixture of wavelengths, incandescent lighting was added at a 1:10 incandescent:fluorescent wattage ratio (Downs, 1975).

Physical dimensions of the chamber and the lighting intensity achievable with the types of fixtures used limited the distance between the lights and soil surface to 83 cm. Lights were 2 m above the floor. A total of thirteen, 2-tube, 2.4 m long fixtures; two, 2-tube, 1.2 m long fixtures and eight incandescent bulbs supplied the required lighting. To help counteract the effects of a relatively low intensity, an 18 hr lighting period was selected. An automatic timer controlled the on/off lighting sequence.

Design temperatures of 24-degrees C (daytime) and 18-degrees C (nighttime) were achieved through the use of a 28,000 BTU air conditioner (model ARS-280-50, Whirlpool Corporation, Benton Harbor, MI), two thermostats (model 2E206, Dayton Electric Manufacturing Co., Chicago, IL), and a timer (model 2E021, Dayton Electric). Thermostats were placed in the center of the chamber at a height corresponding to the root zone. A third thermostat (model 2E206, Dayton Electric) was connected to the lighting circuit disconnect to provide high temperature protection if the air conditioner failed.

It was not feasible to remove the fluorescent light ballasts from the growth chamber. Alternatively, the outlet of the air conditioner was positioned to blow over the ballasts to provide maximum cooling (Figure 6).

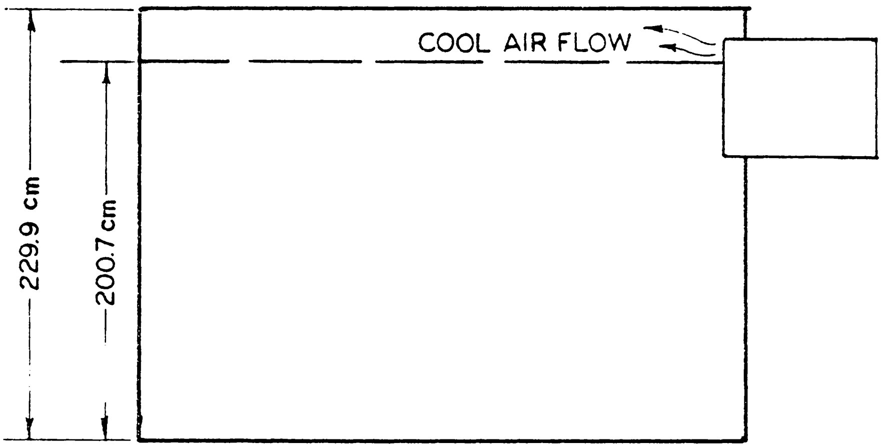

Figure 6: Profile of Growth Chamber

3.5 SUCTION REGULATION

Suction at the base of each column was maintained through a vacuum system patterned after that of Cole (1968) (Figure 7). The system was driven by a single stage vacuum pump ("A", Figure 7) (Welch Scientific Co.) which was connected to a vacuum resevoir "B" (Figure 7) that had been constructed from a 757 L steel water tank. A variable differential vacuum switch "C" (Figure 7) controlled the on/off cycle of the vacuum pump in response to the vacuum demand from the resevoir. A network of 1.27 cm steel pipe connected the resevoir to the soil columns. Adjustable vacuum switches "D" (Figure 7) controlled the vacuum to groups of soil columns through solenoids "E" (Figure 7) and permitted maintenance of a different vacuum at each of three different groups of columns. Teflon tape and vacuum grease were used on all pipe connections.

Vacuum flasks "F" (Figure 7) were connected to manifolds "G" (Figure 7) by means of vacuum hoses. Tygon vacuum tubing was used to connect each flask to the base plate of a corresponding column "H" (Figure 7). Hose connections at points "G" and "H" were made using plastic nipples which were threaded into the manifold and base plate respectively.

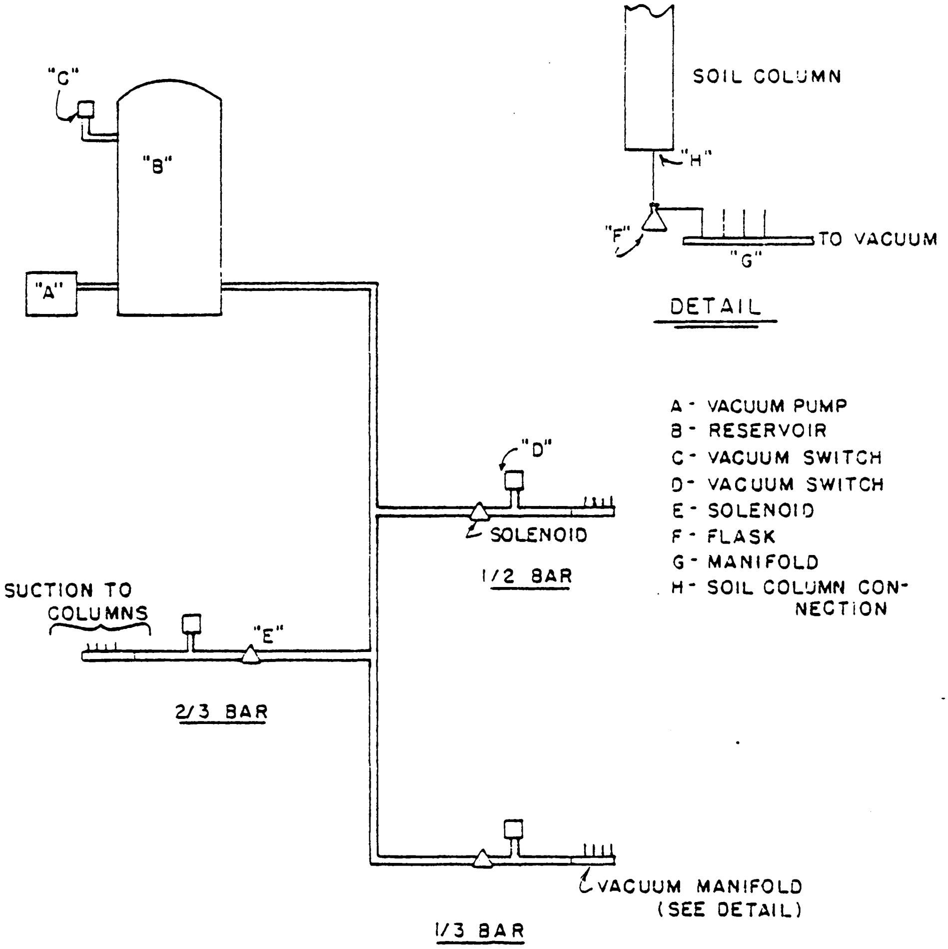

Figure 7: Suction Regulation System.

3.6 PROCEDURES

3.6.1 Experimental Design

Three treatments (i.e., liquid residence times in the root zone) were selected for investigation. These were induced by maintaining different suctions at the bases of different soil columns. Suctions of 1/3 bar, 1/2 bar and 2/3 bar were selected as reasonable levels of soil tension which could be expected 70 cm deep in a soil receiving irrigation on a regular basis. Additionally, these tensions were selected because (a) 1/3 bar is routinely taken as field capacity for most soils; (b) 2/3 bar was the maximum tension achievable with the equipment at hand; and (c) 1/2 bar provided an intermediate point between the above constraints. Although the growth chamber was constructed to maintain constant environmental conditions, the three treatments were randomly assigned locations within the chamber in an effort to eliminate bias from slight environmental variations (Figure 8).

Similarly, soil columns were randomly assigned to each treatment forming a completely randomized design. Four columns were assigned to each of the three treatments. Group 1 corresponded to Treatment 1 (1/3 bar suction) and contained Columns 4, 5, 8, and 16. Group 2 (Treatment 2, 1/2 bar) contained Columns 10, 11, 12, and 14. Columns 6, 9, 13, and 15 comprised Group 3 (Treatment 3, 2/3 bar).

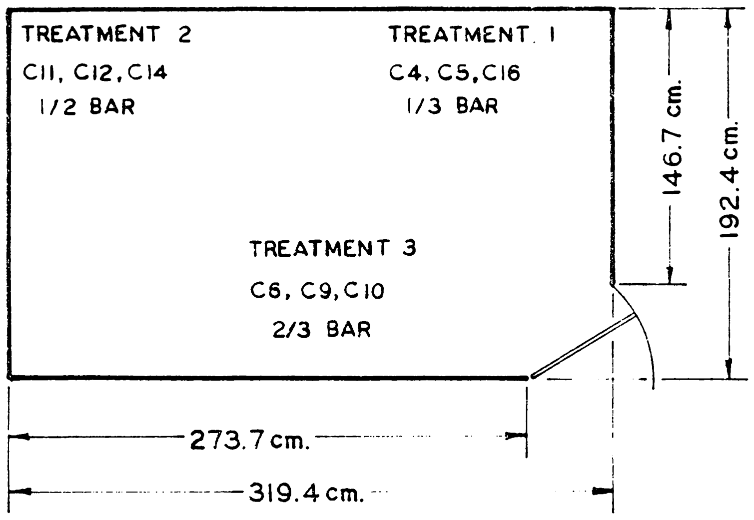

Figure 8: Location of Soil Columns in Environmental Chamber

3.6.2 Synthetic Wastewater

The chemical composition of most wastewaters is variable. Although this study was designed to approximate actual field conditions as closely as possible, use of an authentic wastewater could have introduced another potential source of variation in the results of the investigations. Consequently, a decision was made to use a synthetic wastewater to control potential variability.

Wastewater that would approximate a typical anaerobic swine lagoon effluent was selected for the study. An extensive review of the literature revealed that formulae for a synthetic approximation to this type of wastewater did not exist. However, information was available on the organic strength, volatile acids content, concentrations of inorganic constituents, and pH of actual wastewaters from anaerobic swine lagoons. From these data it was possible to develop a formula for the synthetic wastewater. Table 5 lists the components of this wastewater and the amounts required for a 1-litre volume. Table 6 gives the theoretical chemical composition of the wastewater.

Original wastewater formulation specified a concentration of 250 mg/L NH_4^+ (194.4 mg/L NH_4^+-N) and 60 mg/L organic nitrogen. An error in proportioning components of the waste in some batches resulted in theoretical concentrations less

TABLE 5

Formulation of Synthetic Wastewater

Component	Amount per 1 litre solution
Acetic Acid	0.254 ml
Propionic Acid	0.046 ml
Glycerin	0.145 ml
Yeast Extract	752.0 mg
Palmitic Acid, crystal	50.0 mg
Cellulose, powdered	480.0 mg
Ammonium Chloride	742.0 mg
Potassium Hydroxide, 1N	7.5 ml
Distilled Water	to 1 litre

TABLE 6

Theoretical Chemical Composition of Stock Synthetic Wastewater

Organic Strength	2000 mg/l COD
Volatile Acids	300 mg/l
Organic Nitrogen	60 mg/l
Fat	50 mg/l
Starch	249 mg/l
Glycerol	145 mg/l
NH_4^+-N	250 mg/l
COD/TOC	2.75
pH	7.4

than this amount (i.e., 165 mg/L NH_4^+-N). Because wastewater samples could not be analyzed immediately due to time constraints, this error was not detected until mid-August, 1981. Theoretical nitrogen concentrations in batches made after August 14, 1981 were as specified in the wastewater formulation.

Actual concentrations of NH_4^+-N, NO_3^--N, and Cl^- are presented in Table 7 and Table 8. Batches during both periods contained less than the theoretical concentrations of NH_4^+-N and Cl^-, but more NO_3^--N. High concentrations of NO_3^--N in pre-August 14, 1981 wastewater samples were probably erroneous detections, resulting from a faulty sensor in the nitrate probe. A new sensor was installed prior to analyzing samples of wastewater made after August 14, 1981.

Unfortunately, the nitrogen content of this wastewater was not compatable with a long-term application sequence such as was designed for this project. Thus, stock wastewater was diluted tenfold to permit long-term application. Dilution was accomplished by adding the required amount of stock wastewater directly to plastic bottles which were used as drip irrigators. These were then brought to the required volume with distilled water. All transfers were made with graduated cylinders.

TABLE 7

Chemical Composition of Stock Synthetic Wastewater, Pre-August 14, 1981

Date Made	Date Collected	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L
121481	121680	362.00	100.33	14.68
121481	121780	397.00	136.89	7.23
121481	121880	368.00	77.78	10.16
121481	122080	400.00	106.56	11.97
121481	122180	408.00	137.67	6.10
121481	122180	413.00	136.11	5.87
123081	123080	426.00	139.22	5.42
123081	123180	429.00	131.44	5.65
123081	10581	410.00	136.11	5.42
010781	10781	398.00	130.67	13.32
010781	10781	385.00	127.56	9.26
012681	12681	298.00	81.67	57.81
033081	33081	284.00	109.67	65.71
	Mean	382.92	119.36	16.82
	Std. Dev.	45.30	21.81	20.26

TABLE 8

Chemical Composition of Actual Synthetic Wastewater, Post-August 14, 1981

Date Made	Date Collected	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH
081481	81481	617.83	177.89	2.49	6.71
081481	81481	633.62	167.52	2.49	6.79
082181	82181	580.06	159.81	2.01	5.99
082181	83181	641.66	155.08	1.98	5.99
090881	90981	700.91	151.79	2.35	6.52
090881	91081	620.43	153.10	2.43	6.60
090881	91481	542.31	153.10	2.33	6.48
091481	91481	502.77	138.72	2.13	6.46
091481	91581	546.89	149.85	2.31	6.52
091481	91781	526.58	149.21	2.26	6.51
091481	91881	492.31	149.85	2.22	6.46
091481	92281	504.89	146.68	2.40	6.50
092781	92881	480.04	134.62	2.34	6.90
092781	92981	480.04	142.95	2.74	7.02
092781	100681	507.02	144.18	2.78	7.02
092781	101581	428.51	134.04	2.88	6.96
092781	101681	472.03	148.57	2.77	6.96
100681	100681	456.42	138.72	2.77	6.88
100681	101581	416.08	151.79	2.55	6.61
101581	101581	537.77	146.67	3.01	6.53
101581	101681	636.29	148.57	2.64	6.53
101581	101781	513.45	146.05	2.55	6.49
102281	102281	586.46	141.75	2.74	6.46
102281	102281	591.47	197.13	2.61	6.47
102281	102381	599.06	197.13	2.19	6.52
102281	102481	559.66	197.13	2.51	6.48
102281	102981	635.66	201.28	2.38	6.53
102981	102981	671.94	195.50	2.94	7.02
102981	103081	509.68	192.27	3.17	7.00
102981	103181	591.47	193.88	3.06	6.93
102981	110581	498.95	194.68	2.93	7.00
102981	110581	529.56	198.78	.	6.98
110681	110681	536.36	199.61	2.14	5.76
110681	110681	588.96	196.31	2.12	5.75
	Mean	551.09	164.54	2.52	6.60
	Std. Dev.	69.79	24.02	0.32	0.34

Analytical results of diluted wastewater samples collected from the drip irrigators are given in Table 9. These analyses were made on samples of a batch of wastewater[1] made from post-August 14, 1981 stock wastewater. Comparison of data in Table 9 with those in Table 8 indicates that NH_4^+-N concentrations in the diluted wastewater were within expected ranges (i.e. 10 percent of the stock wastewater concentrations). Chloride concentrations, however, were much less than expected. Nitrate-N concentrations were negligible in the diluted wastewater.

Table 10 gives results of analyses for total Kjeldahl nitrogen (TKN) performed on some randomly selected samples of wastewater. Comparison of these data with those presented for NH_4^+-N in the wastewater (Table 7 and Table 8) indicates that the amount of organic nitrogen added as yeast was close to the targeted concentration of 60 mg/L.

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[1] Hereafter, when used alone, the term "wastewater" will refer to diluted wastewater made from stock wastewater.

TABLE 9

Composition of Wastewater From Drip Irrigators

Column	Date Collected	Cl^- mg/L	NH_4^+ -N mg/L	NO_3^- -N mg/L	pH
4	90981	28.17	16.17	1.78	6.33
5	90981	27.18	16.17	1.31	6.29
6	90981	26.64	16.31	1.19	6.20
9	90981	25.39	16.85	1.19	6.35
10	90981	29.56	17.49	0.99	6.15
11	90981	26.43	16.65	1.17	6.16
12	90981	26.53	17.06	1.20	6.23
13	90981	24.29	16.65	1.13	6.27
14	90981	25.29	16.99	1.12	6.18
15	90981	25.80	18.08	1.08	6.15
16	90981	25.70	16.37	1.03	6.31
4	91581	31.27	16.24	.85	6.04
5	91581	27.62	15.71	.84	5.98
16	91581	26.22	15.71	.84	5.99
9	91881	33.20	19.00	.95	6.03
10	91881	30.52	15.73	.82	6.06
11	91881	34.01	17.28	1.05	6.14
12	91881	33.60	17.06	.92	6.17
14	91881	31.90	16.92	.86	6.01
15	91881	33.74	16.92	.97	6.21
4	92281	26.32	23.04	1.05	6.20
5	92281	24.59	19.07	.72	6.13
16	92281	25.90	18.69	.74	6.25
6	92881	27.40	19.00	.91	6.50
9	92881	27.18	19.23	.67	6.43
10	92881	25.90	19.07	.61	6.55
11	92881	25.70	19.15	.69	6.49
12	92881	24.79	19.23	.60	6.44
13	92881	25.39	19.07	.80	6.66
14	92881	24.89	19.23	.71	6.62
15	92881	24.10	19.07	.59	6.48
4	92981	24.59	19.31	.83	6.60
5	92981	23.62	19.00	.82	6.57
16	92981	21.72	17.64	.85	6.53
	Mean	29.04	17.00	0.89	6.06
	Std. Dev	5.92	3.72	0.28	0.83

TABLE 10

TKN Content of Selected Wastewater Samples

DATE COLLECTED	TOTAL KJELDAHL NITROGEN, mg/L
12/16/80	197.4
8/14/81	253.2
10/15/81	263.2
Mean	237.9

3.6.3 Liquid Applications

Liquid applications began with the planting of fescue in July, 1980, and continued into December, 1980, while fescue was becoming established. Liquid was applied from a graduated cylinder at rates needed to promote good vegetative growth.

3.6.3.1 Phase 1

Programmed applications of both distilled water and wastewater continued through mid-March, 1981, in an attempt to induce and observe different moisture flow rates through the root zone of each soil column. Unsaturated flow theory (Hillel, 1980) predicted different flow rates in response to different soil suctions only if the original soil moisture conditions were the same. To satisfy this criterion, wastewater and/or distilled water was added only when the soil tension, as reflected by the tensiometers, was within prescribed limits. Liquid was thus applied whenever soil suction at the 10.2-cm tensiometer was 550-600 mb. Equal volumes were applied to each column, usually 500 mL (2.74 cm) per application. Liquid was applied by drip irrigation from plastic bottles which hung above the columns, and were adjusted to provide an application rate of 2.54 cm/hr.

3.6.3.2 Phase 2

From mid-March until mid-August, 1981, only tap water was applied to the columns while an attempt was being made to model the previously collected tensiometer and effluent data (see description below).

Only wastewater was applied to the columns from mid-August to early September, 1981. Thereafter applications of wastewater were followed by a flush of distilled water until the experiments were terminated in mid-November, 1981.

3.6.3.3 Phase 3

In the final set of experiments (September, 1981 to mid-November, 1981), flush water (distilled water) was used as a method of controlling the residence time of wastewater in the root zone. To achieve different residence times, flush water applications were made at different intervals of time after wastewater applications. On one group of columns (Group 1; Columns 4, 5, 16), flush water was applied 12 hours after wastewater. Flush water followed wastewater application by 24 hours on Group 2 (Columns 11, 12, and 14), and by 36 hours on Group 3 (Columns 6, 9, and 10). These time intervals were selected to represent a range of application cycles that would be used in typical land-based wastewater treatment systems.

The same suctions originally used on the different groups of columns also were maintained throughout these latter investigations. Three columns (rather than four as originally planned) were used in each group (Treatment) in these experiments because, during previous Phases, problems were encountered with some of the original twelve columns either in maintaining an airtight seal around the ceramic plates or in collecting soil water samples from the 17.8-cm samplers. These columns were discarded from further study.

Two of the discarded columns were originally a part of the same group (Group 3), so their elimination from the study left that group with only two operable columns. One original group (Group 2) had no losses, however, so a column from this group (Column 10) was transferred to make up the deficiency in Group 3.

3.6.4 Wastewater Additions

As discussed previously, stock wastewater was diluted tenfold in plastic bottles which were suspended above the soil columns. Transfers of both stock wastewater and distilled water were made using graduated cylinders to assure consistent mixes throughout the study.

Wastewater additions generally parallelled liquid additions during Phase 3 of the study. Application of wastewater during earlier Phases, however, was more infrequent due to problems with the seals around the ceramic base plates on the columns which required a number of soil columns to be removed from the study for repairs. Dates and volumes of wastewater additions are given in Table 11. Graphical displays of these additions are contained in Appendix B.

TABLE 11

Wastewater Additions

DATE	COLUMN NUMBER								
	4	5	16	11	12	14	6	9	10
12/16/80				A	A		A	A	
12/17/80	A	A							
12/18/80								A	
12/20/80	A	A							
12/21/80			A	A				A	
12/31/80		A					A		
1/ 1/81	A		A						
1/ 2/81				A	A				
1/ 5/81	A	A	A	A	A		A	A	
1/10/81	B	B	B	B	B	B	B	B	B
8/14/81	A	A	A	A	A	A	A	A	A
8/21/81	A	A	A	A	A	A	A	A	A
8/31/81	B	B	B	B	B	B	B	B	B
9/ 9/81	A	A	A	A	A	A	A	A	A
9/15/81	A	A	A						
9/17/81							A		
9/18/81				A	A	A		A	A
9/22/81	A	A	A						
9/28/81				A	A	A	A	A	A
9/29/81	A	A	A						
10/ 6/81	A	A	A	A	A	A	A	A	A
10/15/81	A	A	A						
10/16/81				A	A	A			
10/17/81							A	A	A
10/22/81	A	A	A						
10/23/81				A	A	A			
10/24/81							A	A	A
10/29/81	A	A	A						
10/30/81				A	A	A			
10/31/81							A	A	A
11/ 5/81	A	A	A						
11/ 6/81				A	A	A	A	A	A

A - 50 mL Stock Wastewater and 450 mL Distilled Water
B - 100 mL Stock Wastewater and 900 mL Distilled Water

3.6.5 Volatilization Study

A series of experiments were performed to assess the loss of nitrogen from the soil surface by ammonia volatilization. The apparatus used to make these measurements is shown in Figure 9.

A small vacuum pump (model 0211-V36A, Gast Manufacturing Corp., Benton Harbor, MI) was used to draw air through a chamber enclosing the top of each soil column. This chamber consisted of a 15-cm section of 15-cm diameter PVC pipe mounted on the soil column casing with duct tape. The top of the chamber was sealed with a Plexiglas plate. Inlet and outlet ports were constructed from 0.62-cm diameter acrylic plastic and located directly opposite each other as near the base of the chamber as possible.

Incoming air was first drawn through dilute (0.1 N) H_2SO_4 (Hargrove and Kissel, 1979) to remove background NH_3. Then, after passing across the soil surface, it was drawn through 175 mL of boric acid-indicator solution (Bremner, 1965) to collect the volatilized NH_3. Finally, the air was passed through a water trap to prevent acid fumes from reaching the vacuum pump. A single vacuum pump was used to operate three chambers simultaneously.

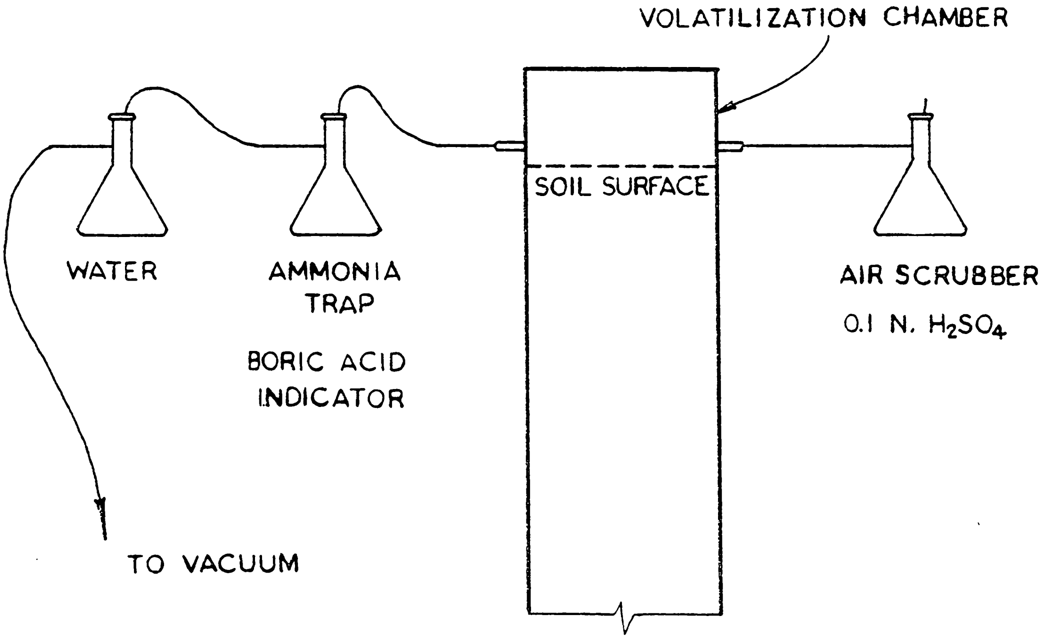

Figure 9: Experimental Apparatus for Volatilization Experiments

Because the rate of volatilization from a soil system depends, in part, on the movement of air across the soil surface (Kissel, Brewer, and Arkin; 1979), care was taken to achieve an air flow rate through the chamber comparable to that which typically occurred across the tops of the soil columns. Normal room air flow across each column was first measured with a hot wire anemometer. With the volatilization chamber in place and the vacuum pump drawing air through the collection system, air flow was again measured by inserting the anemometer through an access port into the volatilization chamber. The vacuum pump was adjusted to produce the proper flow rate. Measurements of air flow both with and without the volatilization chamber in place were made at the same location just above the top edge of the soil column casing (approximately 7.6 cm above the soil surface). Air flow below this height was assumed to be near zero.

Experiments were performed with collection periods of 6, 9, 11 and 23 hours. Ammonia collection began immediately after a 1-hour wastewater application period. The 11- and 23-hour collection times corresponded to the 12- and 24-hour "rest" periods, respectively, which were maintained between wastewater and flushwater applications. Two different attempts to achieve a 35-hour collection time corresponding with the 36-hour "rest" period failed because of repeated equipment malfunctions. Instead, a 6- and 9-hour period was achieved before equipment failures forced discontinuance of this experiment.

A 20-mL aliquot of boric acid-indicator solution from each column was titrated with 0.0001 N H_2SO_4 to determine NH_3 content. Results were applied to the total volume of boric-acid indicator solution to determine the total amount of NH_3 volatilized from each soil column.

3.6.6 Computer Analysis

As noted previously, tensiometers were employed in this study to gather data to determine moisture flow rates through the root zone. Unfortunately, these data were so erratic it was not possible to make such determinations. As an alternative, computer modeling of moisture conditions within the soil columns was selected to determine moisture flow rates.

A soil moisture model written in Continuous System Modeling Program (CSMP) language (Hillel, 1977) was chosen for this purpose. This particular model offered several advantages:

1. This, and other similar models had been previously tested and used widely (Hillel, 1977; Hagin and Amberger, 1974)

2. Simplicity, with no rewriting required to fit the needs of this study

3. Allowed resolution of the soil profile into thin layers

4. Embodied a deterministic approach to predicting soil moisture movement.

Despite numerous attempts, however, this model could not be made functional, and its use was discontinued. The model seemed to be incompatible with the version of CSMP being supported by the Virginia Tech Computing Center.

A more complex Fortran model (Saxton, Johnson and Shaw; 1974), given the acronym SPAW (Soil, Plant, Air and Water), model was chosen as a second alternative. Although this model required some modifications to fit the requirements of the study, it offered the following important advantages:

1. A layered structure permitting separation of the soil profile into thin sections

2. A deterministic moisture redistribution routine (based on Darcy's law), and

3. Demonstrated effectiveness (Saxton, Johnson, and Shaw, 1974).

3.6.6.1 Description of SPAW Model Modifications

Appendix C lists the required inputs for the SPAW model and gives an indication of its exceptional flexibility. Figure 10 briefly outlines the model computational sequence.

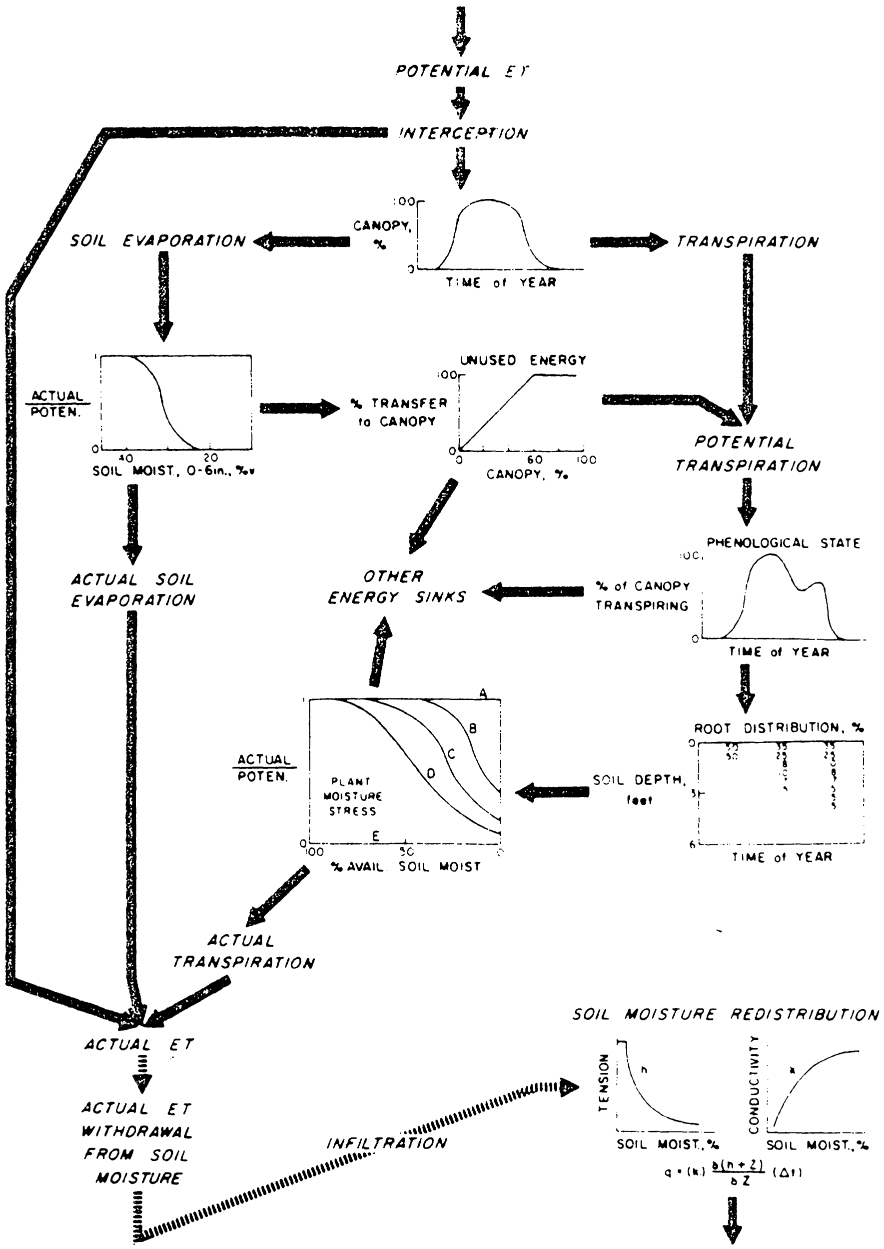

Figure 10: Flowchart for SPAW Model (from Saxton, Johnson and Shaw, 1974)

The model was designed to simulate watershed-scale hydrology. Thus, because it was to be used in this study to simulate moisture movement through soil columns, several simplifications of the original SPAW model were made. Runoff relationships were eliminated, and crop data and many crop-related routines were discarded since the model was used over relatively short time periods when crop conditions could be assumed constant. Plant stress and yield reduction functions were discarded because planned moisture additions (5 cm/wk) were assumed adequate for normal crop growth.

Moisture movement routines were retained essentially intact except for the description of the infiltration process. In the original model, no time distribution was given to infiltration and virtually all precipitation (less evapotranspiration, interception, and runoff) was assumed to be stored in the top 15-cm layer until storage in that zone was exceeded. When this layer was saturated, excess moisture was immediately cascaded into the next 15-cm layer until it was saturated. This procedure was continued until the storage of all infiltrated water was complete. The process was accomplished all in one time step, which was sufficient because the model was designed to update the moisture status on a daily basis.

For this study, soil moisture profiles were desired on a much more frequent basis, especially when soil moisture content was changing rapidly (i.e. during and immediately after infiltration). Two modifications were made to the SPAW model to achieve increased resolution during these periods. An easily implemented change was the use of very small time steps during infiltration to achieve a more "continuous" simulation of this period.

A more difficult change was modification of the SPAW infiltration routine to move moisture downward according to Darcian flow theory, rather than to simply "cascade" it instantly through succeeding soil layers.

Figure 11 outlines the computational sequence of the modified routine, Subroutine INFIL. The mathematical equation basic to both the infiltration and redistribution process is the one-dimensional finite difference form of Darcy's flow equation, which can be expressed as follows:

$$Q = \bar{K}\,(\Theta)\left(\frac{P_2 - P_1 - \Delta Z}{\Delta Z}\right)\Delta t \qquad (1)$$

where:

Q = amount of flow,

$\bar{K}\,(\Theta)$ = average unsaturated hydraulic conductivity,

P_2 = pressure in lower soil layer,

P_1 = pressure in upper soil layer,

ΔZ = difference in elevation between soil layer centroids,

Δt = time step.

When a soil layer became saturated, $\bar{K}(\theta)$ was replaced by Ksat, (saturated hydraulic conductivity).

One-dimensional, vertical flow was assumed to be appropriate in this study because the plastic casings effectively prevented lateral moisture movement. A schematic of the modified program is given in Figure 12.

3.6.6.2 Geometric Model Structure

The geometric structure of the SPAW model is shown in Figure 13. The soil profile was divided into 5.08-cm or 7.62-cm layers. Equation (1) was solved for each of these layers to simulate moisture movement through the soil columns. Four moisture characteristic curves were used to describe the flow properties of the soil profile. One each was required for three horizons and one for the ceramic plate at the base of the profile.

3.6.6.3 Model Input

Potential evapotranspiration was estimated for each column using a mass balance approach and assuming evapotranspiration to be the difference between liquid additions and

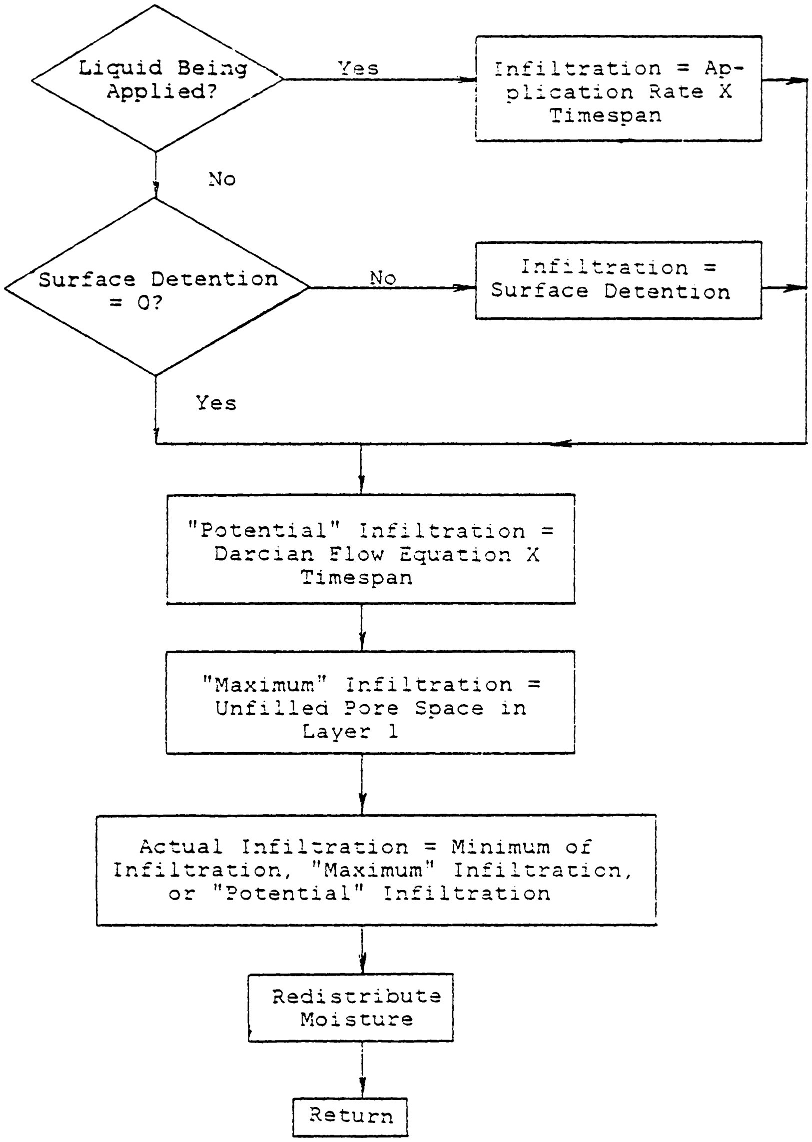

Figure 11: Flowchart for Subroutine INFIL

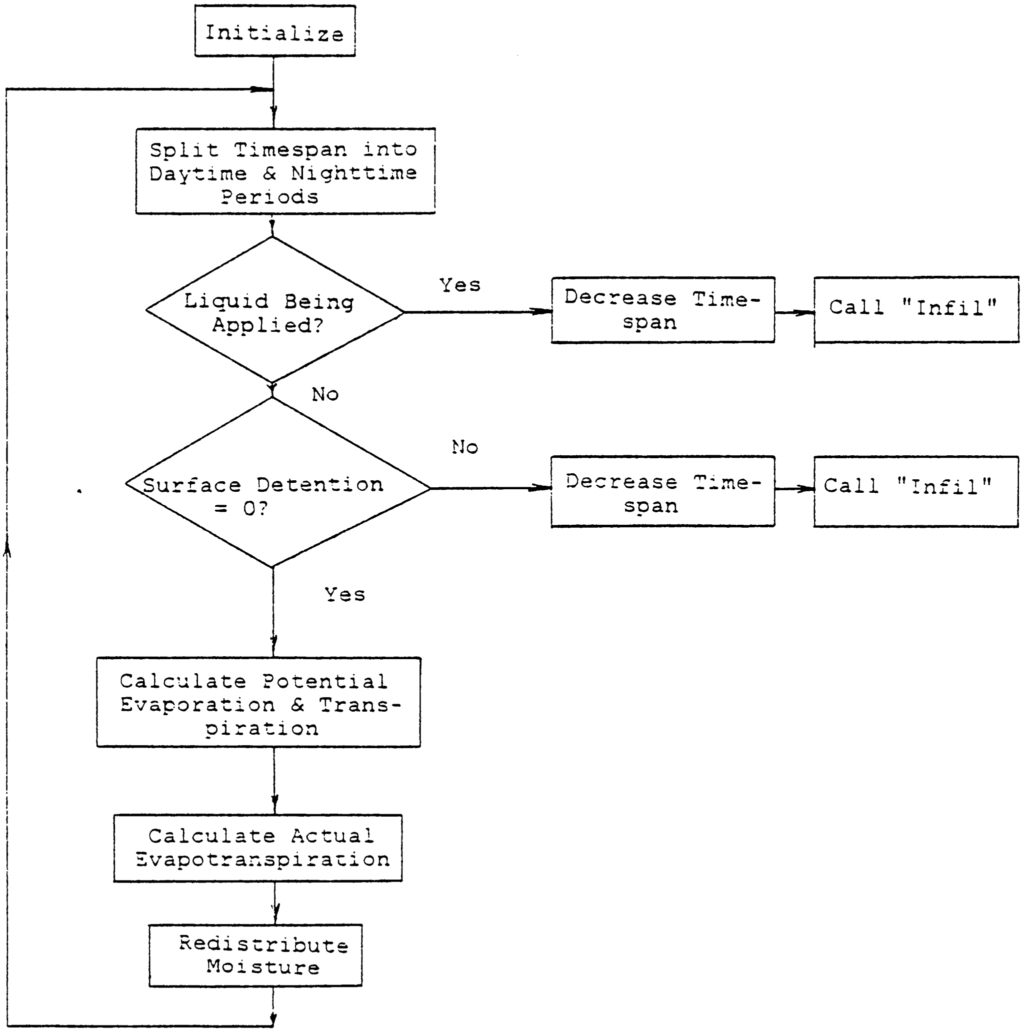

Figure 12: Flowchart for Modified SPAW Model

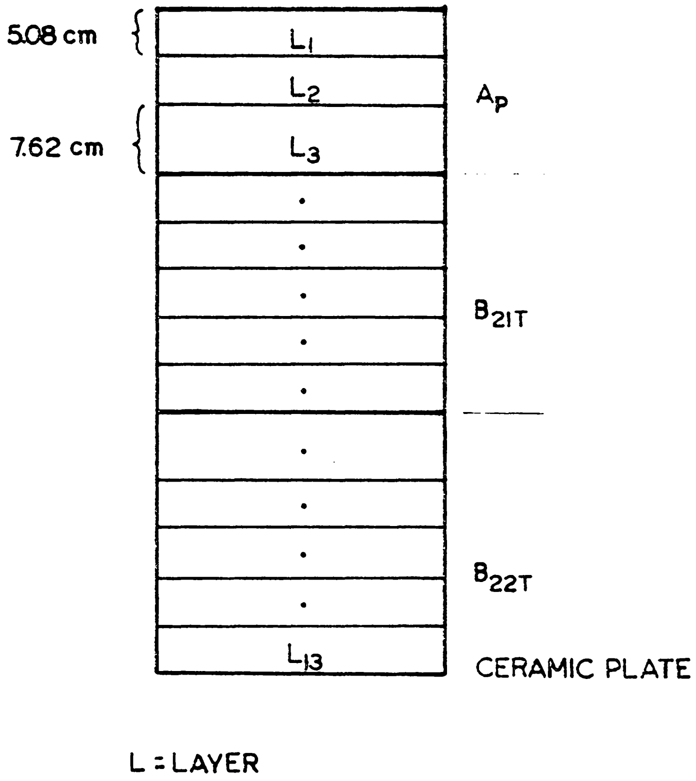

Figure 13: Geometric Structure of Modified SPAW Model

the sum of moisture losses via drainage and storage in the soil profile. Rates were proportioned into daytime and nighttime values on an hourly basis. These are discussed in the following section.

The tempe cell method (Soilmoisture Equipment Corp., 1979a) was used to determine characteristic moisture retention values for the various soil samples at matric suctions between zero and 1 bar. Moisture retention data at 3, 5, and 15 bar were obtained by the pressure plate method (Soilmoisture Equipment Corp., 1979b). The method of Campbell (1974) was used to calculate unsaturated hydraulic conductivities. Moisture characteristic curves and hydraulic conductivities as a function of soil tension are presented in Figures 14 and 15, respectively.

3.6.6.4 Model Calibration

Equation (1) is an explicit finite difference representation of the Darcy's flow equation and required *a priori* estimates of soil tensions throughout the column before model calibration could be accomplished. These data were available only at tensiometer locations and at the ceramic plate.

Intermediate soil tensions were estimated by plotting soil tension against depth in the column and constructing a

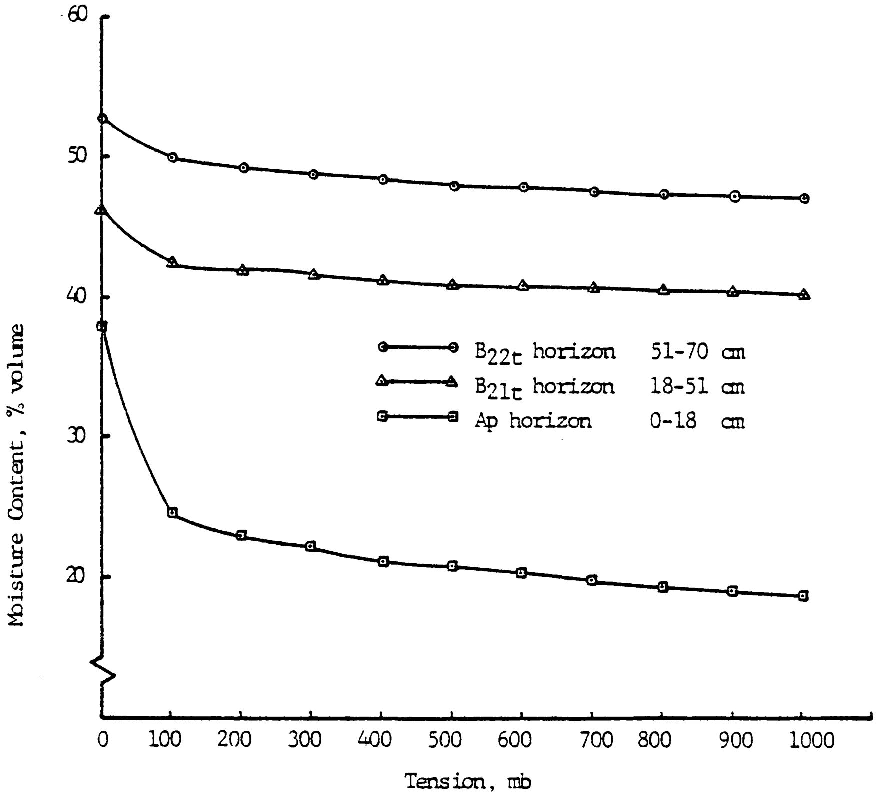

Figure 14: Moisture Characteristic Curves

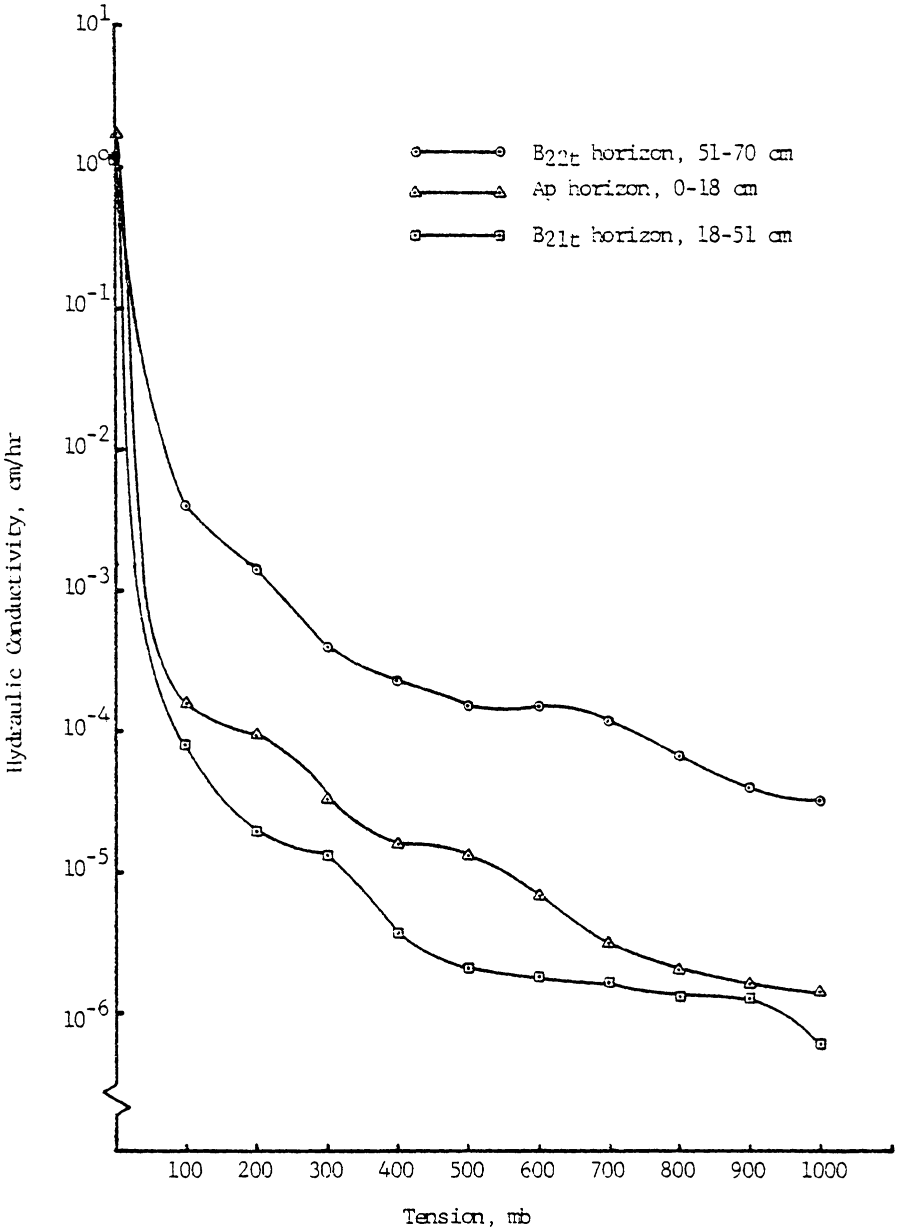

Figure 15: Hydraulic Conductivities

continuous soil tension curve through the known data points. To construct the soil tension curve, a smooth transition in tension was assumed to occur from one layer to the next, and from one horizon to the next. After the curve was drawn, soil tensions at other locations could be determined from the graph. Figure 16 is a typical soil tension curve constructed using the above procedure. Similar curves were constructed for other soil columns (having other initial moisture distributions).

The objective of the calibration process was to simulate observed drainage from the base of each column, as well as observed soil moisture content at the three tensiometer locations within the soil profile. More emphasis was placed on correctly matching drainage volumes with predictions than on matching soil moisture content because measurements of drainage were believed to be much more accurate than soil tension measurements.

Calibration of the model was basically a trial and error procedure in which several parameters in the model were systematically varied to achieve an acceptable match between simulated and observed drainage and soil moisture data.

Parameters that were adjusted in the calibration procedure are listed in Table 12. Tables 13 and 14 contain the values of these parameters that gave acceptable model results for each soil column.

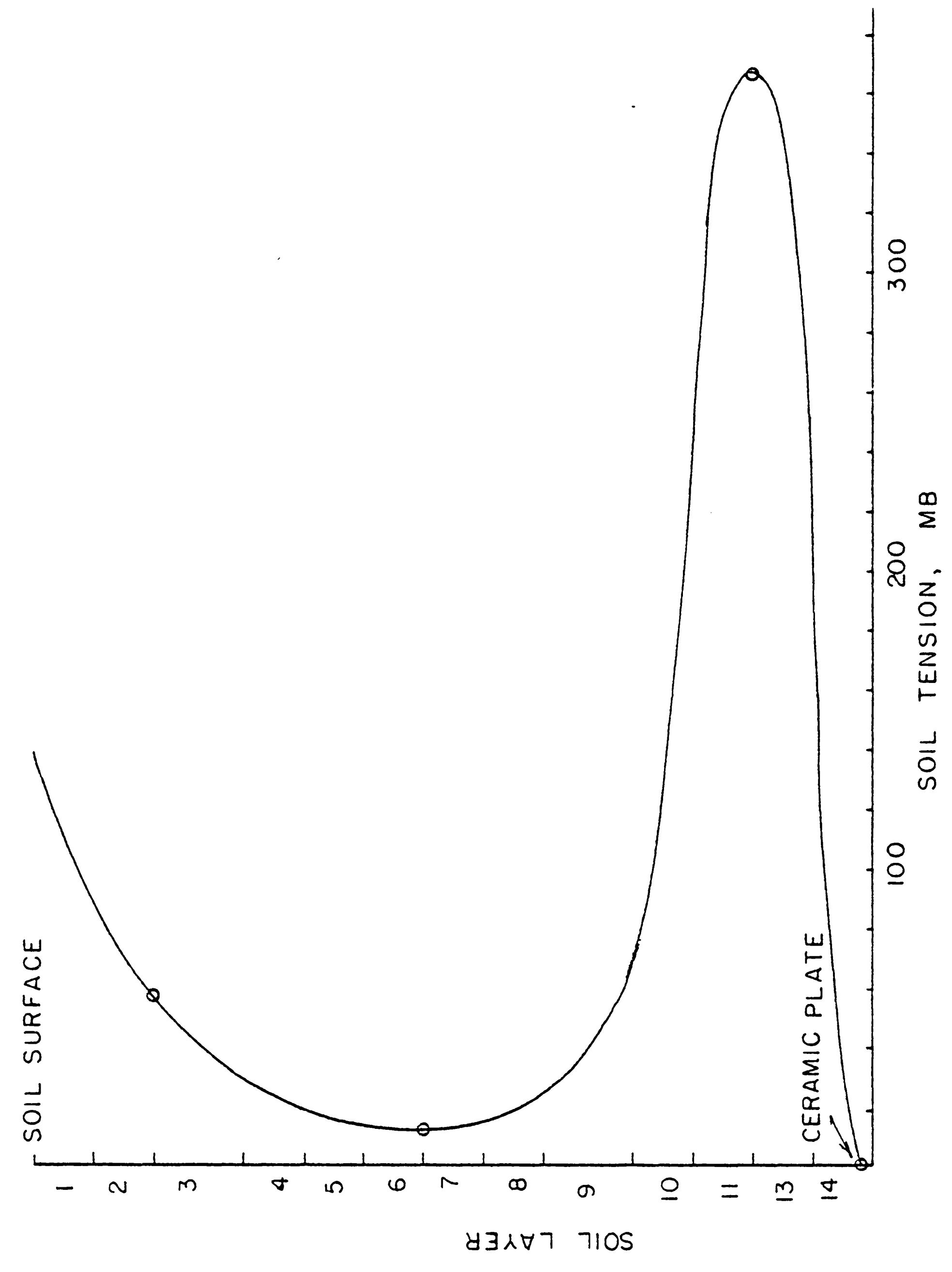

Figure 16: Derived Soil Tension Distribution Curve

TABLE 12

Parameters Adjusted for Modified SPAW Model Calibration

PARAMETER	DESCRIPTION
SUCTN	Suction applied to ceramic plate, mb
CNSTNT	Volumetric moisture content of surface layer at saturation (can be modified by FACTR(1))
SATFAC	Maximum moisture content for a given soil layer as a percentage of total saturation (e.g. SATFAC=0.9, layer can only become 90% saturated
NPTSAT	Number of layers to which SATFAC applies
IRRIG	Number of timespans into which liquid application periods are divided
NRTLYR	Number of layers into which roots are assumed to penetrate
RDIST(I)	Fraction of total root volume in layer "I"
PETRD	Potential daytime evapotranspiration rate
PETRN	Potential nighttime evapotranspiration rate
CANVAL	Fratcion of soil surface covered by vegetation
PFACTD	Adjustment factor for PETRD
PFACTN	Adjustment factor for PETRN
CFACTR	Adjustment factor for CANVAL
FACTOR(J)	Adjustment factor applied to unsaturated hydraulic conductivity curve for horizon "J"
FACTR(J)	Adjustment factor applied to soil tension curve for horizon "J"

TABLE 13

Final Values of Parameters Used in Modified SPAW Model Calibration

COLUMN #	TREAT-MENT	SUCTN MB	CNSTNT	SATFAC(NPTSAT)	IRRIG
4	1	333.0	0.375	0.80 (3)	6
5	1	333.0	0.375	0.90 (3)	6
16	1	333.0	0.375	0.90 (3)	6
12	2	500.0	0.375	0.90 (3)	6
14	2	500.0	0.375	0.90 (3)	6
6	3	667.0	0.375	0.9 (3)	6
9	3	667.0	0.375	0.90 (3)	6
13	3	667.0	0.375	0.90 (3)	6

COLUMN #	TREAT-MENT	PETRD(PFACTD)	PETRN(PFACTN)	CANVAL(CFACTR)
4	1	0.0756(0.85)	0.0432(1.00)	0.8000(1.00)
5	1	0.0397(1.00)	0.0227(1.00)	0.8000(1.00)
16	1	0.0691(1.015)	0.0395(1.00)	0.8000(1.00)
12	2	0.0565(0.80)	0.0323(1.00)	0.8000(1.00)
14	2	0.0387(1.10)	0.0221(1.00)	0.8000(1.00)
6	3	0.0453(1.11)	0.0259(1.00)	0.8000(1.00)
9	3	0.0322(1.30)	0.0184(1.00)	0.8000(1.00)
13	3	0.0551(0.70)	0.0315(1.00)	0.8000(1.00)

TABLE 14

Final Values of Parameters Used in Modified SPAW Model Calibration

COLUMN #	NRTLYR	LAYER I	RDIST(I)	HORIZON J	FACTOR(J)	FACTR(J)
4	5	1	0.40	1	0.008	1.000
		2	0.30	2	0.008	1.000
		3	0.10	3	0.008	1.000
		4	0.10	4	0.008	1.000
		5	0.10			
5	5	1	0.40	1	0.020	0.980
		2	0.30	2	0.020	0.980
		3	0.10	3	0.020	0.980
		4	0.10	4	0.020	0.980
		5	0.10			
16	5	1	0.40	1	0.010	1.000
		2	0.30	2	0.010	1.000
		3	0.10	3	0.010	1.000
		4	0.10	4	0.013	1.000
		5	0.10			
12	5	1	0.40	1	0.010	0.950
		2	0.30	2	0.010	0.950
		3	0.10	3	0.010	0.950
		4	0.10	4	0.010	0.950
		5	0.10			
14	5	1	0.40	1	0.015	1.050
		2	0.30	2	0.015	1.050
		3	0.10	3	0.015	1.050
		4	0.10	4	0.0185	1.000
		5	0.10			
6	5	1	0.40	1	0.0048	1.000
		2	0.30	2	0.0048	1.000
		3	0.10	3	0.0048	1.000
		4	0.10	4	0.0048	1.000
		5	0.10			

TABLE 14, continued

Final Values of Parameters Used in Modified SPAW Model Calibration

COLUMN #	NRTLYR	LAYER I	RDIST(I)	HORIZON J	FACTOR(J)	FACTR(J)
9	5	1	0.40	1	0.0240	0.950
		2	0.30	2	0.0240	0.950
		3	0.10	3	0.0240	0.950
		4	0.10	4	0.0240	0.950
		5	0.10			
13	5	1	0.40	1	0.0057	1.050
		2	0.30	2	0.0057	1.050
		3	0.10	3	0.0057	1.050
		4	0.10	4	0.0057	1.050
		5	0.10			

Comparisons of observed and simulated drainage are given in Table 15. The observed and simulated soil moisture data are presented in Appendix D. As evidenced in Appendix D, agreement between observed soil moisture and that predicted by the modified SPAW model was very good, particularly since tensiometer data on which observed soil moisture was based were so erratic. Because the model predicted both observed drainage and soil moisture so well, it was considered to be an especially reliable means for assessing moisture movement through the soil profile.

3.6.6.5 Verification of Moisture Flow Equation

The foundation on which moisture movement during both infiltration and redistribution was based was the Darcian flow equation. However, the finite difference form of the equation used in the model was, by the very nature of finite differences, an approximate solution to Darcy's partial differential equation. Because this equation was so critical to attaining reliable model results, it was checked for accuracy by comparing results with a model that used a more exact form of the unsaturated flow equation.

The equation employed the hydraulic diffusivity concept and can be expressed as:

$$\frac{\delta\Theta}{\delta t} = \frac{\delta}{\delta z}\left(D(\Theta)\ \frac{\delta\Theta}{\delta z}\right) + \frac{\delta K(\Theta)}{\delta z} \qquad (2)$$

where:

TABLE 15

Observed and Simulated Drainage Volumes

Column Number	Final Cumulative Drainage, cm Observed	Predicted by SPAW
4	1.732	1.049
5	4.435	4.464
16	0.987	1.050
6	1.382	1.360
9	6.573	6.536
13	1.820	5.043
12	3.218	6.547
14	3.317	3.362

Θ = volumetric moisture content;

t = time;

z = distance in the vertical direction;

D = hydraulic diffusivity; and

K (Θ) = unsaturated hydraulic conductivity.

The advantage of using hydraulic diffusivity is that its range in variation is much smaller than hydraulic conductivity (Hillel, 1980). This generally leads to a more exact solution to the unsaturated flow equation.

Data describing the moisture characteristics of a North Carolina soil and a computer program to solve Equation (2) were obtained from Skaggs.[2] These soil data contained both diffusivity and conductivity measurements. Both models were operated on the same data base with the exception that the modified SPAW model used the hydraulic conductivity relationships and Skaggs' model used hydraulic diffusivity relationships. The agreement between model predictions was excellent as shown in Table 16. The analysis further supported the reliability of the modified SPAW model as a tool for predicting moisture movement.

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[2] R. W. Skaggs, Biological and Agricultural Engineering Department, North Carolina State University, Raleigh, NC. 1980. Personal communication.

TABLE 16

Predicted Moisture Distributions - Modified SPAW vs. Skaggs

DEPTH, cm	MOISTURE CONTENT % VOLUME	
	Modified SPAW	Skaggs
0.00	0.37500	0.37500
5.08	0.37321	0.37101
10.16	0.36948	0.36674
15.24	0.36544	0.36216
20.32	0.36102	0.35723
25.40	0.35618	0.35190
30.48	0.35081	0.34610
35.56	0.34481	0.33976
40.64	0.33800	0.33276
45.72	0.33012	0.32491
50.80	0.32073	0.31594
55.88	0.30895	0.30536
60.96	0.29260	0.29211
66.04	0.25424	0.27277
71.12	0.22349	0.22350

3.6.6.6 Model Usage

Not all columns could be successfully modeled. In addition, time constraints prevented verification of the calibrated modified SPAW model on independent data. Nevertheless, its use as an analytical tool was justified based on data with which it was calibrated. Agreement between simulated and observed drainage was good and the moisture flow equation appeared to yield accurate results. Consequently, predictions produced by the model were analyzed to determine liquid residence times in the root zone.

These predictions were analyzed in two ways. In the first approach, residence time in the root zone was defined as the length of time necessary for liquid inputs to be balanced by losses (through evapotranspiration and drainage), taking into account the changes in moisture storage within the root zone. When this criterion was satisfied, the elapsed time was determined. This analysis was performed on each column.

The second approach involved a detailed examination of the moisture balance in the root zone between successive liquid applications. The objective of this analysis was to assess the magnitude of drainage from the root zone during and following liquid applications.

3.6.7 Wastewater and Leachate Sampling and Preservation

Samples of wastewater were collected for analysis each time wastewater was applied. Samples of leachate at the 17.8-cm depth (i.e., below the root zone) were also collected each time wastewater was applied. All samples were frozen immediately after collection for chemical analysis.

Soil water samples were obtained by means of porous cup soil water samplers, each of which was attached to a collection flask. A suction of 38 cm Hg (1/2 bar) was applied to each flask. Sample collection began at the 17.8-cm depth when the tensiometer at the 10.2-cm depth indicated that the wetting front had reached the 17.8-cm depth. This time was estimated by assuming moisture movement between 10.2 and 17.8 cm occurred at a rate equal to that between 0 and 10.2 cm. Collection periods of up to 24 hours were required to obtain sufficient sample for chemical analysis. These were immediately frozen after collection. Sufficient sample volumes could not be obtained at the 48.3-cm depth within a 24-hour period so sampling efforts at this depth were discontinued.

Effluent samples were collected at the base of each column on a weekly basis during Phase 1 experiments (December, 1980, through mid-March, 1981). Samples were collected less regularly during the second phase (late July - early September, 1981). From late September, 1981 until termination of the experiments in November, 1981, effluent samples were collected at weekly intervals. To prevent bacterial activity in the effluent samples, ten drops of concentrated H_2SO_4 were added to each vacuum collection flask. When the flasks were emptied, samples were measured for volume and immediately The flasks were washed and more acid added prior to reuse.

3.6.8 Dilution Investigations

Near the end of the study, experiments were conducted to determine the extent soil water samples at 17.8 cm might have been diluted by flush water additions during Phase 3. The experiments consisted of applying distilled water colored with food dye (representing flush water) to the soil columns and extracting samples at the 17.8-cm depth for color analysis. Because the wastewater was colorless when made and contained only one undissolved constituent (starch) that was probably removed as the wastewater moved through the soil, wastewater was assumed to have 100 percent light transmittance at this depth.

Standard dilutions of the applied water were made and analyzed with a spectrophotometer for light transmittance and development of a standard curve relating percentage light transmittance to dilution (Figure 17). Samples collected at 17.8 cm were similarly analyzed and compared to the standard curve. Because the dilution of the colored water was being measured in these experiments, high light transmittance indicated significant dilution of the colored flush water by wastewater in the soil. Conversely, this condition indicated that little dilution of the wastewater occurred as the result of flush water additions. Consequently, only negligible correction was needed for samples exhibiting high light transmittance. Correction factors are presented in Table 17. The consequences of these findings are discussed later in Section 4.3.1.2..

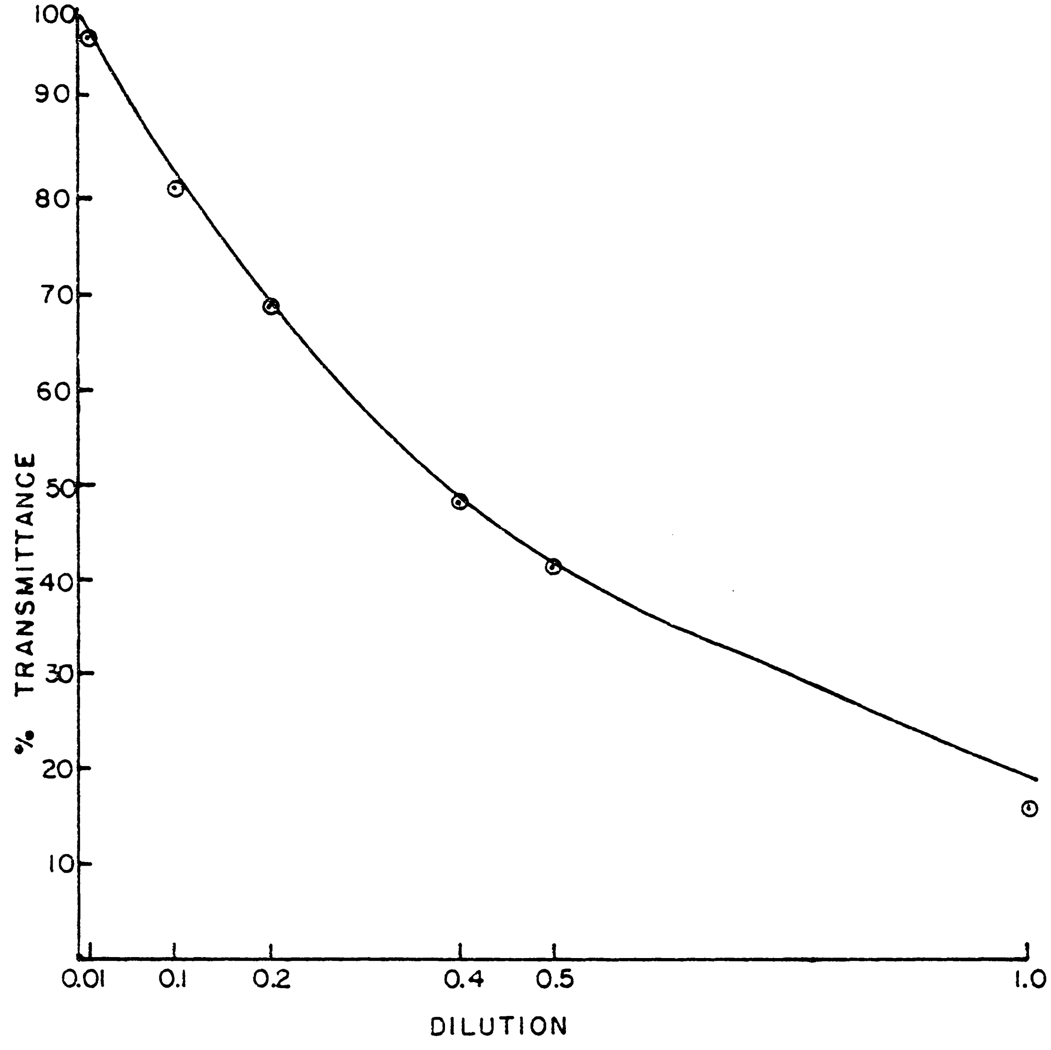

Figure 17: Percentage Light Transmittance versus Dilution of Colored Flush Water

TABLE 17

Correction Factors to Account for Dilution of Soil Water Samples Collected at 17.8 cm

COLUMN NUMBER	TIME AFTER APPLICATION HRS.	% TRANSMITTANCE	DILUTION	FACTOR
4	10	53	0.35	1.54
4	24	60	0.28	1.39
16	24	77	0.14	1.16
11	12	51	0.37	1.59
11	25	73	0.17	1.20
12	12	97	0.01	1.01
12	25	98	0.01	1.01
14	12	80	0.12	1.14
14	25	90	0.045	1.05
9	12	77	0.14	1.16
9	24	80	0.12	1.14
10	12	73	0.17	1.20
10	24	55	0.32	1.47

3.6.9 Analytical Procedures

All soil water, effluent, and synthetic wastewater samples were analyzed for Cl^-, NH_4^+-N, and NO_3^--N using specific ion electrodes (Models 94-17, 95-10, and 93-07, respectively, Orion Research Inc., Cambridge, MASS) and a Model 801 digital pH/mV meter (Orion Research Inc.). A Fisher pH electrode (Model 13-639-97, Fisher Scientific Co., Pittsburgh, PA) and Fisher 620 Accumet pH meter (Fisher Scientific Co.) were used to analyze pH.

Some samples of wastewater and soil water were analyzed for total nitrogen using a block digestor (Industrial Procedure No. 321-74A, Technicon Industrial Systems, Tarrytown, NY) followed by steam distillation using the semi-micro Kjeldahl procedure (Bremner, 1965). Selected soil samples were analyzed for total nitrogen using the block digestion procedure of Nelson and Sommers (1972) but substituting "Kelpak" (Matheson Chemical Co.) reagents for the catalysts. The analysis was completed by steam distillation using the semi-micro Kjeldahl technique (Bremner, 1965).

Preliminary soil analyses were made by the Virginia Tech Extension Soil Testing Laboratory using standard techniques (Donohue and Gettier, 1980) for pH, nitrate nitrogen, and percent organic matter. Mechanical analysis of soil was performed using the hydrometer method (Day, 1964).

3.6.10 Statistical Procedures

Wastewater applications were made under two experimental conditions. During Phases 1 and 2 of the study, liquid (including wastewater) was being applied when soil tensions at 10.2 cm were 550-600 mb. Different residence times in the root zone were being induced by different suctions at the base of the soil columns. During Phase 3, suction at the base of each column was maintained as in Phases 1 and 2, but in addition, flush water applications were used to achieve more positive control over wastewater residence time in the root zone.

Consequently, data from soil water and effluent samples were segregated into two groups for statistical analysis. One group was comprised of chemical data from samples collected during Phases 1 and 2 of the study (i.e. before 9/10/81). Data from samples collected after 9/10/81 were placed in a second group. In addition, soil water sample data were analyzed separately from effluent sample data.

The Statistical Analysis System (SAS Institute, 1979) was used for all statistical analyses. Univariate analysis was used to determine the variability of both soil water and effluent sample data. Analysis of variance and, where appropriate, mean separation, were used to determine possible treatment effects.

Chapter IV

RESULTS

4.1 RESIDENCE TIME DETERMINATIONS

Tensiometer data were highly variable. Especially noticeable was the variability in measurements at the 17.8-cm depth. Because of this variability, it was not possible to isolate differences between the rate of moisture movement through different soil columns and/or the same soil column when at different soil tensions.

Attempts to model moisture movement using CSMP (Hillel, 1977) were unsuccessful because the model could not be made functional, despite its simplicity and widespread distribution. Use of the modified SPAW model, however, did allow calculation of liquid residence time in the root zone (Table 18). These times were determined using a mass balance concept of liquid residence time.

Values given in Table 18 represent times required for liquid additions to the columns to be balanced by drainage and evapotranspiration losses from the root zone. In some cases, tensiometers indicated that it was time for another liquid addition before all previously applied liquid had left the root zone. Thus, the values in Table 18 do not al-

TABLE 18

Range of Residence Times in Root Zone

COLUMN #	RESIDENCE TIME, HRS	COLUMN #	RESIDENCE TIME, HRS	COLUMN #	RESIDENCE TIME, HRS.
		Treatment 1			
4	21.0	5	93.0	6	39.0
	88.3		67.3		34.5
	63.2		47.5		34.5
	89.8		54.5		138.8
	61.5		52.5		42.5
	66.5		67.6		40.5
	120.3		58.3		52.0
	32.0		44.5		44.8
	53.8		37.5		31.4
			54.0		
			54.4		
		Treatment 2			
6	93.5	9	27.5		
	64.3		92.5		
	44.8		109.0		
	48.9		49.0		
	59.5		48.2		
	123.6		177.0		
	73.3		51.5		
	24.5		50.8		
	43.0		46.4		
	52.2		44.9		
		Treatment 3			
12	47.5	14	37.5		
	78.8		54.9		
	99.0		114.8		
	47.5		150.8		
	28.5				
	212.6				
	94.1				
	42.2				

ways indicate the amount of time any single application of liquid was in the root zone.

Analyses of moisture balance in the root zone during and between individual liquid applications provided more insight into the fate of applied liquid. Figures 18 through 25 are graphical representations of moisture balances in the root zone for individual columns during and after single liquid applications. In these figures, evapotranspiration, storage, and drainage are presented as percentages of applied liquid. For ease of comparison, figures are presented for application periods which began when initial moisture content in the root zone of each column was approximately equal. These figures are, however, representative of other application periods (Appendix E).

Drainage curves had a characteristic shape which indicated rapid drainage lasting for approximately 2 hours followed by a much lower drainage rate. Rapid drainage occurred because liquid additions were made when the root zone was near saturation (50 to 75 percent saturated in most cases). Saturation was taken to be the volumetric moisture content at 0 mb soil tension (from characteristic curves) taking into account the adjustments made to these values during model calibration (Tables 12, 13, and 14).

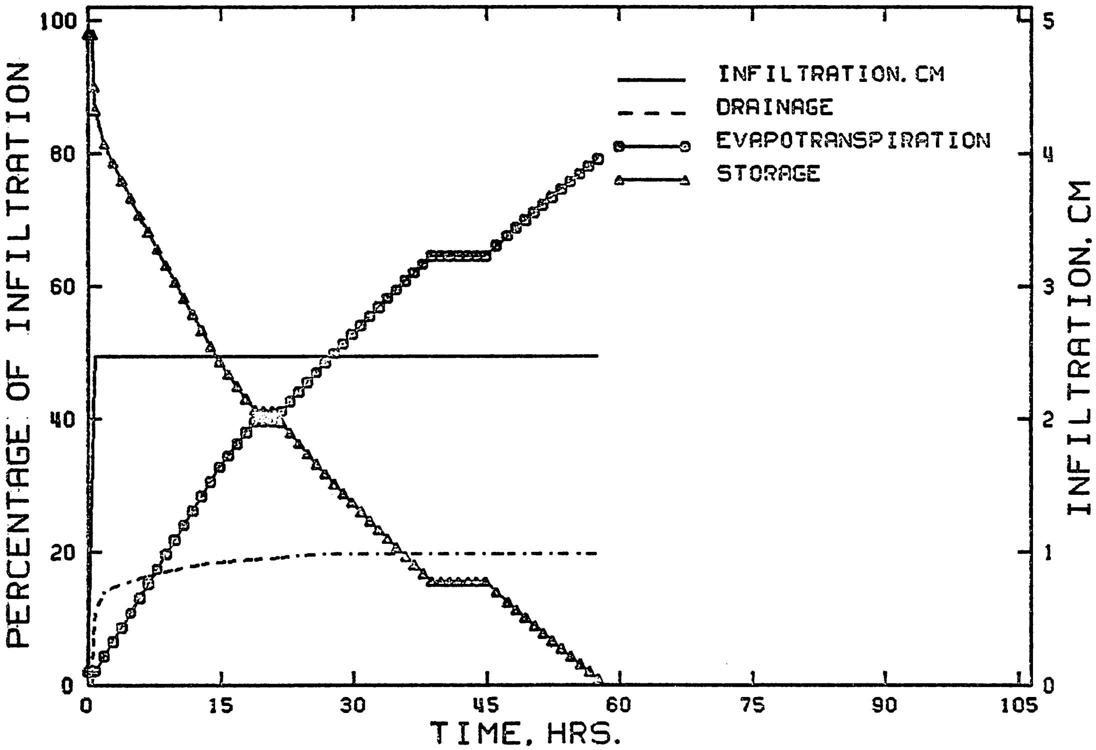

Figure 18: Moisture Balance in Root Zone for Column 4
(Upper 5 cm = 42 percent Saturated

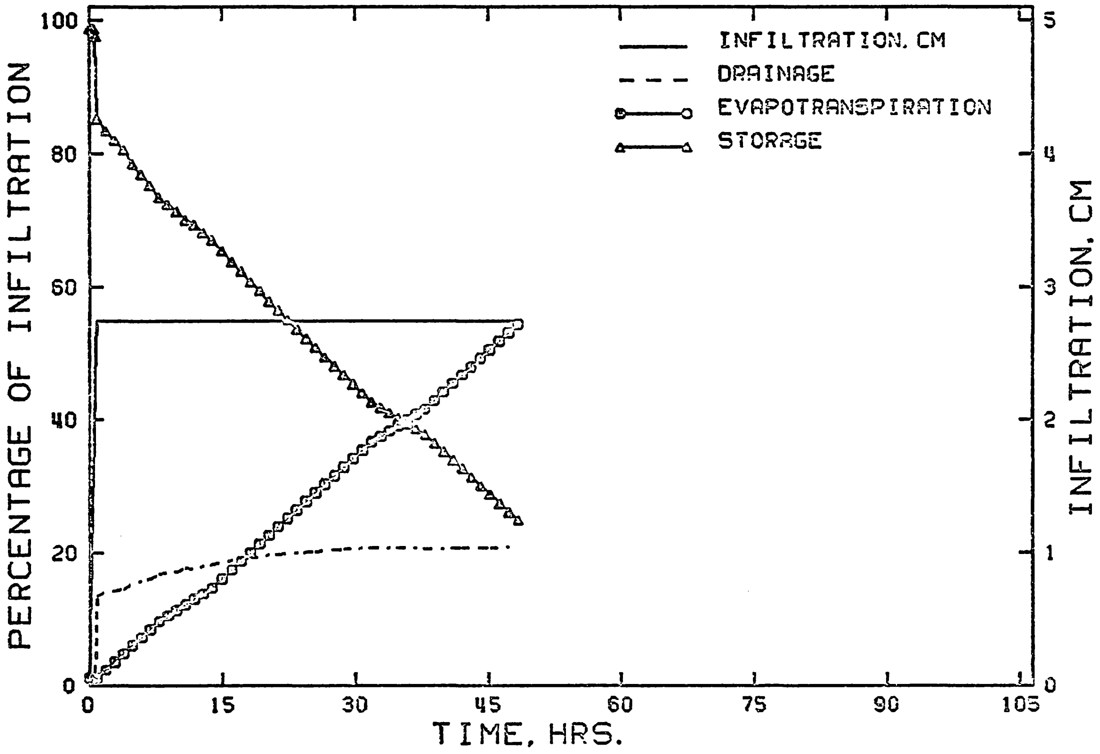

Figure 19: Moisture Balance in Root Zone for Column 5 (Upper 5 cm = 41 percent Saturated

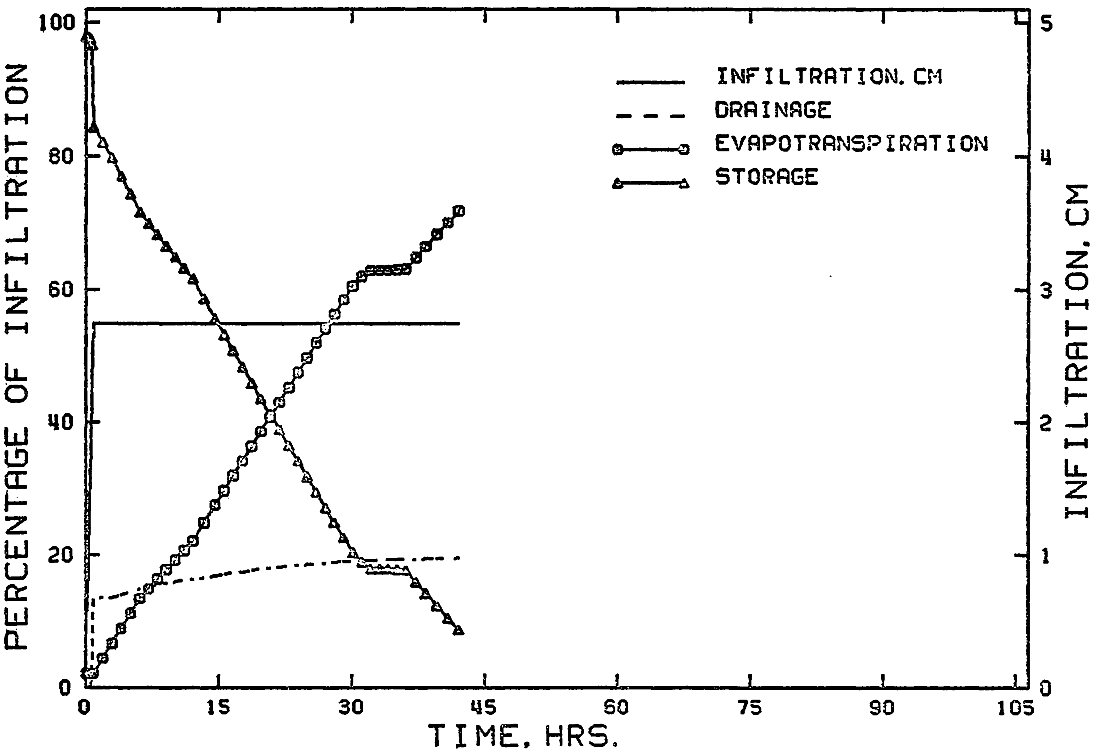

Figure 20: Moisture Balance in Root Zone for Column 16 (Upper 5 cm = 42 percent Saturated

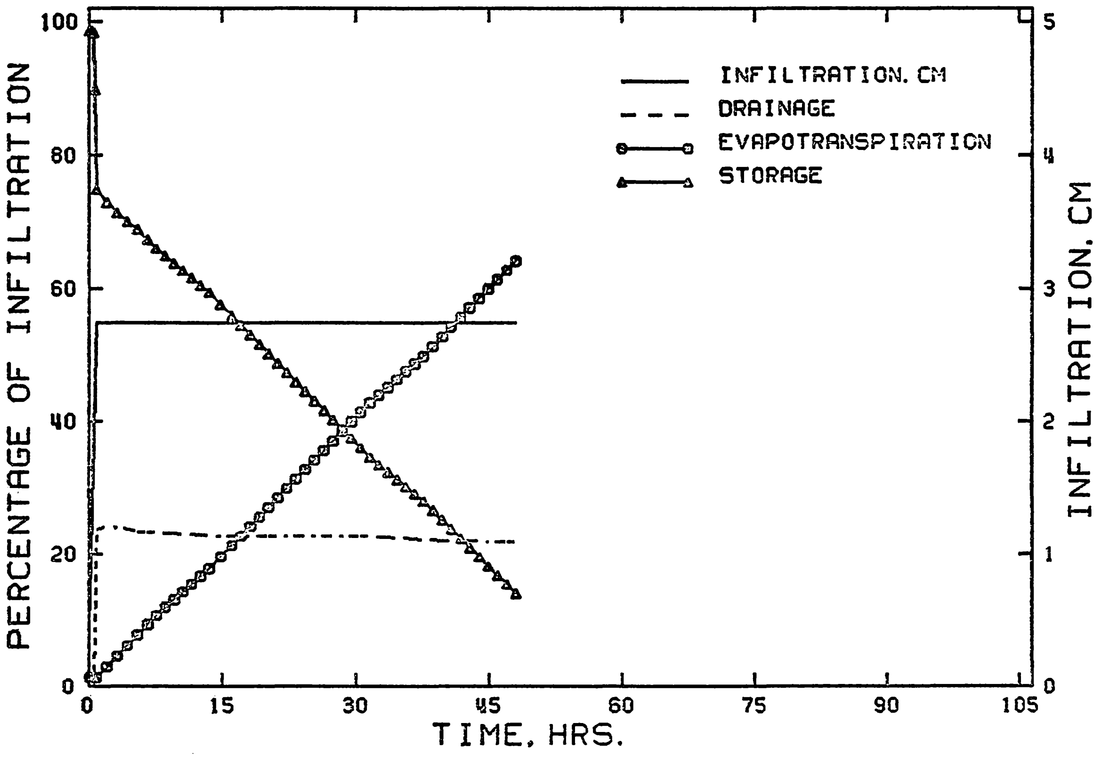

Figure 21: Moisture Balance in Root Zone for Column 12
(Upper 5 cm = 42 percent Saturated

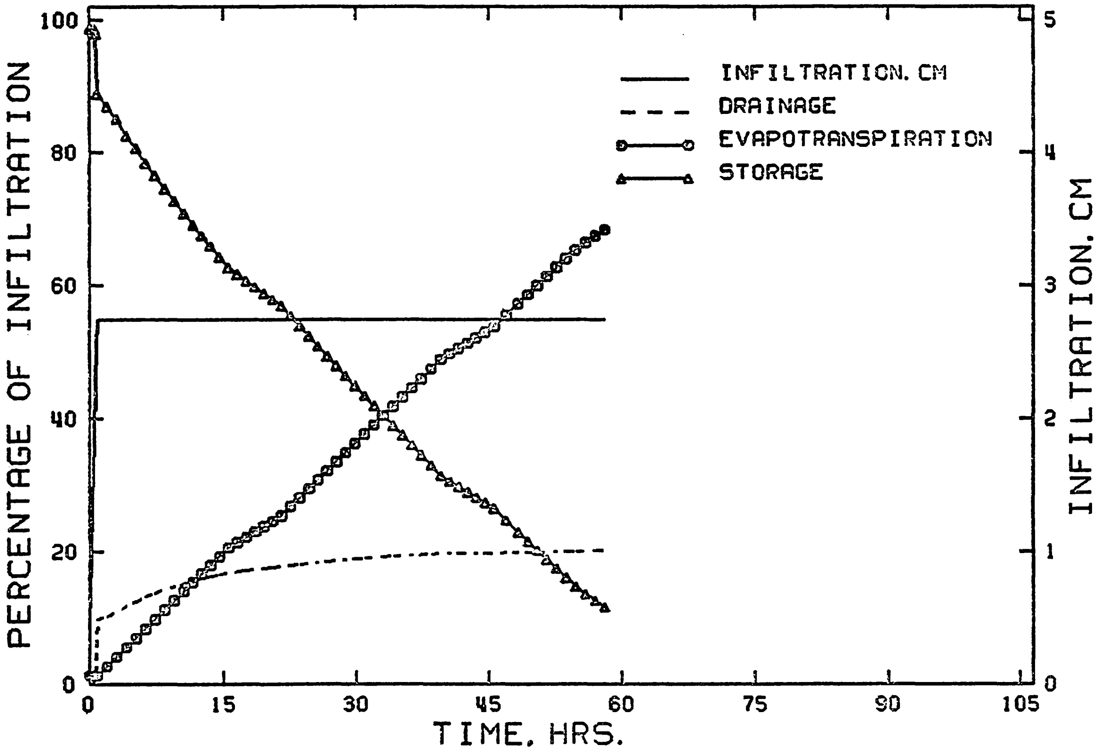

Figure 22: Moisture Balance in Root Zone for Column 14 (Upper 5 cm = 42 percent Saturated

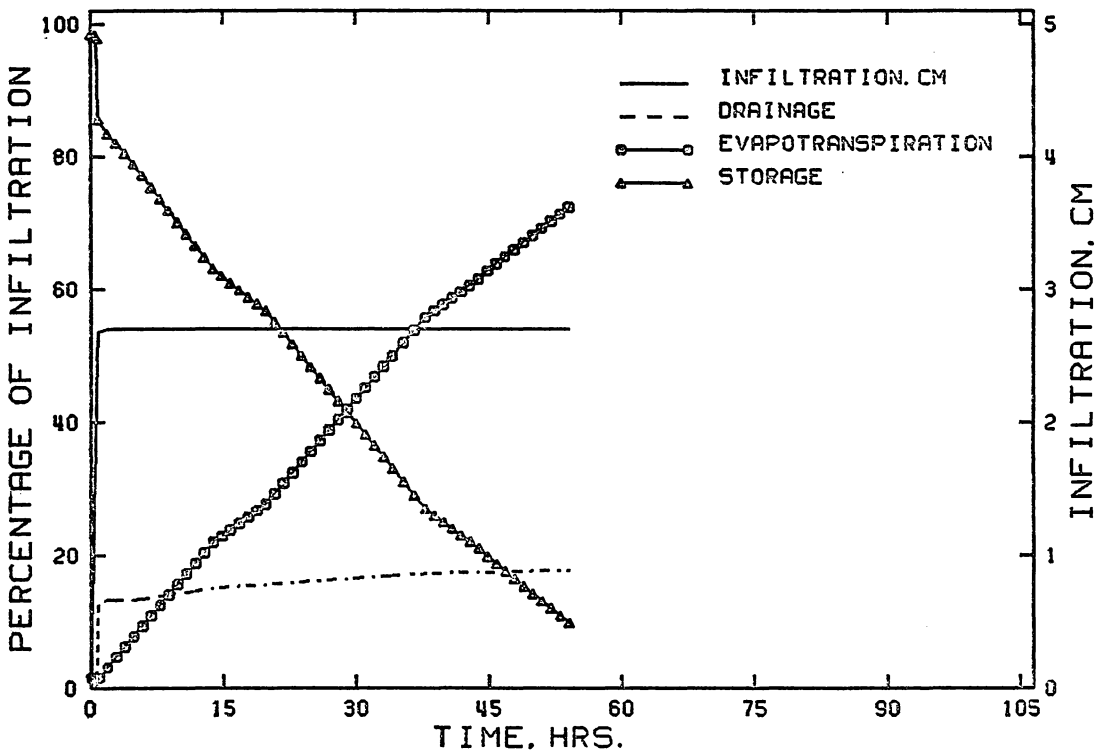

Figure 23: Moisture Balance in Root Zone for Column 6
(Upper 5 cm = 41 percent Saturated

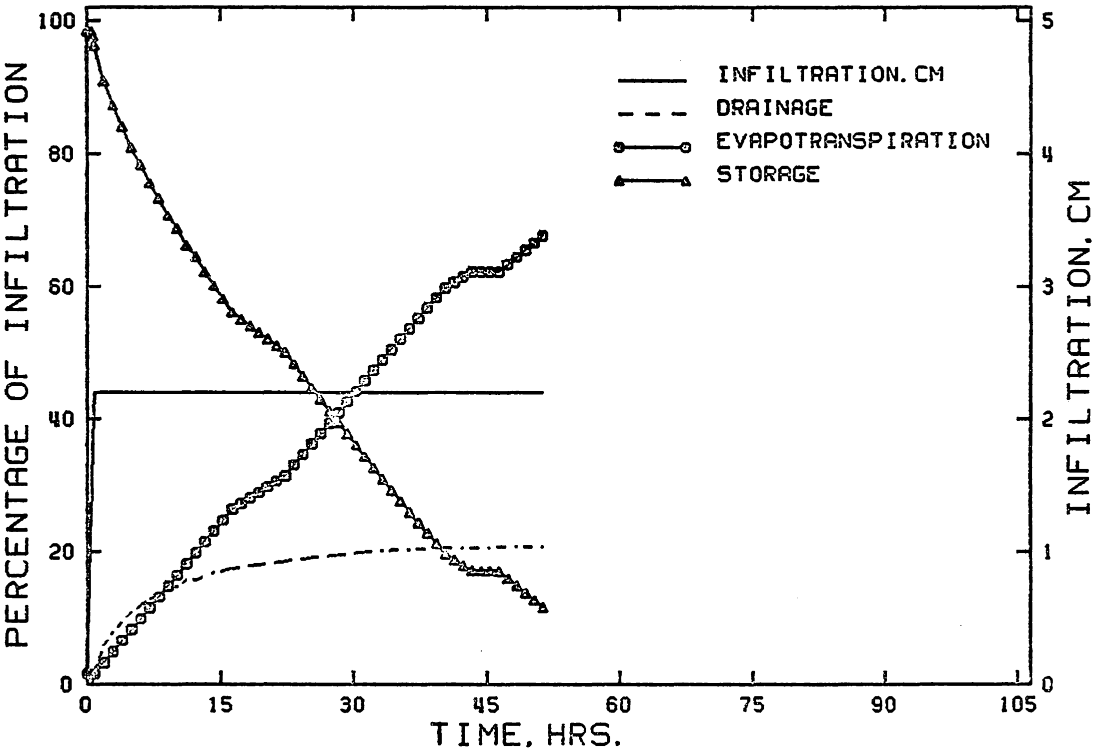

Figure 24: Moisture Balance in Root Zone for Column 9
(Upper 5 cm = 42 percent Saturated

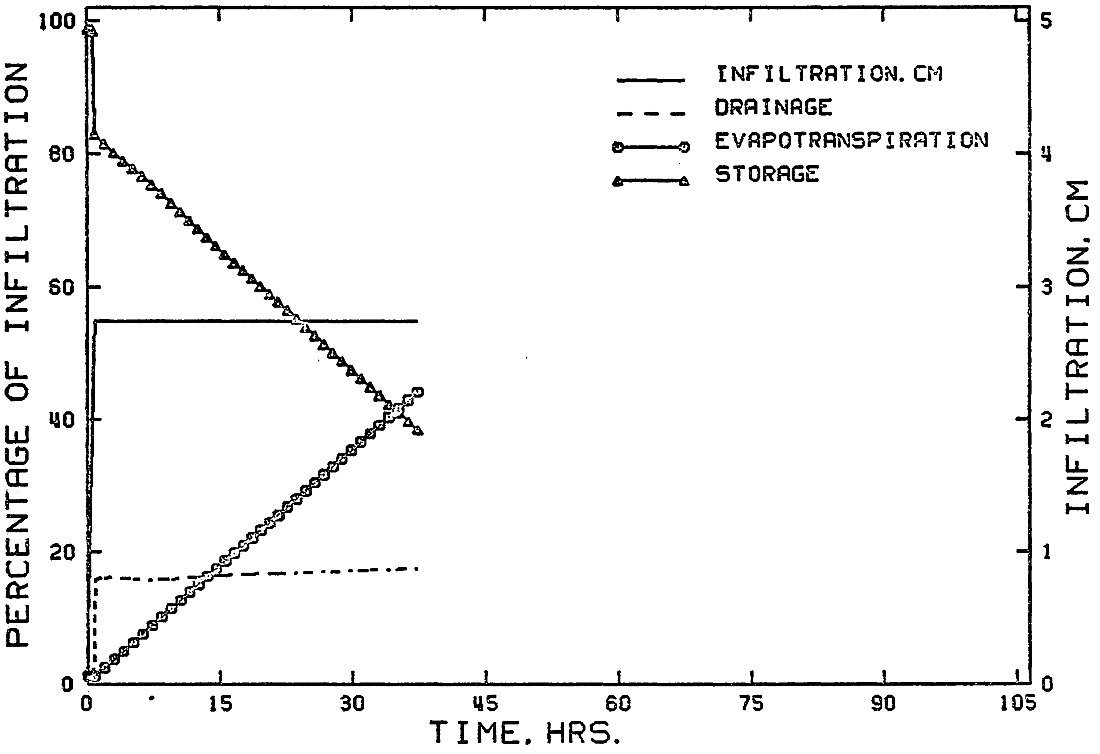

Figure 25: Moisture Balance in Root Zone for Column 13
(Upper 5 cm = 43 percent Saturated

4.1.1 Statistical Analyses

Drainage curves were separated into two segments - Segment I consisting of the rapid drainage period, and Segment II consisting of the gradual drainage period (Figure 26). Each segment was analyzed to obtain a simple, mathematical relationship to describe its shape.

Initial drainage was defined as the total amount of drainage that had occurred when the slope of the drainage curve (i.e. drainage rate) reached a maximum and began decreasing. This point is designated as the inflection point on Figure 26. As indicated in Figures 18 through 25, these changes in slope were well-defined and easily identified.

Two procedures were used to estimate initial drainage. In the first method, initial drainage was approximated by "maximum potential drainage" (i.e. the amount by which liquid applications exceeded unfilled pore space in the root zone). To determine maximum potential drainage, moisture content in the root zone was determined at the time of each liquid application. These values were subtracted from the saturation moisture content to obtain the amount of unfilled pore space (which could potentially accept applied liquid). Statistical tests (paired t-tests) were used to compare these estimates of initial drainage with observed values (as defined previously). Results of the analysis are presented

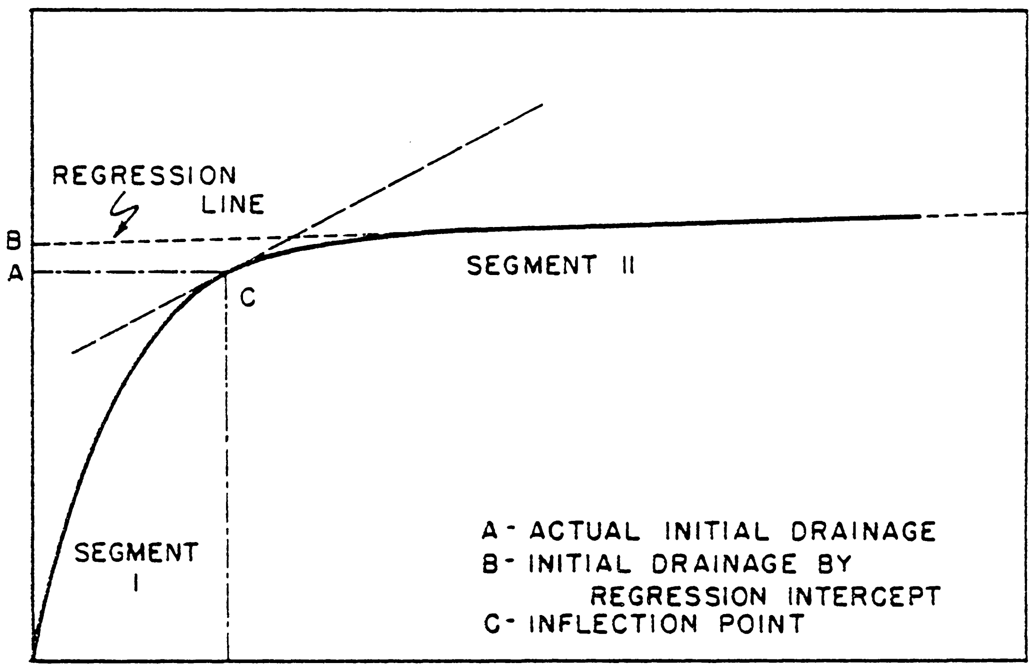

Figure 26: Separation of Drainage Curves for Statistical Analysis

in Table 21. These indicate that there is no significant difference between actual initial drainage and estimates of initial drainage by "maximum potential drainage" except for Column 9.

The second method of estimating initial drainage involved statistical analysis of Segment II of the drainage curves. In this procedure, linear regression was used to determine the relationship between drainage and time for the gradually sloping portion of each drainage curve. The regressions fit the drainage curves well as shown in Table 22, which gives the means of correlation coefficients from all regressions on drainage curves for each column.

The intercepts from these regressions were then assumed to be approximately equal to initial drainage (Figure 26). These estimates also were compared to observed initial drainage using paired t-tests, and the results are given in Table 23. This analysis indicated there was no significant difference (except for Column 9) in actual initial drainage and estimates of initial drainage using the intercepts of regression equations describing the gradually sloping portion of each drainage curve.

Because estimates of initial drainage by both methods described above were statistically identical to actual initial drainage, the estimates themselves were compared sta-

TABLE 21

Statistical Comparison of Observed and Estimated Initial Drainage (by Maximum Potential Drainage)

Column Number	t	Pr>t	Significance
4	0.60	0.56	NS
5	-0.58	0.58	NS
16	0.72	0.49	NS
12	-1.33	0.20	NS
11	1.39	0.19	NS
14	-0.95	0.37	NS
6	1.24	0.23	NS
9	2.42	0.03	S

NS - not significant at the 5 % level
S - significant at the 5 % level

TABLE 22

Correlation Coefficients for Regressions on Segment II of Drainage Curves

Column Number	Correlation Coefficients		
	Mean	Stand. Deviation	Sample Size
4	.729	0.267	15
5	.742	0.110	13
16	.779	0.230	12
12	.914	-	15
11	.867	0.173	14
14	.752	0.292	7
6	.870	-	15
9	.798	0.104	14

TABLE 23

Statistical Comparison of Observed and Estimated Initial Drainage (by Linear Regression)

Column Number	t	Pr>t	Significance
4	-0.08	0.94	NS
5	-1.51	0.16	NS
16	-2.39	0.04	NS
12	-1.09	0.29	NS
11	-1.82	0.09	NS
14	-1.20	0.27	NS
6	-2.04	0.06	NS
9	-2.59	0.02	S

NS - not significant at the 5 % level
S - significant at the 5 % level

tistically. This was done because "maximum potential drainage" is an easily determined quantity, and, if no different from the intercepts of the regression equations describing Segment II of the drainage curves, could be used in conjuction with these equations to predict drainage at any time after liquid application. The means of initial drainage volumes estimated by both procedures are given for each column in Table 24. Drainage volumes predicted by each of these procedures were compared statistically using a paired t-test. Results from these tests are presented in Table 25 and show that drainage predicted by the two methods was significantly different within Treatment 3. This was probably because both estimates of initial drainage were statistically different from actual initial drainage for one (Column 9) of the two columns in Treatment 3.

The rate of drainage after the point of inflection of each drainage curve is equal to the slope of the regression equations. Means of these slopes for each column are presented in Table 26. Duncan's multiple range test was used to test for statistical differences in these slopes among treatments. Results of this test are presented in Table 27, and indicate that at the 5 percent level there were no significant differences in slope estimates among treatments.

TABLE 24

Mean Values of Predicted and Calculated Initial Drainage

Column Number	Initial Drainage, cm Predicted*	Initial Drainage, cm Calculated**
	Treatment 1	
4	0.6321	0.5532
5	0.5272	0.4679
16	0.3868	0.4319
Treatment	0.5544	0.4891
	Treatment 2	
12	0.7449	0.7932
11	0.3122	0.0266
14	0.9499	0.9354
Treatment	0.8588	0.8722
	Treatment 3	
6	0.3801	0.3258
9	0.7161	0.6411
Treatment	0.5481	0.4834

* - predicted intercept from linear regression analysis
** - calculated as maximum potential drainage

TABLE 25

Comparison of Initial Drainage Calculation: Linear Regression Analysis vs. Maximum Potential Drainage

Treatment	t Statistic	Significance Level
1	1.29	0.1250 NS
2	-0.58	0.5673 NS
3	2.99	0.0057 HS

NS - not significant at the 5% level
HS - significant at the 1% level

TABLE 26

Mean Values for Slopes of Drainage Curves as Predicted by Linear Regression Analysis

Column Number	Predicted Slope cm/hr
Treatment 1	
4	-0.0001*
5	0.0025
16	0.0026
Treatment 2	
12	0.0008
11	0.0042
14	0.0014
Treatment 3	
6	0.0020
9	0.0023

*Negative slope indicates root zone was drier than lower profile and was adsorbing moisture from lower soil layers.

TABLE 27

Duncan's Multiple Range Test on Drainage Curve Slopes Averaged within Treatments

Treatment	Mean Slope	Duncan's M.R. Comparison*
1	0.002127	A
2	0.001122	A
3	0.001564	A

* - Means with the same letter are not significantly different at the 5 % level of significance

4.2 NITROGEN ADDITIONS AND REMOVALS

4.2.1 Additions

Seals around the suction plates on all columns required frequent repair necessitating removal of the columns from operation for varying lengths of time. This, coupled with the fact that wastewater made prior to mid-August, 1981 was proportioned incorrectly, resulted in nitrogen additions which were less than the target rate of 116 kg/ha. Table 28 gives the cumulative amounts of nitrogen added to each column. These rates were calculated using nitrogen concentrations determined from chemical analysis of each batch of wastewater (Tables 7 and 8) and the amount of wastewater applied (Table 11).

Values for organic nitrogen presented in Table 29 were calculated as the difference between mean TKN values (Table 10) and mean NH_4^+-N values in the wastewater (Tables 7 and 8).

TABLE 28

Cumulative NH_4^+-N Applications

Column Number	Target Application Rate, kg/ha	Actual Application Rate, kg/ha
4	116	67
5		70
16		70
6	116	63
9		67
10		54
11	116	67
12		63
14		54

TABLE 29

Organic Nitrogen Additions

Column Number	Organic Nitrogen Additions, kg/ha Before 8/14/81	After 8/14/81	Total
4	16.24	26.06	42.30
5	19.48	26.05	45.53
16	19.49	26.05	45.53
6	16.24	24.05	40.29
9	19.42	24.05	43.47
10	6.49	24.05	30.54
11	19.49	24.05	43.54
12	16.24	24.05	40.29
14	6.49	24.05	30.54

4.2.2 Removals

4.2.2.1 Soil

Results from analyses of soil samples for pH, percentage organic matter and NO_3^--N are presented in Table 30. Designations "Before" and "After" refer to samples taken before wastewater was applied to the soil columns and those taken at the conclusion of the experiment, respectively. Without exception there was very little change in soil organic matter content; however, dramatic reductions occurred in NO_3^--N content, especially in the Ap soil horizon (upper 18 cm).

Total Kjeldahl nitrogen concentrations in soil samples collected at the conclusion of the experiment are presented in Table 31. One column was selected at random from each treatment for analysis. The data in Table 31 indicate a fairly constant level of nitrogen in samples. Because TKN analyses were not performed on soil samples at the beginning of the experiments, no comparisons of changes in TKN content of soil can be made. One would expect, however, that little change would have been detected in this parameter due to the mass of nitrogen involved and the slow rate at which organic nitrogen mineralizes.

TABLE 30

Selected Soil Analyses on Pre- and Post- Experiment Samples

COLUMN NUMBER	DEPTH CM	PH	ORGANIC MATTER %	NO_3^--N PPM	PH	ORGANIC MATTER %	NO_3^--N PPM
		BEFORE			AFTER		
4	8	5.2	2.1	68.0	5.6	2.4	8.0
	33	4.8	0.9	8.0	5.0	0.9	3.0
	70	5.0	0.6	3.0	5.2	0.6	3.0
5	8	5.3	2.1	70.0	5.9	2.2	5.0
	33	4.9	0.9	5.0	5.0	0.9	3.0
	70	4.9	0.6	3.0	5.2	0.7	3.0
16	8	6.0	2.2	70.0	6.5	2.2	3.0
	33	4.7	0.9	13.0	4.9	1.0	3.0
	70	4.5	0.6	13.0	5.1	0.6	3.0
C11	8	5.1	2.5	75.0	6.1	2.3	8.0
	33	4.9	1.0	13.0	4.9	0.9	3.0
	70	4.8	0.6	3.0	5.0	0.7	3.0
C12	8	4.9	2.1	75.0	5.7	2.3	3.0
	33	4.7	0.9	13.0	4.8	1.1	3.0
	70	4.9	0.7	5.0	5.1	0.7	3.0
C14	8	4.6	2.1	83.0	5.4	2.2	3.0
	33	4.7	0.9	13.0	5.0	1.0	3.0
	70	4.8	0.6	3.0	5.2	0.7	3.0
C06	8	5.4	2.0	70.0	5.9	2.1	5.0
	33	4.8	0.8	13.0	5.0	1.1	3.0
	70	4.9	0.6	3.0	5.2	0.7	3.0
C09	8	5.7	1.8	68.0	6.6	1.8	8.0
	33	4.9	0.8	8.0	5.0	0.9	3.0
	70	4.8	0.6	3.0	5.2	0.7	3.0
C10	8	5.8	2.2	58.0	6.2	2.3	18.0
	33	4.8	1.1	18.0	4.9	1.1	3.0
	70	4.9	0.7	3.0	5.1	0.7	3.0

TABLE 31

TKN Content of Selected Soil Samples.

COLUMN #	DEPTH, CM	TKN, mg/L
4	8	3948
4	33	2948
4	58	2685
9	8	3974
9	33	3158
9	58	2237
14	8	4001
14	33	3185
14	58	2922

4.2.2.2 Soil Water and Effluent Samples

Data describing the chemical characteristics of soil water samples collected at 17.8 cm (immediately below the root zone) are given in Appendix F. Similar data for effluent samples collected at the base of each column (i.e. at 70 cm) are presented in Appendix G. Summaries of these data for soil water samples collected before and after September 10, 1981, are contained in Tables 32 and 33, respectively. Table 34 contains summaries of soil water data adjusted for dilution effects. Tables 35 and 36 contain summaries of data describing chemical characteristics of effluent samples collected before and after September 10, 1981, respectively. A summary of the total mass of nitrogen and chloride contained in these samples is presented in Table 37. Concentrations of TKN in selected soil water (17.8-cm) and effluent (70-cm) samples are presented in Table 38.

4.2.2.3 Volatilization

Table 39 contains data on the mass of nitrogen lost to the atmosphere via volatilization of NH_3-N from wastewater after application. Data for cumulative volatilization at 35 hours could not be obtained because of equipment malfunc-

TABLE 32

Chemical Characteristics of Soil Water Samples Collected at 17.8 cm prior to 9/10/81

COLUMN NUMBER		Cl^- mg/L	NH_4^+-N mg/L	NO_3^- -N mg/L
4	MEAN	24.37	0.89	0.90
	S.D.	19.04	0.17	0.53
5	MEAN	16.38	0.79	0.42
	S.D.	8.53	0.07	0.27
16	MEAN	11.44	0.69	2.03
	S.D.	7.51	0.14	1.33
6	MEAN	16.36	0.26	0.54
	S.D.	10.92	0.74	0.22
9	MEAN	13.62	0.69	0.78
	S.D.	12.52	0.11	0.31
10	MEAN	29.13	0.50	0.95
	S.D.	15.95	0.19	0.06
11	MEAN	29.51	0.74	18.35
	S.D.	15.84	0.07	38.78
12	MEAN	16.08	0.68	0.33
	S.D.	10.15	0.22	0.11
14	MEAN	11.44	0.69	2.03
	S.D.	7.51	0.14	1.33

TABLE 33

Chemical Characteristics of Soil Water Samples Collected at 17.8 cm after 9/10/81

COLUMN NUMBER		Cl^- mg/L	NH_4^+-N mg/L	NO_3^- -N mg/L
4	MEAN	24.02	0.89	0.45
	S.D.	6.54	0.33	0.07
5	MEAN	49.72	0.89	0.57
	S.D.	18.00	0.33	0.12
16	MEAN	69.57	0.57	0.95
	S.D.	41.17	0.28	0.33
6	MEAN	60.43	0.74	0.68
	S.D.	19.16	0.43	0.23
9	MEAN	34.71	0.52	0.70
	S.D.	7.50	0.22	0.12
10	MEAN	46.07	0.51	0.74
	S.D.	10.43	0.22	0.36
11	MEAN	33.57	0.54	0.63
	S.D.	10.31	0.25	0.14
12	MEAN	46.32	0.57	0.47
	S.D.	14.17	0.33	0.10
14	MEAN	33.46	0.43	0.37
	S.D.	10.27	0.25	0.07

TABLE 34

Chemical Characteristics of Soil Water Samples Collected at 17.8cm after 9/10/81 - Adjusted for Dilution

COLUMN NUMBER		Cl^- mg/L	NH_4^+-N mg/L	NO_3^- -N mg/L
4	MEAN	35.30	1.31	0.67
	S.D.	9.62	0.49	0.11
5	MEAN	53.34	0.93	0.58
	S.D.	57.51	0.36	0.13
16	MEAN	80.70	0.66	1.10
	S.D.	47.75	0.33	0.39
6	MEAN	60.42	0.74	0.68
	S.D.	19.15	0.43	0.23
9	MEAN	39.91	0.60	0.80
	S.D.	8.63	0.26	0.14
10	MEAN	62.53	0.69	1.00
	S.D.	13.97	0.30	0.48
11	MEAN	46.99	0.35	0.89
	S.D.	14.43	0.83	0.20
12	MEAN	46.77	0.58	0.50
	S.D.	14.31	0.33	0.10
14	MEAN	38.48	0.50	0.43
	S.D.	11.81	0.29	0.08

TABLE 35

Chemical Characteristics of Effluent Samples Collected at 70 cm prior to 9/10/81

COLUMN NUMBER		Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L
4	MEAN	4.56	1.75	4.80
	S.D.	2.64	3.05	8.32
5	MEAN	4.34	0.76	2.57
	S.D.	3.44	0.39	4.18
16	MEAN	6.87	1.35	33.34
	S.D.	7.18	1.34	55.50
6	MEAN	7.51	1.23	28.91
	S.D.	4.28	0.93	55.29
9	MEAN	26.83	0.76	7.37
	S.D.	67.82	0.35	8.76
10	MEAN	4.49	0.42	1.50
	S.D.	4.52	0.15	0.60
11	MEAN	20.40	0.86	5.32
	S.D.	54.22	0.69	8.40
12	MEAN	3.99	2.31	4.23
	S.D.	1.51	3.38	5.42
14	MEAN	8.92	11.86	82.15
	S.D.	7.98	33.52	187.88

TABLE 36

Chemical Characteristics of Effluent Samples Collected at 70 cm after 9/10/81

COLUMN NUMBER		Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L
4	MEAN	3.50	1.57	6.19
	S.D.	2.03	1.22	10.65
5	MEAN	3.89	0.34	2.06
	S.D.	1.43	0.29	1.16
16	MEAN	5.02	1.92	7.68
	S.D.	1.42	1.55	6.81
6	MEAN	6.69	27.31	42.11
	S.D.	1.44	46.85	73.08
9	MEAN	4.40	4.58	16.01
	S.D.	1.99	3.82	26.96
10	MEAN	18.99	109.92	173.45
	S.D.	-	-	-
11	MEAN	4.48	1.70	6.87
	S.D.	1.35	1.49	4.71
12	MEAN	4.20	6.29	16.50
	S.D.	1.51	9.29	22.24
14	MEAN	NO	DRAINAGE	OCCURRED
	S.D.			

TABLE 37

Cumulative Amounts of Selected Chemicals in Soil Water (17.8 cm) and Effluent (70 cm) Samples

Column	Ending Date	Cl^-, mg	NH_4^+-N, mg	NO_3^--N, mg	pH	Cumulative Volume, mL
Soil Water Samples at 17.8 cm						
4	10/31/81	5.50	0.22	0.16	5.97	248.50
5	10/24/81	1.92	0.06	0.03	5.23	74.50
16	10/31/81	5.50	0.11	0.28	7.02	171.00
6	11/02/81	2.46	0.06	0.04	5.36	68.50
9	11/02/81	5.81	0.13	0.18	5.97	217.00
10	11/02/81	13.13	0.17	0.28	5.55	327.00
11	11/01/81	3.22	0.06	1.03	6.16	109.50
12	11/01/81	7.09	0.11	0.08	4.48	197.50
14	11/01/81	4.44	0.06	0.05	4.35	143.00
Effluent Samples at 70 cm						
4	11/10/81	7.26	2.71	4.37	8.60	2128.00
5	11/10/81	12.72	1.77	3.98	8.67	3011.00
16	10/22/81	3.19	1.17	2.79	8.71	824.00
6	10/05/81	6.86	2.46	6.58	0.0	1183.00
9	11/11/81	16.75	1.85	5.95	1.53	1736.00
10	9/08/81	2.78	0.28	0.85	1.32	634.00
11	11/06/81	15.80	2.63	13.33	1.14	2271.00
12	11/06/81	5.76	3.00	6.66	1.12	1487.00
14	10/05/81	3.14	0.91	13.40	0.0	872.50

TABLE 38

Concentrations of TKN in Selected Soil Water (17.8 cm) and Effluent (70 cm) Samples

COLUMN #	DEPTH, cm	DATE COLLECTED	TKN, mg/L
9	17.8	12/16/80	47.4
11	17.8	1/11/81	136.9
16	17.8	9/24/81	44.2
9	70.0	9/21/81	31.6
11	70.0	9/28/81	37.4
16	70.0	9/10/81	59.5

tion. Data from this experiment were variable, and demonstrated no clear trend when compared on the basis of sample collection time.

4.2.2.4 Crop Uptake

Fescue was cut four times during the study. Yield, nitrogen concentration and mass nitrogen removals are presented in Table 40. In the first three harvests, grass was cut approximately 7.5 cm above the soil surface. Yields on November 12, 1981 appear to be small in comparison to those obtained at other cuttings. However, this is probably due to the shorter growth period between this and the previous (August 11, 1981) harvest. On the final cutting, all above ground vegetation was removed. This explains the relatively large yields recorded at this cutting despite the fact that the growth period was approximately equal to that of the previous harvest.

4.2.2.5 Nutrient Balance

A comparison of mass nitrogen loadings and removals is presented in Table 42.

Mass additions from wastewater were calculated using mass application rates for NH_4^+-N (Table 28) and organic N (Table 29) and multiplying by the area of each column (181.4

TABLE 39

Volatilization of Ammonia Nitrogen

COLUMN #	COLLECTION TIME, HRS AFTER WASTEWATER ADDITION	NH_3-N, μg
4	11	78.3
5	11	49.8
16	11	93.4
16	12	107.6
11	23	77.8
11	23	73.1
12	23	33.7
14	23	68.3
9	35	52.6
6	9	-
9	9	18.5
10	9	16.1
4	35	-
5	35	-
16	35	-

TABLE 41

Crop Yields and Nitrogen Removals

Column #	Yield g	%N	Total N mg	Yield g	%N	Total N mg
		12/12/80			8/11/81	
4	15.95	0.82	130.8	8.10	0.71	57.5
5	7.68	0.76	58.4	6.00	0.82	49.2
16	14.24	0.88	125.3	11.10	0.51	56.6
6	8.52	0.90	76.7	4.90	0.89	43.6
9	3.52	1.06	37.3	7.60	0.89	67.6
10	13.78	1.01	139.2	7.20	0.68	49.0
11	12.15	0.87	105.7	6.40	0.74	47.4
12	15.78	0.79	124.7	7.70	0.72	55.4
14	14.85	0.77	114.4	6.70	0.72	48.2
		11/12/81			1/31/82	
4	3.80	1.22	46.4	11.31	1.21	136.9
5	3.35	1.24	41.5	8.94	1.07	95.7
16	5.60	1.00	56.0	17.16	0.74	127.0
6	3.10	1.36	42.2	10.64	1.10	117.0
9	3.60	1.30	46.8	12.44	1.13	140.6
10	3.50	1.26	44.1	11.28	1.15	129.7
11	3.10	1.12	34.7	12.01	0.91	109.3
12	3.25	1.08	35.1	11.66	1.18	137.6
14	3.75	1.08	40.5	18.85	0.74	139.5

cm). NO_3^--N additions were assumed to be insignificant. Soil nitrogen additions were calculated from Table 30 assuming changes in NO_3^--N content at the 8-cm depth occurred uniformly throughout the entire horizon.

Removals by crop uptake were taken from Table 41. Effluent losses were taken from Table 37 as the sum of NH_4^+-N and NO_3^--N removals.

Differences in mass additions and removals are shown in Table 42. Except for Column 10, additions exceeded losses. Unaccountable losses ranged from 0 (Column 10) to 53 percent (Column 5) of the applied nitrogen.

TABLE 42

Mass Balance of Nitrogen for Entire Study Period

COLUMN	ADDITIONS mg, N		LOSSES mg, N			DIFF. mg, N
	WASTE-WATER	SOIL	CROP	VOLATIL-IZATION	EFFLU-ENT	
4	199.6	285.0	371.0	-	7.0	107.0
5	211.4	309.0	245.0	-	6.0	269.0
16	211.4	318.0	365.0	-	4.0	160.0
6	188.9	309.0	280.0	-	9.0	209.0
9	200.8	285.0	293.0	-	8.0	187.0
10	154.5	190.0	362.0	-	0.0	-0.1 77
11	200.9	318.0	297.0	-	16.0	209.0
12	188.9	342.0	353.0	-	10.0	168.0
14	154.5	380.0	343.0	-	15.0	176.0

4.3 EFFECTS OF RESIDENCE TIME ON NITROGEN REMOVALS

4.3.1 Soil Water Statistical Analyses

4.3.1.1 Treatment Effects

Soil water data collected at 17.8 cm were compared statistically according to date of sample collection to help identify possible variations in pollutant removals with time. Tables 43 and 44 present results of ANOVA analyses of these data. The null hypothesis was that there were no significant differences among treatments.

"F" values in Tables 43 and 44 are the ratios of variance attributable to treatment effects divided by the variance due to sampling, or experimental, errors. "Critical F" values (not presented) represent ratios of these variances which, for a given probability, would be expected to occur by chance. Consequently, a calculated "F" value for a given analysis which is less than the critical "F" for that analysis indicates either 1) that variations in the data are not likely due to treatment effects alone, or 2) that treatment differences do exist but the experiment was not sensitive enough to detect them.

In Tables 43 and 44, comparisons between calculated and critical "F" values are given as "Pr>F" values which indicate the probability that the calculated "F" will be exceeded. Thus, small "Pr>F" values indicate significant differ-

TABLE 43

ANOVA Analysis of Soil Water Sample Data for Treatment Effects: Phases 1 and 2

DATE	Cl^- F	Cl^- Pr>F		NH_4^+-N F	NH_4^+-N Pr>F		NO_3^--N F	NO_3^--N Pr>F	
12/18/80	6.26	0.24	NS	I	I		I	I	
12/22/80	0.01	0.92	NS	I	I		0.23	0.67	NS
1/02/81	I	I		I	I		I	I	
1/06/81	0.74	0.54	NS	I	I		0.99	0.46	NS
1/11/81	3.44	0.13	NS	I	I		0.37	0.71	NS
8/15/81	0.73	0.52	NS	0.30	0.75	NS	1.83	0.25	NS
8/22/81	0.07	0.93	NS	0.56	0.60	NS	0.79	0.51	NS
9/01/81	0.67	0.55	NS	0.76	0.51	NS	0.61	0.58	NS
Entire Period	0.28	0.76	NS	0.13	0.87	NS	1.62	0.28	NS

I - insufficient data for analysis
NS - not significant at the 5% level

TABLE 44

ANOVA Analysis for Soil Water Sample Data for Treatment Effects:Phase 3

DATE	Cl^- F	Cl^- Pr>F		NH_4^+ -N F	NH_4^+ -N Pr>F		NO_3^- -N F	NO_3^- -N Pr>F	
9/10/81	0.67	0.56	NS	0.31	0.74	NS	3.45	0.13	NS
9/16/81	I	I		I	I		I	I	
9/24/81	0.48	0.65	NS	11.08	0.02	S	0.73	0.53	NS
9/29/81	I	I		I	I		I	I	
9/30/81	1.19	0.36	NS	7.66	0.02	S	0.87	0.46	NS
10/07/81	0.05	0.94	NS	0.51	0.62	NS	4.49	0.07	NS
10/08/81	I	I		I	I		I	I	
10/18/81	0.77	0.50	NS	3.70	0.10	NS	0.71	0.52	NS
10/25/81	0.10	0.90	NS	11.51	0.01	S	1.70	0.27	NS
10/31/81	0.74	0.52	NS	0.87	0.47	NS	1.19	0.37	NS
11/01/81	I	I		I	I		I	I	
Entire Period	0.38	0.69	NS	2.93	0.13	NS	1.30	0.33	NS

I - insufficient data for analysis
NS - not significant at the 5% level
S - significant at the 5% level

ences among treatments because there is a small probability that a critical "F" value will exceed the calculated "F".

Table 43 reveals no detectable significant differences among treatments during Phases 1 and 2 of the study for any of the three parameters tested (Cl^-, NH_4^+-N, NO_3^--N). Table 44 indicates that on occasion, differences among treatments were detected for NH_4^+-N. Because sufficient sample for chemical analysis could not be collected on some dates, statistical comparisons could not be made.

4.3.1.2 Phase 3: Modified Soil and Water Sample Data

Near the conclusion of the study, experiments were conducted to determine the extent to which soil water samples might have been diluted by flush water. Table 45 presents results of ANOVA analyses on soil water data which were adjusted for possible dilution effects. These results are little different from those presented in Table 44 for unadjusted data. This tends to indicate that in this experiment dilution effects are relatively unimportant in the statistical analysis of soil water data collected at 17.8 cm.

4.3.1.3 Column/Treatment Interactions

ANOVA analyses were performed on soil water data averaged during Phases 1 and 2 and during Phase 3 to investigate

TABLE 45

ANOVA Analysis of Modified Soil Water Data for Treatment Effects:Phase 3

DATE	Cl^- F	Cl^- Pr>F	NH_4^+-N F	NH_4^+-N Pr>F	NO_3^--N F	NO_3^--N Pr>F
9/10/81	0.76	0.52 NS	0.35	0.72 NS	4.79	0.08 NS
9/16/81	I	I	I	I	I	I
9/24/81	0.53	0.62 NS	10.21	0.02 S	0.70	0.54 NS
9/29/81	1.26	0.34 NS	4.86	0.05 NS	0.55	0.60 NS
9/30/81	I	I	I	I	I	I
10/07/81	0.03	0.97 NS	5.03	0.06 NS	0.40	0.68 NS
10/08/81	I	I	I	I	I	I
10/18/81	1.01	0.42 NS	1.77	0.26 NS	0.83	0.47 NS
10/25/81	0.15	0.86 NS	4.18	0.08 NS	1.63	0.28 NS
10/31/81	0.98	0.43 NS	0.71	0.53 NS	1.36	0.33 NS
11/01/81	I	I	I	I	I	I
Entire Period	0.08	0.98 NS	0.22	0.91 NS	0.26	0.89 NS

I - insufficient data for analysis
NS - not significant at the 5% level
S - significant at the 5% level

possible soil column variability. These analyses separated sources of variation in the observed data into those from treatment effects, sampling error, and experimental unit error. The null hypothesis tested was that there was no variability among columns within a given treatment.

Results of these analyses are presented in Table 46. The "F" value given is the variance due to treatment and columns within treatments divided by variance due to sampling error. "Pr>F" values are probabilities that the calculated "F" values will be exceeded.

Results given in Table 46 indicate that during Phases 1 and 2, column variability within treatments was significant for NH_4^+-N analyses. However, during Phase 3, NH_4^+-N observations were not significantly influenced by within-treatment column variation, whereas column variation was significant for both Cl^- and NO_3^--N.

TABLE 46

ANOVA Analysis for Experimental Unit Error - Soil Water Samples Collected at 17.8 cm

Period	Parameter	F	Pr>F	Significance
Phases 1 & 2	Cl^-	1.98	0.10	NS
	NH_4^+-N	5.29	0.00	HS
	NO_3^--N	1.04	0.41	NS
Phase 3	Cl^-	5.68	0.00	HS
	NH_4^+-N	1.53	0.19	NS
	NO_3^--N	5.91	0.00	HS

HS - significant at the 1% level
NS - not significant at the 5% level

4.3.2 Effluent Statistical Analysis

Identical analyses were performed on data from effluent samples collected at 70 cm during these time periods. Results given in Tables 47 and 48 indicate no detectable differences among treatments for any parameter during either time span.

Table 49 presents results of ANOVA analyses used to determine the significance of experimental unit error. This source of error was significant in NO_3^--N analyses during Phases 1 and 2, and for all analyses during Phase 3.

TABLE 47

ANOVA Analysis of Effluent Sample Data for Treatment Effects: Phases 1 and 2

DATE	Cl^- F	Cl^- Pr>F	NH_4^+-N F	NH_4^+-N Pr>F	NO_3^--N F	NO_3^--N Pr>F
12/17/80	I	I	I	I	I	I
12/29/80	0.88	0.48 NS	0.06	0.94 NS	1.19	0.39 NS
1/19/81	0.42	0.68 NS	0.77	0.52 NS	I	I
1/26/81	0.66	0.55 NS	I	I	1.73	0.26 NS
2/04/81	0.12	0.75 NS	I	I	3.15	0.17 NS
2/09/81	0.50	0.63 NS	I	I	0.38	0.70 NS
2/17/81	0.55	0.61 NS	I	I	1.22	0.38 NS
2/23/81	1.42	0.34 NS	I	I	0.67	0.57 NS
3/09/81	0.80	0.52 NS	I	I	0.33	0.75 NS
7/20/81	0.94	0.44 NS	0.06	0.93 NS	0.69	0.53 NS
7/27/81	3.13	0.37 NS	0.28	I	I	I
8/14/81	0.05	0.94 NS	2.24	0.22 NS	0.83	0.49 NS
8/31/81	1.04	0.41	I	I	I	I
9/08/81	0.95	0.43 NS	1.17	0.38 NS	0.51	0.62 NS
Entire Period	0.91	0.46 NS	1.07	0.41 NS	0.78	0.50 NS

I - insufficient data for analysis
NS - not significant at the 5% level

TABLE 48

ANOVA Analysis of Effluent Sample Data for Treatment Effects: Phase 3

DATE	Cl^-		NH_4^+-N		NO_3^--N	
	F	P>F	F	P>F	F	P>F
9/10/81	I	I	I	I	I	I
9/14/81	1.02	0.45 NS	15.03			
9/16/81	I	I	I	I	I	I
9/21/81	5.78	0.06 NS	1.02	0.43 NS	0.90	0.46 NS
9/28/81	0.41	0.69 NS	0.70	0.55 NS	0.98	0.43 NS
10/05/81	0.61	0.62 NS	1.36	0.37 NS	1.57	0.31 NS
10/07/81	I	I	I 45		2.58	0.35 NS
10/16/81	0.93	0.51 NS	0.56	0.59 NS	0.03	0.88 NS
10/22/81	I	I	I	I	I	I
10/27/81	I	I	I	I	I	I
11/05/81	I	I	I	I	I	I
11/06/81	I	I	I	I	I	I
11/07/81	2.93	0.22 NS	1.07	0.40 NS	11.80	0.07 NS
11/08/81	I	I	I	I	I	I
11/10/81	I	I	I	I	I	I
Entire Period	2.61	0.35 NS	9.11	0.20 NS	1.08	0.48 NS

I - insufficient data for analysis
NS - not significant at the 5% level

TABLE 49

ANOVA Analysis for Experimental Unit Error - Effluent Samples Collected at 70 cm

Period	Parameter	F	Pr>F	Significance
Phases 1 & 2	Cl^-	0.79	0.57	NS
	NH_4^+-N	1.25	0.29	NS
	NO_3^--N	2.23	0.05	S
Phase 3	Cl^-	14.66	0.00	HS
	NH_4^+-N	15.67	0.00	HS
	NO_3^--N	8.51	0.00	HS

NS - not significant at the 5% level
HS - significant at the 1% level
S - significant at the 5% level

Chapter V

DISCUSSION

5.1 RESIDENCE TIME DETERMINATIONS

5.1.1 Tensiometry

In this study, tensiometers were used for making inferences about soil moisture conditions because more sophisticated moisture sensing techniques were not available. Tensiometers have many recognized limitations and are subject to measurement errors due to poor construction, poor soil contact, leakage of air into the instrument, and limited operating range. Nevertheless, they are an often-used research tool for the study of problems involving soil moisture because of their relatively low cost.

A great deal of care was expended to assure the most accurate data possible from these devices. After construction, each unit was tested for cracks in the ceramic cups as well as faulty seals around all joints. A tedious installation process was used to assure intimate contact with the soil. Only freshly deaerated distilled water was used to fill the instruments. Generally, readings were made only after tensiometers had been recharged with water to remove any air bubbles.

Despite these precautions, several difficulties were encountered in obtaining what were considered to be reliable data. The predominant problem was an inability to keep tensiometers at the 10.2-cm depth serviced properly. This difficulty arose because of physical constraints on the size of the environmental chamber and was probably intensified by rapid uptake of soil moisture by roots at this depth. (Sectioning of the soil columns at the conclusion of the experiment confirmed that the largest concentration of roots was in the upper 18 cm of the soil profile.)

Placement of light fixtures above the soil columns was restricted to a height of 82 cm in order to achieve the desired lighting intensity. In addition, an extremely low ceiling limited the height to which the tensiometer tubes could be raised. This restricted measurement of soil suctions to approximately 700 mb, well below the 850-mb suction at which liquid continuity fails and causes the mercury/water column in tensiometers to separate. Consequently, when the soil suction at 10.2 cm exceeded 700 mb, mercury was drawn into the ceramic cup. As soon as this condition was discovered, the tensiometer was flushed with water in an attempt to force the mercury from the cup. However, because the tensiometers were embedded in the soil at a 20 degree angle with the horizontal, it is possible that not all mercury was removed. Had mercury been drawn into pores of the ceramic cups, accuracy of the tensiometers could have been further impaired. The same problem occurred on occasion with tensiometers at other depths.

5.1.2 Computer Modeling

A basic premise of this research was the concept that reaction time is as important in treatment of wastes by soil as by any other process. Reaction time for land treatment systems was arbitrarily viewed as the length of time wastewater was in the root zone. An analogy was drawn between residence (reaction) time in the root zone and residence time in a reactor for more conventional processes. This implied a mass balance approach which described residence time as the time required for liquid additions to the root zone to be balanced by liquid losses.

Defining residence time in such a manner resulted in prediction of a range of residence times by computer modeling techniques (Table 18). As noted earlier, these values do not represent the time required for one individual application of liquid to traverse the root zone. Rather, they indicate the time required for drainage and evapotranspiration from the root zone to match accumulated liquid additions.

A graphical presentation of this concept is provided in Figure 27 which presents the simple case of only two different applications of liquid. In Figure 27a, Liquid 1 is applied at time $t=t_0$ and enters the root zone. Assuming that this volume moves as a unit, at some time $t_1>t_0$ a portion of the liquid has left the root zone by drainage and evapotranspiration, but the remainder is still in the root zone (Figure 27b). At time $t_2>t_1$, Liquid 2 enters the root zone and more of Liquid 1 drains from the root zone or exits by evapotranspiration (Figure 27c). In reality, Liquids 1 and 2 have identical characteristics and in fact experience some mixing within the root zone so that it becomes difficult to ascertain exactly when all of Liquid 1 leaves the root zone (Figure 27d).

To satisfy a definition of residence time based on mass balance considerations, the process described above must continue until losses by evapotranspiration and drainage match liquid additions. The length of time required for this to occur is variable, depending on such factors as volume of liquid applied and moisture content of the soil. In some instances the length of time required for <u>all</u> liquid to leave the root zone is greatly exaggerated because, as the soil dries, hydraulic conductivities decrease rapidly and reduce the rate at which liquid can leave the root zone as

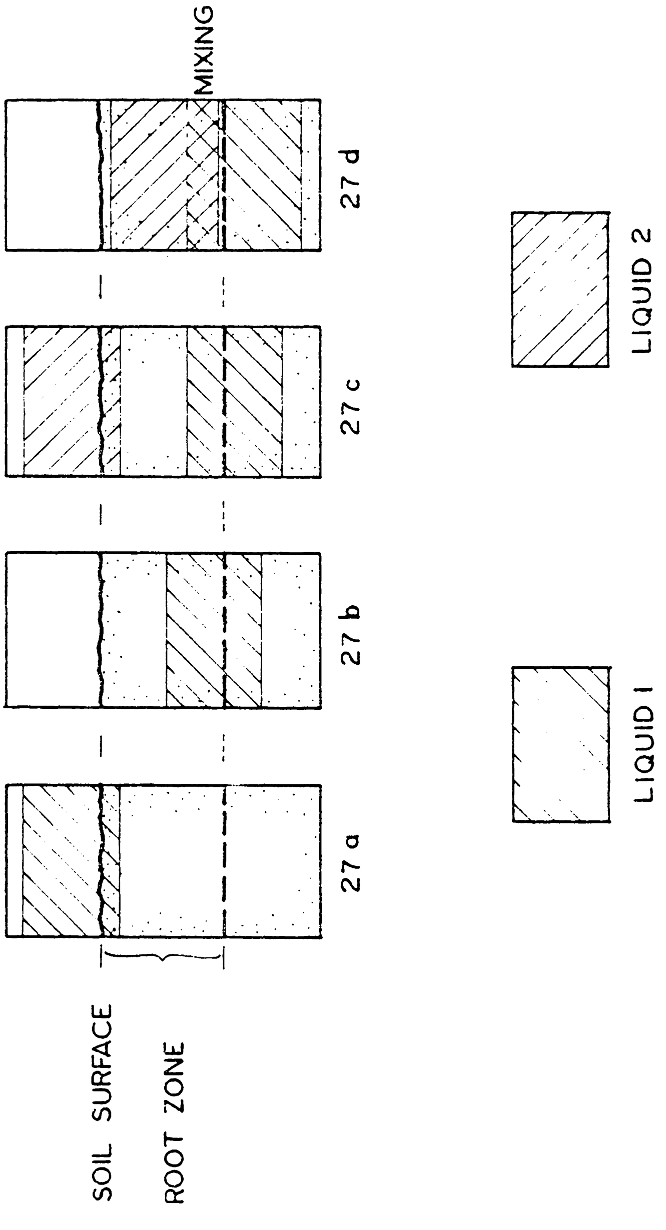

Figure 27: Mass Balance Concept of Residence Time

drainage. Evapotranspiration rates also decrease as the soil dries. The range in residence times reported in Table 18 clearly reflects these effects.

Recognition of these deficiences prompted reformulation of the residence time concept as stated early in the study, and required a different approach to analyses of simulated moisture flows. Emphasis was placed on the fate of applied liquid during and after application, but prior to subsequent liquid additions. Resulting model predictions are presented graphically in Figures 18 through 25 and in Appendix D.

These figures vividly illustrate the variation in residence times reported in Table 18. For example, comparison of Figure 18 with Figure 22 reveals that virtually all liquid applied to Column 4 had left the root zone 59 hours after application whereas only 90 percent of the liquid applied to Column 14 had exited the root zone. According to the "mass balance" concept of residence time discussed earlier, liquid applied to Column 4 would have experienced approximately a 60-hour residence time and liquid applied to Column 14 would have exhibited a residence time in excess of 60 hours.

Although liquid entering the root zone may exit by drainage and evapotranspiration, in a land-based wastewater treatment system, transport of contaminants from the root zone to deeper soil horizons and groundwater can only occur via drainage. Thus, the nature of drainage from these systems is of paramount importance for purposes of assessing the efficiency of such systems in removing certain pollutants.

This is not to say, however, that evapotranspiration has no influence upon the efficiency of a land-based treatment system. It is evapotranspiration that helps remove moisture from the root zone. By so doing evapotranspiration reduces the amount of liquid which can potentially drain from the root zone and aids in the retention of wastewater in the root zone by renewing the moisture storage capacity.

Nevertheless, under certain circumstances, the effects of evapotranspiration can be somewhat overshadowed by liquid applications. Figures 18 through 25 illustrate this point and indicate that a significant amount of the liquid exiting the root zone as drainage occurred soon after the liquid was applied to the surface. Such rapid drainage was possible only if the soil had become saturated. This is not surprising since the root zone was very wet at the time liquid applications were made (i.e. 50-75 percent saturated).

Intuitively, description of drainage under these conditions is especially important since such a large portion of drainage from the root zone occurs soon after liquid is added. Thus a search was begun for a relationship between the amount of rapid drainage, initial soil moisture conditions, and the amount of liquid applied.

A suitable relationship was found by defining "available storage capacity" of the root zone as the difference between saturated moisture content and initial moisture content at the time of liquid application, a concept which has been used in mathematically modeling infiltration (Holtan, England, and Shanholtz, 1967) and nitrate movement in the soil profile (Levin, 1964; Burns, 1977). This, in turn, led to the definition of "maximum potential drainage" as the difference between the amount of liquid applied and available storage capacity.

A relationship was sought, however, which could be used not only to predict initial drainage, but also total drainage after some specified time period. Examination of drainage curves predicted by the modified SPAW model revealed most curves had a similar shape that consisted of a steeply sloping early portion and a gradually sloping tail. Consequently, drainage curves were separated into two sections, as described previously, and statistical techniques used to describe their shape. It appeared that the height of the gradually sloping tail was related to the amount of initial drainage, so for a first approximation, initial drainage was assumed to be approximately equal to the y-intercept of the gradually sloping portion of each drainage curve. Table 24 gives the mean values of initial drainage for each curve determined as "maximum potential drainage" and as the intercept of the gradually sloping portion of each curve. Also shown are the mean slopes of these curves for each treatment. It appears from Table 24 that drainage predicted by the two procedures is approximately equal. The importance of this equality for predictive purposes cannot be overstated, for it means that the initial part of the drainage curve can be calculated easily by knowing only the amount of liquid to be applied and the moisture status of the root zone at the time of liquid application. Both measurements are easily obtained.

To statistically test the equality of drainage predicted by the two procedures, a paired t-test was performed on the drainage estimates. The results of this comparison are given in Table 25. These results indicate that, except for Treatment 3, drainage predicted by the two procedures described above are not statistically different. Of course, this was the desired result, since it justifies the use of "maximum potental drainage" to quantify initial drainage and thus characterize the early portion of the drainage curves. It is unfortunate, for predictive purposes, that statistical differences were found in drainage estimates by the two procedures for Treatment 3 since this difference tends to limit the widespread applicability of "maximum potential drainage" as a means to predict initial drainage.

Linear regression analysis was used to obtain intercepts of the gradually sloping portion of the drainage curves. This analysis also provided estimates of the slopes of those portions of the drainage curves. The average of all slopes for each column are presented in Table 26. To test for significant differences in these slopes among treatments, Duncan's multiple range test was performed on the mean of all slopes in each treatment. The results of this analysis are given in Table 27. The fact that no significant differences were detected in slope estimates supports the use of an average slope to describe the latter portion of all drainage curves. For predictive purposes, this, too, is highly desirable, since it means, in effect, that there is one underlying relationship which describes the latter gradually sloping portion of the drainage curves. Combined with the procedure to predict initial drainage, this technique permits the entire drainage curve to be determined *a priori* if the amount of liquid to be applied and the moisture status of the soil at the time of liquid additions are known.

The validity of this procedure is illustrated in Table 50, which summarizes results of a t-test comparing drainage calculated using the procedure described above with observed drainage (i.e. that predicted by the modified SPAW model). Initial drainage from the root zone was calculated as "maximum potential drainage", and the average slope of all drainage curves (from Table 27) was used to describe drainage as a function of time after initial drainage. Table 50 indicates no statistical differences at the 5 percent level between observed drainage and drainage predicted by empirical means.

5.1.2.1 Basis and Applicability of Predictive Equations

From a treatment efficiency standpoint, (i.e. comparison of contaminants introduced into the root zone with those leaving it), the relationship between wastewater application and drainage is of importance in the design and operation of a land application system. The modified SPAW model confirmed that rapid drainage will occur from a near-saturated root zone as soon as the available storage capacity is exceeded by liquid applications.

A relationship based on this concept was found which would allow *a priori* prediction of the amount of drainage to be expected from a given application of liquid. While the

TABLE 50

Comparison of Observed Drainage and Empirically Predicted Drainage

Treatment	t	Pr>|t|	Significance
1	-0.65	0.5213	NS
2	-1.77	0.0868	NS
3	0.27	0.7889	NS

NS - not significant at the 5% level

relationships which were developed were based on simulated drainage from a mathematical model, their theoretical basis rests on widely accepted concepts of moisture flow into and through the soil profile, and moisture loss from the soil profile by evapotranspiration. Thus, the applicabilty of this predictive procedure is not as limited as one might first assume.

For example, the notion that a given volume of soil has a specific "available storage capacity" is fundamental to the definitions of "plant available water" and "moisture holding capacity" which are two widely used agronomic terms. Similarly, evapotranspiration is a recognized phenomonon for which numerous empirical and deterministic methods of prediction are available.

One will note that "maximum potential drainage" is dependent on only two things: the amount of liquid to be applied and the moisture status of the soil at the time of liquid application (i.e. "available storage capacity"). "Available storage capacity" is a function of soil characteristics and antecedent moisture conditions, and can most conveniently be determined from moisture characteristic curves which define a soil's moisture content as a function of soil tension. These curves are easily obtained.

Although no definitive calculations were made to define the exact relationship, the latter portion of each drainage curve was influenced by the rate of evapotranspiration from the soil. In this study, laboratory conditions were conducive to high evapotranspiration rates which were approximately twice as large as those occurring under most field conditions. Thus the amount of drainage beyond that which occurred initially was probably somewhat less than what might normally be expected under actual field conditions. Nevertheless, the method of determining this additional drainage (i.e. determination of a drainage/time function) should be as applicable to field conditions as to laboratory conditions.

The soil used in this study exhibited narrow ranges of moisture contents as evidenced by the relatively flat moisture characteristic curves (Figure 14). For example, moisture retention between 0 and 1500 mb soil tension was approximately 0.28 cm/cm in the Ap horizon, 0.09 cm/cm in the B21t horizon, and 0.15 cm/cm in the B22t horizon. Of these amounts, approximately 60 percent in horizons Ap and B21t, and 32 percent in the B22t horizon were held between 0 and 700 mb. Further, 80 percent to 86 percent of water held between 0 and 700 mb tension is actually held between 0 and 300 mb tension. For agronomic purposes, free drainage is assumed to occur between 0 and approximately 300 mb tension.

The experiments in this study were conducted while the root zone was maintained at soil tensions within the operating range of tensiometers (i.e. 0 - 700 mb). Consequently, liquid applications were made when the root zone was very near the point at which free drainage occurs. The shape of the drainage curves in Figures 18 through 25 and Appendix E confirm this fact and indicate that for certain soils, moisture conditions may routinely exist which can be conducive to rapid liquid (and presumedly, contaminant) movement through the root zone. Such conditions would normally be avoided during operation of a land-based wastewater treatment system; however, on soils similar to those used in this study, these soil conditions may, in fact, be unavoidable.

Furthermore, circumstances could arise during the normal operation of a land-based wastewater treatment system which could accelerate or prolong even wetter soil conditions. For example, over-application of wastewater, occurring from either operator error or equipment malfunction, could create saturated soil conditions. Inadequately designed holding facilities, or prolonged wet weather conditions which cause normally adequate holding capacities to be depleted, could force wastewater applications during wet soil conditions. Natural precipitation occurring soon after wastewater application also could increase soil moisture content significantly, and induce rapid liquid movement through the soil profile.

Finally, many land-based wastewater treatment systems are designed for year-round operation. This implies a need to apply at least a small amount of wastewater during each month of operation. In Virginia, precipitation exceeds evapotranspiration by rather wide margins during the months of November through March. Soil moisture content is thus increasing during this period, approaching field capacity over the long term. Wastewater applications during this time would increase soil moisture further and induce rapid liquid movement through the root zone.

The procedure offered here for predicting drainage would be particularly applicable under these circumstances to assess liquid movement from the root zone as a result of wastewater applications. Using such a procedure, "worst case" situations could be explored *a priori* facilitating assessment of the consequences involved, and allowing proper precautions to be taken. These kinds of investigations would be valuable not only for the design and operation of land-based treatment systems, but also in the review of plans for such systems by regulatory officials.

5.2 NITROGEN ADDITIONS AND REMOVALS

5.2.1 Additions

Nitrogen additions on a concentration basis are given in Table 9. These are indicative of the loadings which were made to the soil columns at each wastewater application after August 14, 1981, and are within expected ranges based on composition of the stock wastewater from which they were made (Table 8). It would be safe to assume that short term loadings prior to August 14, 1981, also reflect the concentrations of the stock wastewater from which they were made in a similar fashion. Considering a 10 percent dilution of the stock wastewater, appropriate concentrations (based on analyses presented in Table 7) for Cl^-, NH_4^+-N, NO_3^--N, would be approximately 38 mg/l, 12 mg/L and 1.7 mg/l, respectively.

Mass nitrogen loadings were presented in Table 28. Failure to achieve the target mass application rate of 116 kg/ha NH_4^+-N was disappointing but not critical to the results of this study. The premise upon which this work was planned was that design criteria based only on mass balance considerations may be unreliable over the short term for assuring a safe land treatment system design. While mass loadings are necessary for an adequate long-term design, instantaneous loadings are most important over the short term in order to prevent rapid movement of wastewater constituents through the root zone before they can be transformed into less harmful products (by crop uptake, bacterial action, or other physical, chemical and biological processes). This concept is analogous to the design of conventional wastewater treatment systems which are designed to meet long-term conditions but whose operation can be disrupted by overloading in the short term.

5.2.2 Removals

The important comparisons which must be made to evaluate how well the soil system removed nitrogen from the wastewater are between nitrogen additions to the soil surface and removals from the soil profile. Samples of wastewater as it moved through the soil profile were taken from beneath the root zone (at 17.8 cm) and at the base of the soil columns (70 cm).

Summary data presented in Tables 32 and 33 permit several observations. Of particular interest are the significant reductions at the 17.8-cm depth in NH_4^+-N concentrations from those in the applied wastewater. Assuming 12 mg/L to be a representative of the NH_4^+-N concentrations applied to the soil columns prior to August 14, 1981, removal efficiences for this constituent ranged from 93 (Column 4) to 98 percent (Column 6) during Phases 1 and 2 of the study. Removals during Phase 3 were similarly high. Assuming 17 mg/L NH_4 -N to be representative concentration in wastewater applied during this period (Table 9), data in Tables 32 and 33 indicate NH_4 -N removal efficiences ranging from 95 (Columns 4 and 5) to 97 percent (Column 14). Even when taking into account possible dilution effects (Table 34), NH_4^+-N removal efficiences ranged from 93 (Column 4) to 98 percent (Column 11) during this period.

Several possibilities could account for the observed nitrogen loss: adsorption onto the ceramic cups of the soil water samplers, adsorption onto clay particles, volatilization prior to moving into the soil profile, nitrification to NO_3^- -N, crop uptake, denitrification to nitrogen or nitrogen dioxide gas, or immobilization into organic nitrogen. Although it was not the objective of this study to ascertain their magnitude, measurements were made to estimate all but two of these pathways: adsorption and denitrification.

Comparison of NO_3^--N concentrations found in soil water samples below the root zone (Tables 32 and 33) with those in the applied wastewater (Table 9) indicate removals of NO_3^- -N on the order of 0 to 58 percent (Column 16 and Column 14, respectively). (If dilution effects are considered, removals ranged from 0 [Columns 10, 11, and 16] to 52 percent

[Column 14]). It would appear from these that nitrification of NH_4^+-N to NO_3^--N was negligible or, if it did occur, the transformed NH_4^+-N was readily used by the crop.

Comparison of Table 41 showing mass crop removals with Table 30 which gives changes in NO_3^--N concentrations in the soil seems to favor the latter explanation. Assuming that the loss of NO_3^--N from the 8-cm depth occurred uniformly throughout the entire Ap horizon, it is possible to convert the percentage loss of NO_3^--N to mass removals. These are presented in Table 42. Comparison of these values with those for crop uptake indicate that in most cases, crop removal of nitrogen exceeded what could have been supplied solely by soil nitrogen losses in the Ap horizon. Of course, the roots of the crop did extend into other horizons and undoubtedly satisfied some of their nitrogen needs there, but it would not be unreasonable to assume that at least some of the applied NH_4^+-N was used by the crop either directly as NH_4^+-N or as NO_3^--N.

Examination of data in Table 39 indicates that neglibible NH_4^+-N was lost by volatilization of ammonia from the soil surface. This is not surprising because both the soil and the applied wastewater were at relatively low pH (approximately pH 5 for soil and pH 6 for wastewater). Consequently, volatiliztion was not viewed as a significant sink for the applied nitrogen in this study.

Unfortunately, due to a laboratory oversight, soil samples were not analyzed for TKN prior to the application of wastewater. Therefore it is not possible to make comparisons of the amount of soil organic nitrogen prior to and at the conclusion of these experiments. However, it is unlikely that any detectable differences would have been found because of the large mass of organic N in the soil relative to the amount of N being added via wastewater.

Examination of data on the quality of samples collected at the base of the columns lends additional insight into the possible fate of applied nitrogen. Comparison of Tables 32, 33, 35, and 36 show that relatively large increases in the NO_3^--N concentration of liquid draining through the soil profile occurred between the 17.8-cm depth and the column bottoms. Two reasons can be given for this: movement of NO_3^--N from soil horizons above, or nitrification of NH_4^+-N which possibly moved past the root zone. The extent of either of these pathways cannot be readily determined without the use of labelled nitrogen isotopes.

5.3 RESIDENCE TIME EFFECTS ON NITROGEN REMOVALS

Soil water samples from the 17.8-cm depth (i.e below the root zone) and effluent samples from the bottom of the columns were statistically analyzed according to sample collection date. Only in isolated cases did these analyses indicate any significant differences in nitrogen removals among treatments. Thus no relationship could be developed relating nitrogen removals to wastewater residence time in the root zone. Two explanations can be offered for the failure to observe differences in N removal rates.

One explanation concerns the attainment of different wastewater residence times in the root zone. Difficulty was encountered at the initiation of the study in deducing moisture movement rates from tensiometer data. However, predictions by the modified SPAW model indicated that a large percentage of drainage from the root zone of columns in <u>all</u> treatment groups occurred within similar time spans (approximately 2 hours). In effect, then, there was probably little difference in liquid residence times in the root zone during Phases 1 and 2 of this study. Because wastewater was applied during Phases 1 and 2 under soil conditions similar to those for which the modified SPAW model was used, it is logical to assume that one reason no differences were observed in N removals was because different wastewater residence times were not attained.

During Phase 3, however, more positive control over wastewater residence times was attempted by first applying the wastewater, and then flushing it from the root zone at varying times after application. If, though, the initial application of wastewater had moved through the root zone in a manner similar to that in Phases 1 and 2, real difference in residence time would not have been achieved, despite the use of flush water.

A completely different explanation for the failure to observe differences in nitrogen removals as a function of wastewater residence time in the root zone is that the experimental design was not sensitive enough to detect the differences. In other words, variability in observed removal rates could not be explained by differences in treatment only.

In general, variations in observed data can be caused by treatment differences and sampling (experimental) error. In some instances, experimental unit error can account for a large portion of sampling error. Experimental unit error results from variations in the experimental units which, in this study, were the soil columns. Statistical analyses of variance were performed on means of all observations to determine if this source of error was, in fact, present. Results of these analyses were presented in Tables 46 and 49, and indicated that for both soil water and effluent samples, experimental unit error was significant during portions of the study.

The underlying assumption in establishing the completely randomnized design was that there was no inherent variability within the treatment units. Although spatial variability of soil characteristics is well-known, this assumption of homogeneity was believed to be justified because the samples were collected closely to one another (i.e. within a 3-m X 3-m area). If the assumption that soil characteristics were homogenous is true, the effect of the sampling device on soil structure and/or the interaction between the soil columns and the casing becomes immediately suspect as a cause for variability within experimental units.

Examination of data on the concentration of Cl^- in the effluent samples (Tables 35 and 36) does not lend support to either of these arguments however. In only two cases (Column 9 and Column 11) during Phases 1 and 2 of the study was there evidence of "short circuiting" of wastewater through the columns. If there had been a massive disturbance of soil structure or if there had been a separation of the soil sample from the casing, concentrations of Cl^- in the effluent would have been little different from those in the applied wastewater.

Differences in crop growth are another possible source of experimental unit error in this study. Comparison of Table 46 and 49 reveals that in Phases 1 and 2, experimental unit error was significant only for NH_4^+ -N in soil water samples and for NO_3^- -N in effluent samples. This is in contrast to Phase 3 in which experimental unit error was highly significant for all parameters except NH_4^+-N in the soil water samples. The fact that this source of variation was so significant for effluent samples might reflect the influence of root penetration deeper into the soil profile as the experiment progressed and the crop matured.

However, considering the manner in which Phase 3 of the study was conducted in relation to Phases 1 and 2, the real source of experiment unit error may well have been variations in soil properties, especially those influencing soil moisture movement. In Phase 3, positive control over residence time in the root zone was exerted by hydraulically forcing liquid through the root zone at various intervals. Consequently the hydraulic properties of the soil were more important in this phase of the study than in Phases 1 and 2 when suction at the base of each column was relied upon to induce different liquid residence times in the root zone. The fact that the unsaturated hydraulic conductivity curves had to be adjusted by such wide margins in order to simulate observed inflows and outflows with the modified SPAW model lends support to the possibility that soil physical properties were the primary source of experimental unit error in this study. Whether experimental unit error was due to crop growth, soil characteristics, or some other factors, this source of error could have masked any treatment effects on nitrogen removals from the wastewater.

However, it should also be emphasized that the number of observations upon which these statistical inferences were drawn was extremely small. Since the power of a statistical test is directly related to the sample size on which the test is based, qualifications must be placed on inferences made from tests using small data bases.

Even though no relationship could be defined to describe nitrogen removals as a function of wastewater residence time in the root zone, significant reductions in NH_4^+ -N were, in fact, achieved in the upper 18 cm of the soil profile (i.e. the assumed root zone).

Chapter VI

CONCLUSIONS

6.1 OBJECTIVES

This study had three primary objectives:

1. To determine the effect of residence time in the root zone on the removal of nitrogen from a land-applied wastewater;

2. To develop a simple, easily used predictive method for relating the removal of nitrogen from a land-applied wastewater to wastewater residence time in the root zone;

3. To identify criteria which would permit application of the findings from this study to other situations.

6.2 CONCLUSIONS

6.2.1 Objective 1

No significant differences were observed between rates of movement of wastewater through the root zone and removal of nitrogen from the wastewater. This was due in part to variability in the experimental units (soil columns) used as reactors for the study. It also may have been due to a failure to achieve different wastewater residence times in the root zone. For example, liquid applications were made during near-saturated soil conditions causing rapid movement of wastewater through the root zone. Consequently, computer modeling showed that a significant amount of drainage occurred within 2 hours of liquid applications. Nevertheless, significant NH_4^+ -N reductions (up to 90 percent of applied NH_4^+-N) were achieved within the root zone in as little as 2 hours. However, because the experiment was not designed to determine the exact nature of such reductions, the fate of this NH_4^+-N cannot be determined with certainty.

6.2.2 Objective 2

The use of a soil with a high percentage of soil moisture occurring within a narrow range in soil tension, and the need to maintain soil tensions within the operating range of tensiometers, resulted in liquid and wastewater applications at soil moisture conditions that approached those at which free drainage occurs from the soil. Under such conditions, initial drainage was seen to occur rapidly after liquid was applied. This rapid drainage depended chiefly on the initial moisture condition of the soil and the amount of liquid applied. Both of these variables can be readily determined in actual practice to predict drainage from the root zone of a land-based wastewater treatment system operating in soils with physical characteristics similar to those encountered in this study.

6.2.3 Objective 3

The findings of this study regarding the movement of a land-applied wastewater from the root zone should apply equally well to situations involving other soil types and other wastewaters under similar soil moisture conditions. Soil moisture characteristic curves and the anticipated amount of liquid application will define the amount of potential rapid drainage from the root zone. Data regarding the moisture properties of various soils can be readily obtained from local Soil Conservation Service offices or from land grant university extension offices. Methods used to predict the total amount of drainage from the root zone (or other comparable segment of the soil profile) will depend on local crop and environmental conditions.

Chapter VII

SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY

A laboratory study was conducted to develop a relationship between the length of time a land-applied wastewater was in the root zone (residence time) and the degree to which nitrogen was removed from the wastewater as it moved through the root zone. Undisturbed soil samples were collected in 15-cm diameter X 70-cm long plastic casings. These were instrumented with tensiometers, porous cup soil water samplers, and ceramic base plates, and placed in an environmental chamber.

The use of tensiometers as moisture sensing devices required that liquid additions be made frequently to maintain soil tensions within the operating range of the tensiometers. In addition, a soil was used that exhibited a rather narrow range in moisture contents between 0 and 1500 mb soil tension. Consequently, liquid and wastewater additions were made under soil conditions which were near those at which free drainage of soil water is considered to occur. Thus, depending on the soil, such moisture conditions would be normal for a properly designed land-based wastewater treatment system or could be created by a variety of natural or man-induced circumstances. Equations were developed that predict drainage from the root zone under these circumstances.

Statistical analyses failed to reveal any effect of treatment (i.e. residence time in the root zone) on removals of nitrogen from the wastewater as it moved through the root zone. Experimental unit error was significant in some cases, however, and could have masked treatment effects. Comparison of the nitrogen content of applied wastewater with that of soil water samples collected from beneath the root zone indicated large reductions in NH_4^+-N concentrations as wastewater moved through the root zone. Effluent samples from the base of some soil columns indicated that perhaps some of the NH_4^+-N removed from the wastewater had been nitrified and moved through the soil profile as NO_3^--N.

Although no correlation could be found to describe nitrogen removals from a land-applied wastewater as a function of the time it was in the root zone, a procedure was developed for predicting the extent of drainage resulting from the application of wastewater to the soil surface.

7.2 RECOMMENDATIONS

The basic premise of this work was that the concept of "residence time" is as important a consideration in the treatment of wastewater by soil as it is in treatment of wastewater by any other alternative. "Residence time" for a land application system was arbitrarily defined as the amount of time required for a surface-applied wastewater to move through the root zone. The underlying hypothesis was that since wastewater treatment in soil is a physical-biological-chemical process, the degree to which contaminants are removed from the wastewater is a direct function of the length of time the wastewater remains in the root zone. The use of a soil with a narrow range in moisture content versus soil tension resulted in high moisture conditions being reached soon after wastewater application. This, in turn, precluded the attainment of significantly different residence times in the root zone. Although such soil conditions may be typical for certain soil types, future investigations should include soils which exhibit a wider range in soil moisture contents as a function of soil tension. In addition, more sophisticated soil moisture monitoring equipment, such as dual gamma ray attenuation, is absolutely essential to attain increased precision in determining bulk densities and movement of the moisture front.

Experimental unit error was shown to be a significant source of variability in this study and would mask relationships between treatment efficiencies and residence time unless very pronounced effects existed. Variability in soil characteristics is a well-recognized and difficult problem. In this, as in many studies, time and monetary limitations restricted the number of samples which could be collected, instrumented and managed. Ogilvie and Warkentin (1973) have recommended the use of samples which are of sufficient size to include at least 10 soil structural units. Bauder and Schneider (1979), however, encountered difficulty with experimental unit error using undisturbed samples 30.5 cm in diameter. A statistical technique needs to be developed which will ameliorate problems encountered when conducting experiments using a limited number of soil samples.

Further study should be made to better define the relationship between evapotranspiration rates and the amount of drainage which ultimately occurs from the root zone in a given time period. Once this relationship is known, the procedure developed for predicting drainage following wastewater application can be extended to other situations.

Finally, using a rainfall simulator infiltrometer with dual gamma ray attenuation, field studies should be conducted to determine the transferability of the conclusions obtained from this laboratory investigation.

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Appendix A

SOIL PROFILE DESCRIPTION

Cecil Gravelly Sandy Loam
Soil Profile Description

Ap----0 to 18 cm; brown (10 YR 4/3) gravelly sandy loam; moderate very fine granular structure; very friable, slightly sticky, slightly plastic; 22 percent coarse fragments; many very fine and fine roots; abrupt smooth boundary.

B1t---where present is yellowish brown (10 YR 5/6) clay loam varies from 0 to 20 cm in thickness.

B21t--18 to 51 cm; yellowish red (5 YR 5/6) clay; many medium faint red (2.5 YR 4/8) mottles; moderate medium angular blocky structure; friable, sticky, plastic; thin continuous clay films; 5 percent coarse fragments; common very fine and fine roots ; clear wavy boundary.

B22t--76 to 107 cm; red (2.5 YR 4/8) clay; many medium distinct reddish browm (5 YR 4/4) and common medium distinct reddish yellow (7.5 YR 6/6) mottles; moderate fine angular blocky structure; friable, sticky, very plastic; thin discontinuous clay films; 10 percent coarse fragments; few very fine roots ; gradual wavy boundary.

B3t---107 to 140 cm; mottled red, reddish yellow clay loam; moderate medium ansular blocky structure; friable, sticky, plastic; thin patchy clay films; 12 percent coarse fragments; gradual irregular boundary.

C-----140 to 152 cm; mottled reddish brown, reddish yellow, red, and dusky red sandy clay loam; massive; friable, slightly sticky, slightly plastic; 15 percent coarse fragments.

Remarks: B1t discontinuous - north end of pit had B1t, south end did not. Possibly missing due to clearing operation 20 years before. This pit was 137 m east of pit 78-11.

Location: Approximately 1.6 km north of junction of the Blackstone 460 Bypass and Route 606, 450 feet east of Route 606, 5.6 km north of the Towm of Blackstone in Nottoway County, Virginia.

Physiography: Piedmont (main summit)

Drainage: Well drained

Elevation: 126 m

Slope: 2 percent

Aspect: North-northwest

Parent material: Granite gneiss and phyllite

Vegetation: White clover-orchardgrass-tall fescue-bluegrass pasture

Classification: Typic Hapludult; clayey, kaolinitic, thermic

Appendix B

LIQUID ADDITIONS TO SOIL COLUMNS

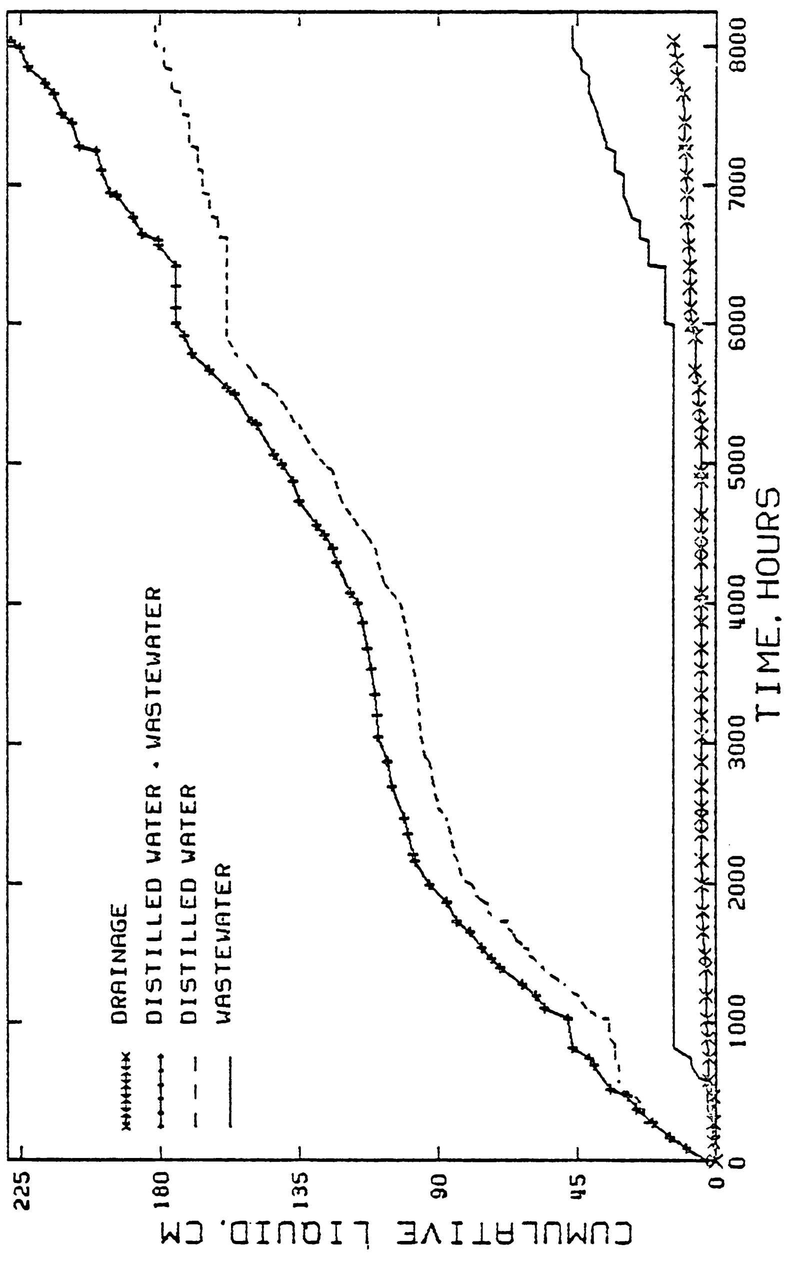

Figure B-1 : Cumulative Liquid Applications and Drainage for Column 4, 12/80 - 11/81.

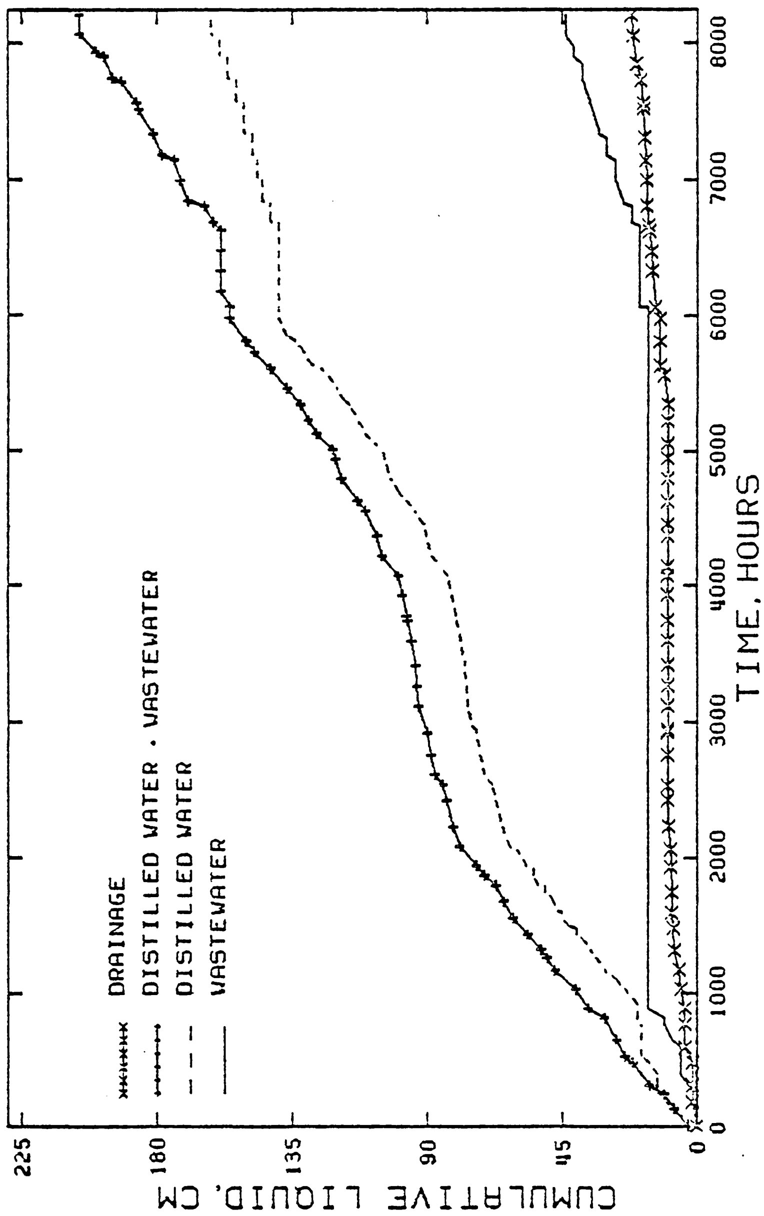

Figure B-2 : Cumulative Liquid Applications and Drainage for Column 5, 12/80 - 11/81.

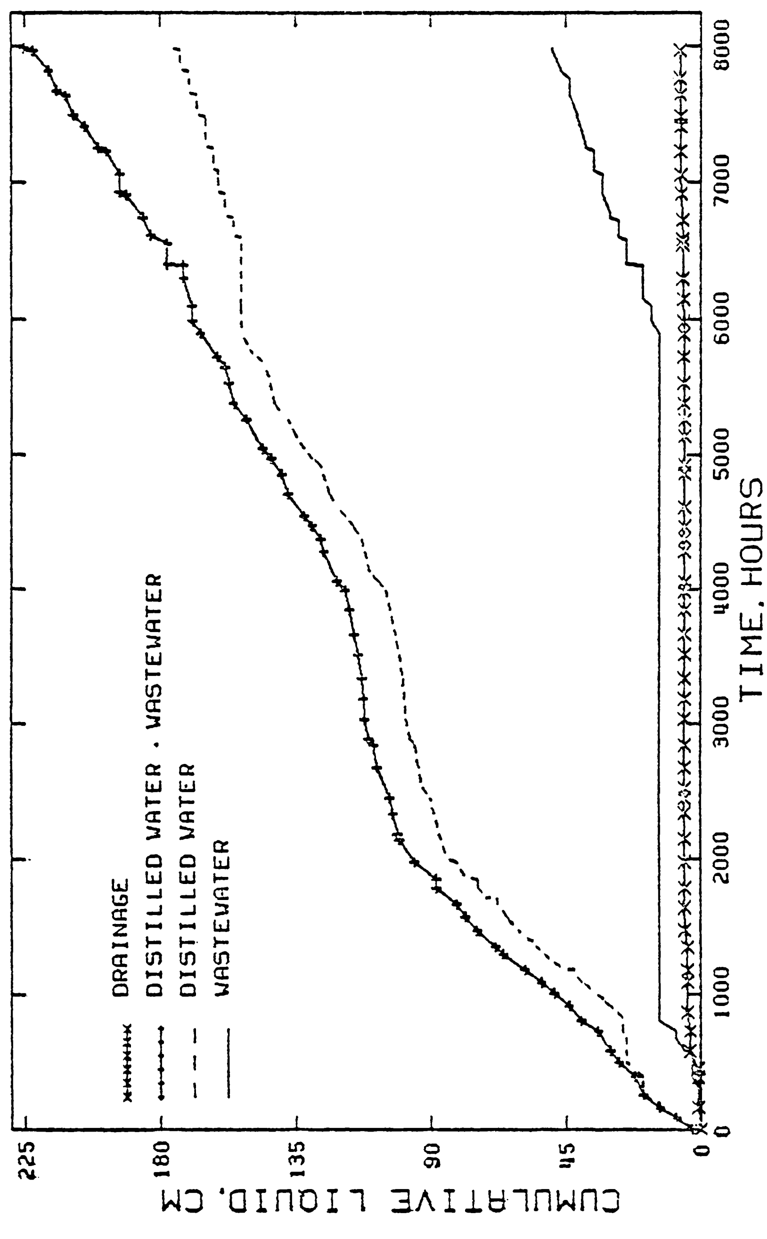

Figure B-3 : Cumulative Liquid Applications and Drainage for Column 16, 12/80 - 11/81.

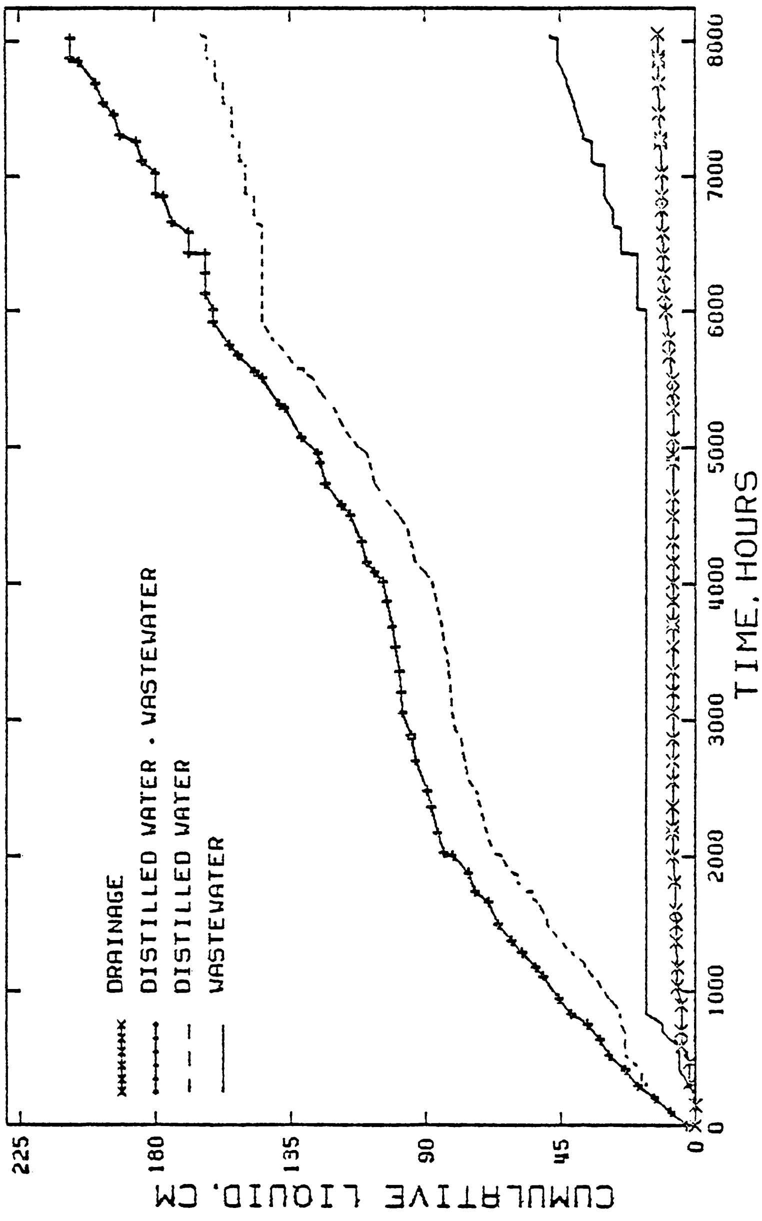

Figure B-4 : Cumulative Liquid Applications and Drainage for Column 11, 12/80 - 11/81.

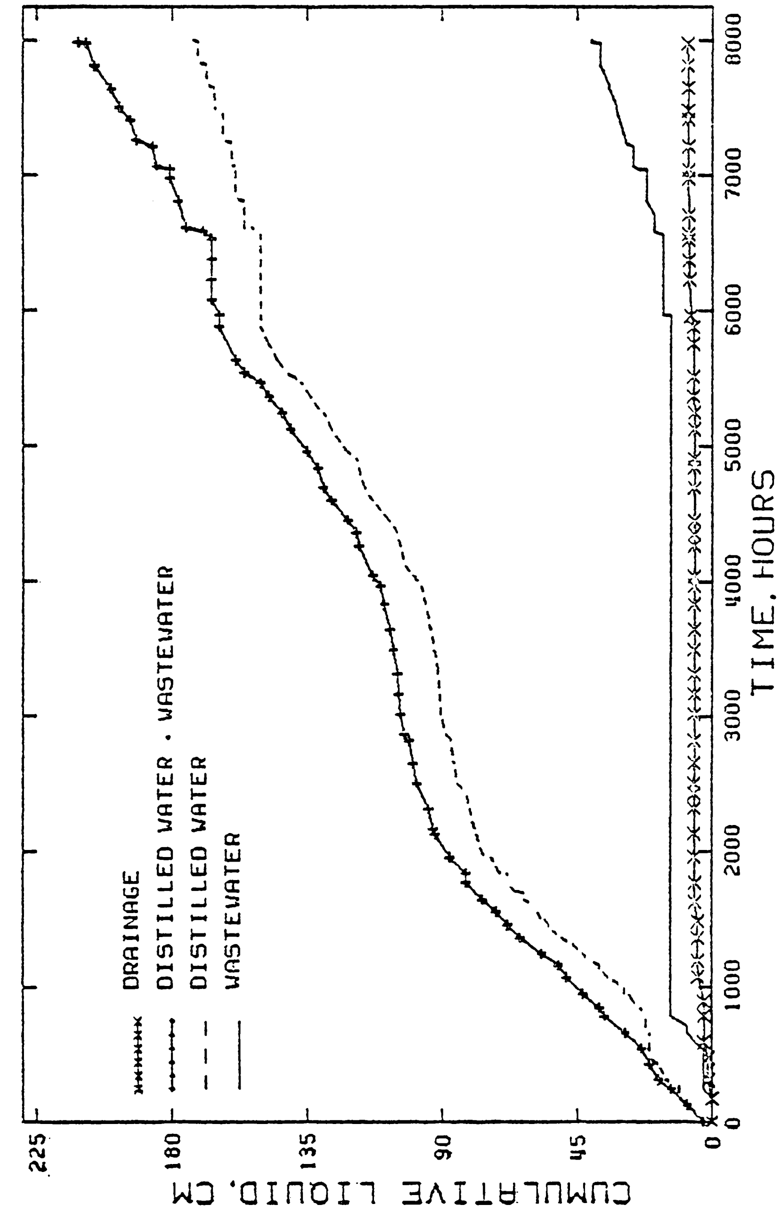

Figure B-5 : Cumulative Liquid Applications and Drainage for Column 12, 12/80 - 11/81.

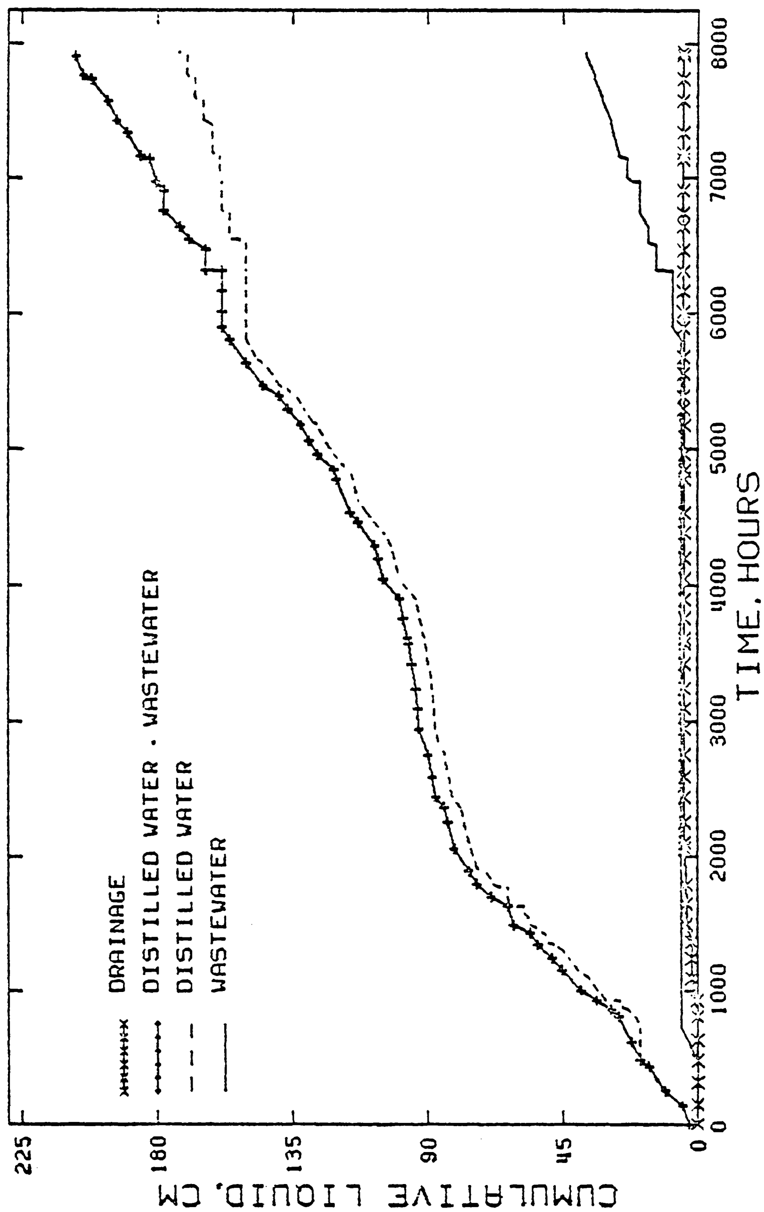

Figure B-6 : Cumulative Liquid Applications and Drainage for Column 14, 12/80 - 11/81.

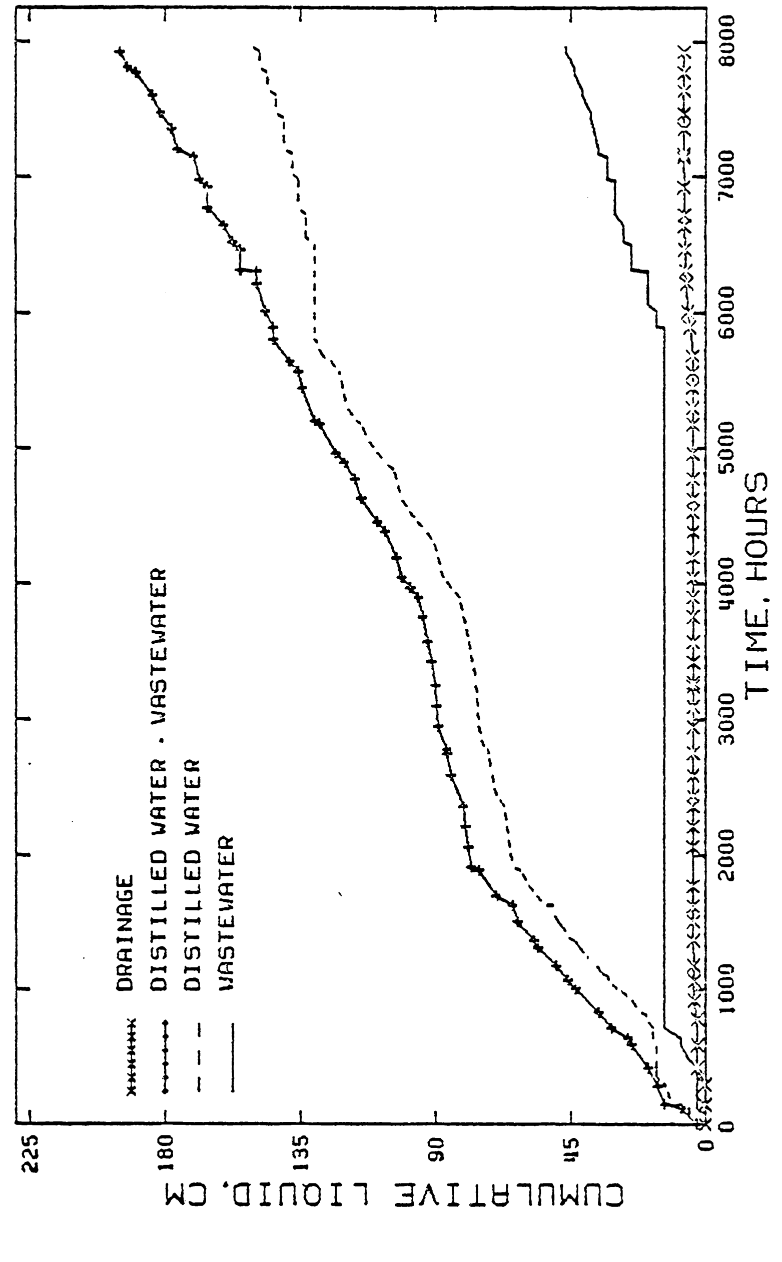

Figure B-7 : Cumulative Liquid Applications and Drainage for Column 6, 12/80 - 11/81.

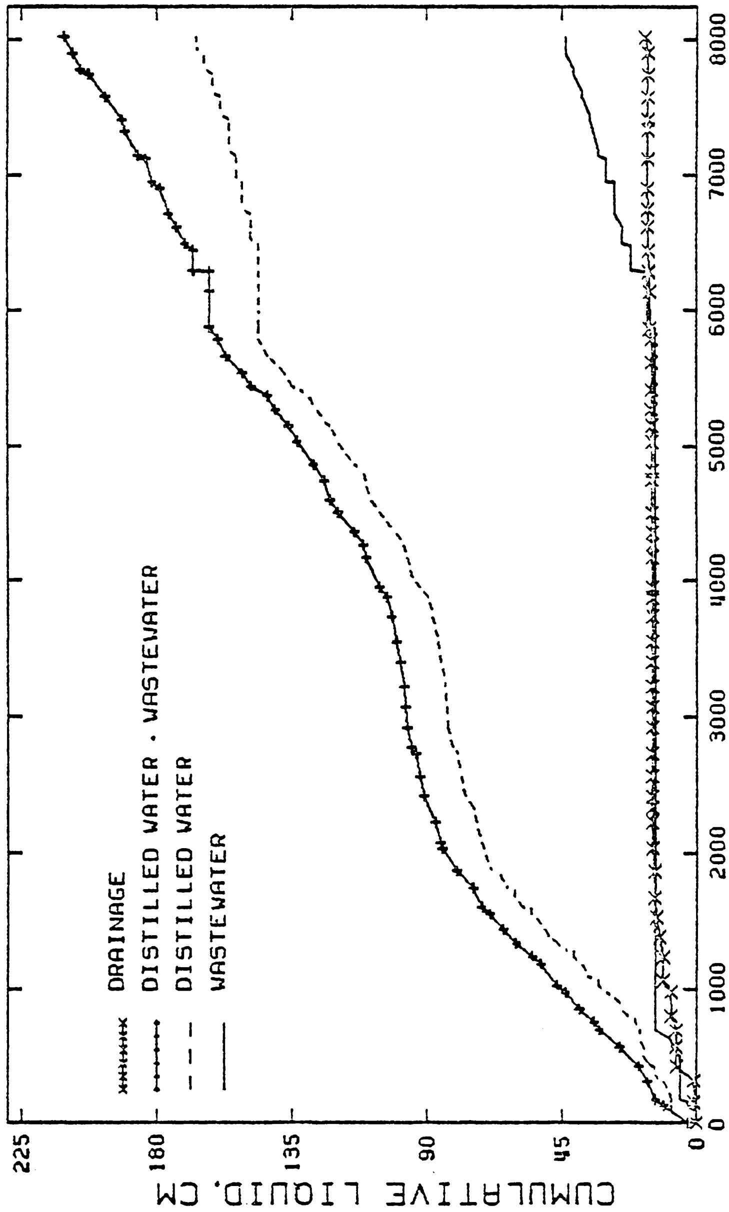

Figure B-8 : Cumulative Liquid Applications and Drainage for Column 9, 12/80 - 11/81.

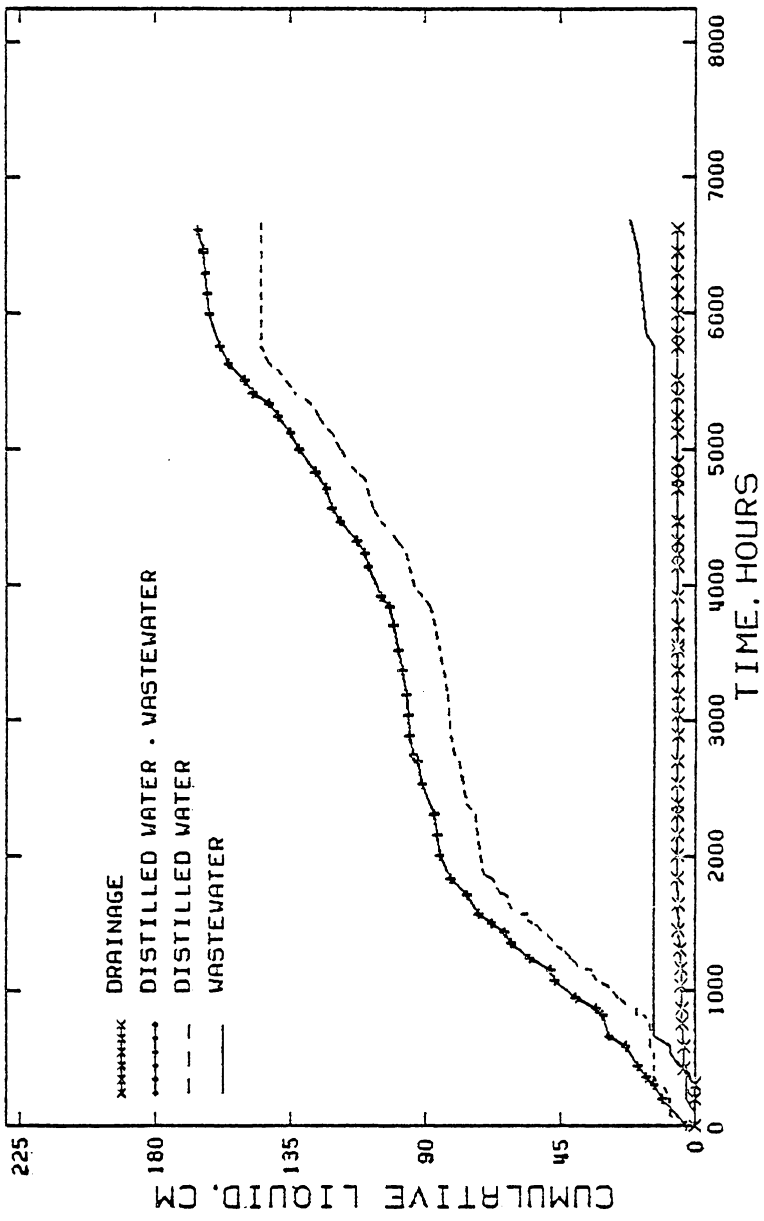

Figure B-9 : Cumulative Liquid Applications and Drainage for Column 13, 12/80 - 11/81.

Appendix C

SPAW MODEL INPUTS

Input Data
for
SPAW MODEL
(Soil-Plant-Air-Water)

Climatic Data

Required:

*1) Daily pan evaporation
2) Average annual pond evaporation
*3) Daily precipation

Optional:

4) Daily runoff
5) SCS curve numbers

Crop Data

Required:

*1) Plant and harvest dates
*2) Canopy - precent ground shading by days since crop planting date
3) Canopy stress susceptibility
*4) Phenology - percent of canopy actively transpiring by days since planting date
5) Phenology stress susceptibility - percent reduction for selected stress values
*6) Roots - percent of water uptake from each defined soil layer
7) Moisture stress curves - crop water stress relationships related to potential ET and available soil water in layers with roots
*8) Yield susceptibility - a relationship to reflect the relative effect of crop stress on crop yield by stage of growth

Soil Data

Required:

*1) Profile
-layer depths (inches)
-soil types to define water characteristics of each layer
2) Darcy flow parameters
Tolerance - maximum tension change per time step.
Maximum, minimum time - Delta time used by the Darcy finite difference solution
3) Soil evaporation percent - percent between wilting point and field capacity to which the evaporation can be dried

Optional:
Observed soil moisture - percent moisture by defined soil layers

Notes:

-Those dates preceded by * require field observations or estimates to represent the study site. Other data are optional or defined by general knowledge of the plant or soil characteristics.

Appendix D

OBSERVED AND SIMULATED SOIL MOISTURE DATA

Table D-1 .
- COLUMN NUMBER ---- 4

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
1.000	1.000	0.0	.23594	.20458	15.3	.42400	.41813	1.40	.49073	.49090	-.347E-01
2.000	1.000	2.74									
96.750	94.750	0.0	.17675	.20290	-12.9	.42813	.40926	4.61	.50353	.48540	3.73
97.750	1.000	2.74									
99.000	1.250	0.0	.28742	.37370	-23.1	.42781	.40922	4.54	.50330	.48540	3.69
104.000	5.000	0.0	.27260	.37370	-27.1	.42752	.41090	4.05	.50313	.48468	3.81
113.250	9.250	0.0	.24644	.37370	-34.1	.42706	.41574	2.72	.50279	.48438	3.80
145.500	32.250	0.0	.20047	.23804	-15.8	.42572	.41318	3.03	.50139	.48354	3.69
146.500	1.000	1.37									
147.750	1.250	0.0	.24226	.24181	.186	.42547	.41735	1.94	.50120	.48510	3.32
162.000	14.250	0.0	.23465	.24355	-3.65	.42459	.41590	2.09	.50064	.48336	3.58
169.500	7.500	0.0	.22106	.23108	-4.34	.42425	.41112	3.19	.50041	.48339	3.52
173.000	3.500	0.0	.21128	.22616	-6.58	.42414	.41017	3.41	.50031	.48330	3.52
220.000	47.000	0.0									
221.000	1.000	2.74									
245.000	24.000	0.0	.22363	.31780	-29.6	.42376	.45520	-6.91	.49862	.50068	-.412
257.000	12.000	0.0	.20888	.28920	-27.8	.42372	.44233	-4.21	.49838	.49596	.488
269.000	12.000	0.0	.19275	.23615	-18.4	.42369	.42179	.450	.49810	.49452	.725
281.000	12.000	0.0	.18776	.22560	-16.8	.42365	.42188	.419	.49776	.49244	1.08
289.750	8.750	0.0	.17761	.20889	-15.0	.42362	.41610	1.81	.49753	.49196	1.13
290.750	1.000	1.65									
293.500	2.750	0.0	.22732	.23833	-4.62	.42360	.42303	.135	.49741	.49148	1.21
305.500	12.000	0.0	.22003	.24268	-9.33	.42356	.42133	.530	.49710	.49020	1.41
308.500	3.000	0.0	.21325	.23775	-10.3	.42355	.41903	1.08	.49703	.49030	1.37
330.000	21.500	0.0	.18957	.20938	-9.46	.42349	.41450	2.17	.49652	.48885	1.57
331.000	1.000	2.47									
353.000	22.000	0.0	.24223	.37370	-35.2	.42339	.42354	-.364E-01	.49593	.48740	1.75
377.500	24.500	0.0	.20495	.35290	-41.9	.42330	.41698	1.52	.49552	.48630	1.90
382.500	5.000	0.0	.19844	.33860	-41.4	.42329	.41208	2.72	.49545	.48600	1.94
425.500	43.000	0.0	.16535	.19950	-17.1	.42313	.40870	3.53	.49485	.48233	2.60
427.500	2.000	0.0	.16321	.20200	-19.2	.42313	.40870	3.53	.49483	.48420	2.19
428.500	1.000	2.60									
504.000	75.500	0.0	.17166	.19950	-14.0	.42282	.40870	3.46	.49396	.47600	3.77
505.000	1.000	4.93									
508.500	3.500	0.0	.29353	.36850	-20.3	.44948	.46261	-2.84	.49385	.48760	1.28
521.000	12.500	0.0	.26837	.34380	-21.9	.44359	.44779	-.938	.49471	.49148	.658
545.500	24.500	0.0	.23804	.23717	.366	.43543	.42262	3.03	.50055	.49196	1.75
554.750	9.250	0.0	.21652	.21580	.331	.43340	.41748	3.81	.50166	.49180	2.00
569.500	14.750	0.0	.20138	.21301	-5.46	.43018	.41550	3.53	.50174	.49005	2.39
593.250	23.750	0.0	.18244	.37370	-51.2	.42779	.40999	4.34	.50146	.48905	2.54
594.250	1.000	2.74									
604.000	9.750	0.0	.26782	.25800	3.81	.42707	.41636	2.57	.50116	.48880	2.53
622.250	18.250	0.0	.23761	.22721	4.58	.42635	.41186	3.52	.50077	.48579	3.08
630.750	8.500	0.0	.21925	.21485	2.05	.42605	.40985	3.95	.50059	.48504	3.21
631.750	1.000	2.74									

Table D-1 ,continued.

\- COLUMN NUMBER ---- 4

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
641.750	10.000	0.0	.28544	.34900	-18.2	.44880	.45052	-.382	.50066	.48730	2.74
651.500	9.750	0.0	.26111	.30350	-14.0	.44369	.44701	-.742	.50265	.48810	2.98
668.500	17.000	0.0	.24088	.24094	-.264E-01	.43814	.43180	1.47	.50509	.48830	3.44
679.000	10.500	0.0	.22390	.21837	2.53	.43542	.41934	3.84	.50566	.48830	3.55
680.000	1.000	1.65									
690.000	10.000	0.0	.26568	.23891	11.2	.43308	.41991	3.14	.50575	.48830	3.57
712.500	22.500	0.0	.22956	.33860	-32.2	.42956	.41748	2.90	.50540	.48830	3.50
719.000	6.500	0.0	.21529	.21147	1.81	.42893	.41390	3.63	.50521	.48840	3.44
720.000	1.000	2.20									
743.000	23.000	0.0	.24379	.30480	-20.0	.43227	.45130	-4.22	.50434	.49100	2.72
764.000	21.000	0.0	.22392	.23224	-3.58	.42949	.42790	.372	.50386	.49100	2.62
786.000	22.000	0.0	.19541	.20894	-6.47	.42747	.41816	2.23	.50324	.49100	2.49
794.000	8.000	0.0	.18829	.19500	-3.44	.42706	.41154	3.77	.50297	.49100	2.44
795.000	1.000	4.40									
811.000	16.000	0.0	.27112	.37370	-27.4	.45685	.45871	-.405	.52677	.50684	3.93
833.000	22.000	0.0	.24351	.37370	-34.8	.44933	.44974	-.915E-01	.52533	.50684	3.65
845.250	12.250	0.0	.22673	.36460	-37.8	.44630	.42336	5.42	.52396	.50460	3.84
858.000	12.750	0.0	.21034	.21438	-1.88	.44399	.42147	5.34	.52240	.49468	5.60
865.250	7.250	0.0	.19941	.20650	-3.43	.44266	.41735	6.06	.52152	.49356	5.67
866.250	1.000	2.74									
881.750	15.500	0.0	.27031	.33080	-18.3	.45010	.45286	-.609	.52092	.49340	5.58
888.500	6.750	0.0	.25412	.29310	-13.3	.44792	.44038	1.71	.52096	.49340	5.59
889.500	1.000	1.65									
912.250	22.750	0.0	.25779	.31000	-16.8	.45212	.45130	.182	.52467	.49620	5.74
915.250	3.000	0.0	.24611	.29570	-16.8	.45100	.44740	.804	.52460	.49620	5.72
929.500	14.250	0.0	.24177	.24369	-.790	.44727	.43765	2.20	.52356	.49572	5.62

Table D-2 ,continued.

\- COLUMN NUMBER ---- 5

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
678.500	11.000	0.0	.26913	.26813	.372	.43243	.44151	-2.06	.50377	.48108	4.72
689.000	10.500	0.0	.25320	.23868	6.09	.43074	.44533	-3.28	.50343	.47991	4.90
711.500	22.500	0.0	.23650	.20816	13.6	.42625	.44571	-4.37	.50139	.47912	4.65
712.500	1.000	1.65									
742.000	29.500	0.0	.24947	.22831	9.27	.42673	.45336	-5.87	.49897	.47902	4.16
763.000	21.000	0.0	.23354	.20166	15.8	.42318	.45336	-6.66	.49757	.47814	4.06
764.000	1.000	2.74									
785.000	21.000	0.0	.29164	.31909	-8.60	.43729	.45336	-3.54	.50320	.48338	4.10
793.000	8.000	0.0	.27602	.28979	-4.75	.43384	.45336	-4.31	.50373	.48275	4.35
810.000	17.000	0.0	.25043	.23541	6.38	.43028	.45336	-5.09	.50335	.51125	-1.54
832.000	22.000	0.0	.23442	.19972	17.4	.42597	.45336	-6.04	.50118	.48089	4.22
833.000	1.000	2.74									
844.250	11.250	0.0	.30934	.33310	-7.13	.44024	.45336	-2.89	.50496	.49643	1.72
857.000	12.750	0.0	.28781	.30890	-6.83	.43739	.44151	-.934	.50671	.48722	4.00
864.250	7.250	0.0	.27434	.28087	-2.32	.43551	.43043	1.18	.50695	.48612	4.29
880.750	16.500	0.0	.25053	.23371	7.20	.43201	.41552	3.97	.50570	.48353	4.58
887.500	6.750	0.0	.23969	.21944	9.23	.43042	.41016	4.94	.50497	.48108	4.97
888.500	1.000	2.20									
911.250	22.750	0.0	.28739	.30890	-6.96	.43739	.43807	-.155	.50701	.48361	4.84
914.250	3.000	0.0	.28170	.29743	-5.29	.43606	.43425	.418	.50697	.48353	4.85
928.500	14.250	0.0	.26005	.24647	5.51	.43359	.42164	2.84	.50638	.48236	4.98

Table D-3 .

\- COLUMN NUMBER ---- 16

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
3.750	3.750	0.0	.23751	.24471	-2.94	.43008	.43024	-.372E-01	.48565	.48561	.723E-02
15.500	11.750	0.0	.22513	.23325	-3.48	.42871	.42377	1.16	.48608	.48510	.201
19.000	3.500	0.0	.21402	.22777	-6.04	.42820	.42331	1.15	.48630	.48540	.186
40.250	21.250	0.0	.19067	.19612	-2.78	.42621	.41958	1.58	.48772	.48300	.977
41.250	1.000	2.47									
63.250	22.000	0.0	.24323	.26190	-7.13	.42499	.41878	1.48	.48873	.48020	1.78
87.750	24.500	0.0	.20475	.20594	-.577	.42425	.41518	2.18	.48938	.47927	2.11
88.750	1.000	2.47									
92.750	4.000	0.0	.29956	.33990	-11.9	.42399	.41645	1.81	.48929	.47928	2.09
135.750	43.000	0.0	.20686	.20300	1.90	.42381	.41302	2.61	.48989	.47939	2.19
136.750	1.000	2.47									
214.250	77.500	0.0	.17794	.19950	-10.8	.42368	.40870	3.67	.49020	.48114	1.88
215.250	1.000	4.40									
218.750	3.500	0.0	.32953	.37370	-11.8	.44464	.46261	-3.89	.49016	.47600	2.97
231.250	12.500	0.0	.29664	.30740	-3.50	.44208	.45130	-2.04	.49027	.47600	3.00
255.750	24.500	0.0	.24311	.22046	10.3	.43468	.43063	.940	.49518	.47925	3.32
265.000	9.250	0.0	.22767	.20050	13.6	.43262	.42262	2.37	.49690	.47600	4.39
266.000	1.000	2.74									
279.750	13.750	0.0	.29941	.33080	-9.49	.43909	.44818	-2.03	.49872	.47600	4.77
303.500	23.750	0.0	.24375	.22896	6.46	.43456	.42868	1.37	.50160	.47600	5.38
307.250	3.750	0.0	.24021	.22504	6.74	.43387	.42790	1.40	.50167	.47971	4.58
308.250	1.000	2.74									
314.250	6.000	0.0	.32182	.33860	-4.96	.44870	.45832	-2.10	.50182	.49396	1.59
332.500	18.250	0.0	.26965	.26580	1.45	.44252	.45715	-3.20	.50497	.49388	2.24
341.000	8.500	0.0	.24417	.23195	5.27	.43943	.45286	-2.97	.50606	.49420	2.40
352.000	11.000	0.0	.24141	.22113	9.17	.43653	.44818	-2.60	.50648	.49372	2.58
361.750	9.750	0.0	.22219	.20100	10.5	.43420	.44194	-1.75	.50645	.49228	2.88
362.750	1.000	3.84									
378.750	16.000	0.0	.30088	.32560	-7.59	.45562	.46105	-1.18	.52346	.52672	-.618
389.750	11.000	0.0	.26636	.24297	9.63	.45093	.45832	-1.61	.52360	.51580	1.51
400.250	10.500	0.0	.24709	.23238	6.33	.44823	.45520	-1.53	.52274	.50992	2.52
422.750	22.500	0.0	.22430	.19725	13.7	.44250	.44506	-.574	.52000	.49732	4.56
423.750	1.000	3.29									
453.250	29.500	0.0	.26223	.23847	9.96	.45027	.45676	-1.42	.52386	.51524	1.67
474.250	21.000	0.0	.23684	.20666	14.6	.44467	.44818	-.783	.52141	.50180	3.91
475.250	1.000	2.74									
496.250	21.000	0.0	.28413	.28660	-.862	.45011	.45715	-1.54	.52104	.51160	1.85
504.250	8.000	0.0	.26115	.23775	9.84	.44744	.45481	-1.62	.52078	.50740	2.64
505.250	1.000	1.10									
521.250	16.000	0.0	.26411	.25930	1.86	.44405	.44935	-1.18	.51919	.49928	3.99
543.250	22.000	0.0	.23172	.21158	9.52	.43970	.43960	.228E-01	.51695	.49580	4.27
551.750	8.500	0.0	.21189	.20050	5.68	.43817	.43141	1.57	.51602	.49460	4.33
552.750	1.000	2.74									
555.500	2.750	0.0	.32619	.32950	-1.00	.43741	.46280	-5.49	.51549	.49524	4.09
568.250	12.750	0.0	.28930	.32690	-11.5	.43995	.45910	-4.17	.51413	.49652	3.55

Table D-3 ,continued.

- COLUMN NUMBER ---- 16

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
575.500	7.250	0.0	.26408	.26840	-1.61	.43959	.45520	-3.43	.51358	.49564	3.62
592.000	16.500	0.0	.24185	.22749	6.31	.43693	.44779	-2.43	.51253	.49340	3.88
598.750	6.750	0.0	.22878	.21229	7.77	.43581	.44350	-1.73	.51206	.49292	3.88
599.750	1.000	2.20									
622.500	22.750	0.0	.25346	.26580	-4.64	.43480	.45364	-4.15	.51012	.49404	3.26
625.500	3.000	0.0	.24399	.24326	.299	.43451	.45130	-3.72	.50991	.49300	3.43
639.750	14.250	0.0	.23542	.22476	4.74	.43271	.44467	-2.69	.50893	.49140	3.57

Table D-4 .
\- COLUMN NUMBER ---- 11

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
26.250	26.250	0.0	.21873	.20260	7.96	.42319	.41977	.815	.49056	.48970	.176
27.250	1.000	2.74									
95.750	68.500	0.0	.22391	.20430	9.60	.42877	.41835	2.49	.50273	.48850	2.91
96.750	1.000	2.74									
97.750	1.000	0.0	.28600	.36200	-21.0	.46032	.41791	10.1	.52045	.48850	6.54
102.750	5.000	0.0	.28182	.36200	-22.1	.45273	.41881	8.10	.52244	.48665	7.35
112.250	9.500	0.0	.27191	.34900	-22.1	.44678	.42037	6.28	.52040	.48585	7.11
144.250	32.000	0.0	.24350	.23572	3.30	.43600	.41859	4.16	.51106	.48465	5.45
145.250	1.000	1.37									
146.500	1.250	0.0	.29557	.35160	-15.9	.43532	.41924	3.84	.51021	.48715	4.73
160.750	14.250	0.0	.27157	.31260	-13.1	.43690	.41785	4.56	.50734	.48441	4.73
168.250	7.500	0.0	.25895	.26580	-2.58	.43517	.41689	4.38	.50635	.48435	4.54
171.750	3.500	0.0	.25388	.24297	4.49	.43426	.41649	4.27	.50582	.48384	4.54
218.750	47.000	0.0									
219.750	1.000	2.74									
243.750	24.000	0.0	.25362	.31780	-20.2	.44286	.45676	-3.04	.51945	.50460	2.94
255.750	12.000	0.0	.25047	.28400	-11.8	.44009	.45208	-2.65	.51531	.49780	3.52
267.750	12.000	0.0	.24186	.23369	3.50	.43632	.44428	-1.79	.51149	.49652	3.01
279.750	12.000	0.0	.23616	.22084	6.94	.43351	.43960	-1.39	.50826	.49428	2.83
288.500	8.750	0.0	.22697	.20538	10.5	.43141	.43024	.272	.50620	.49356	2.56
289.500	1.000	1.65									
292.250	2.750	0.0	.27058	.32820	-17.6	.45422	.42517	6.83	.51358	.49292	4.19
307.500	15.250	0.0	.25425	.25280	.572	.44115	.42322	4.24	.51479	.49132	4.78
328.750	21.250	0.0	.24284	.21400	13.5	.43464	.42069	3.32	.50923	.48955	4.02
335.500	6.750	0.0	.23759	.20450	16.2	.43286	.41909	3.29	.50774	.48920	3.79
336.500	1.000	2.47									
351.750	15.250	0.0	.30079	.33340	-9.78	.44228	.42014	5.27	.50720	.48715	4.12
376.250	24.500	0.0	.26135	.23804	9.79	.43622	.41835	4.27	.50676	.48600	4.27
381.250	5.000	0.0	.25402	.22882	11.0	.43479	.41748	4.15	.50610	.48600	4.14
424.250	43.000	0.0	.22517	.19950	12.9	.42606	.40924	4.11	.50000	.48324	3.47
502.750	78.500	0.0	.18223	.21666	-15.9	.42378	.42317	.144	.49381	.48516	1.78
503.750	1.000	2.74									
507.250	3.500	0.0	.26879	.36330	-26.0	.45693	.45910	-.473	.52676	.49005	7.49
519.750	12.500	0.0	.25757	.35550	-27.5	.44791	.45559	-1.69	.52254	.48760	7.17
544.250	24.500	0.0	.24523	.26710	-8.19	.43872	.44935	-2.37	.51385	.48745	5.42
553.500	9.250	0.0	.24158	.22798	5.97	.43591	.44038	-1.02	.51110	.48390	5.62
568.250	14.750	0.0	.23064	.20754	11.1	.43241	.42400	1.98	.50728	.48735	4.09
569.250	1.000	2.74									
592.000	22.750	0.0	.28928	.31910	-9.35	.44210	.44818	-1.36	.51060	.48820	4.59
602.750	10.750	0.0	.27202	.27880	-2.43	.43886	.44467	-1.31	.50988	.48960	4.14
621.000	18.250	0.0	.24929	.23001	8.38	.43430	.43297	.307	.50705	.48850	3.80
629.500	8.500	0.0	.24260	.21356	13.6	.43205	.42363	1.99	.50534	.48840	3.47
630.500	1.000	1.65									
640.500	10.000	0.0	.29256	.33340	-12.2	.43715	.42290	3.37	.50271	.48745	3.13
650.250	9.750	0.0	.27477	.26580	3.38	.43607	.42096	3.59	.50249	.48740	3.10

Table D-4 ,continued.

- COLUMN NUMBER ---- 11

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
666.750	16.500	0.0	.25235	.22938	10.0	.43287	.41897	3.32	.50181	.48630	3.19
677.750	11.000	0.0	.24240	.20722	17.0	.43025	.41655	3.29	.50109	.48625	3.05
678.750	1.000	2.74									
688.750	10.000	0.0	.31838	.35550	-10.4	.45001	.43492	3.47	.50922	.48504	4.99
711.250	22.500	0.0	.28093	.29180	-3.72	.44112	.42829	3.00	.51160	.48504	5.48
741.750	30.500	0.0	.24408	.20916	16.7	.43313	.41890	3.40	.50646	.48501	4.42
762.750	21.000	0.0	.22965	.19500	17.8	.42869	.41394	3.56	.50156	.48468	3.48
763.750	1.000	3.57									
784.750	21.000	0.0	.30480	.32040	-4.87	.44992	.44272	1.63	.52071	.48450	7.47
792.750	8.000	0.0	.29254	.28140	3.96	.44594	.43414	2.72	.51873	.48450	7.07
809.750	17.000	0.0	.27062	.23412	15.6	.44227	.42340	4.46	.51563	.48456	6.41
831.750	22.000	0.0	.24845	.20200	23.0	.43597	.41903	4.04	.51021	.48468	5.27
832.750	1.000	2.74									
844.000	11.250	0.0	.31900	.34900	-8.60	.45219	.42673	5.97	.52056	.48468	7.40
856.750	12.750	0.0	.29960	.31390	-4.56	.44825	.42673	5.04	.51961	.48486	7.17
864.000	7.250	0.0	.28842	.28790	.181	.44627	.42271	5.57	.51847	.48690	6.48
880.500	16.500	0.0	.26790	.22952	16.7	.44145	.42037	5.02	.51481	.48444	6.27
887.250	6.750	0.0	.25656	.21856	17.4	.43928	.41862	4.93	.51327	.48474	5.88
888.250	1.000	1.65									
911.000	22.750	0.0	.28856	.27880	3.50	.44232	.41490	6.61	.51263	.48450	5.81
913.000	2.000	0.0	.28533	.26060	9.49	.44202	.41474	6.58	.51234	.48459	5.73
914.000	1.000	2.74									
928.250	14.250	0.0	.31882	.34510	-7.62	.45534	.45988	-.987	.52579	.50992	3.11

Table D-5 .

\- COLUMN NUMBER ---- 12

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
26.250	26.250	0.0	.22953	.19190	19.6	.42067	.39852	5.56	.49079	.46246	6.13
27.250	1.000	2.74									
94.250	67.000	0.0	.22794	.19318	18.0	.42047	.40193	4.62	.49280	.46030	7.06
96.000	1.750	0.0	.22655	.19446	16.5	.42010	.40184	4.54	.49258	.46027	7.02
97.000	1.000	2.74									
102.750	5.750	0.0	.31224	.34143	-8.55	.43574	.43614	-.935E-01	.49369	.46082	7.13
112.250	9.500	0.0	.29615	.32908	-10.0	.43195	.43577	-.877	.49519	.46713	6.01
144.250	32.000	0.0	.23761	.21339	11.4	.42332	.42725	-.920	.49397	.46812	5.52
145.250	1.000	1.37									
146.500	1.250	0.0	.29531	.21618	36.6	.42238	.42948	-1.65	.49350	.47268	4.40
160.750	14.250	0.0	.27064	.22752	19.0	.42215	.42021	.460	.49192	.46721	5.29
168.250	7.500	0.0	.25367	.21492	18.0	.42119	.41577	1.31	.49124	.46607	5.40
171.750	3.500	0.0	.24722	.20781	19.0	.42058	.41317	1.79	.49093	.46569	5.42
184.250	12.500	0.0	.23255	.19309	20.4	.41868	.40613	3.09	.48979	.46412	5.53
218.750	34.500	0.0									
219.750	1.000	2.74									
243.750	24.000	0.0	.26678	.30438	-12.4	.41744	.43911	-4.93	.48397	.48363	.703E-01
255.750	12.000	0.0	.24607	.26856	-8.38	.41614	.43837	-5.07	.48351	.47375	2.06
267.750	12.000	0.0	.22954	.21286	7.84	.41404	.43244	-4.26	.48297	.47109	2.52
279.750	12.000	0.0	.22467	.19534	15.0	.41208	.41762	-1.33	.48226	.46957	2.70
282.500	2.750	0.0	.21849	.19190	13.9	.41172	.42429	-2.96	.48207	.46843	2.91
283.500	1.000	1.65									
288.500	5.000	0.0	.27573	.22448	22.8	.41071	.42318	-2.95	.48155	.46713	3.09
292.250	3.750	0.0	.26810	.22490	19.2	.41018	.41910	-2.13	.48126	.46631	3.21
307.500	15.250	0.0	.23815	.21432	11.1	.40920	.40873	.115	.48003	.46512	3.21
328.750	21.250	0.0	.22049	.18953	16.3	.40727	.40096	1.57	.47824	.46312	3.26
329.750	1.000	2.47									
351.750	22.000	0.0	.27442	.23096	18.8	.41667	.39957	4.28	.47657	.46141	3.28
376.250	24.500	0.0	.23238	.20384	14.0	.41276	.39681	4.02	.47701	.46027	3.64
377.250	1.000	1.37									
381.250	4.000	0.0	.28157	.19943	41.2	.41179	.39607	3.97	.47697	.46027	3.63
382.250	1.000	1.65									
424.250	42.000	0.0	.22195	.21764	1.98	.40840	.39814	2.58	.47604	.45838	3.85
502.750	78.500	0.0	.16206	.18953	-14.5	.40342	.38971	3.52	.47389	.45719	3.65
503.750	1.000	5.48									
507.250	3.500	0.0	.31552	.35254	-10.5	.43938	.43948	-.235E-01	.50062	.46251	8.24
519.750	12.500	0.0	.29576	.32784	-9.79	.43503	.43948	-1.01	.50065	.48469	3.29
544.250	24.500	0.0	.25130	.22876	9.86	.42812	.43318	-1.17	.49822	.47344	5.23
553.500	9.250	0.0	.23678	.20152	17.5	.42567	.42688	-.284	.49700	.47162	5.38
568.250	14.750	0.0	.23100	.18525	24.7	.42267	.42058	.496	.49487	.46843	5.65
569.250	1.000	2.74									
592.000	22.750	0.0	.28334	.30314	-6.53	.43267	.42799	1.09	.49980	.46574	7.31
602.750	10.750	0.0	.26229	.23082	13.6	.42942	.42799	.334	.49900	.46493	7.33
621.000	18.250	0.0	.23367	.20105	16.2	.42524	.41095	3.48	.49660	.46013	7.92
624.750	3.750	0.0	.23164	.19190	20.7	.42430	.40354	5.14	.49608	.46331	7.07

Table D-5 ,continued.

- COLUMN NUMBER ---- 12

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
625.750	1.000	2.74									
629.500	3.750	0.0	.31528	.34884	-9.62	.43928	.42281	3.90	.50062	.46293	8.14
640.500	11.000	0.0	.29804	.32908	-9.43	.43546	.42355	2.81	.50046	.46255	8.19
650.250	9.750	0.0	.27922	.28709	-2.74	.43210	.42281	2.20	.50014	.46222	8.20
666.250	16.000	0.0	.25121	.22393	12.2	.42822	.41317	3.64	.49834	.46159	7.96
667.250	1.000	0.0	.24997	.19370	29.0	.42796	.40193	6.48	.49821	.46144	7.97
668.250	1.000	2.74									
688.750	20.500	0.0	.28723	.33772	-15.0	.43346	.43244	.235	.50001	.46090	8.48
711.250	22.500	0.0	.24884	.26239	-5.16	.42741	.42948	-.481	.49783	.46056	8.09
741.750	30.500	0.0	.22246	.18525	20.1	.42082	.40096	4.95	.49353	.46312	6.57
742.750	1.000	3.30									
762.750	20.000	0.0	.28789	.31055	-7.30	.43356	.43689	-.761	.50004	.50038	-.691E-01
784.750	22.000	0.0	.24964	.21980	13.6	.42770	.42948	-.414	.49797	.50038	-.482
792.750	8.000	0.0	.23636	.19743	19.7	.42558	.42132	1.01	.49691	.50038	-.694
793.750	1.000	3.84									
809.750	16.000	0.0	.29547	.32414	-8.84	.43465	.43948	-1.10	.49974	.50038	-.129
831.750	22.000	0.0	.25574	.22793	12.2	.42871	.43466	-1.37	.49847	.50038	-.382
844.000	12.250	0.0	.23470	.19481	20.5	.42545	.42281	.625	.49688	.49826	-.276
845.000	1.000	2.74									
856.750	11.750	0.0	.30366	.33278	-8.75	.43662	.43948	-.651	.50059	.47010	6.49
864.000	7.250	0.0	.28936	.30685	-5.70	.43396	.43726	-.753	.49977	.46957	6.43
880.200	16.200	0.0	.26163	.23261	12.5	.42959	.43207	-.575	.49896	.46873	6.45
887.250	7.050	0.0	.24896	.21725	14.6	.42765	.42948	-.425	.49810	.46820	6.39
888.250	1.000	1.65									
911.000	22.750	0.0	.27694	.22159	25.0	.42809	.41910	2.15	.49593	.46626	6.36
914.000	3.000	0.0	.27137	.21685	25.1	.42736	.40013	6.80	.49582	.46607	6.38
915.000	1.000	1.10									
928.250	13.250	0.0	.29369	.27968	5.01	.42823	.41206	3.92	.49470	.46502	6.38

Table D-6 .
- COLUMN NUMBER ---- 14

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
2.000	2.000	0.0	.28026	.29547	-5.15	.42360	.44346	-4.48	.47603	.50308	-5.38
3.000	1.000	2.47									
5.750	2.750	0.0	.35027	.39239	-10.7	.46715	.48574	-3.83	.47611	.50311	-5.37
6.750	1.000	2.47									
78.500	71.750	0.0	.25538	.23673	7.88	.46356	.44279	4.69	.54220	.51293	5.71
79.500	1.000	2.74									
83.000	3.500	0.0	.34915	.38420	-9.12	.47950	.48574	-1.29	.54169	.51188	5.82
95.500	12.500	0.0	.32942	.36099	-8.75	.47419	.48165	-1.55	.54377	.51219	6.17
120.000	24.500	0.0	.28776	.29547	-2.61	.46703	.46240	1.00	.54238	.51088	6.17
129.250	9.250	0.0	.27032	.25101	7.69	.46436	.44394	4.60	.54112	.51011	6.08
144.000	14.750	0.0	.25674	.23894	7.45	.46097	.44134	4.45	.53873	.50898	5.85
167.750	23.750	0.0	.23895	.21607	10.6	.45590	.43531	4.73	.53465	.50728	5.40
168.750	1.000	2.74									
178.500	9.750	0.0	.32900	.36372	-9.55	.46218	.48206	-4.12	.53270	.50630	5.21
196.750	18.250	0.0	.29412	.32140	-8.49	.46170	.44443	3.89	.53177	.50623	5.04
205.250	8.500	0.0	.27608	.27090	1.91	.45969	.44148	4.13	.53144	.50634	4.96
216.250	11.000	0.0	.26186	.25466	2.82	.45759	.43959	4.09	.53066	.50634	4.80
226.000	9.750	0.0	.25345	.23739	6.76	.45540	.43266	5.26	.52956	.50645	4.56
227.000	1.000	3.29									
243.000	16.000	0.0	.32989	.36235	-8.96	.47564	.48287	-1.50	.54268	.52513	3.34
254.000	11.000	0.0	.30786	.33505	-8.12	.47053	.47141	-.186	.54321	.52193	4.08
264.500	10.500	0.0	.29381	.31049	-5.37	.46790	.46363	.921	.54236	.51950	4.40
287.000	22.500	0.0	.26212	.24114	8.70	.46201	.44346	4.18	.53932	.51356	5.02
317.500	30.500	0.0	.23570	.20475	15.1	.45554	.43109	5.67	.53417	.50816	5.12
318.500	1.000	3.29									
338.500	20.000	0.0	.31845	.34734	-8.32	.46932	.46895	.778E-01	.53716	.50638	6.08
360.500	22.000	0.0	.27954	.25679	8.86	.46322	.44293	4.58	.53703	.50649	6.03
368.500	8.000	0.0	.26671	.24324	9.65	.46097	.43904	5.00	.53630	.50649	5.89
369.500	1.000	1.65									
385.500	16.000	0.0	.30964	.35417	-12.6	.46281	.43518	6.35	.53423	.50660	5.45
407.500	22.000	0.0	.27039	.25588	5.67	.45919	.43040	6.69	.53265	.50697	5.07
416.000	8.500	0.0	.25620	.24063	6.47	.45724	.42662	7.18	.53183	.50728	4.84
417.000	1.000	3.29									
419.750	2.750	0.0	.34930	.38283	-8.76	.48534	.48574	-.824E-01	.54879	.50743	8.15
432.500	12.750	0.0	.33209	.39239	-15.4	.47878	.48574	-1.43	.55051	.50436	9.15
439.750	7.250	0.0	.31804	.39239	-18.9	.47603	.48574	-2.00	.54965	.50575	8.68
456.250	16.500	0.0	.29421	.39239	-25.0	.47122	.48574	-2.99	.54731	.53395	2.50
463.000	6.750	0.0	.28018	.34461	-18.7	.46914	.48246	-2.76	.54609	.52454	4.11
486.750	23.750	0.0	.25528	.25466	.245	.46294	.48574	-4.69	.54146	.51664	4.80
489.750	3.000	0.0	.25383	.25238	.574	.46213	.45462	1.65	.54088	.51555	4.91
504.000	14.250	0.0	.24320	.23791	2.23	.45909	.44501	3.17	.53812	.51272	4.95

Table D-7 .

\- COLUMN NUMBER ---- 6

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
94.250	94.250	0.0	.20098	.20470	-1.82	.43120	.40950	5.30	.50176	.48695	3.04
95.250	1.000	0.0	.19994	.20200	-1.02	.43109	.40930	5.32	.50175	.48690	3.05
96.250	1.000	2.74									
102.750	6.500	0.0	.30503	.35550	-14.2	.43014	.40912	5.14	.50159	.48579	3.25
112.250	9.500	0.0	.29043	.32950	-11.9	.42955	.40900	5.02	.50145	.48510	3.37
144.250	32.000	0.0	.23891	.20390	17.2	.42844	.40930	4.68	.50096	.48351	3.61
145.250	1.000	1.37									
146.500	1.250	0.0	.28353	.21542	31.6	.42823	.40930	4.63	.50090	.48423	3.44
160.750	14.250	0.0	.26496	.22483	17.8	.42763	.40930	4.48	.50074	.48114	4.07
168.250	7.500	0.0	.24404	.20670	18.1	.42738	.40930	4.42	.50066	.48104	4.08
171.750	3.500	0.0	.24074	.37370	-35.6	.42727	.46261	-7.64	.50062	.48069	4.15
218.750	47.000	0.0									
219.750	1.000	2.74									
243.750	24.000	0.0	.26145	.33080	-21.0	.42507	.45364	-6.30	.49893	.48755	2.33
255.750	12.000	0.0	.24399	.31000	-21.3	.42489	.44428	-4.36	.49881	.48760	2.30
267.750	12.000	0.0	.22954	.23325	-1.59	.42474	.42751	-.648	.49867	.48830	2.12
279.750	12.000	0.0	.22096	.22293	-.885	.42460	.43102	-1.49	.49853	.48770	2.22
288.500	8.750	0.0	.20563	.20275	1.42	.42449	.42216	.551	.49842	.48810	2.11
289.500	1.000	1.65									
292.250	2.750	0.0	.25626	.32040	-20.0	.42442	.42946	-1.17	.49835	.48800	2.12
307.500	15.250	0.0	.24469	.26320	-7.03	.42420	.42262	.375	.49811	.48685	2.31
310.500	3.000	0.0	.24200	.24152	.197	.42417	.42101	.750	.49807	.48690	2.29
328.750	18.250	0.0	.22392	.21301	5.12	.42400	.41844	1.33	.49777	.48546	2.54
335.500	6.750	0.0	.21056	.20450	2.96	.42397	.41590	1.94	.49766	.48543	2.52
336.500	1.000	2.47									
351.750	15.250	0.0	.28632	.33600	-14.8	.42384	.42073	.739	.49689	.48471	2.51
376.250	24.500	0.0	.24228	.23398	3.55	.42379	.41807	1.37	.49643	.48387	2.60
381.250	5.000	0.0	.23739	.22236	6.76	.42378	.41707	1.61	.49634	.48405	2.54
424.250	43.000	0.0	.19423	.19950	-2.64	.42373	.40885	3.64	.49558	.48149	2.93
425.250	1.000	2.47									
502.750	77.500	0.0	.19390	.19950	-2.81	.42359	.40870	3.64	.49439	.47600	3.86
503.750	1.000	5.21									
507.250	3.500	0.0	.33274	.36070	-7.75	.46271	.46261	.217E-01	.51816	.48191	7.52
519.750	12.500	0.0	.31521	.33600	-6.19	.45906	.45364	1.19	.51840	.48564	6.75
544.250	24.500	0.0	.26752	.23905	11.9	.45156	.43570	3.64	.51977	.48695	6.74
553.500	9.250	0.0	.24459	.21770	12.4	.44926	.42239	6.36	.51969	.48795	6.50
568.250	14.750	0.0	.24209	.20265	19.5	.44610	.42156	5.82	.51914	.48620	6.78
569.250	1.000	2.74									
592.000	22.750	0.0	.30194	.32300	-6.52	.45591	.45130	1.02	.52168	.48940	6.59
602.750	10.750	0.0	.27542	.26060	5.69	.45302	.44506	1.79	.52180	.48940	6.62
621.000	18.250	0.0	.24427	.22581	8.18	.44909	.43063	4.29	.52124	.48880	6.64
629.500	8.500	0.0	.24019	.20626	16.5	.44727	.42234	5.90	.52077	.48850	6.61
630.500	1.000	2.74									
640.500	10.000	0.0	.32606	.35420	-7.95	.46058	.46066	-.182E-01	.52138	.48860	6.71
650.250	9.750	0.0	.30619	.32300	-5.21	.45725	.45910	-.402	.52206	.49020	6.50

Table D-7 ,continued.
- COLUMN NUMBER ---- 6

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
666.750	16.500	0.0	.27465	.26450	3.84	.45312	.44818	1.10	.52226	.49050	6.48
677.750	11.000	0.0	.24811	.22819	8.73	.45038	.43570	3.37	.52195	.49070	6.37
678.750	1.000	1.10									
688.750	10.000	0.0	.28314	.24123	17.4	.44806	.43258	3.58	.52127	.48970	6.45
711.250	22.500	0.0	.24491	.22113	10.8	.44450	.42184	5.37	.51967	.48800	6.49
712.250	1.000	1.10									
741.750	29.500	0.0	.23969	.21400	12.0	.44053	.41686	5.68	.51701	.48680	6.21
742.750	1.000	2.20									
762.750	20.000	0.0	.29729	.36070	-17.6	.44100	.42161	4.60	.51521	.48540	6.14
784.750	22.000	0.0	.25011	.28140	-11.1	.44015	.41903	5.04	.51368	.48432	6.06
792.750	8.000	0.0	.24155	.23166	4.27	.43940	.41729	5.30	.51319	.48441	5.94
809.750	17.000	0.0	.23035	.20678	11.4	.43740	.41470	5.47	.51214	.48230	6.19
810.750	1.000	2.70									
831.750	21.000	0.0	.29958	.33080	-9.44	.44198	.43843	.810	.51071	.48850	4.55
844.000	12.250	0.0	.26883	.25930	3.67	.44115	.42372	4.11	.51021	.49000	4.13
856.750	12.750	0.0	.24663	.23746	3.86	.43956	.42290	3.94	.50978	.49020	4.00
864.000	7.250	0.0	.24142	.22321	8.16	.43865	.42106	4.18	.50952	.49075	3.83
865.000	1.000	1.37									
880.500	15.500	0.0	.27039	.23166	16.7	.43623	.42032	3.79	.50876	.49035	3.75
887.250	6.750	0.0	.25560	.22392	14.1	.43552	.41853	4.06	.50844	.49090	3.57
888.250	1.000	2.20									
911.000	22.750	0.0	.29804	.35160	-15.2	.44612	.45481	-1.91	.50778	.49612	2.35
914.000	3.000	0.0	.29189	.35030	-16.7	.44549	.44779	-.513	.50783	.49620	2.34
928.250	14.250	0.0	.26487	.32300	-18.0	.44286	.43960	.741	.50806	.49660	2.31

Table D-8 .

\- COLUMN NUMBER ---- 9

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
18.250	18.250	0.0									
19.250	1.000	1.10									
26.250	7.000	0.0	.27401	.21844	25.4	.42240	.41762	1.14	.49151	.46241	6.29
94.250	68.000	0.0	.19697	.18953	3.93	.40556	.39622	2.36	.47541	.45982	3.39
95.250	1.000	0.0	.19575	.18953	3.28	.40543	.39607	2.36	.47537	.45976	3.40
96.250	1.000	2.74									
97.500	1.250	0.0	.31627	.34266	-7.70	.40508	.39607	2.27	.47508	.45976	3.33
102.750	5.250	0.0	.29712	.34266	-13.3	.41214	.39566	4.16	.47439	.45951	3.24
112.000	9.250	0.0	.27951	.29697	-5.88	.41624	.39566	5.20	.47399	.45885	3.30
144.250	32.250	0.0	.22912	.19404	18.1	.40940	.39593	3.40	.47598	.45838	3.84
145.250	1.000	1.37									
146.500	1.250	0.0	.28186	.21352	32.0	.40847	.39708	2.87	.47583	.45832	3.82
160.750	14.250	0.0	.25573	.22242	15.0	.41097	.39548	3.92	.47545	.45712	4.01
168.250	7.500	0.0	.24081	.20691	16.4	.41009	.39560	3.66	.47554	.45732	3.98
172.750	4.500	0.0	.23213	.19773	17.4	.40926	.39554	3.47	.47557	.45732	3.99
218.750	46.000	0.0									
219.750	1.000	2.74									
243.750	24.000	0.0	.25641	.27968	-8.32	.41283	.43170	-4.37	.47254	.46569	1.47
255.750	12.000	0.0	.23981	.23151	3.58	.41093	.43096	-4.65	.47498	.46289	2.61
267.750	12.000	0.0	.22620	.21007	7.68	.40826	.42355	-3.61	.47566	.46246	2.85
279.750	12.000	0.0	.21661	.19636	10.3	.40610	.41762	-2.76	.47535	.46569	2.07
282.500	2.750	0.0	.21419	.19214	11.5	.40569	.41762	-2.86	.47513	.46130	3.00
283.500	1.000	1.65									
288.500	5.000	0.0	.27150	.30685	-11.5	.40486	.41466	-2.36	.47425	.46133	2.80
292.250	3.750	0.0	.26295	.28215	-6.80	.40468	.40947	-1.17	.47394	.46124	2.75
307.500	15.250	0.0	.23705	.22807	3.94	.40749	.40799	-.121	.47304	.46073	2.67
310.500	3.000	0.0	.23201	.22201	4.51	.40725	.40650	.183	.47286	.46067	2.65
328.750	18.250	0.0	.21798	.19380	12.5	.40474	.40175	.745	.47231	.45993	2.69
329.750	1.000	2.47									
351.750	22.000	0.0	.27026	.29944	-9.74	.41662	.42688	-2.40	.47648	.46084	3.39
376.250	24.500	0.0	.23228	.20971	10.8	.41060	.41762	-1.68	.47623	.46010	3.50
381.250	5.000	0.0	.22960	.19709	16.5	.40946	.41540	-1.43	.47601	.46059	3.35
382.250	1.000	2.47									
424.250	42.000	0.0	.24135	.20736	16.4	.41325	.43022	-3.94	.47782	.46360	3.07
502.750	78.500	0.0	.17708	.18953	-6.57	.40278	.42132	-4.40	.47167	.46312	1.84
503.750	1.000	4.67									
507.250	3.500	0.0	.31578	.35501	-11.1	.43693	.43763	-.159	.48827	.49028	-.409
519.750	12.500	0.0	.29602	.30932	-4.30	.42732	.43614	-2.02	.49165	.47147	4.28
544.250	24.500	0.0	.25400	.21858	16.2	.41925	.42985	-2.47	.48742	.46559	4.69
553.500	9.250	0.0	.23863	.19762	20.8	.41600	.42836	-2.89	.48512	.46502	4.32
554.500	1.000	2.74									
568.250	13.750	0.0	.30222	.32414	-6.76	.43242	.43392	-.347	.49825	.47337	5.26
592.000	23.750	0.0	.26428	.22641	16.7	.42356	.43318	-2.22	.49208	.46805	5.14
602.750	10.750	0.0	.24420	.20682	18.1	.41944	.42651	-1.66	.48902	.46612	4.91
621.000	18.250	0.0	.23043	.18525	24.4	.41391	.42392	-2.36	.48368	.46445	4.14

Table D-8 ,continued.

- COLUMN NUMBER ---- 9

ELAPSED TIME, HRS	TIME-SPAN HRS	RAIN CM	% MOISTURE 10.2 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 33.0 CM SIMULATED	ACTUAL	PCT ERROR	% MOISTURE 61.0 CM SIMULATED	ACTUAL	PCT ERROR
622.000	1.000	3.30									
629.500	7.500	0.0	.30874	.32661	-5.47	.43569	.43540	.656E-01	.50051	.48256	3.72
640.500	11.000	0.0	.29386	.29203	.627	.43102	.43466	-.837	.49804	.47200	5.52
650.250	9.750	0.0	.27580	.22999	19.9	.42722	.43429	-1.63	.49547	.46979	5.47
667.250	17.000	0.0	.25103	.20745	21.0	.42106	.42873	-1.79	.49033	.46626	5.16
678.250	11.000	0.0	.23270	.20384	14.2	.41701	.42207	-1.20	.48710	.46526	4.69
688.750	10.500	0.0	.23129	.20384	13.5	.41422	.42281	-2.03	.48386	.46398	4.29
711.250	22.500	0.0	.21224	.19807	7.15	.40837	.41540	-1.69	.47732	.46198	3.32
712.250	1.000	2.20									
741.750	29.500	0.0	.24257	.22834	6.23	.41179	.42392	-2.86	.47608	.46213	3.02
762.750	21.000	0.0	.22525	.19389	16.2	.40762	.41614	-2.05	.47560	.46159	3.04
763.750	1.000	2.74									
792.750	29.000	0.0	.26254	.23027	14.0	.41878	.43318	-3.32	.48068	.46865	2.57
809.750	17.000	0.0	.23535	.20853	12.9	.41265	.42799	-3.59	.47800	.46559	2.67
813.500	3.750	0.0	.23165	.19591	18.2	.41154	.42725	-3.68	.47739	.46706	2.21
814.500	1.000	2.74									
831.750	17.250	0.0	.29195	.30438	-4.08	.42570	.43540	-2.23	.48828	.47276	3.28
844.000	12.250	0.0	.26630	.22944	16.1	.42040	.43429	-3.20	.48731	.46995	3.69
856.750	12.750	0.0	.24702	.21492	14.9	.41702	.43096	-3.24	.48473	.46683	3.83
864.000	7.250	0.0	.23462	.19579	19.8	.41457	.43022	-3.64	.48306	.46645	3.56
865.000	1.000	2.74									
880.500	15.500	0.0	.29782	.32043	-7.06	.42977	.43614	-1.46	.49531	.47359	4.59
886.750	6.250	0.0	.28512	.27597	3.31	.42744	.43577	-1.91	.49423	.47192	4.73
911.000	24.250	0.0	.24526	.21025	16.7	.41895	.43096	-2.79	.48817	.46759	4.40
914.000	3.000	0.0	.24203	.19739	22.6	.41790	.42948	-2.70	.48735	.46698	4.36
915.000	1.000	2.74									
928.250	13.250	0.0	.30388	.32290	-5.89	.43336	.43540	-.469	.49932	.46683	6.96

Appendix E

MOISTURE BALANCE CURVES AND DATA

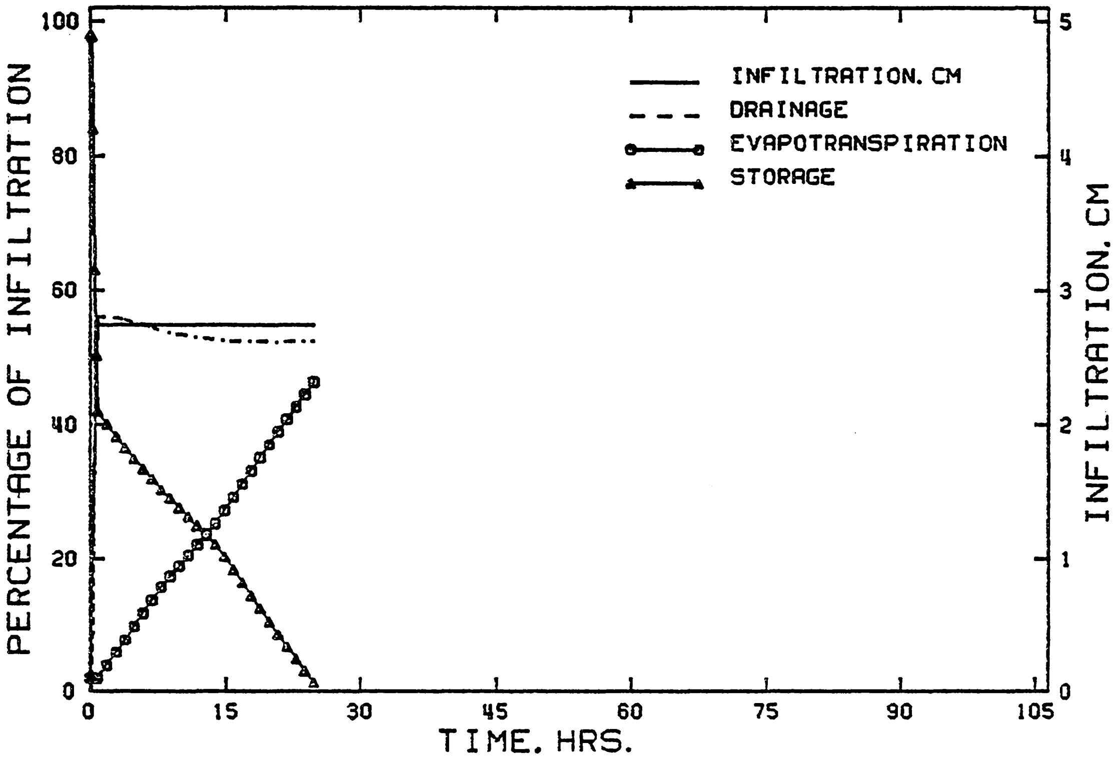

Figure E-1 : Moisture Balance in Root Zone for Column 4
(Root Zone = 53.535 Percent Saturated)

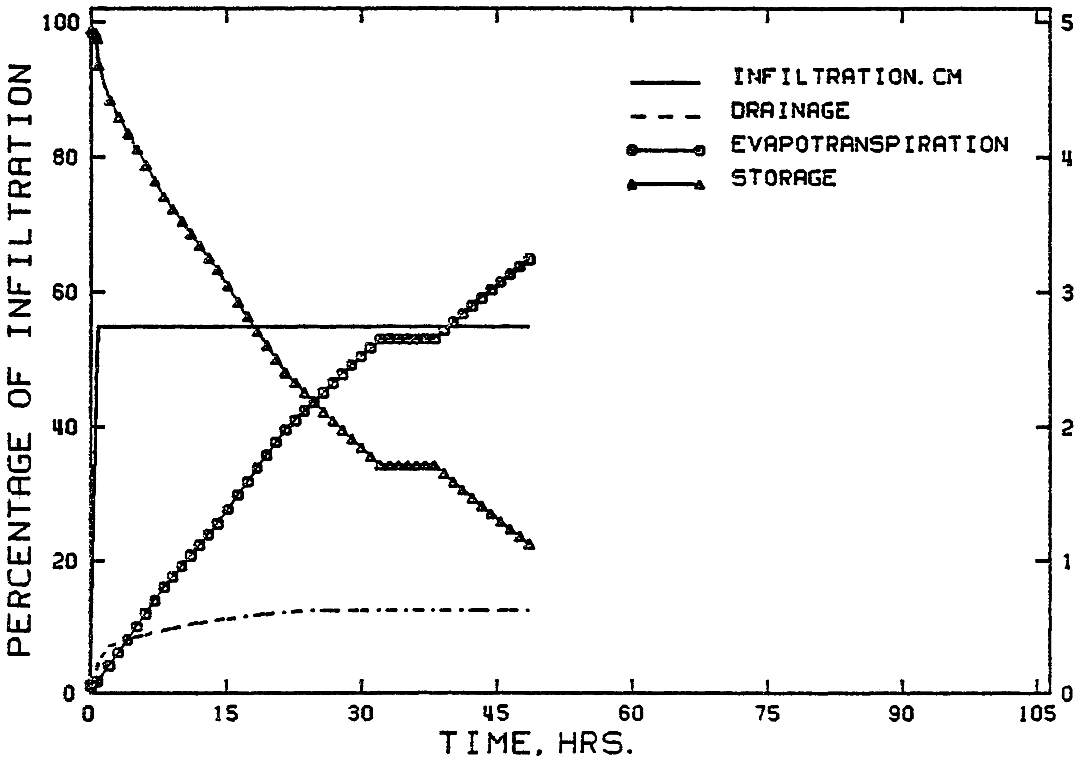

Figure E-2 : Moisture Balance in Root Zone for Column 4
(Root Zone = 64.784 Percent Saturated)

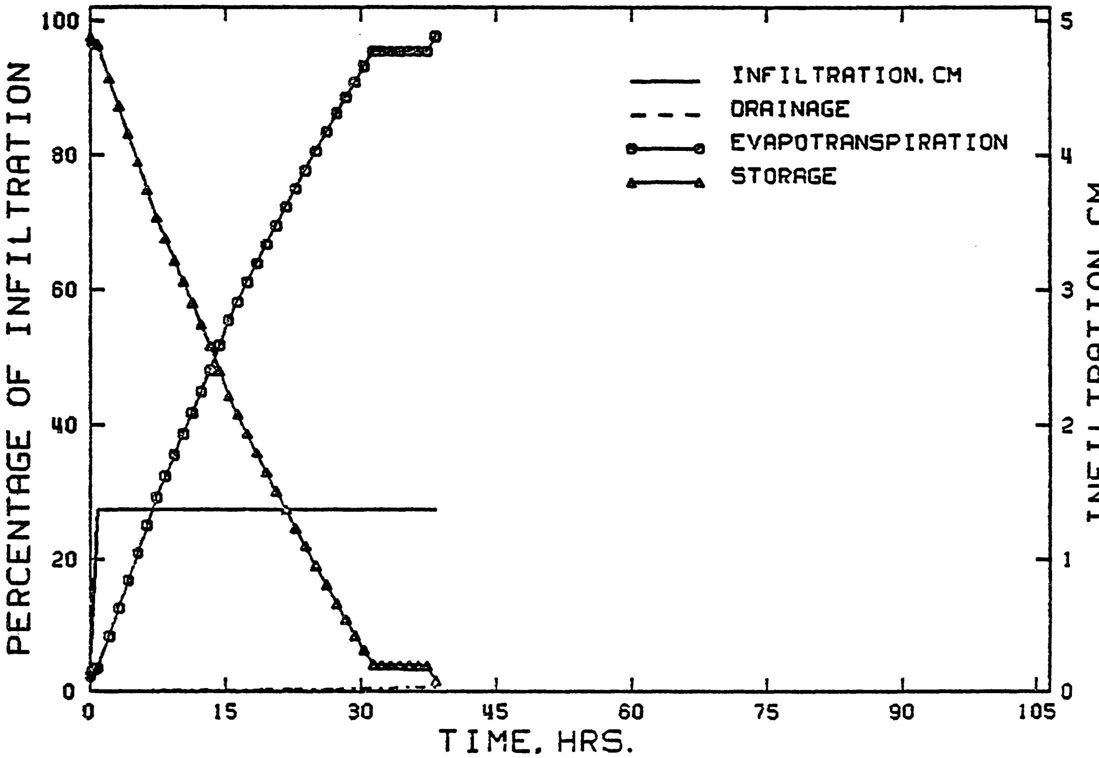

Figure E-3 : Moisture Balance in Root Zone for Column 4
(Root Zone = 52.722 Percent Saturated)

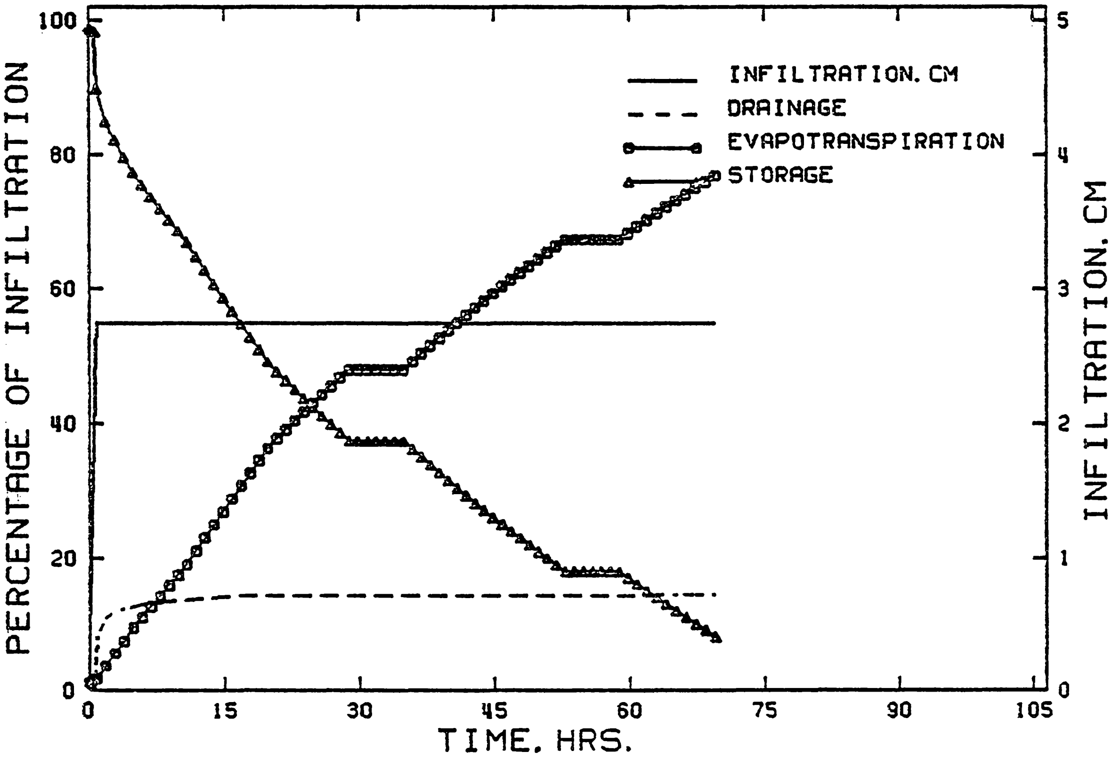

Figure E-4 : Moisture Balance in Root Zone for Column 4
(Root Zone = 56.172 Percent Saturated)

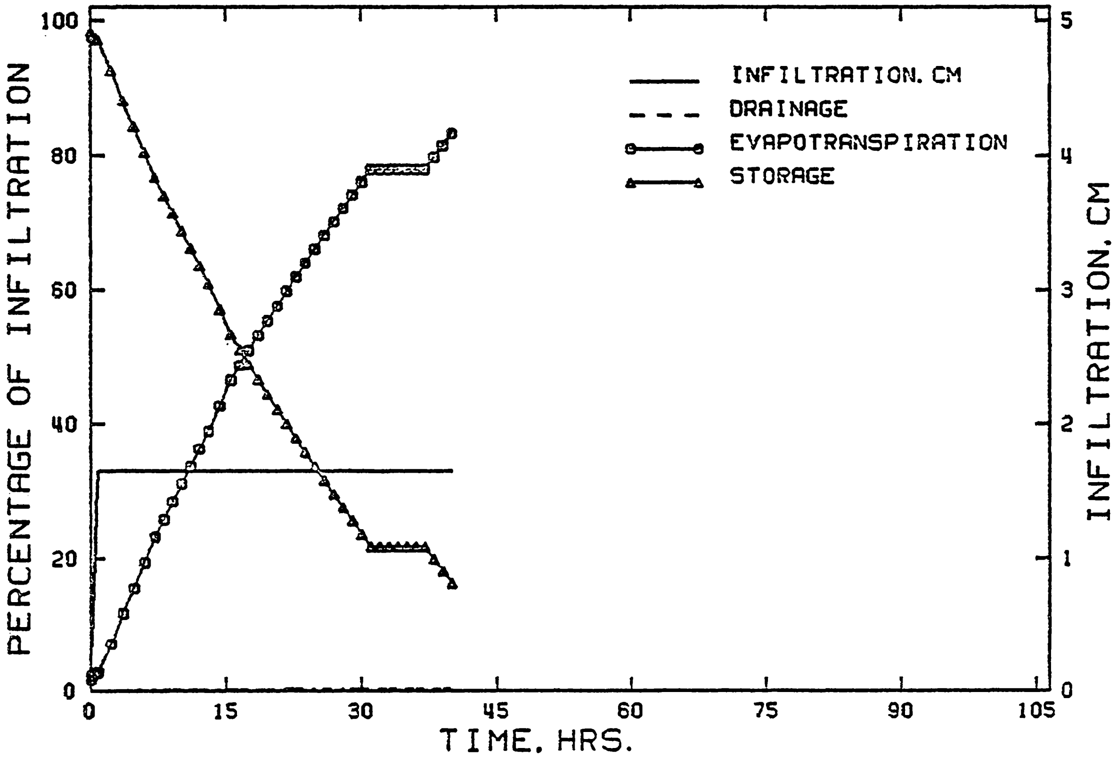

Figure E-5 : Moisture Balance in Root Zone for Column 4
(Root Zone = 58.991 Percent Saturated)

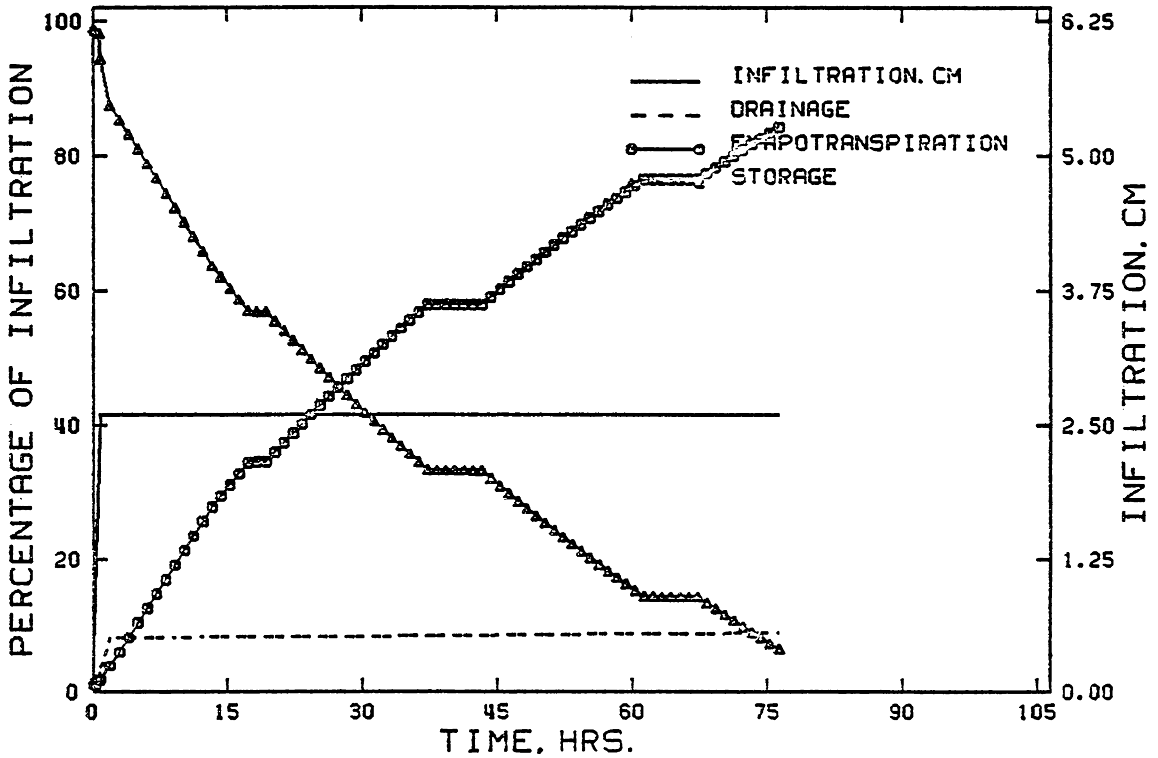

Figure E-6 : Moisture Balance in Root Zone for Column 4
(Root Zone = 52.745 Percent Saturated)

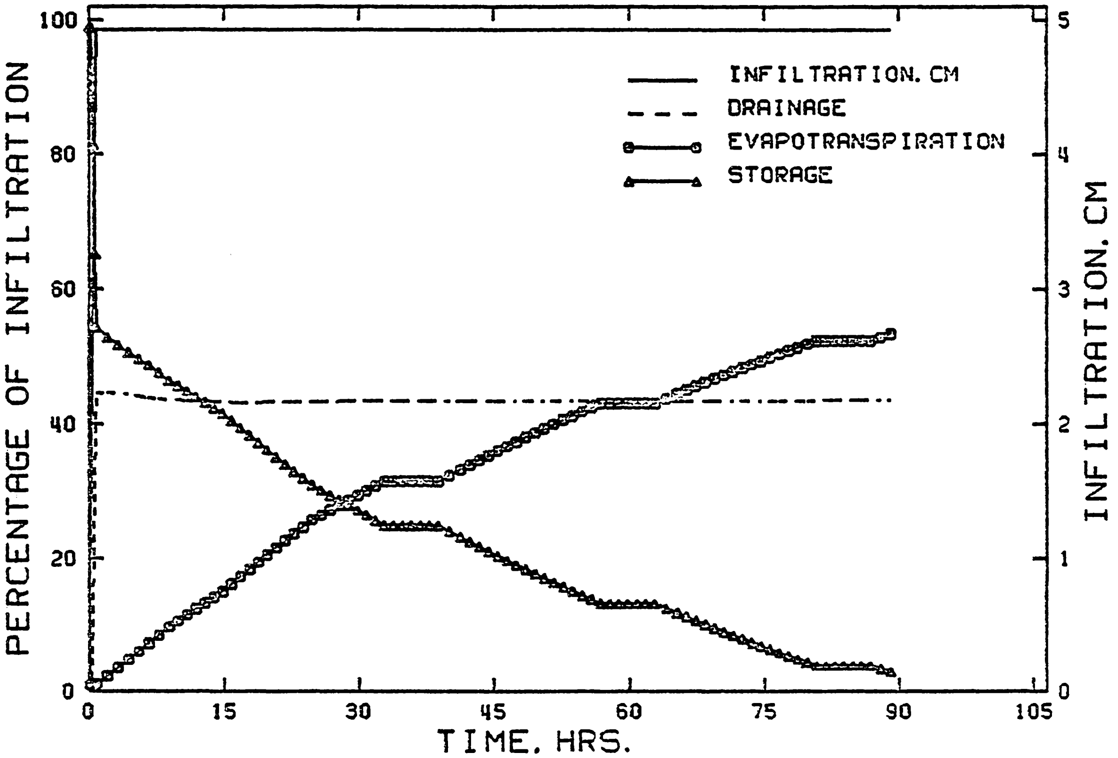

Figure E-7 : Moisture Balance in Root Zone for Column 4
(Root Zone = 65.662 Percent Saturated)

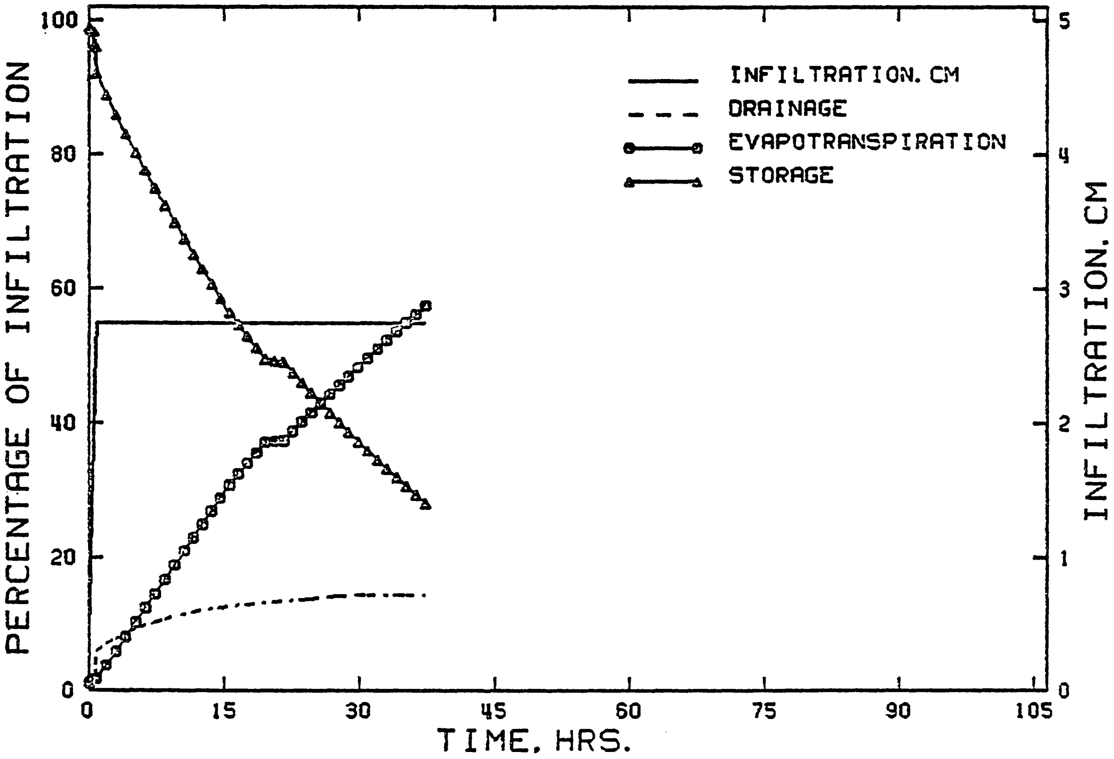

Figure E-8 : Moisture Balance in Root Zone for Column 4
(Root Zone = 64.814 Percent Saturated)

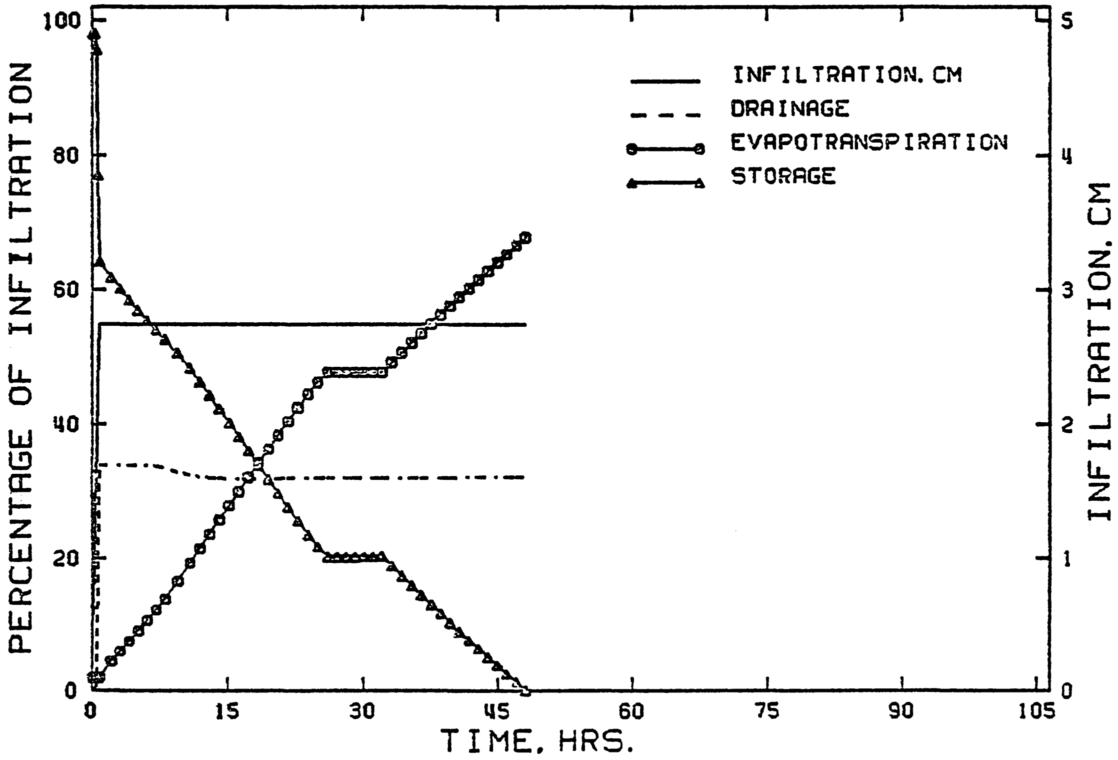

Figure E-9 : Moisture Balance in Root Zone for Column 4
(Root Zone = 70.700 Percent Saturated)

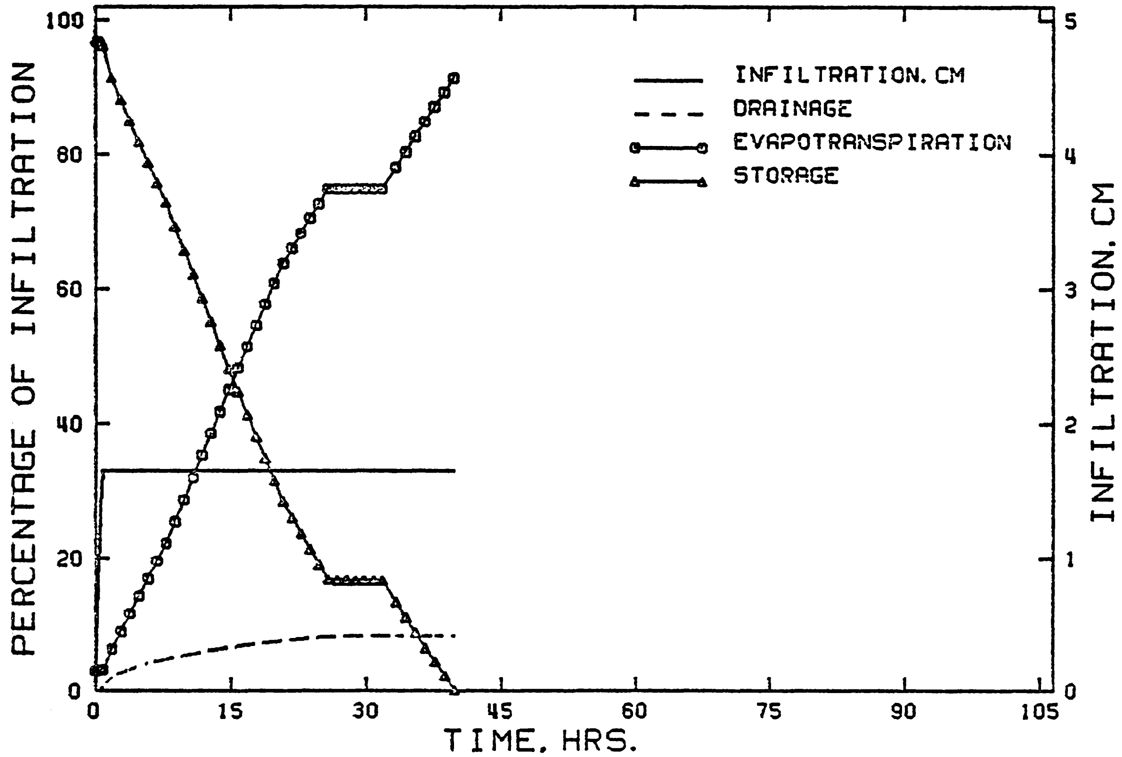

Figure E-10: Moisture Balance in Root Zone for Column 4
(Root Zone = 68.911 Percent Saturated)

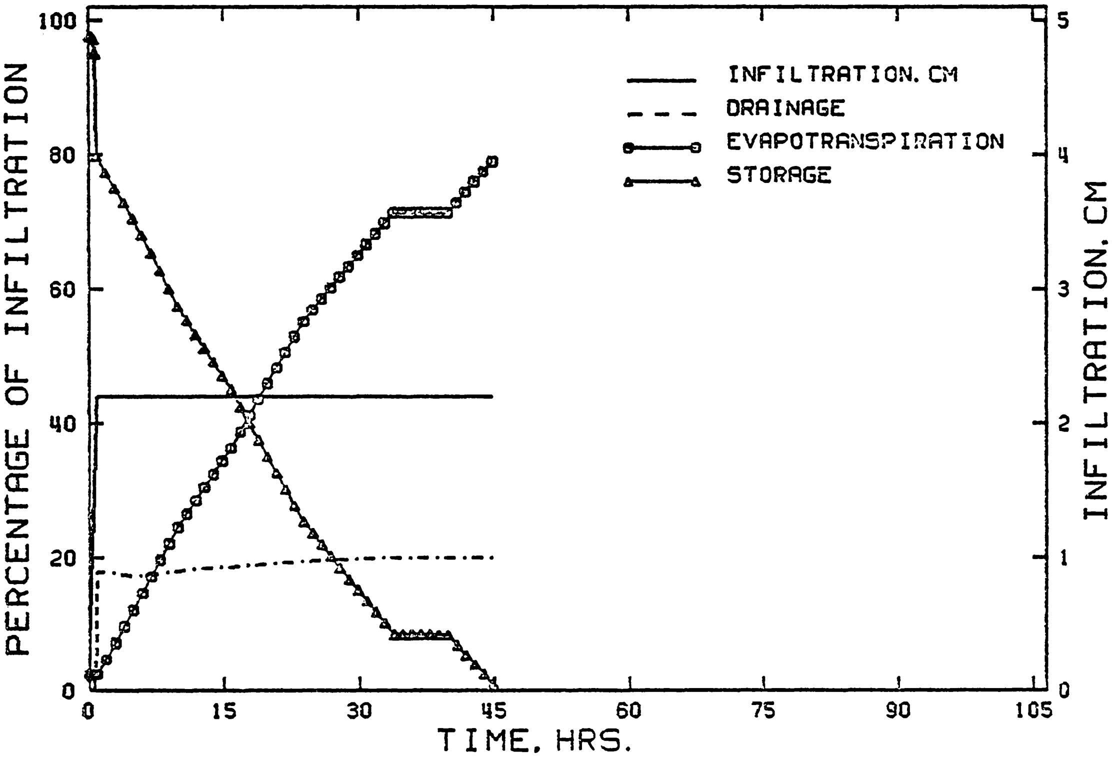

Figure E-11: Moisture Balance in Root Zone for Column 4
(Root Zone = 66.817 Percent Saturated)

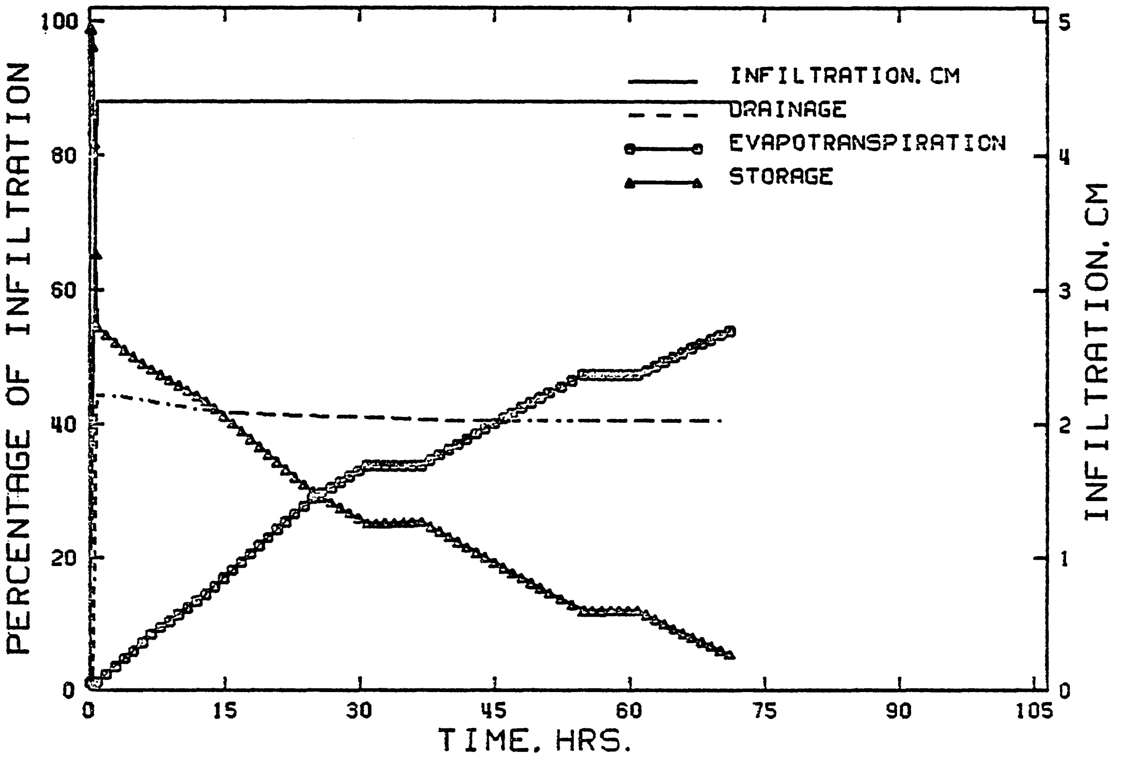

Figure E-12: Moisture Balance in Root Zone for Column 4
(Root Zone = 61.684 Percent Saturated)

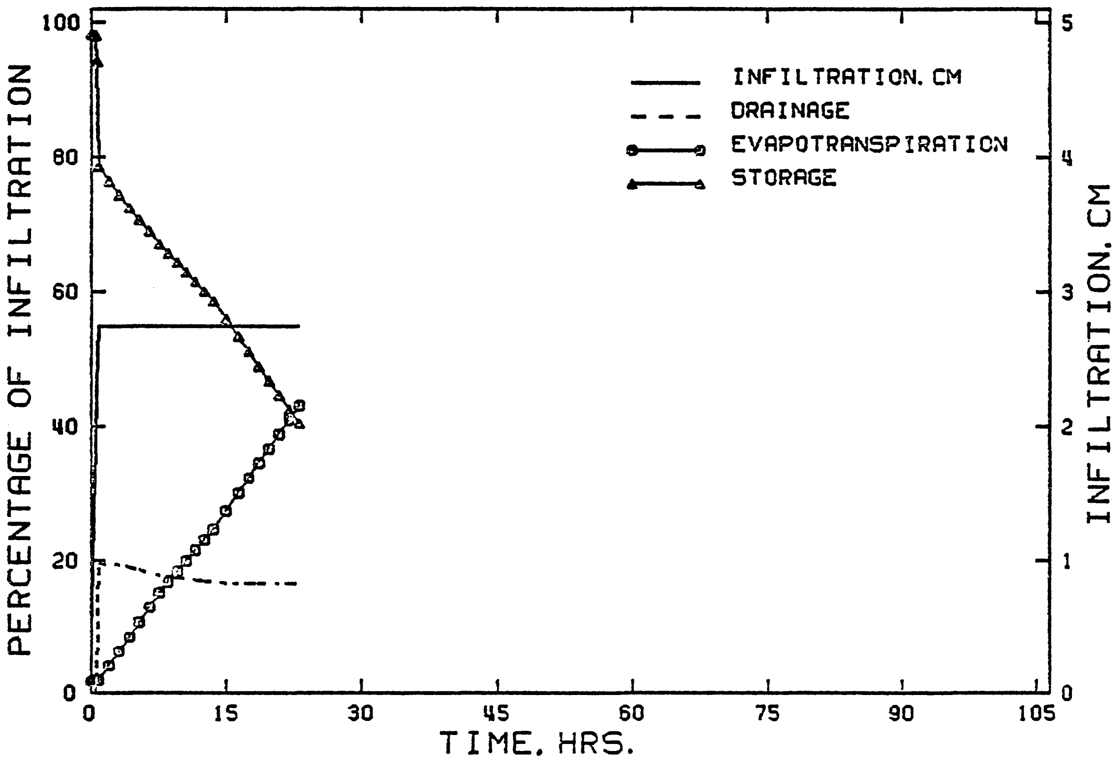

Figure E-13: Moisture Balance in Root Zone for Column 4
(Root Zone = 66.122 Percent Saturated)

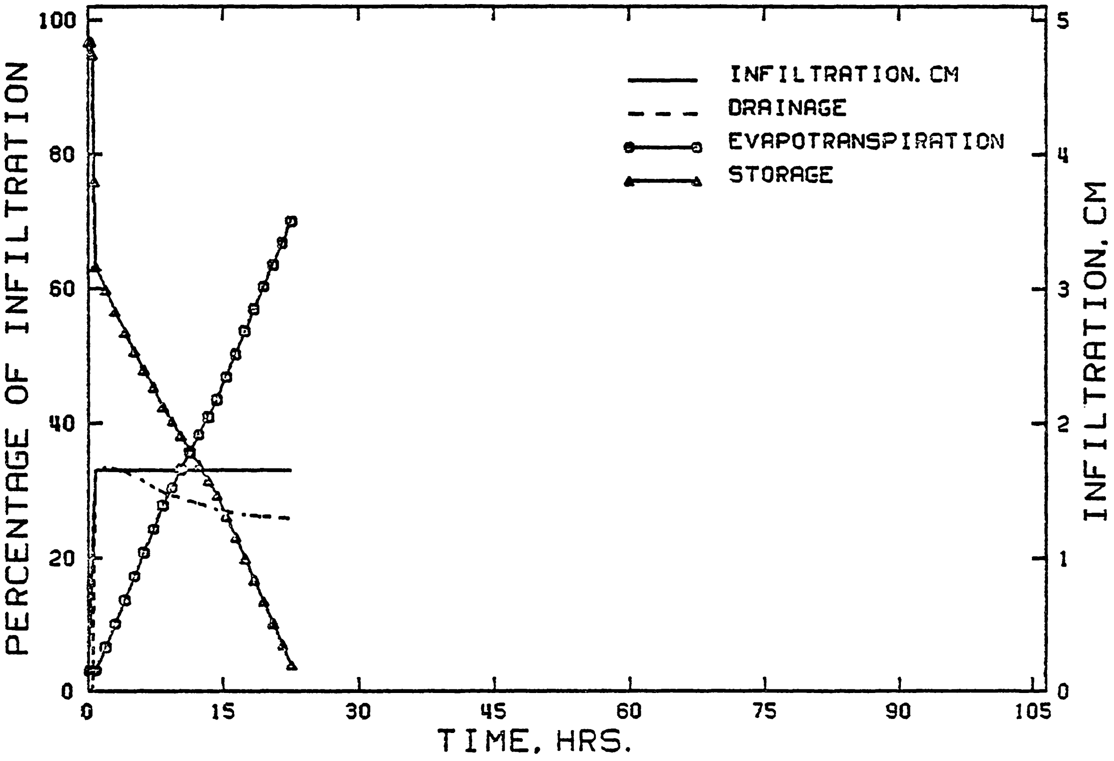

Figure E-14: Moisture Balance in Root Zone for Column 4
(Root Zone = 73.109 Percent Saturated)

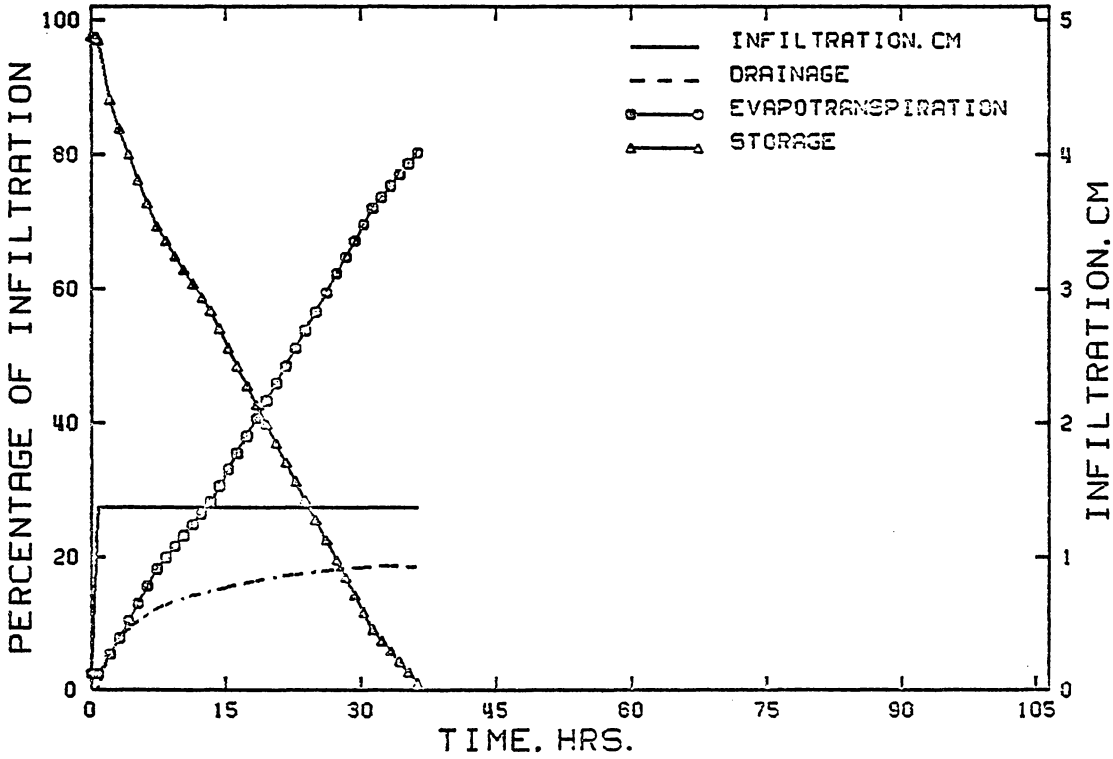

Figure E-15: Moisture Balance in Root Zone for Column 5
(Root Zone = 71.702 Percent Saturated)

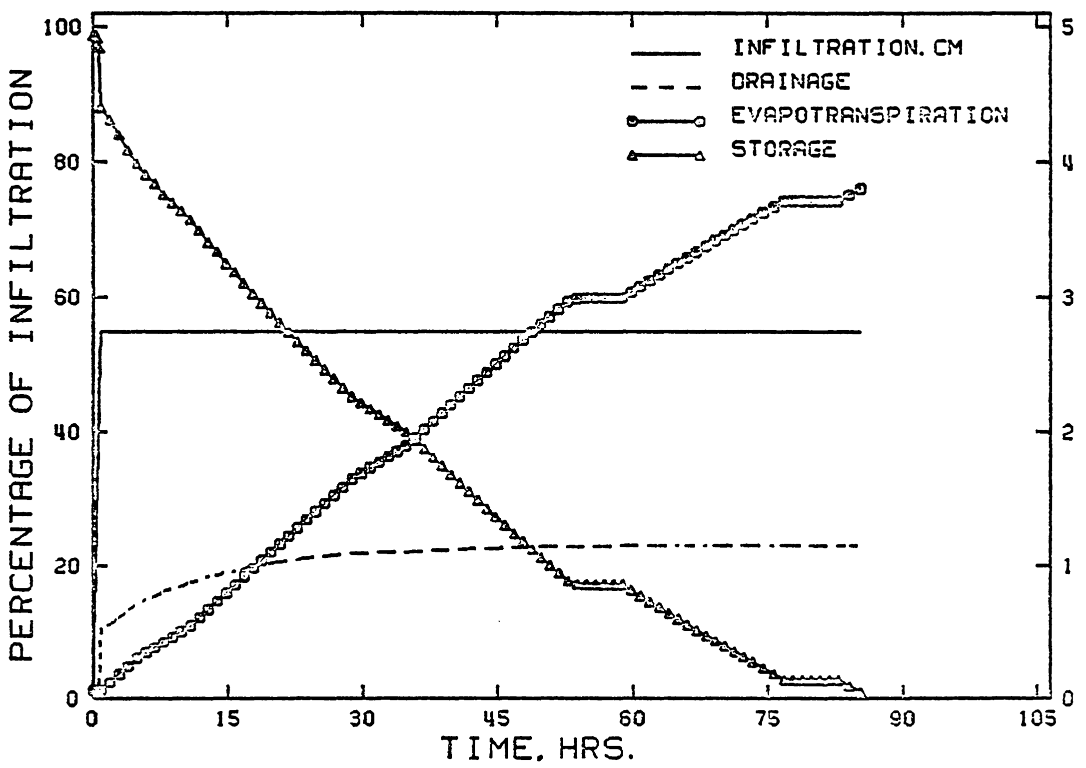

Figure E-16: Moisture Balance in Root Zone for Column 5
(Root Zone = 58.803 Percent Saturated)

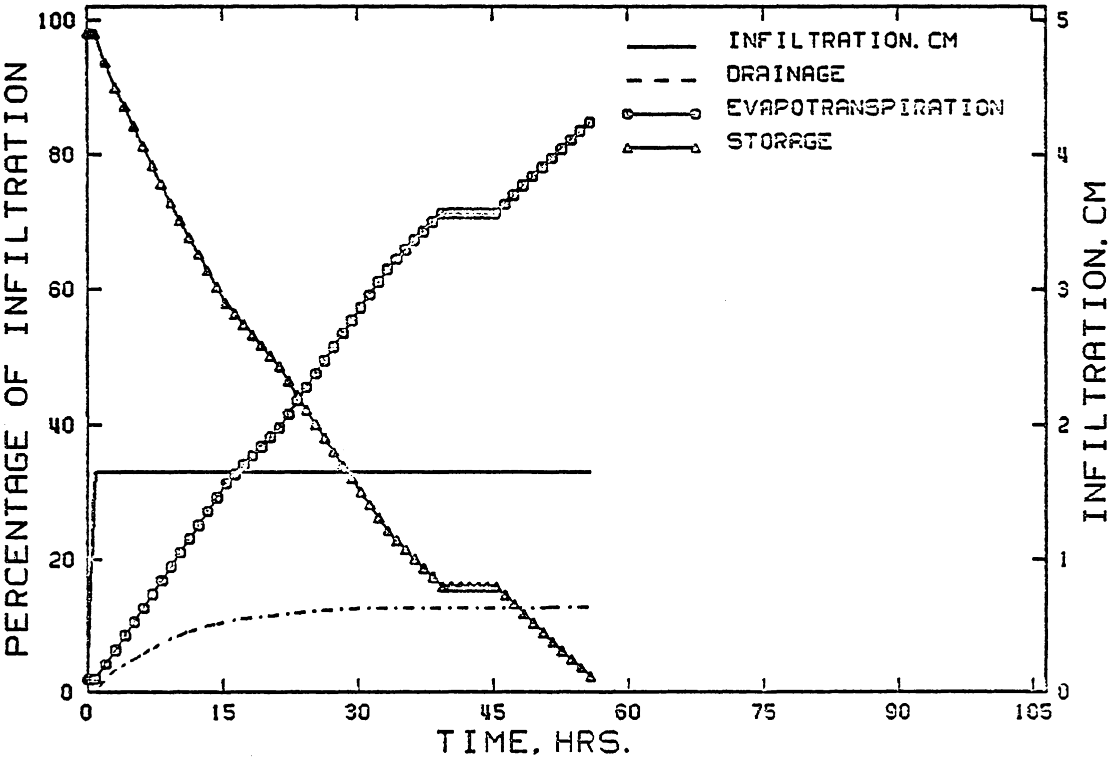

Figure E-17: Moisture Balance in Root Zone for Column 5 (Root Zone = 59.249 Percent Saturated)

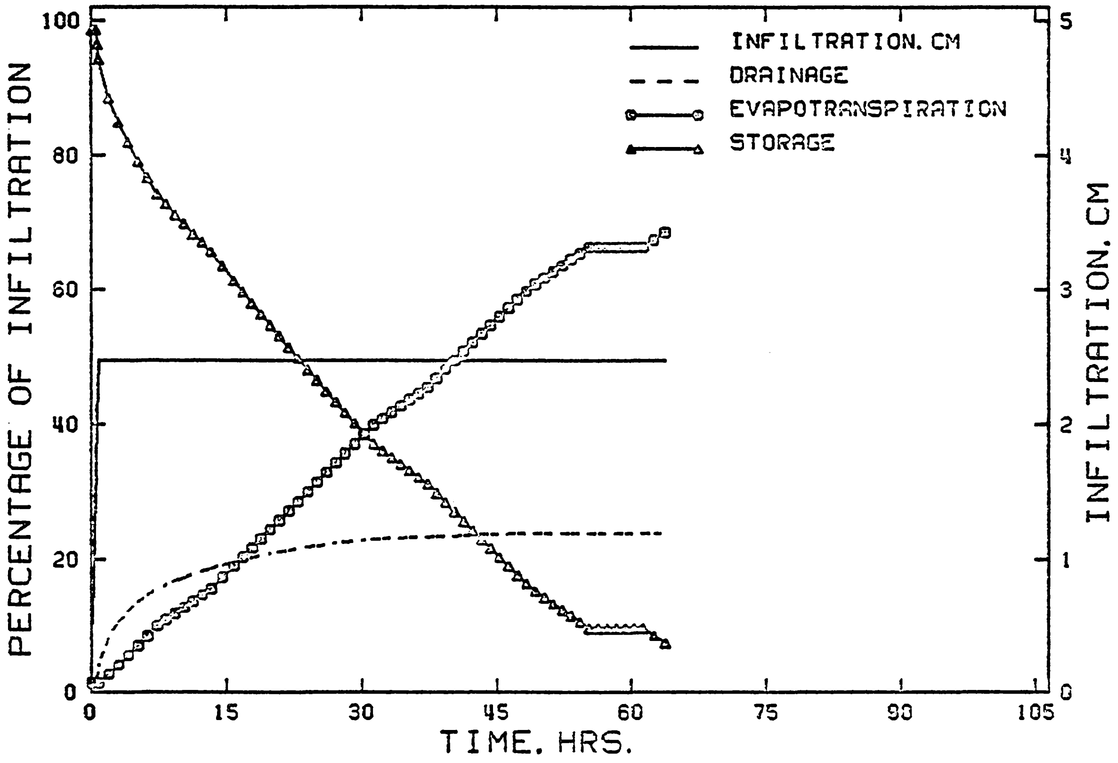

Figure E-18: Moisture Balance in Root Zone for Column 5
(Root Zone = 59.918 Percent Saturated)

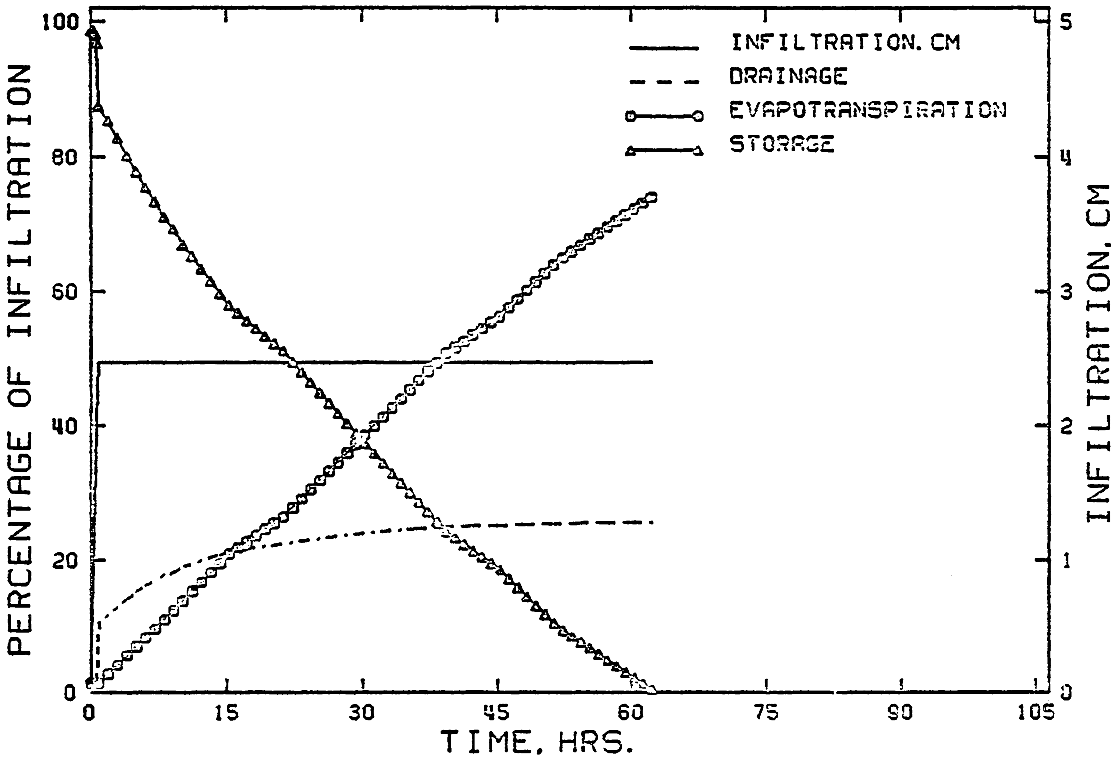

Figure E-19: Moisture Balance in Root Zone for Column 5
(Root Zone = 63.099 Percent Saturated)

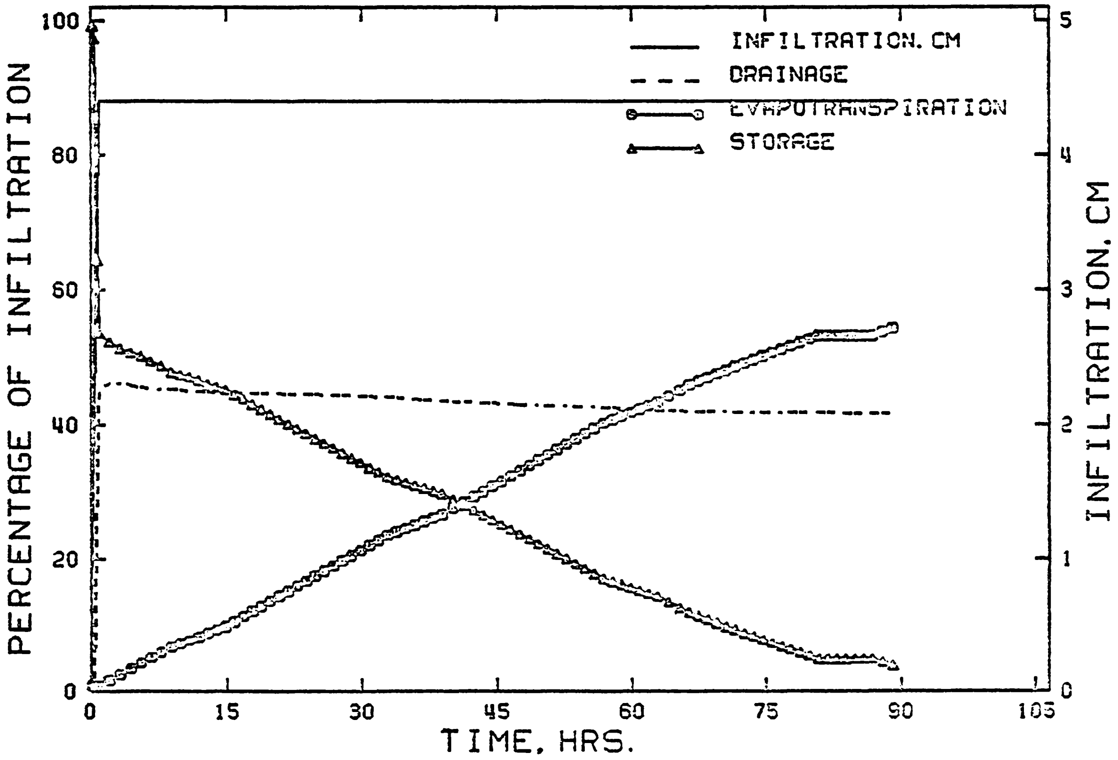

Figure E-20: Moisture Balance in Root Zone for Column 5
(Root Zone = 59.707 Percent Saturated)

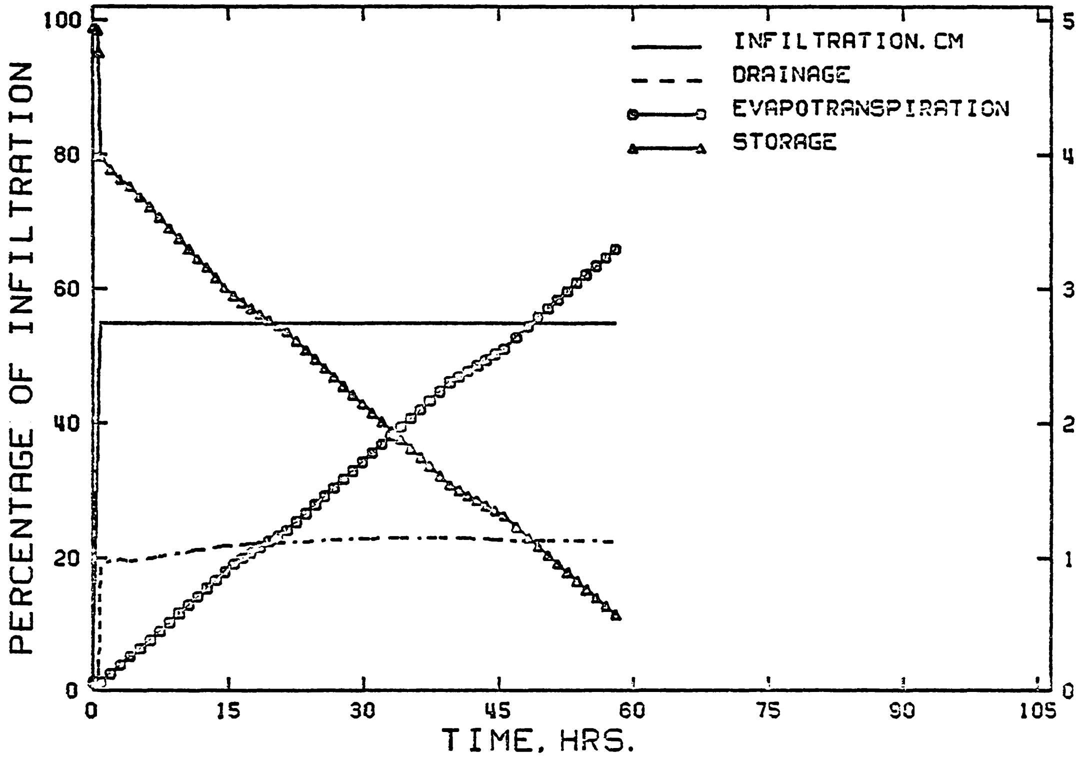

Figure E-21: Moisture Balance in Root Zone for Column 5
(Root Zone = 62.664 Percent Saturated)

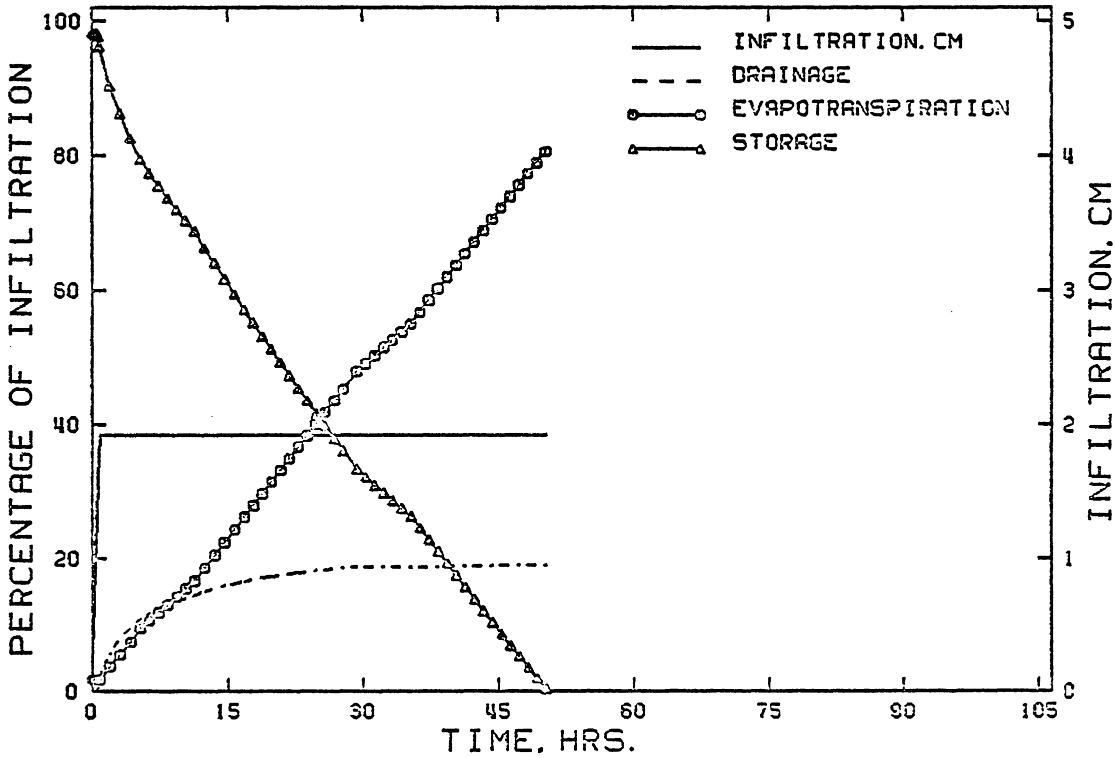

Figure E-22: Moisture Balance in Root Zone for Column 5
(Root Zone = 68.095 Percent Saturated)

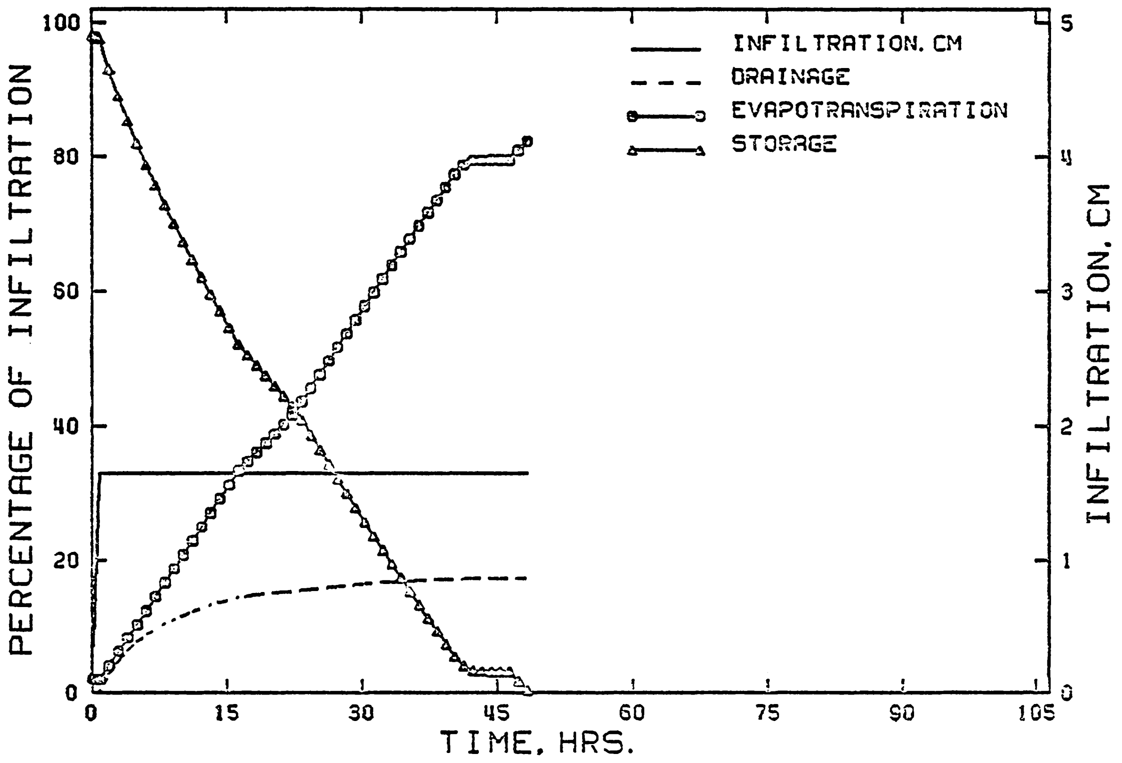

Figure E-23: Moisture Balance in Root Zone for Column 5
(Root Zone = 66.054 Percent Saturated)

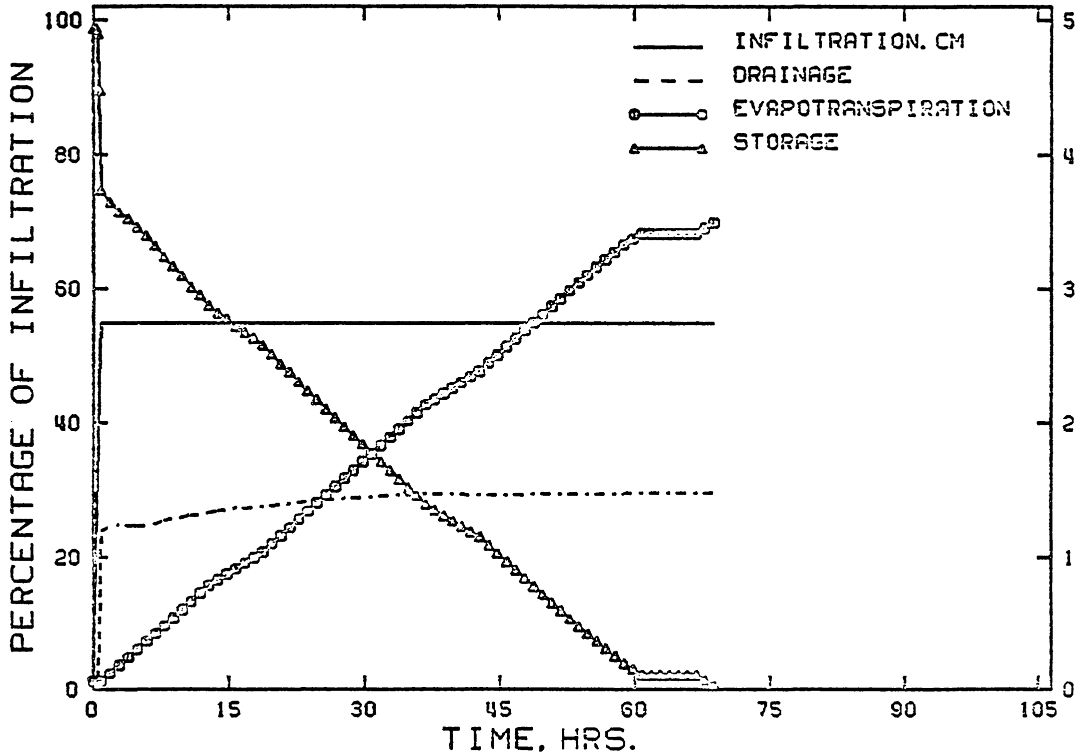

Figure E-24: Moisture Balance in Root Zone for Column 5
(Root Zone = 65.010 Percent Saturated)

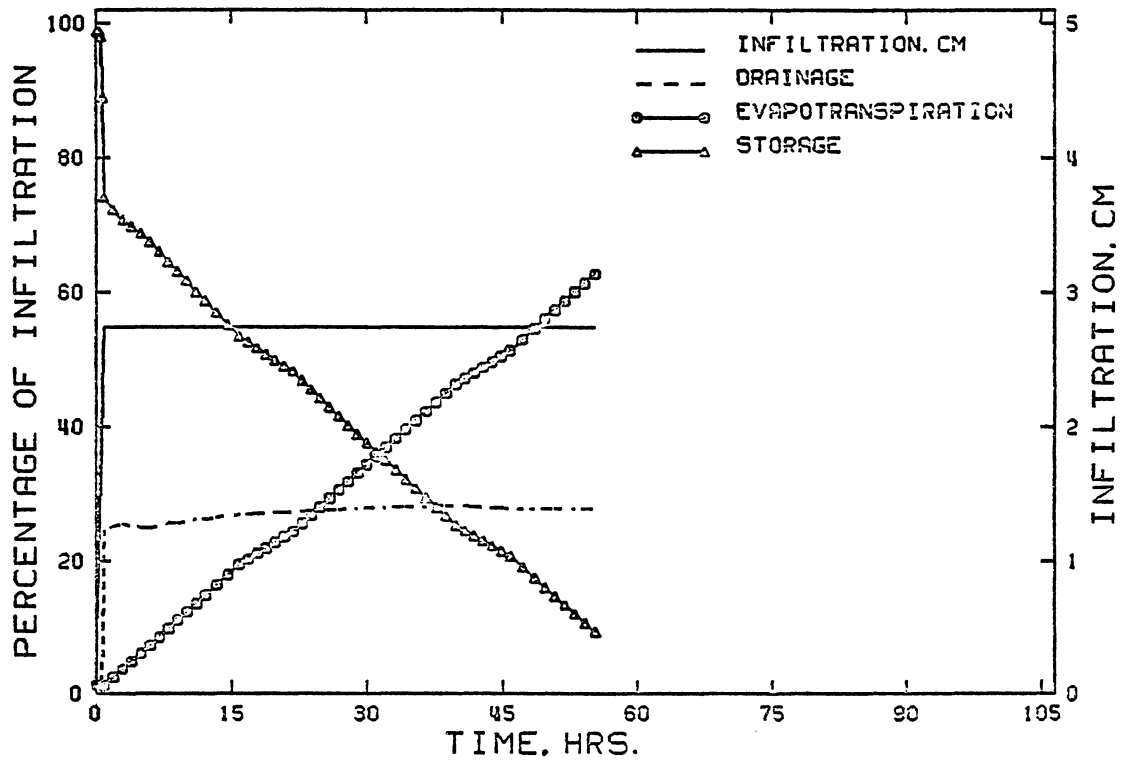

Figure E-25: Moisture Balance in Root Zone for Column 5
(Root Zone = 65.285 Percent Saturated)

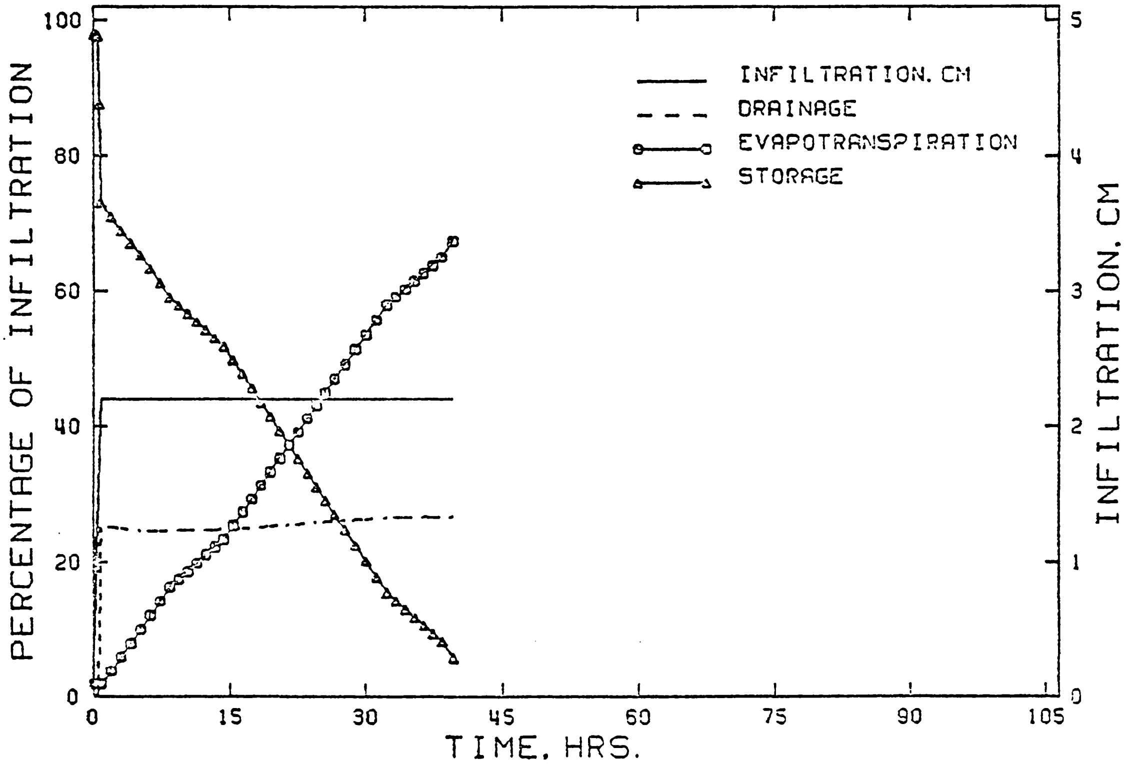

Figure E-26: Moisture Balance in Root Zone for Column 5
(Root Zone = 69.710 Percent Saturated)

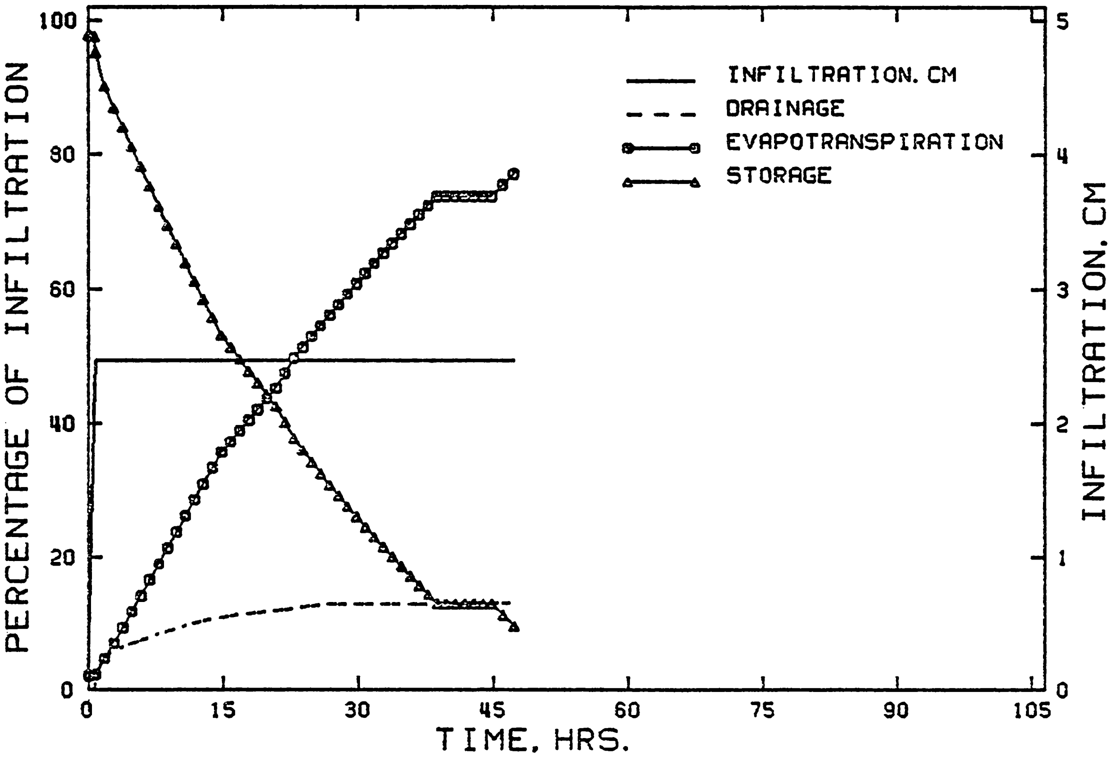

Figure E-27: Moisture Balance in Root Zone for Column 16
(Root Zone = 52.089 Percent Saturated)

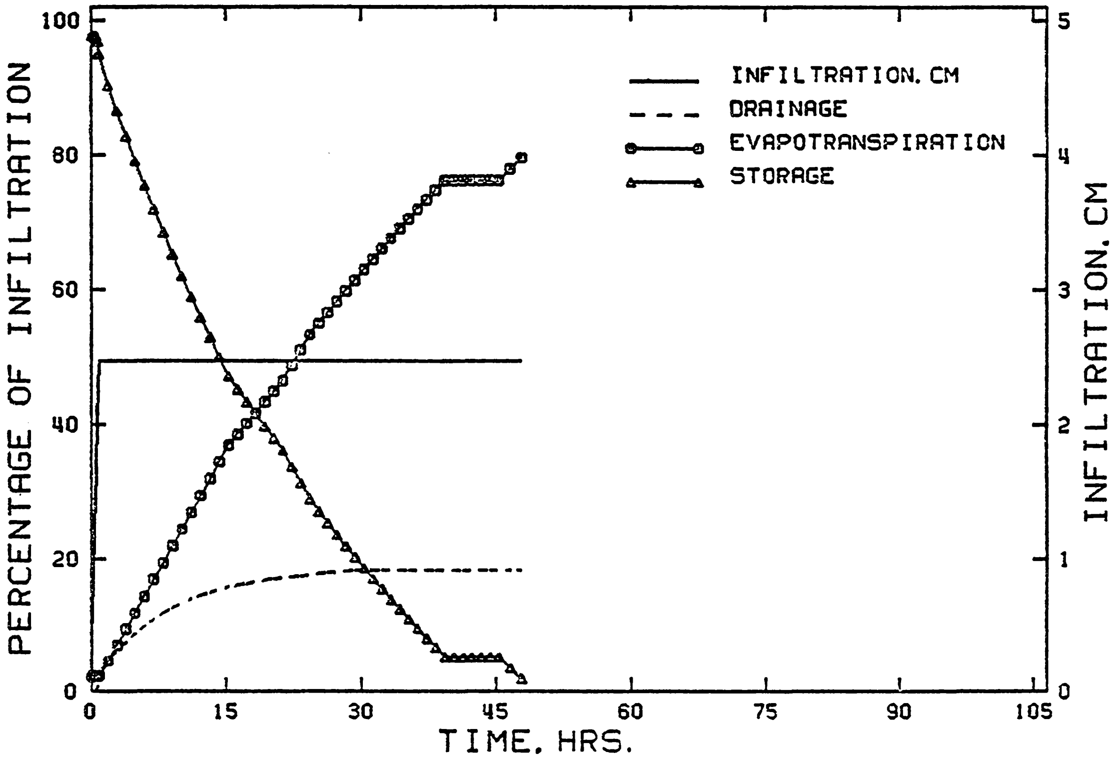

Figure E-28: Moisture Balance in Root Zone for Column 16
(Root Zone = 56.093 Percent Saturated)

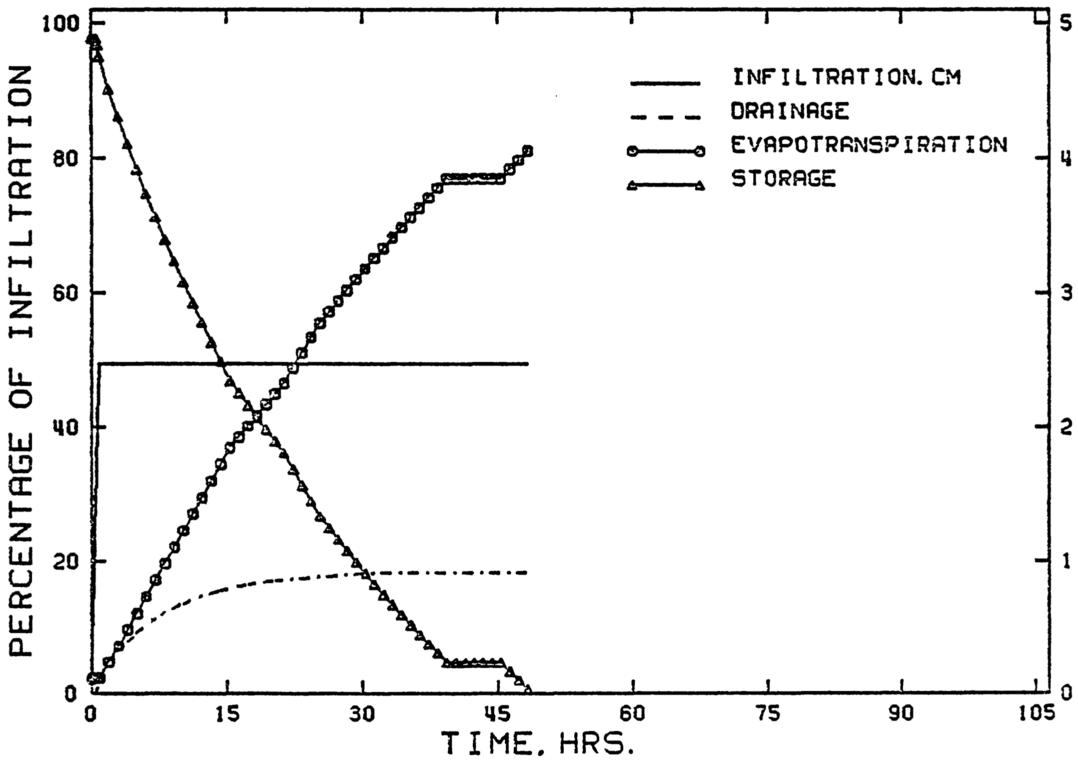

Figure E-29: Moisture Balance in Root Zone for Column 16
(Root Zone = 56.877 Percent Saturated)

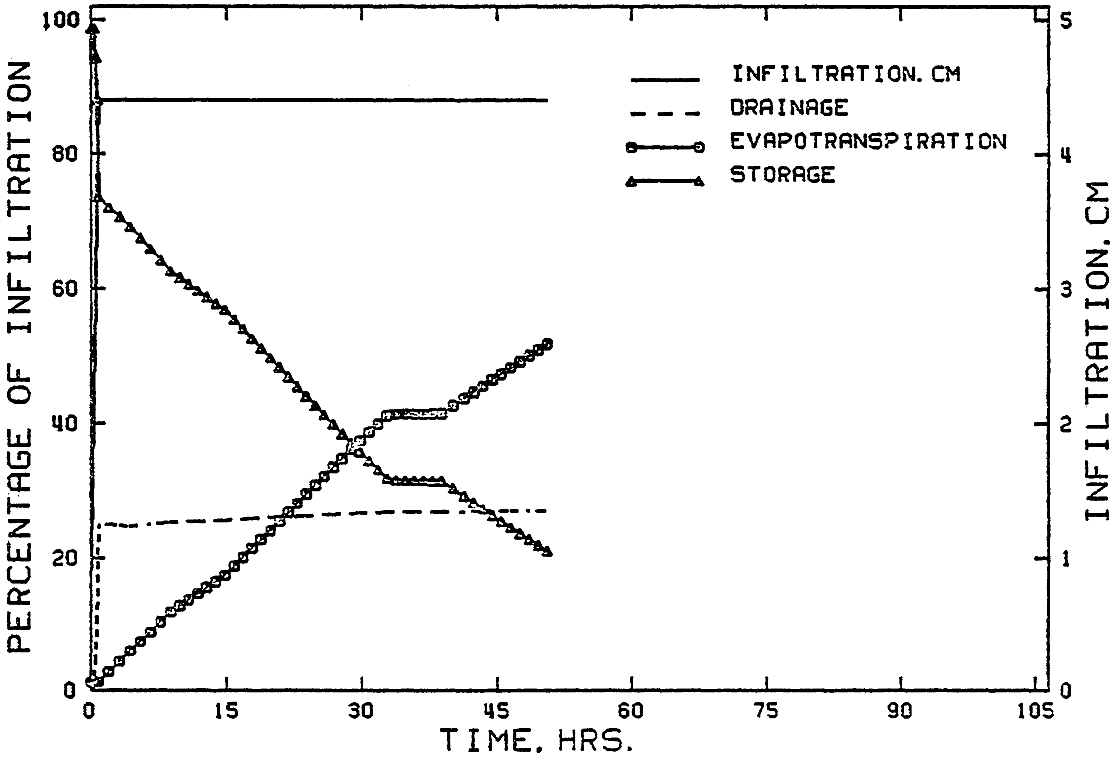

Figure E-30: Moisture Balance in Root Zone for Column 16
(Root Zone = 45.852 Percent Saturated)

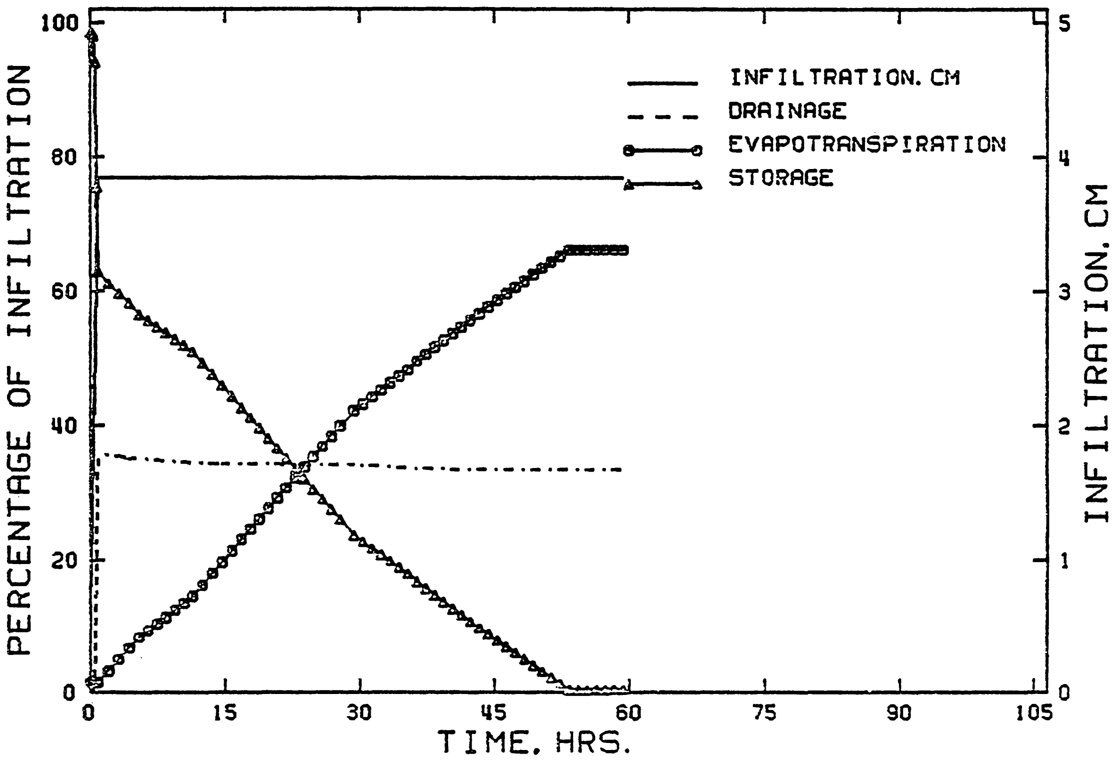

Figure E-31: Moisture Balance in Root Zone for Column 16
(Root Zone = 59.547 Percent Saturated)

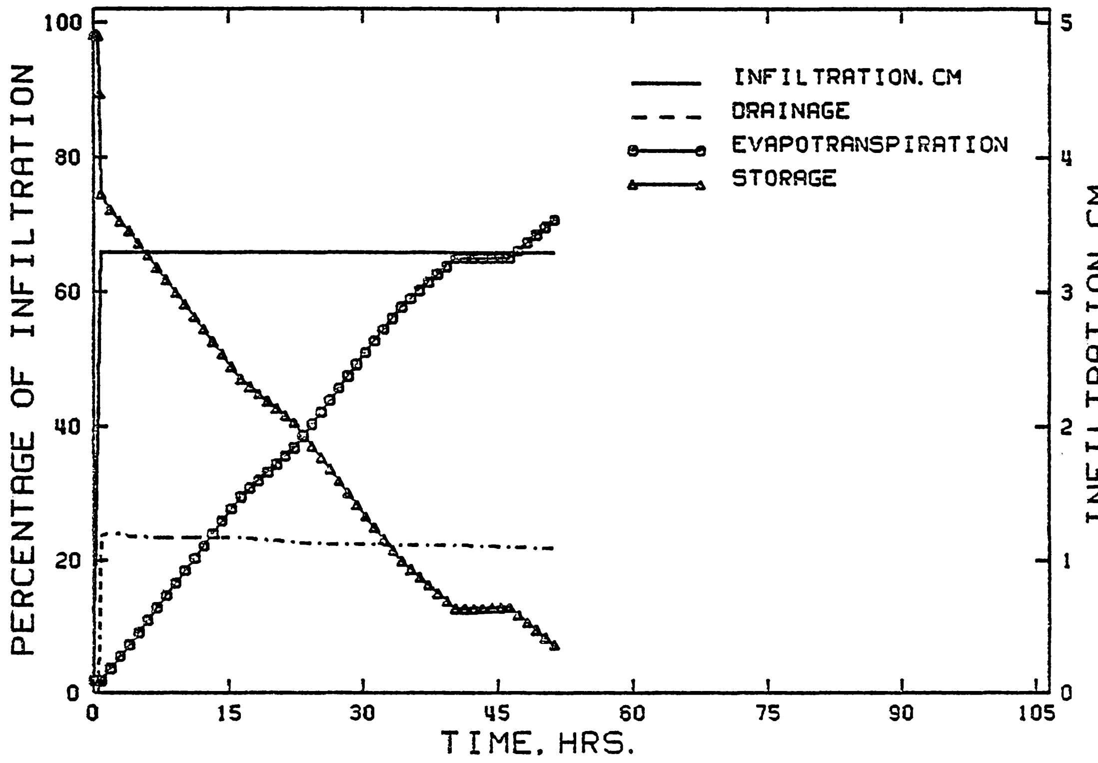

Figure E-32: Moisture Balance in Root Zone for Column 16
(Root Zone = 58.952 Percent Saturated)

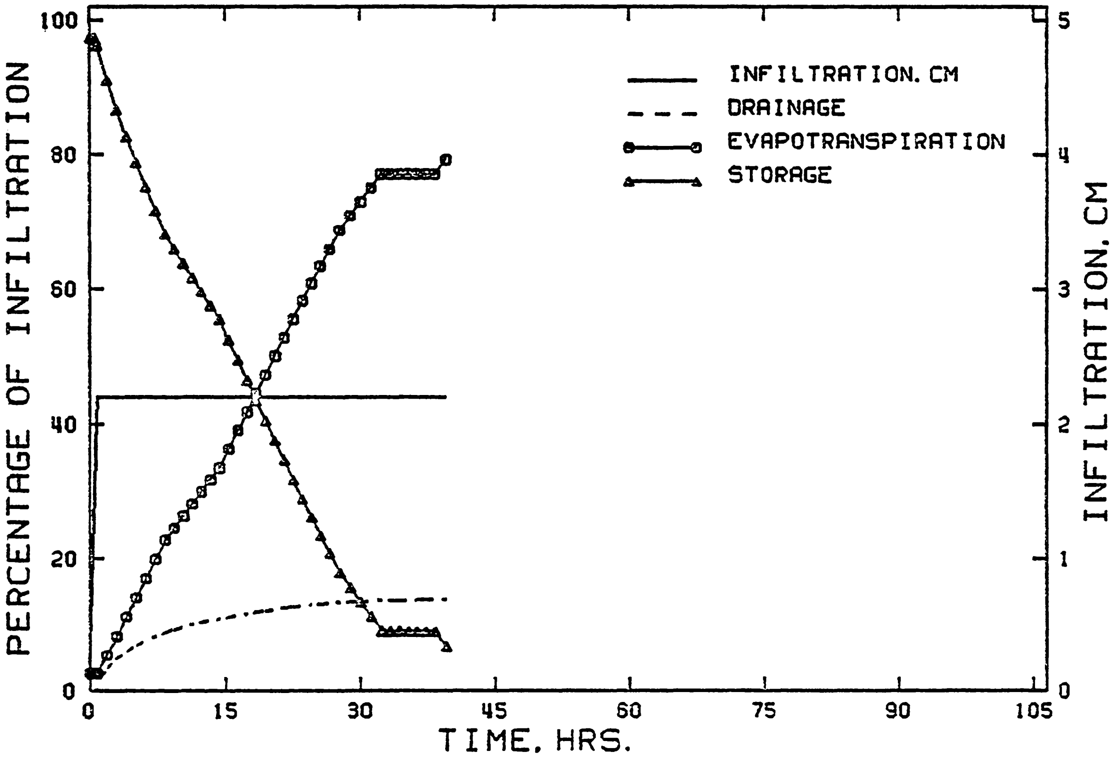

Figure E-33: Moisture Balance in Root Zone for Column 16
(Root Zone = 62.985 Percent Saturated)

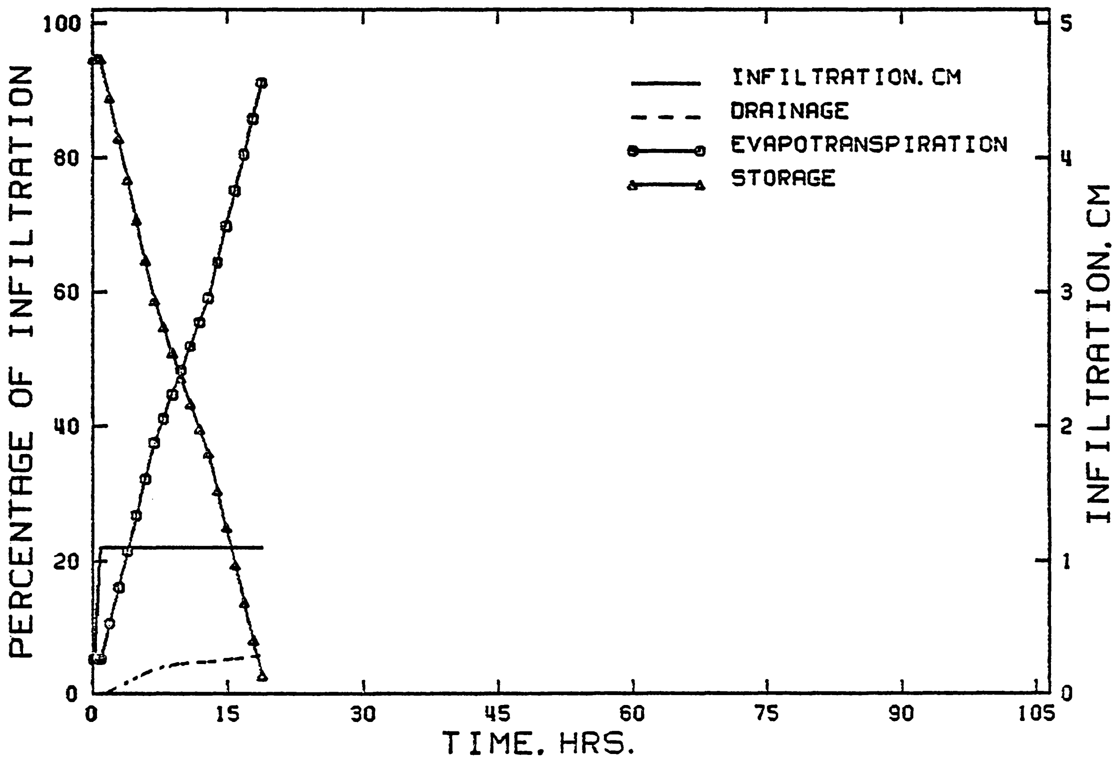

Figure E-34: Moisture Balance in Root Zone for Column 16
(Root Zone = 73.271 Percent Saturated)

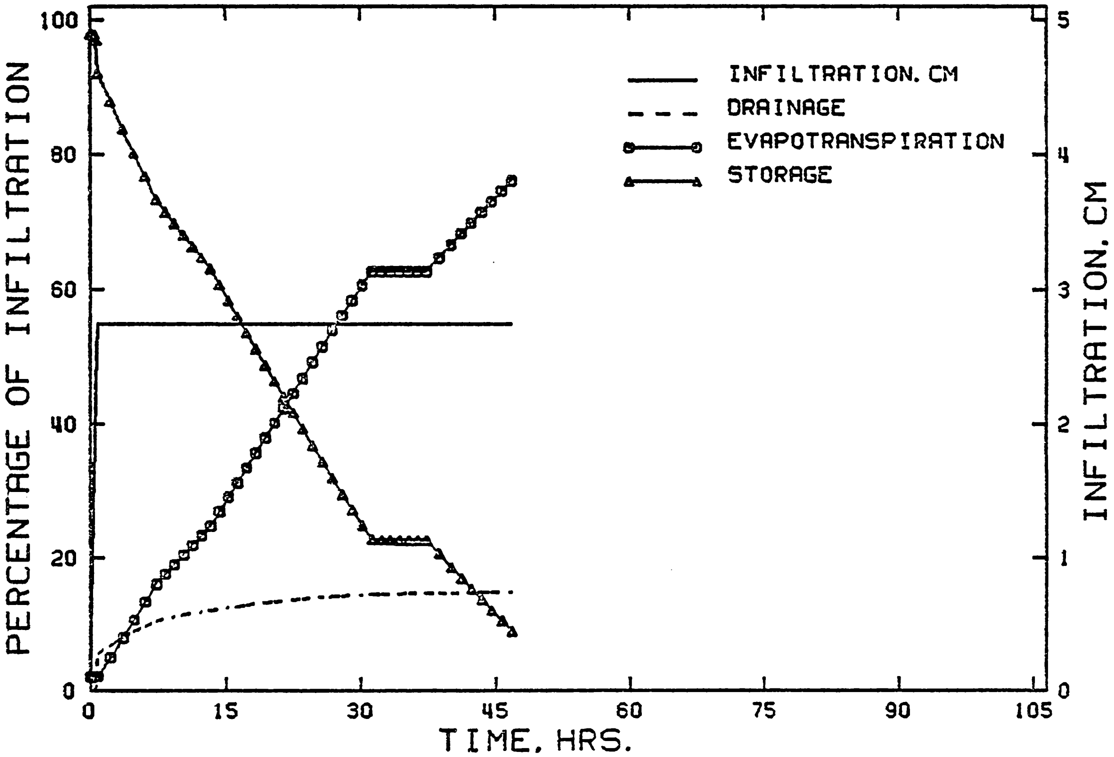

Figure E-35: Moisture Balance in Root Zone for Column 16
(Root Zone = 57.714 Percent Saturated)

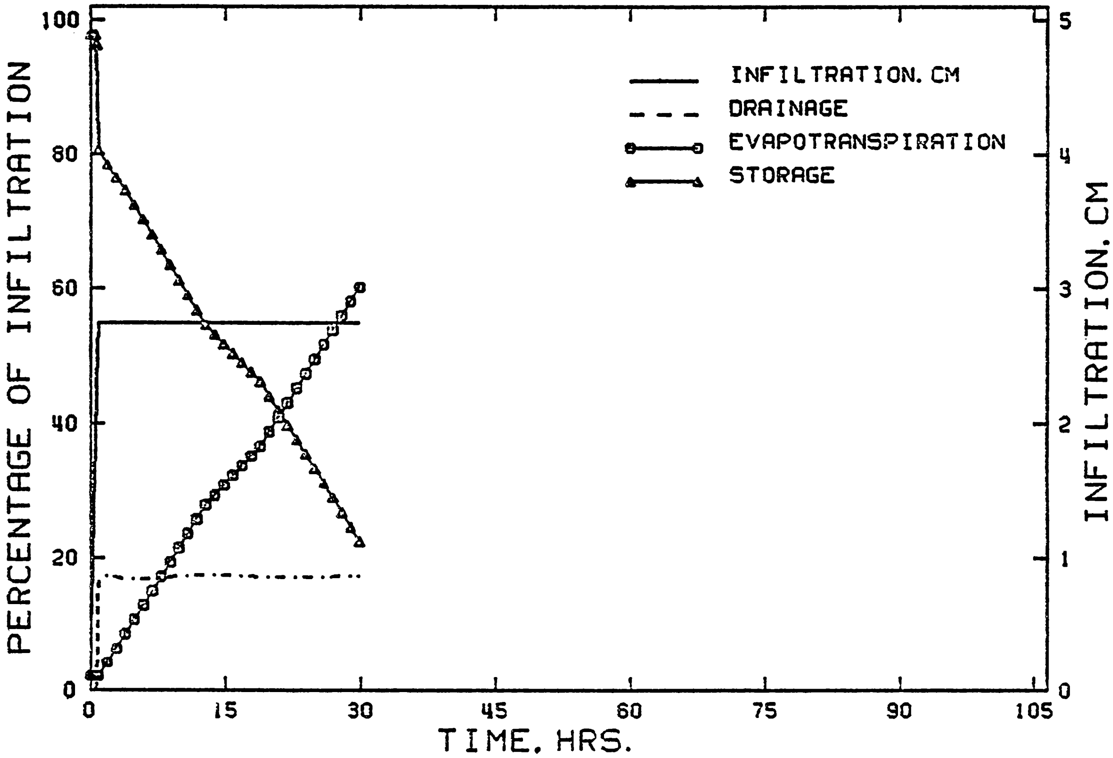

Figure E-36: Moisture Balance in Root Zone for Column 16
(Root Zone = 61.860 Percent Saturated)

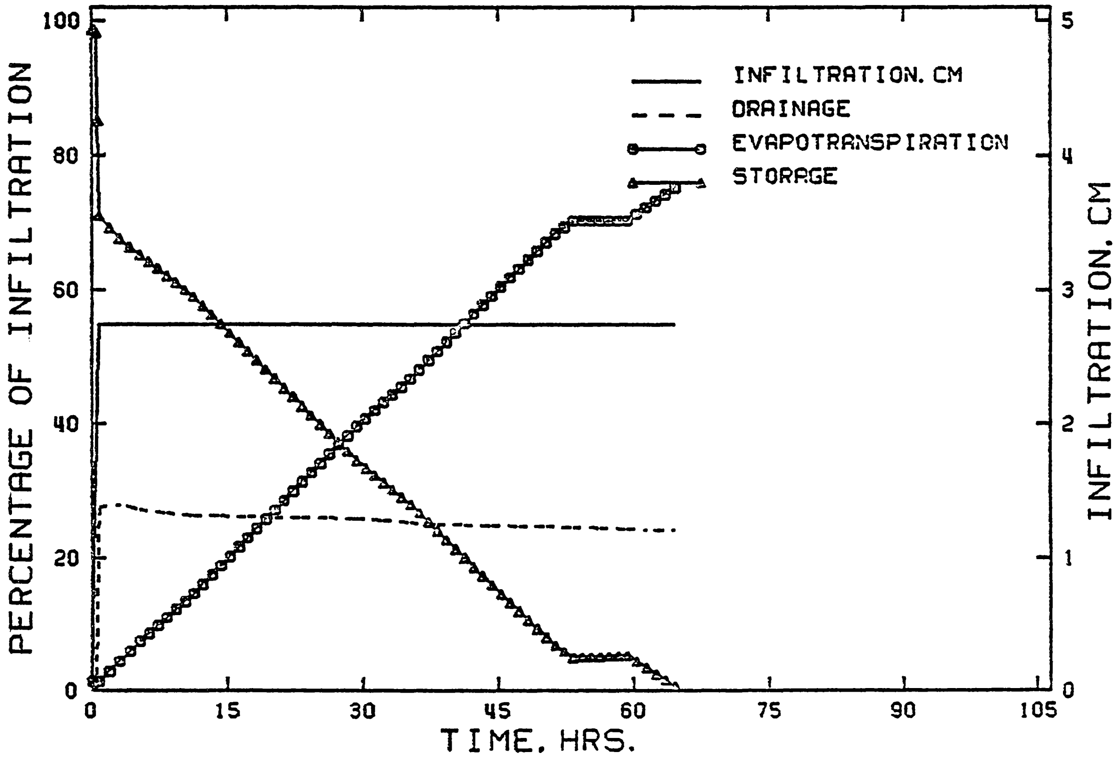

Figure E-37: Moisture Balance in Root Zone for Column 12
(Root Zone = 65.718 Percent Saturated)

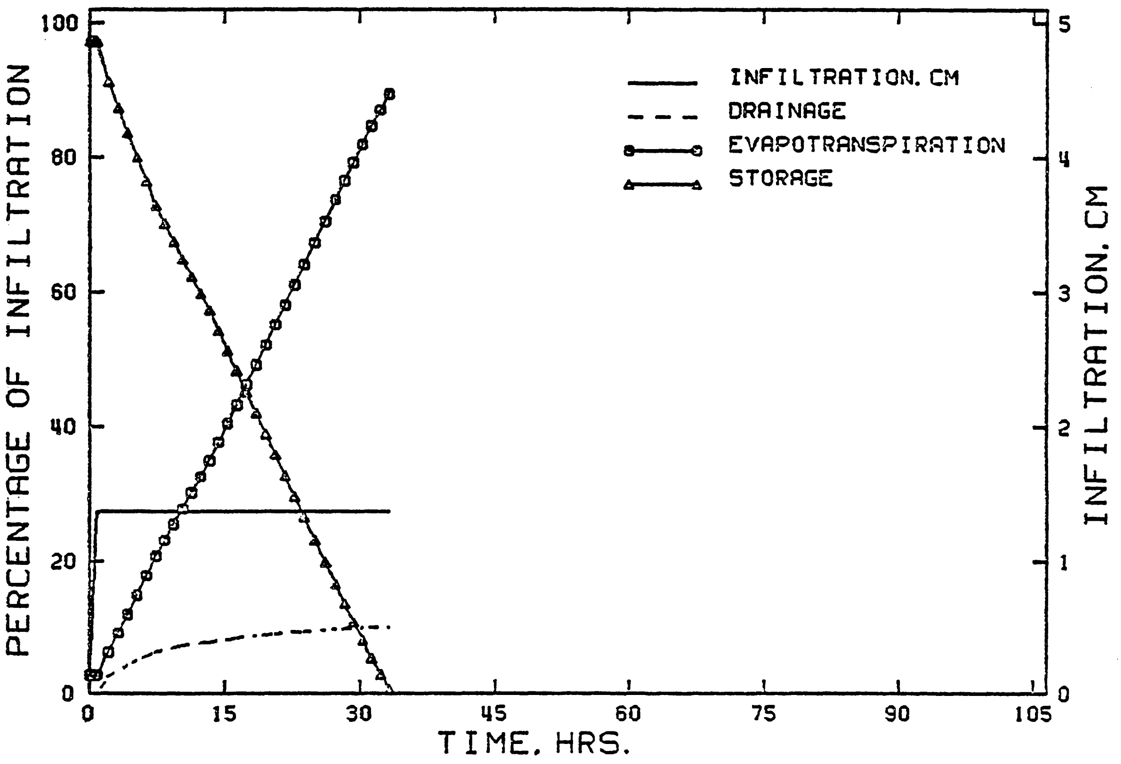

Figure E-38: Moisture Balance in Root Zone for Column 12
(Root Zone = 70.638 Percent Saturated)

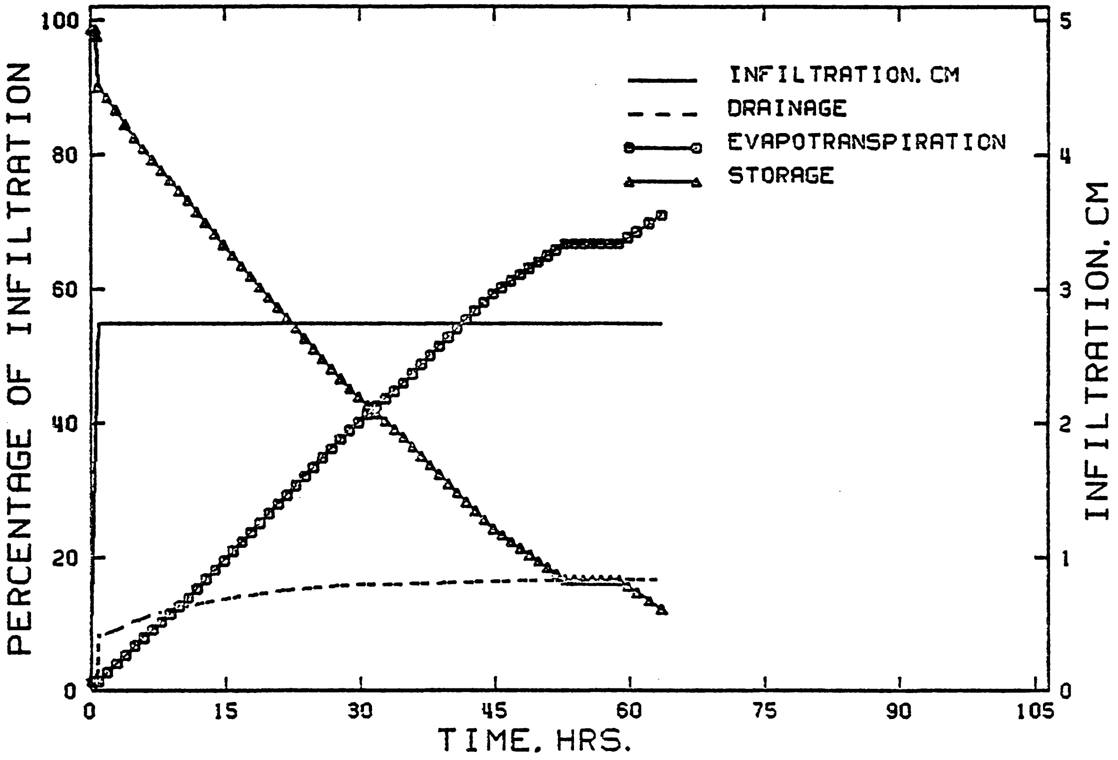

Figure E-39: Moisture Balance in Root Zone for Column 12
(Root Zone = 56.568 Percent Saturated)

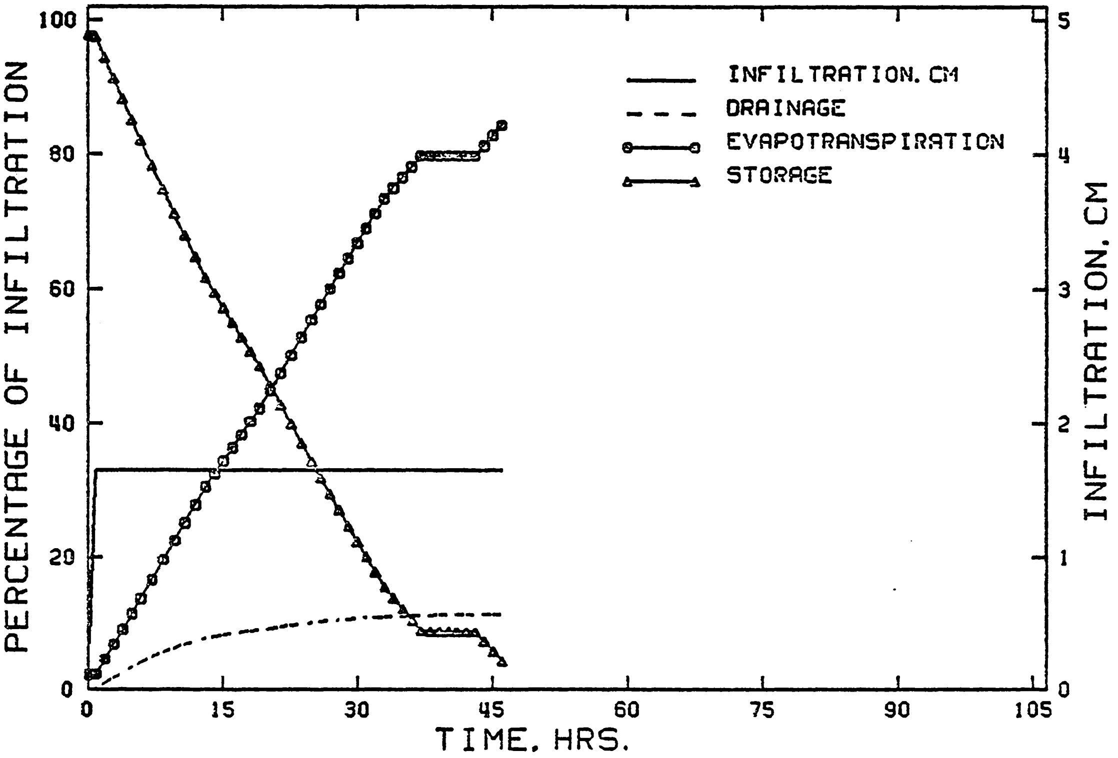

Figure E-40: Moisture Balance in Root Zone for Column 12
(Root Zone = 62.501 Percent Saturated)

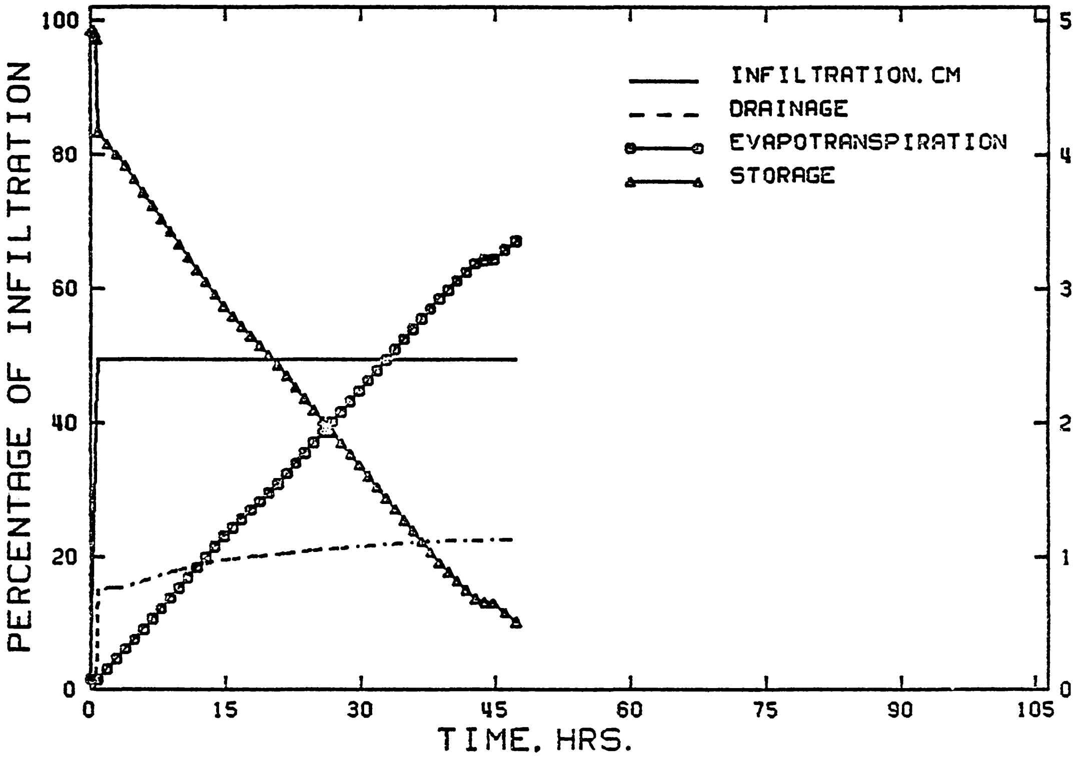

Figure E-41: Moisture Balance in Root Zone for Column 12
(Root Zone = 63.739 Percent Saturated)

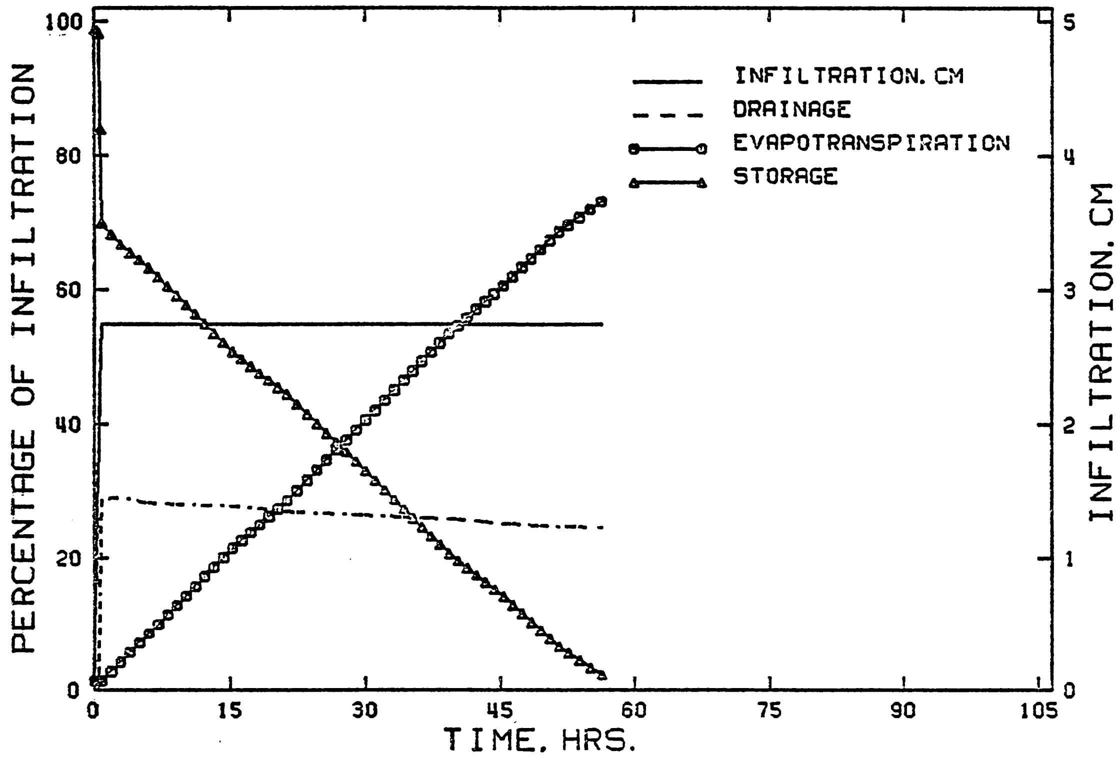

Figure E-42: Moisture Balance in Root Zone for Column 12
(Root Zone = 66.246 Percent Saturated)

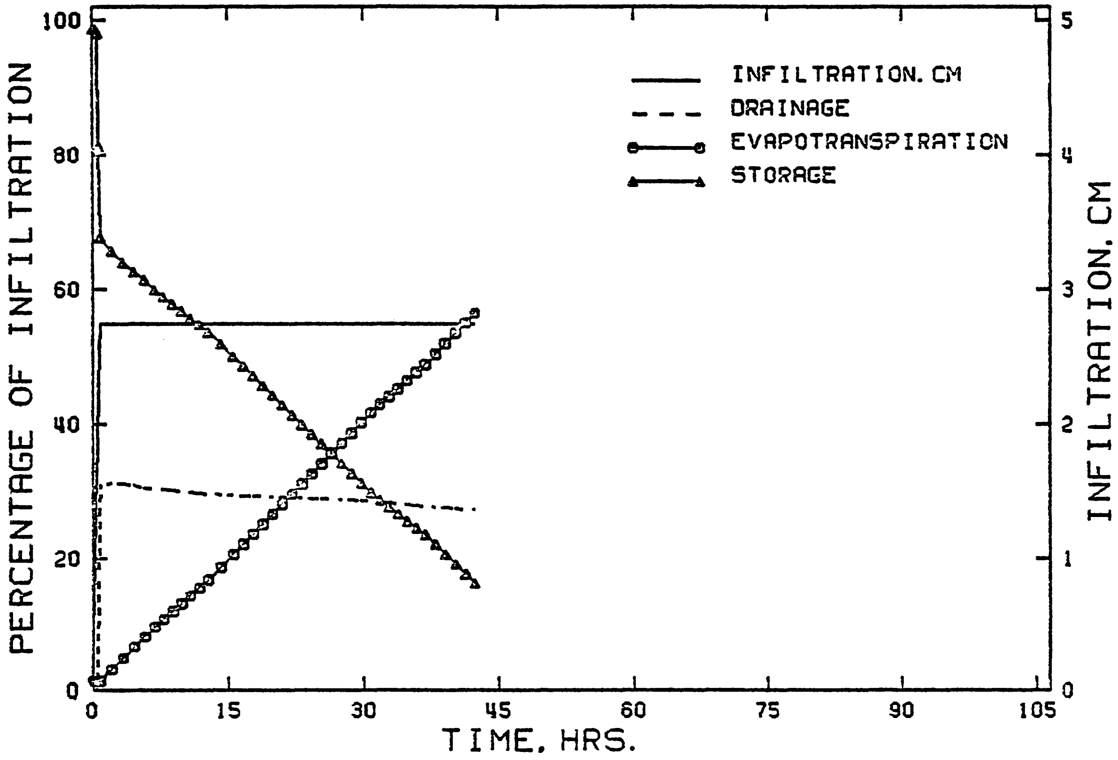

Figure E-43: Moisture Balance in Root Zone for Column 12
(Root Zone = 67.342 Percent Saturated)

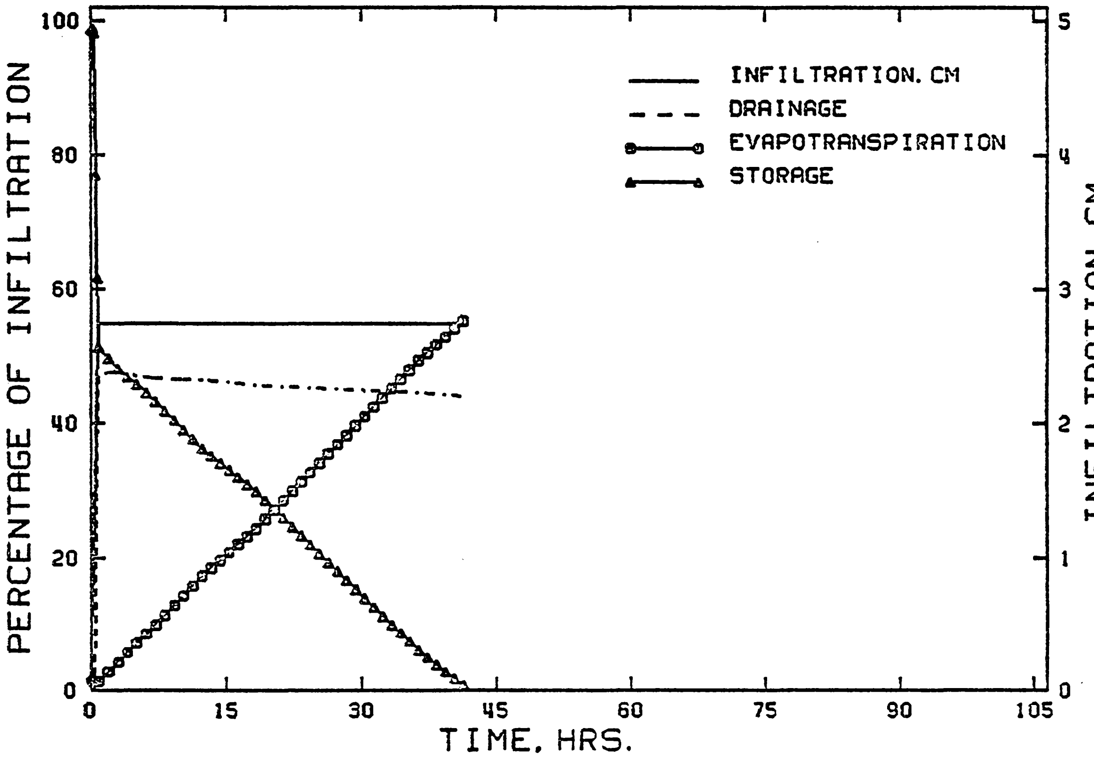

Figure E-44: Moisture Balance in Root Zone for Column 12
(Root Zone = 75.180 Percent Saturated)

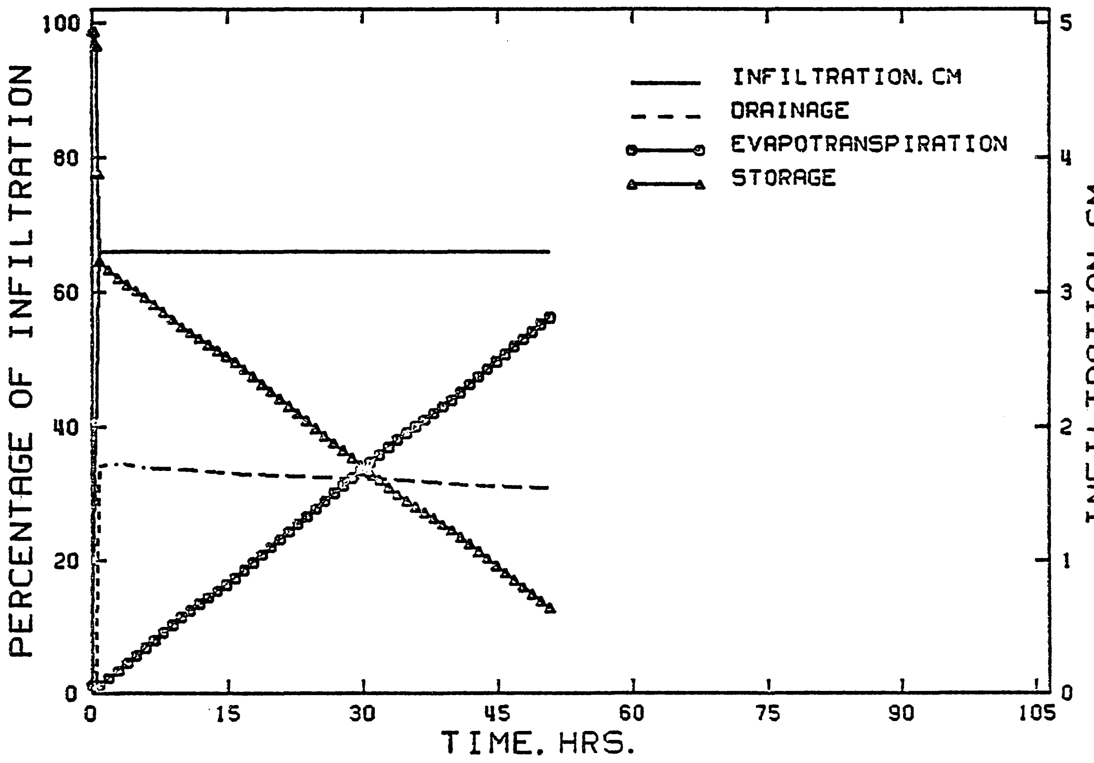

Figure E-45: Moisture Balance in Root Zone for Column 12
(Root Zone = 62.423 Percent Saturated)

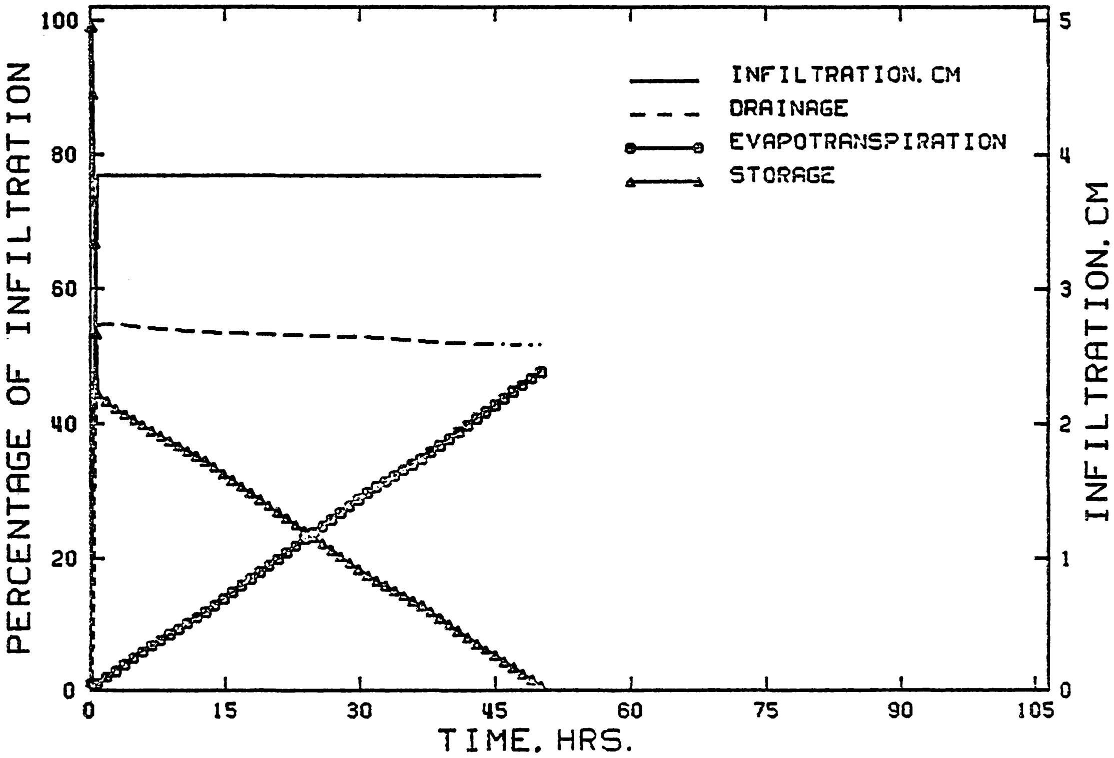

Figure E-46: Moisture Balance in Root Zone for Column 12
(Root Zone = 69.881 Percent Saturated)

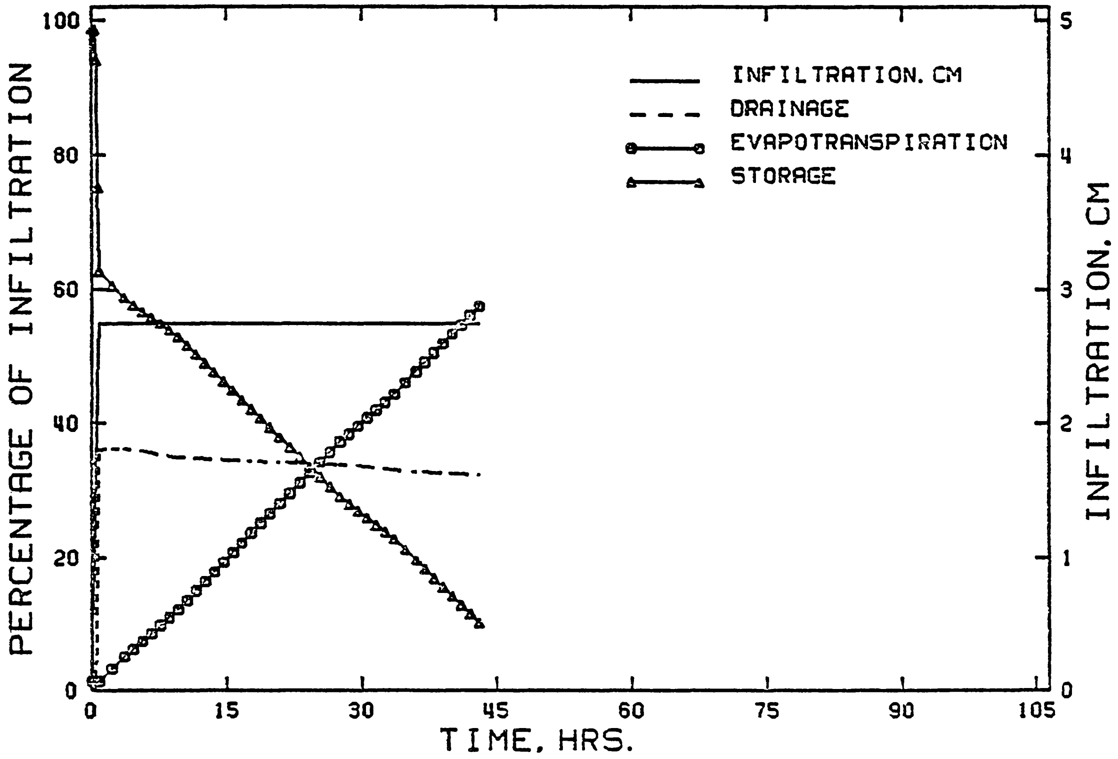

Figure E-47: Moisture Balance in Root Zone for Column 12
(Root Zone = 69.729 Percent Saturated)

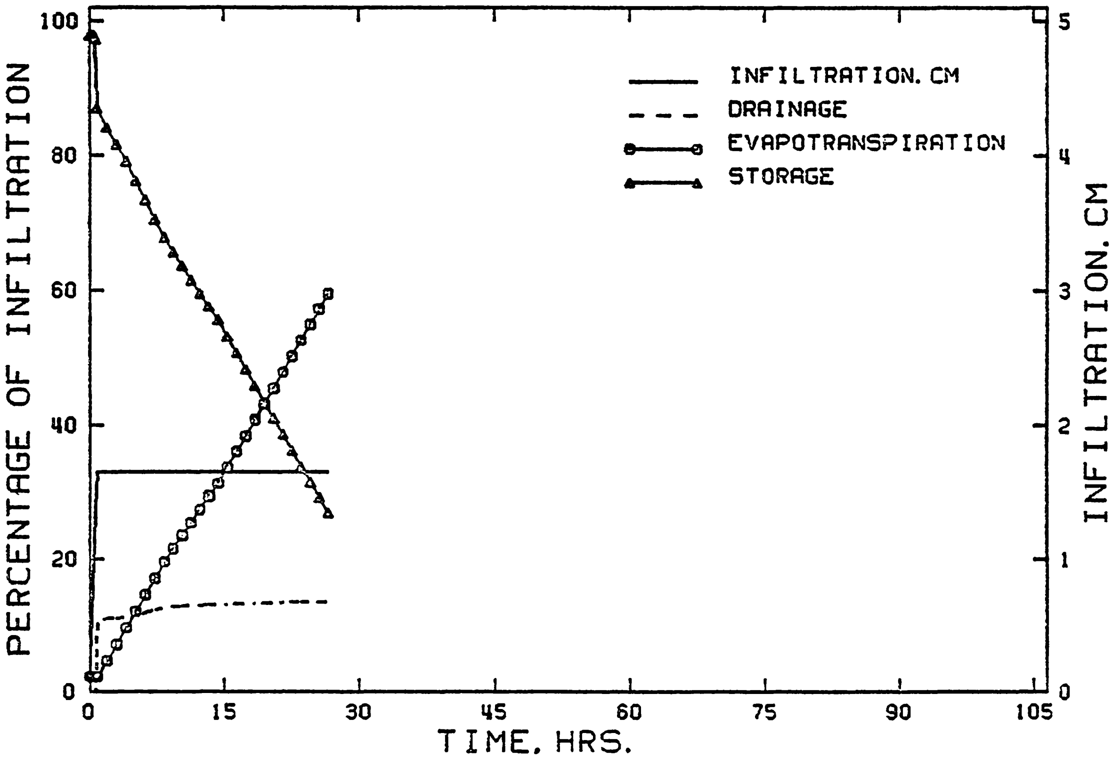

Figure E-48: Moisture Balance in Root Zone for Column 12
(Root Zone = 74.669 Percent Saturated)

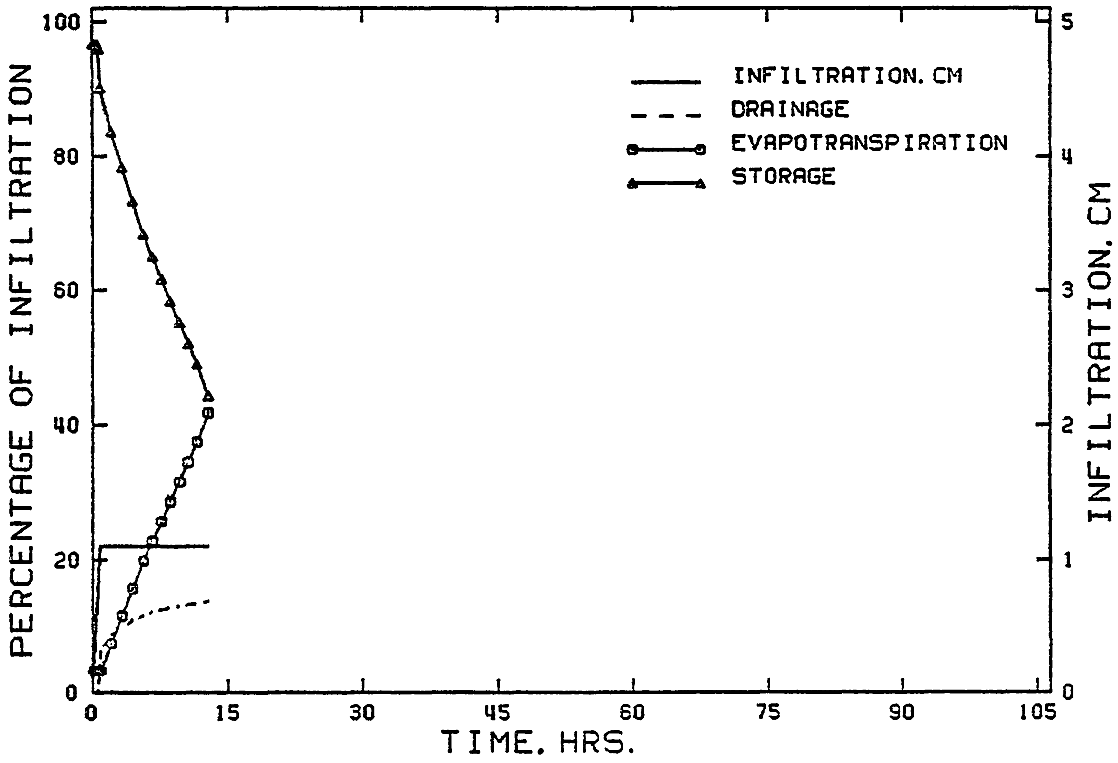

Figure E-49: Moisture Balance in Root Zone for Column 12
(Root Zone = 82.457 Percent Saturated)

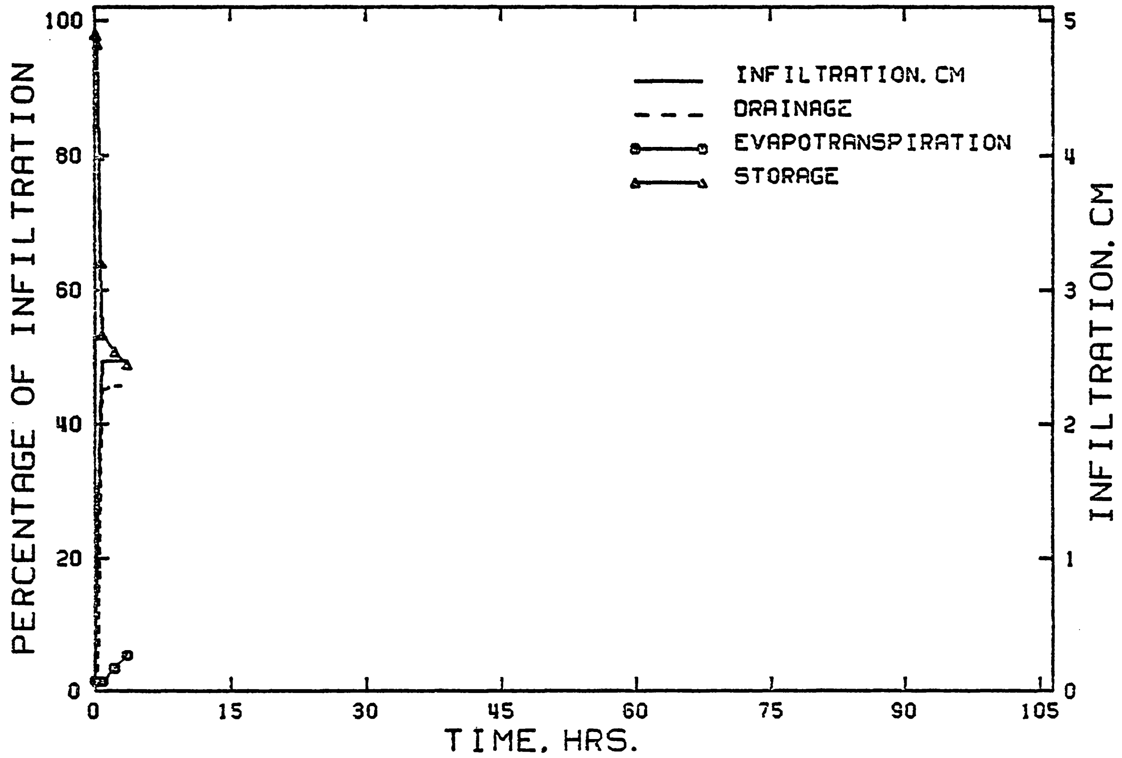

Figure E-50: Moisture Balance in Root Zone for Column 14
(Root Zone = 78.953 Percent Saturated)

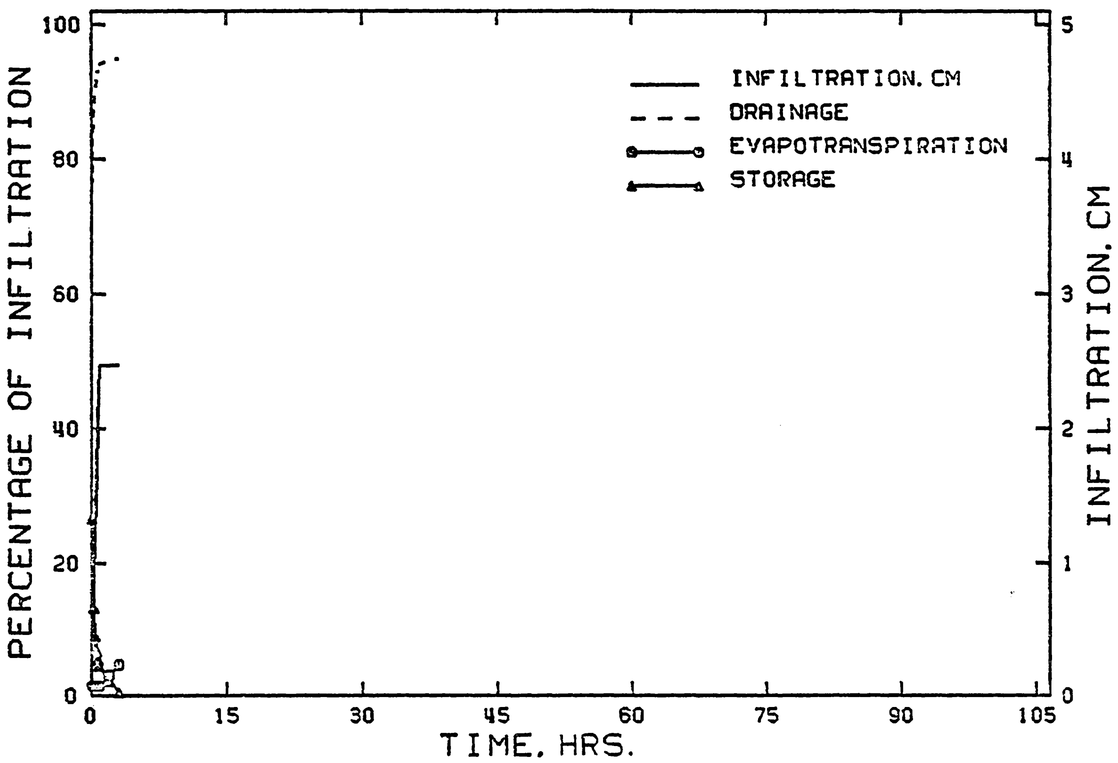

Figure E-51: Moisture Balance in Root Zone for Column 14
(Root Zone = 98.119 Percent Saturated)

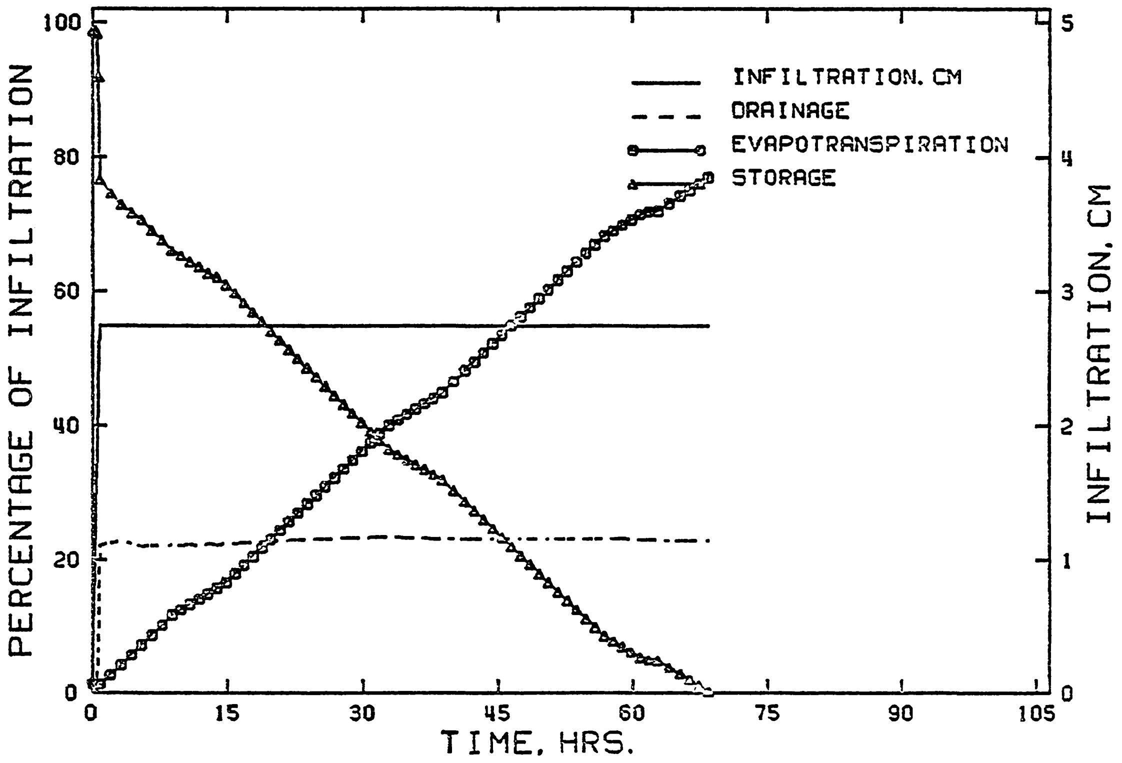

Figure E-52: Moisture Balance in Root Zone for Column 14
(Root Zone = 66.554 Percent Saturated)

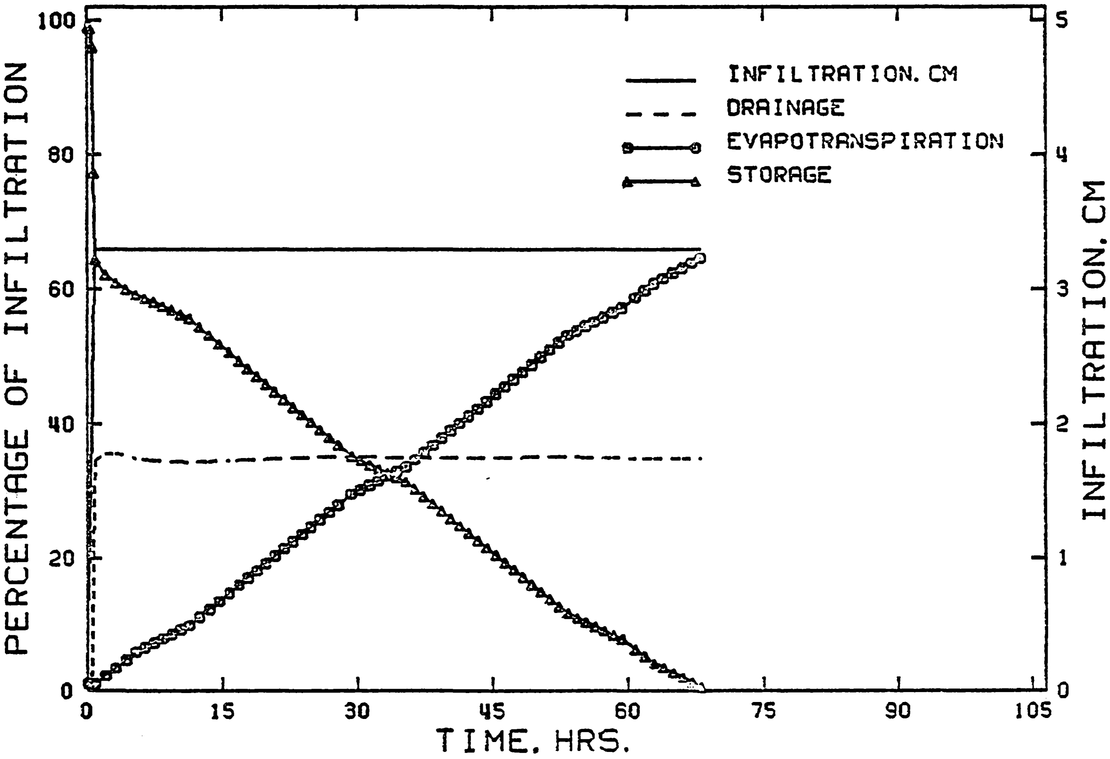

Figure E-53: Moisture Balance in Root Zone for Column 14
(Root Zone = 66.266 Percent Saturated)

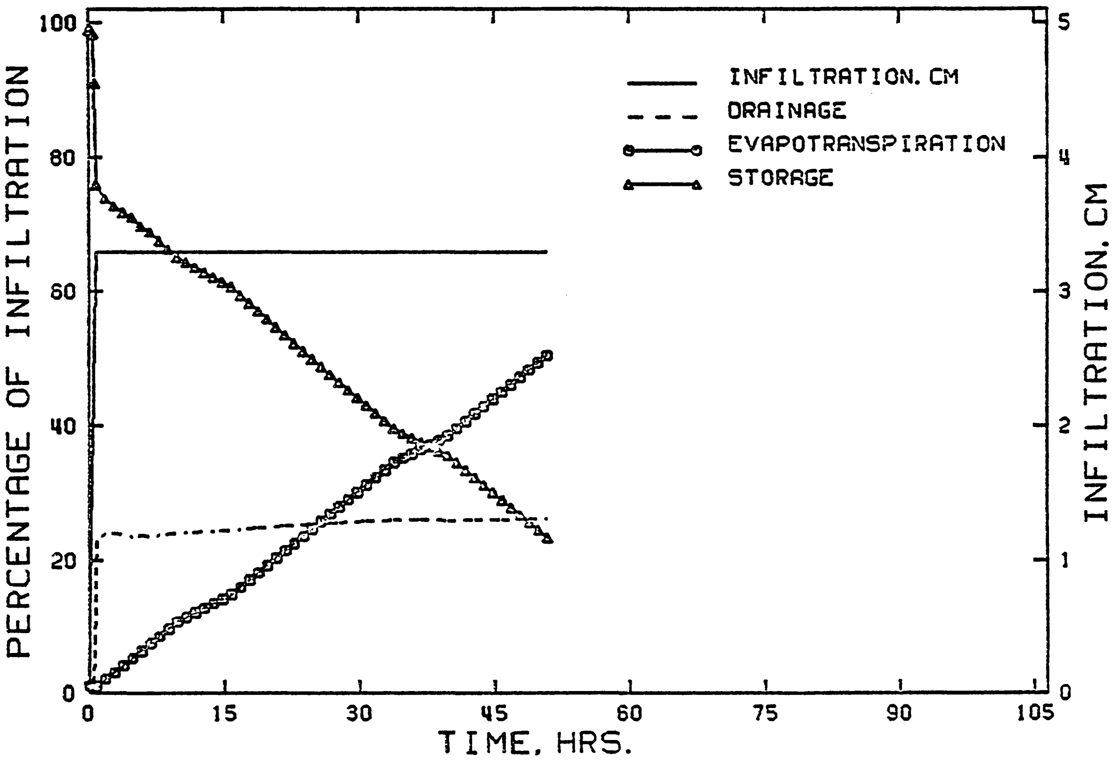

Figure E-54: Moisture Balance in Root Zone for Column 14
(Root Zone = 60.227 Percent Saturated)

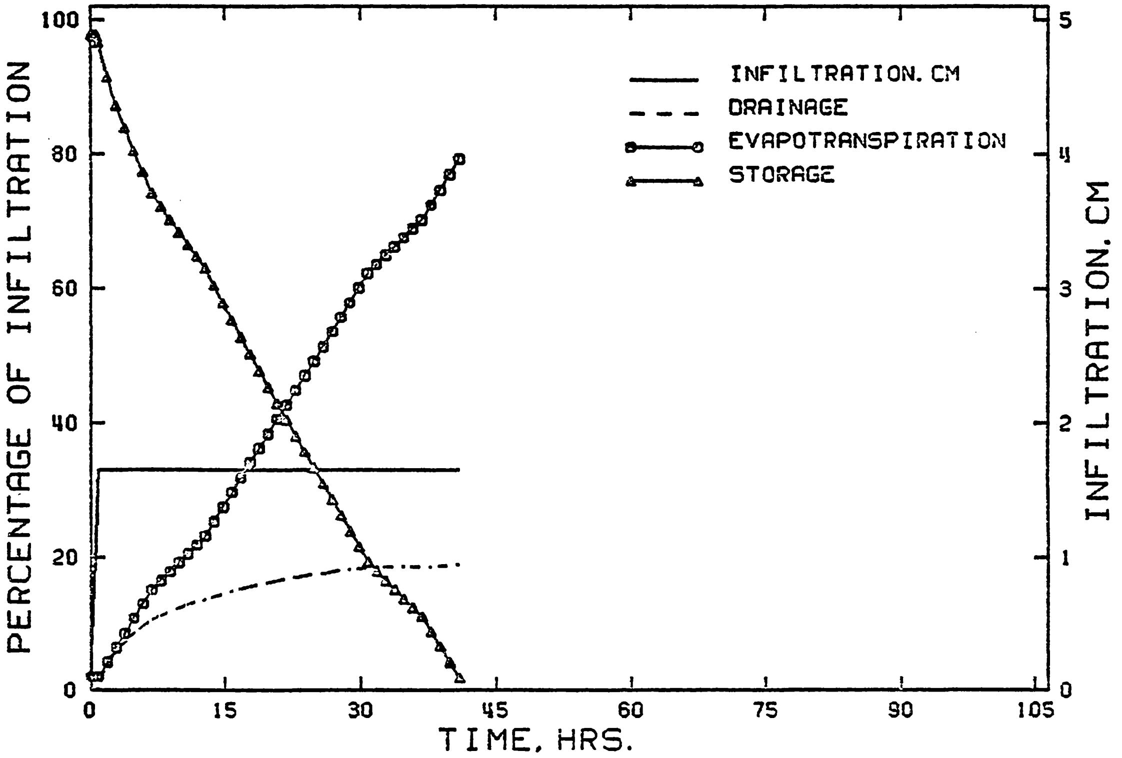

Figure E-55: Moisture Balance in Root Zone for Column 14
(Root Zone = 72.430 Percent Saturated)

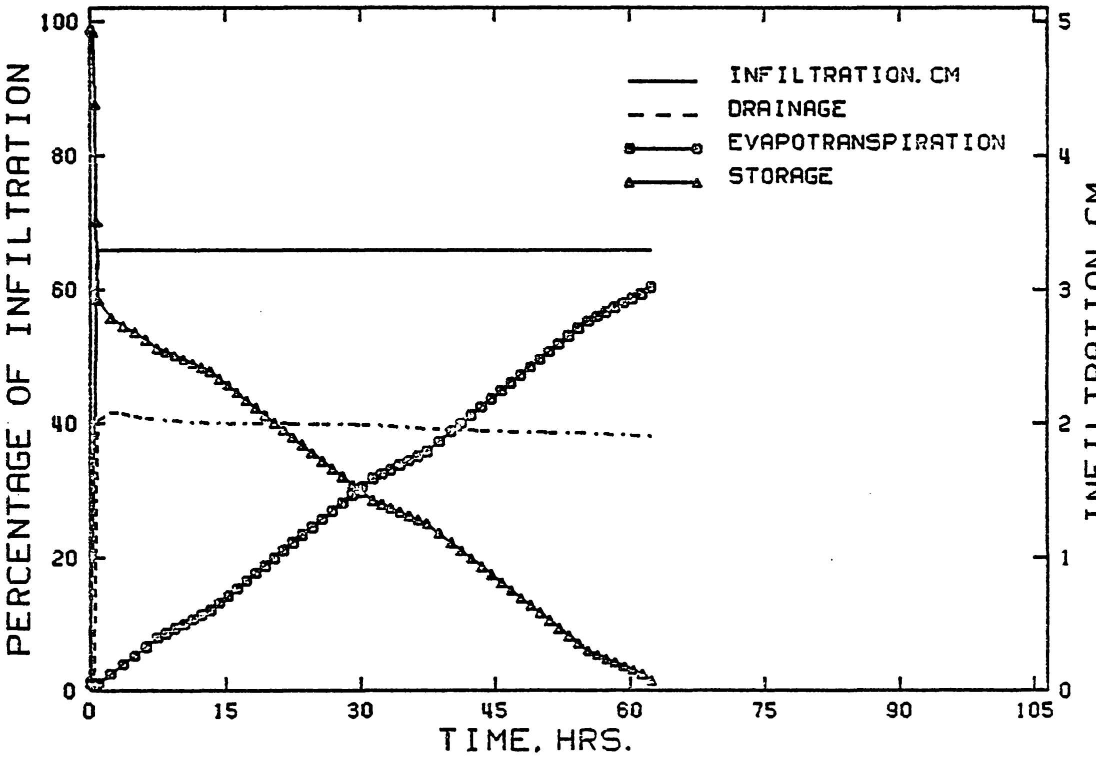

Figure E-56: Moisture Balance in Root Zone for Column 14
(Root Zone = 69.332 Percent Saturated)

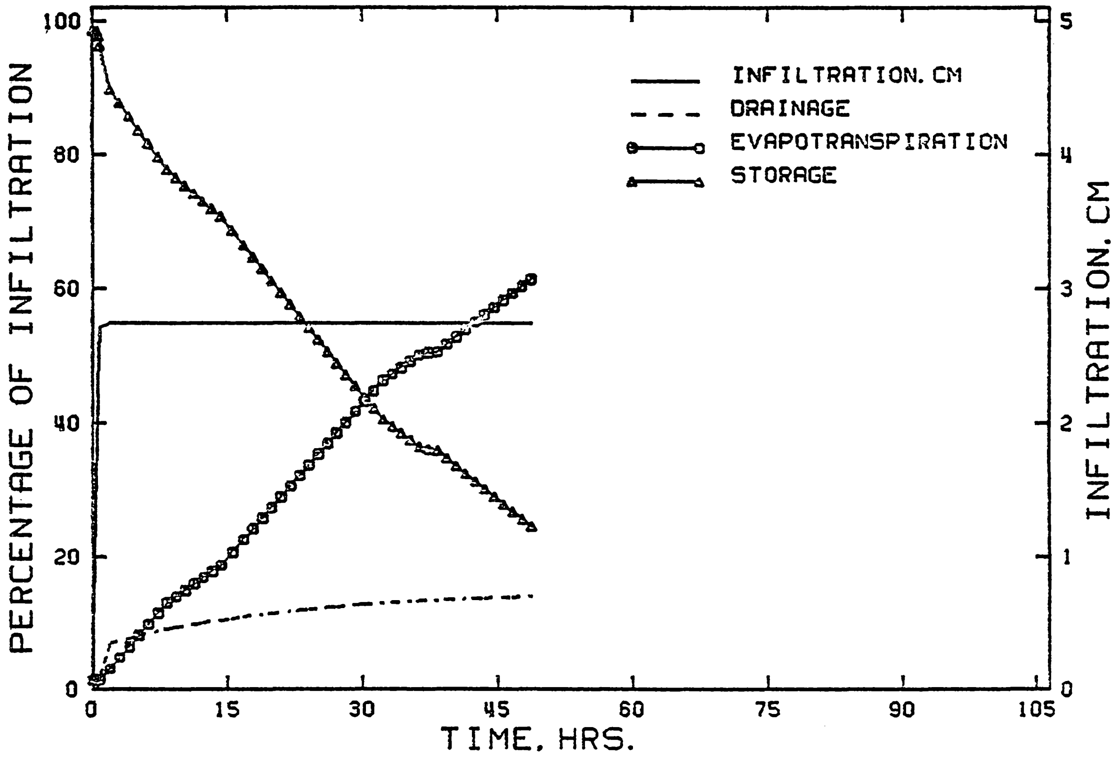

Figure E-57: Moisture Balance in Root Zone for Column 6
(Root Zone = 53.565 Percent Saturated)

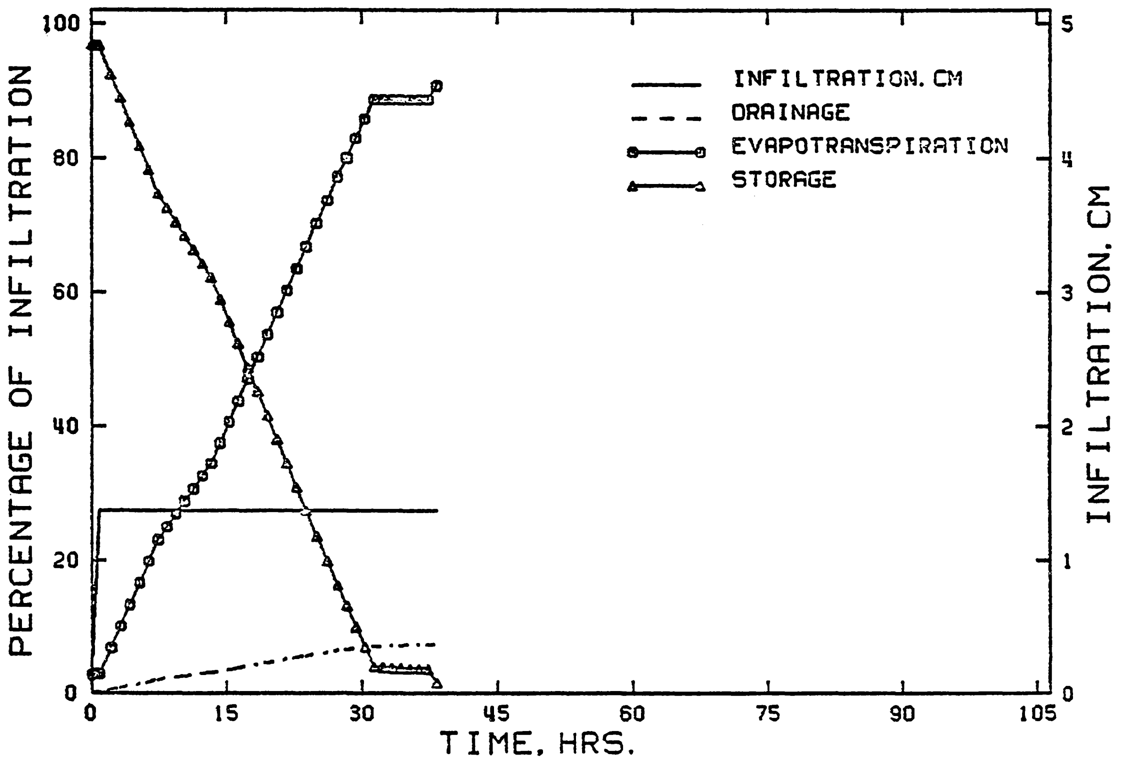

Figure E-58: Moisture Balance in Root Zone for Column 6
(Root Zone = 64.784 Percent Saturated)

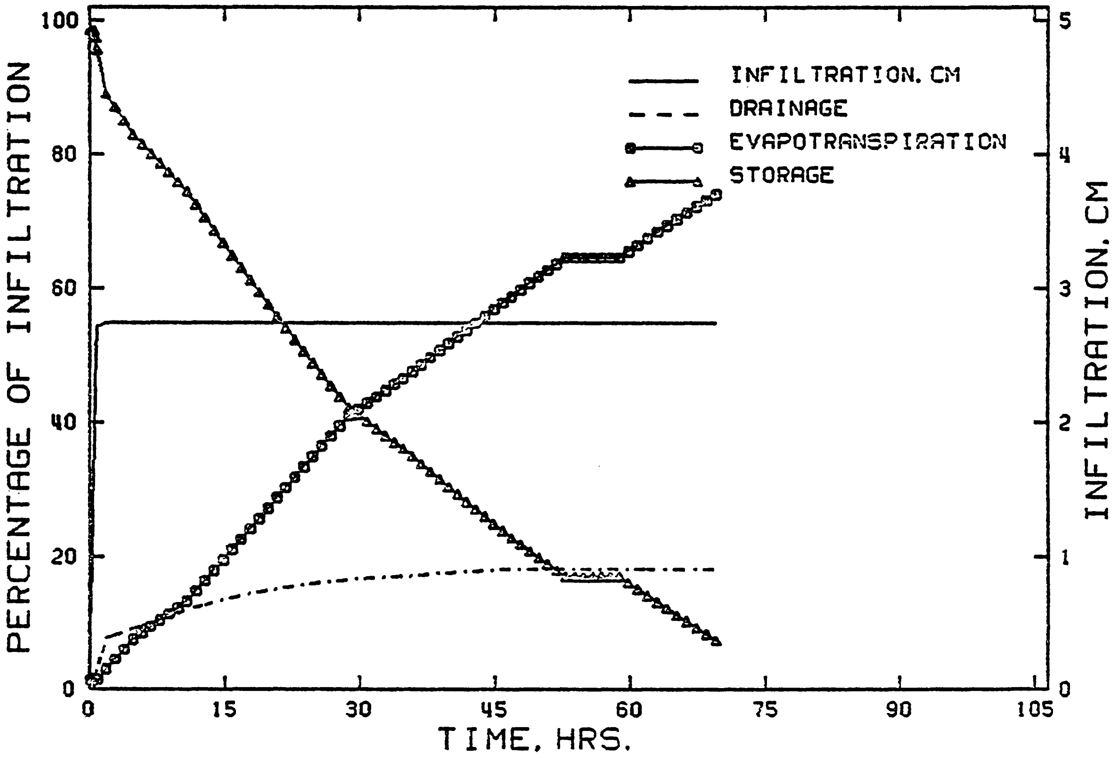

Figure E-59: Moisture Balance in Root Zone for Column 6
(Root Zone = 52.722 Percent Saturated)

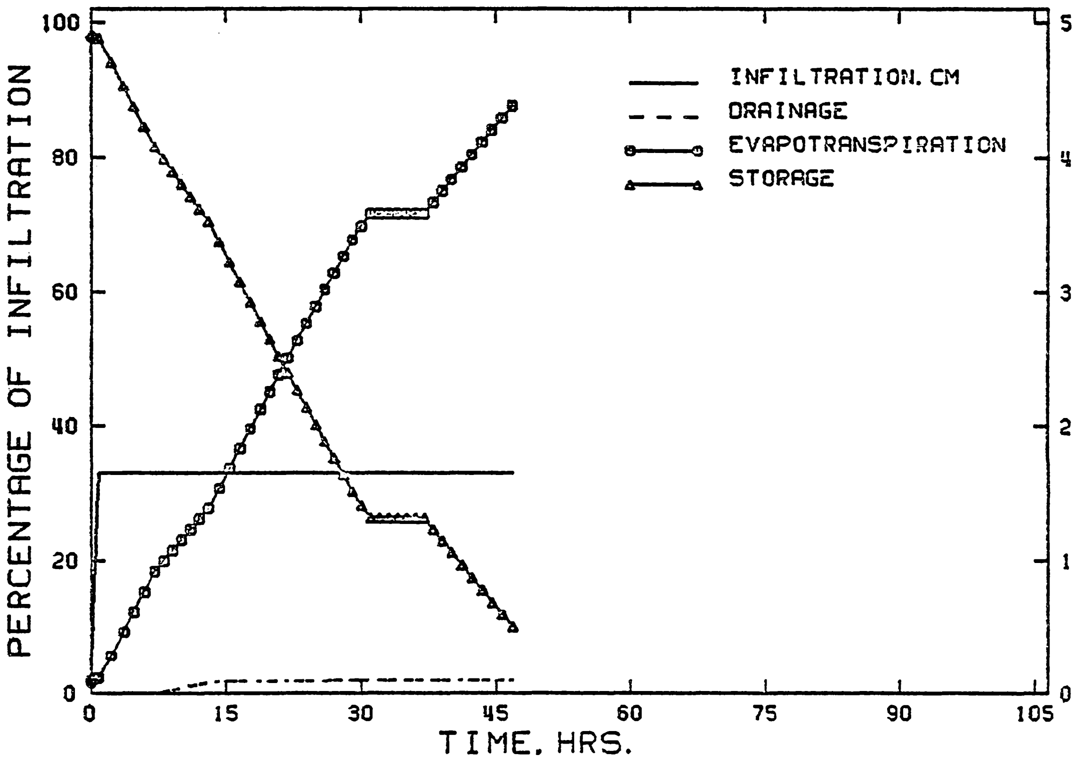

Figure E-60: Moisture Balance in Root Zone for Column 6
(Root Zone = 56.172 Percent Saturated)

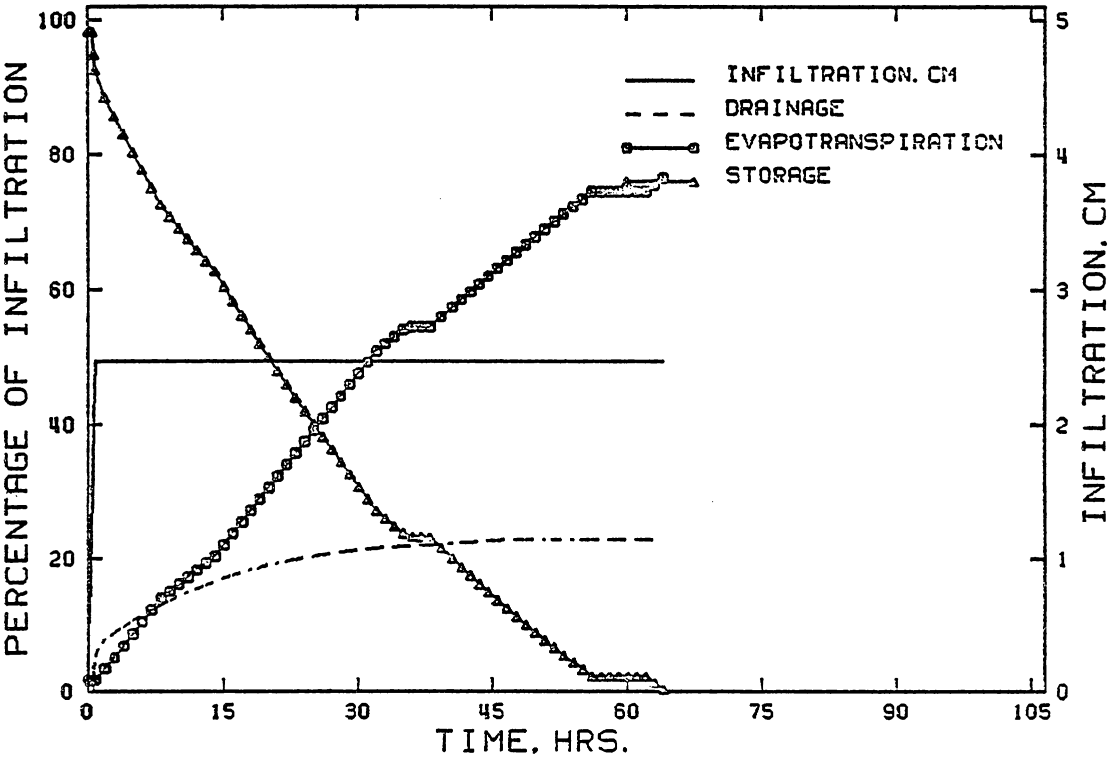

Figure E-61: Moisture Balance in Root Zone for Column 6
(Root Zone = 58.991 Percent Saturated)

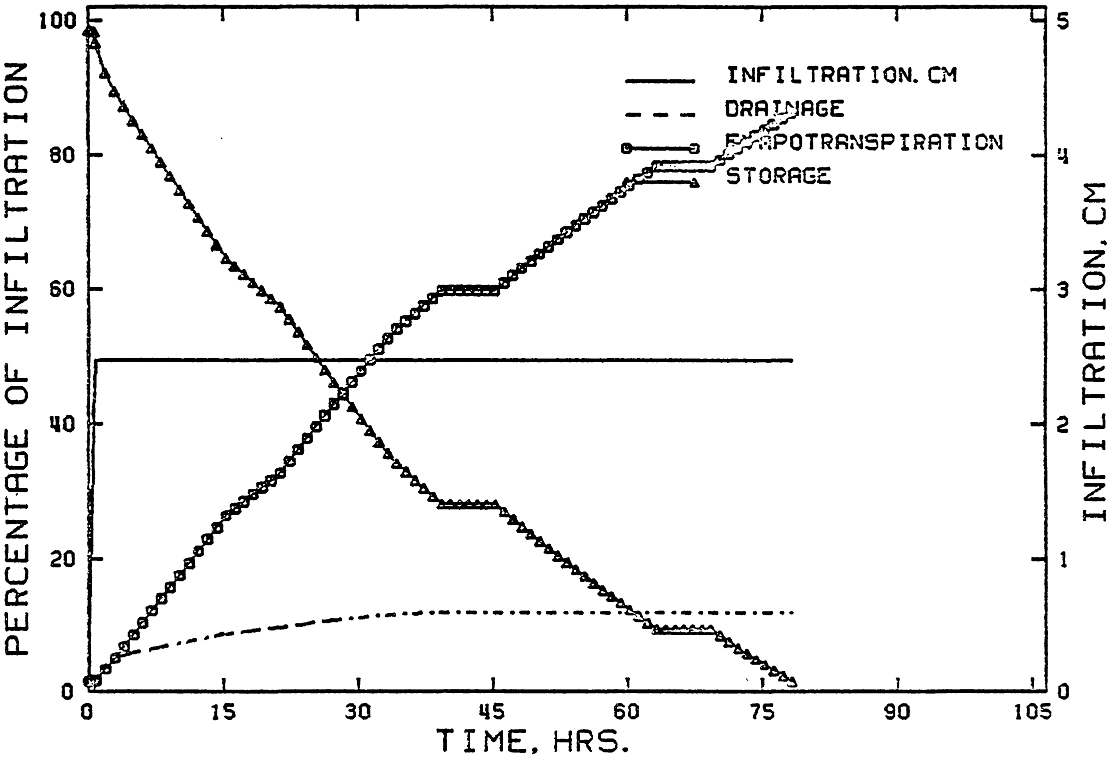

Figure E-62: Moisture Balance in Root Zone for Column 6
(Root Zone = 52.124 Percent Saturated)

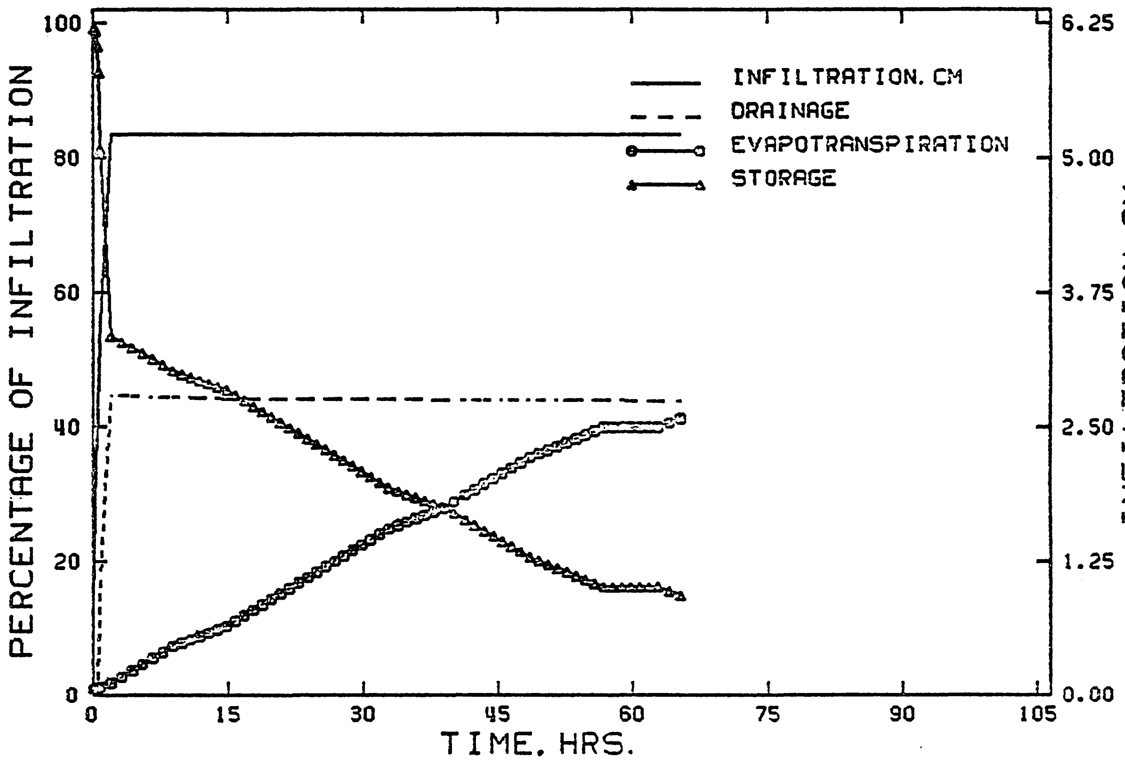

Figure E-63: Moisture Balance in Root Zone for Column 6
(Root Zone = 52.745 Percent Saturated)

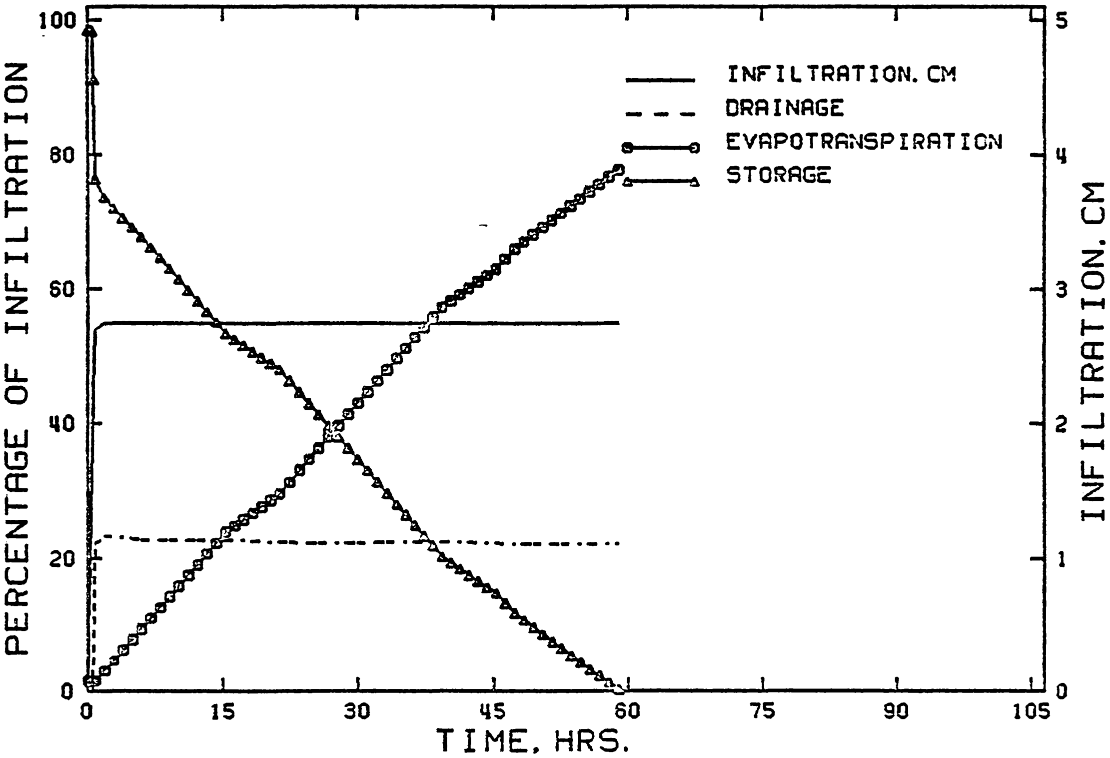

Figure E-64: Moisture Balance in Root Zone for Column 6
(Root Zone = 65.662 Percent Saturated)

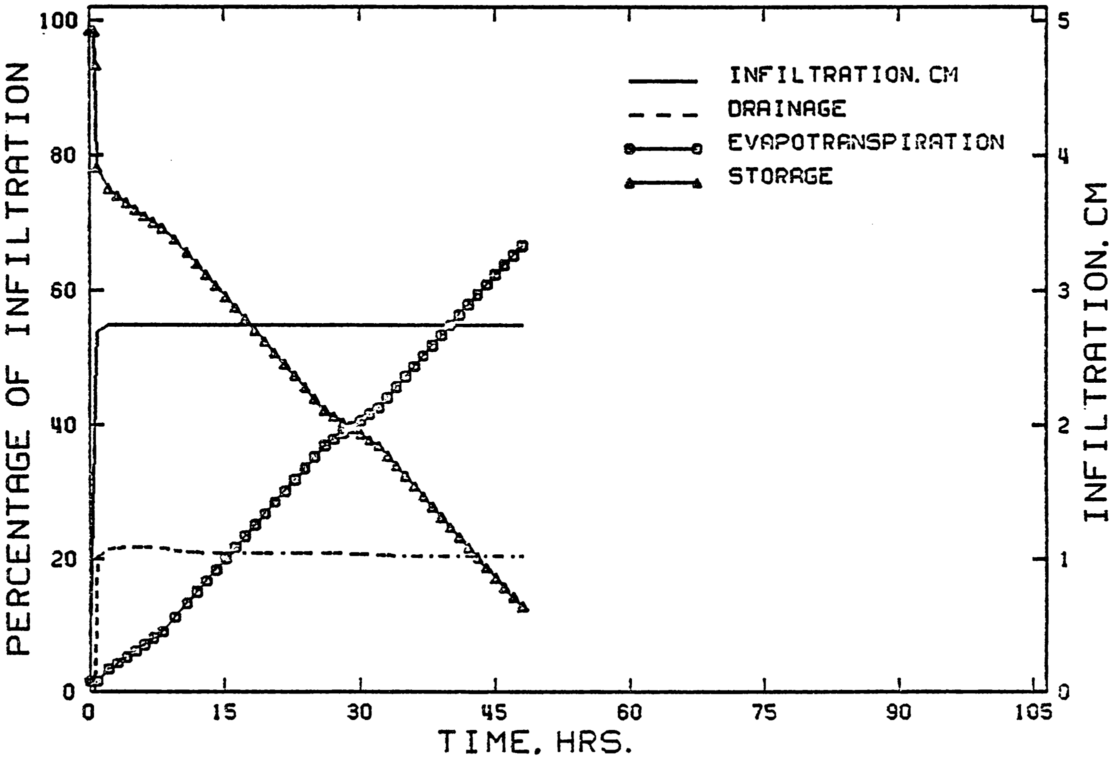

Figure E-65: Moisture Balance in Root Zone for Column 6
(Root Zone = 64.814 Percent Saturated)

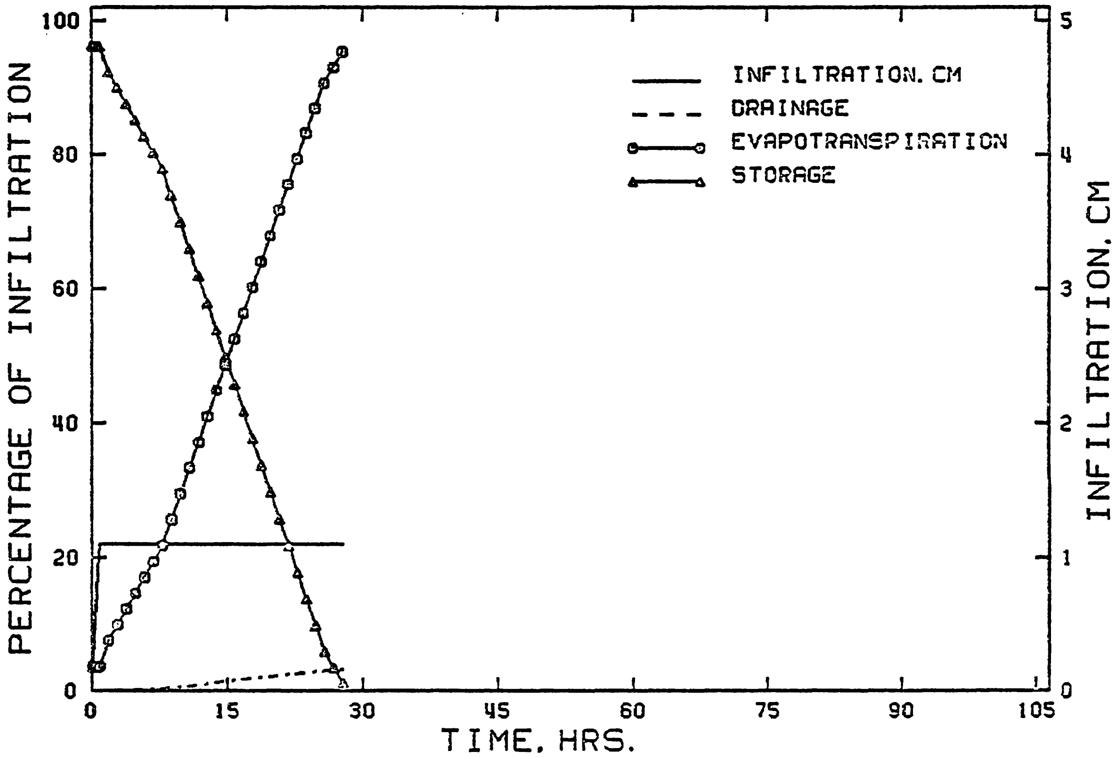

Figure E-66: Moisture Balance in Root Zone for Column 6
(Root Zone = 70.701 Percent Saturated)

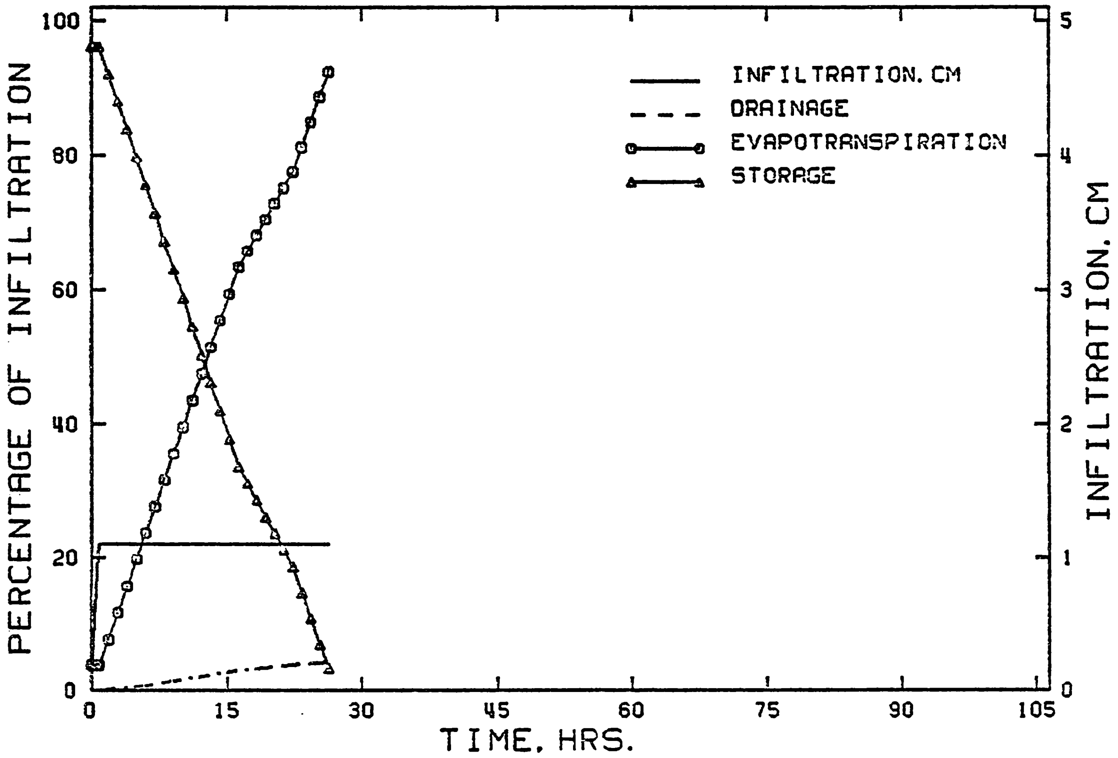

Figure E-67: Moisture Balance in Root Zone for Column 6
(Root Zone = 68.911 Percent Saturated)

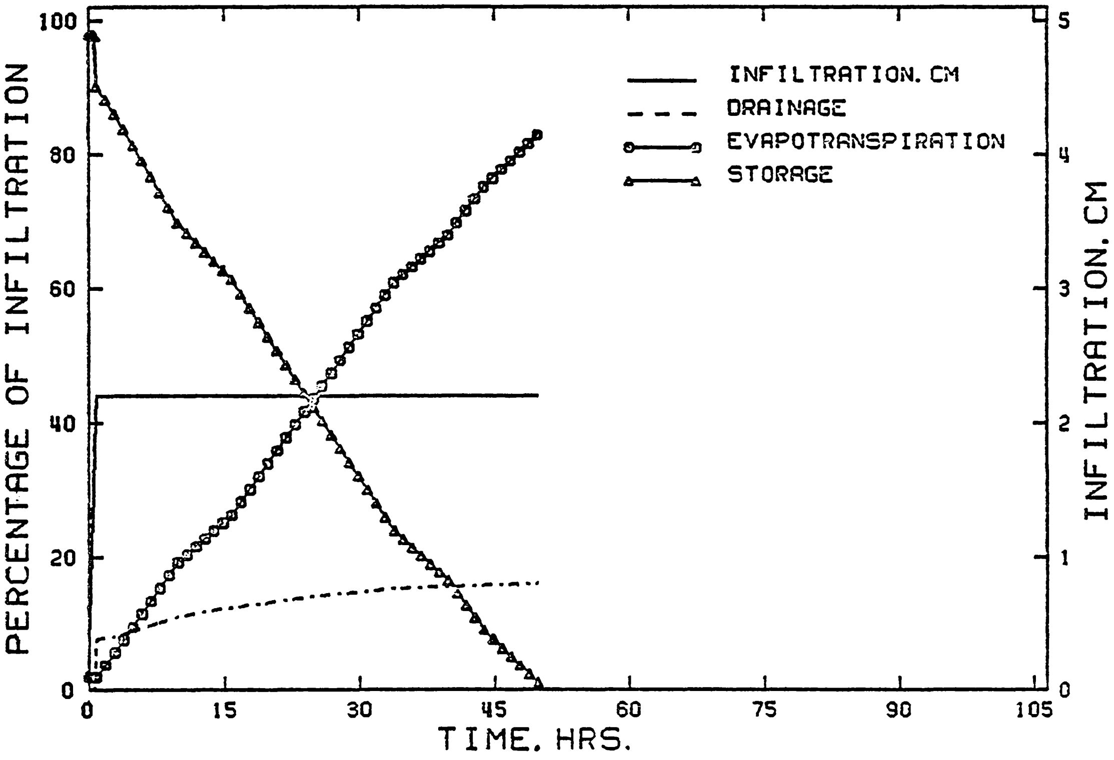

Figure E-68: Moisture Balance in Root Zone for Column 6
(Root Zone = 66.817 Percent Saturated)

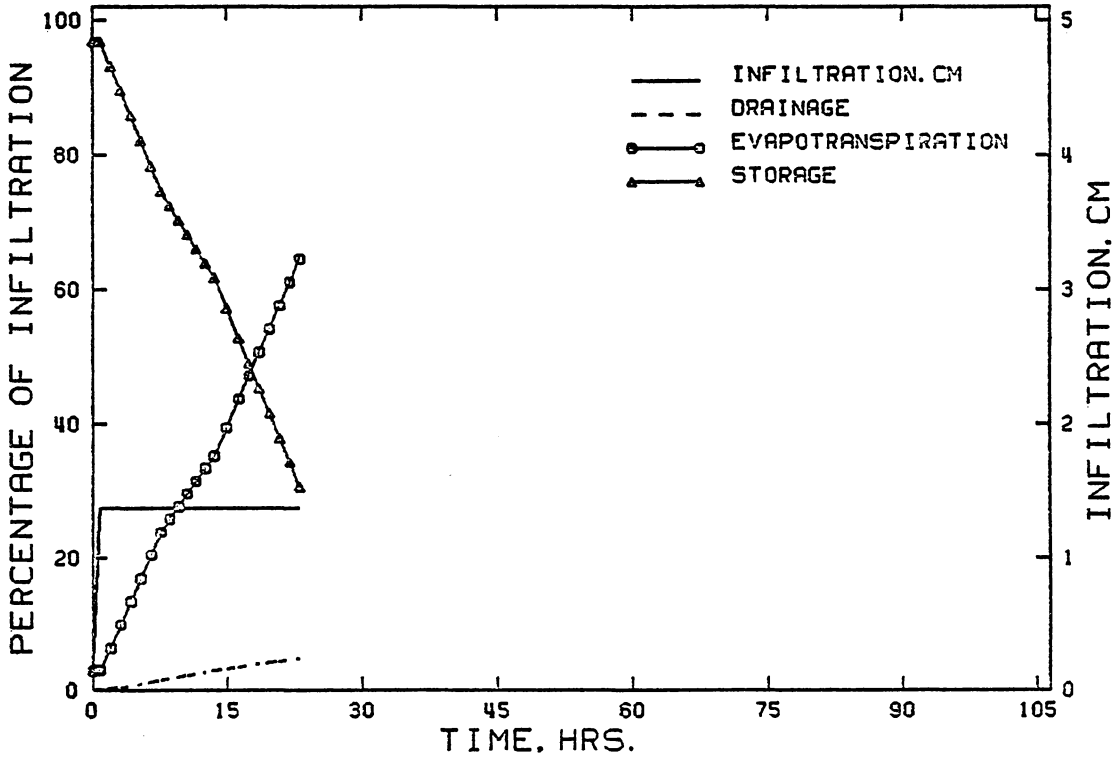

Figure E-69: Moisture Balance in Root Zone for Column 6
(Root Zone = 66.122 Percent Saturated)

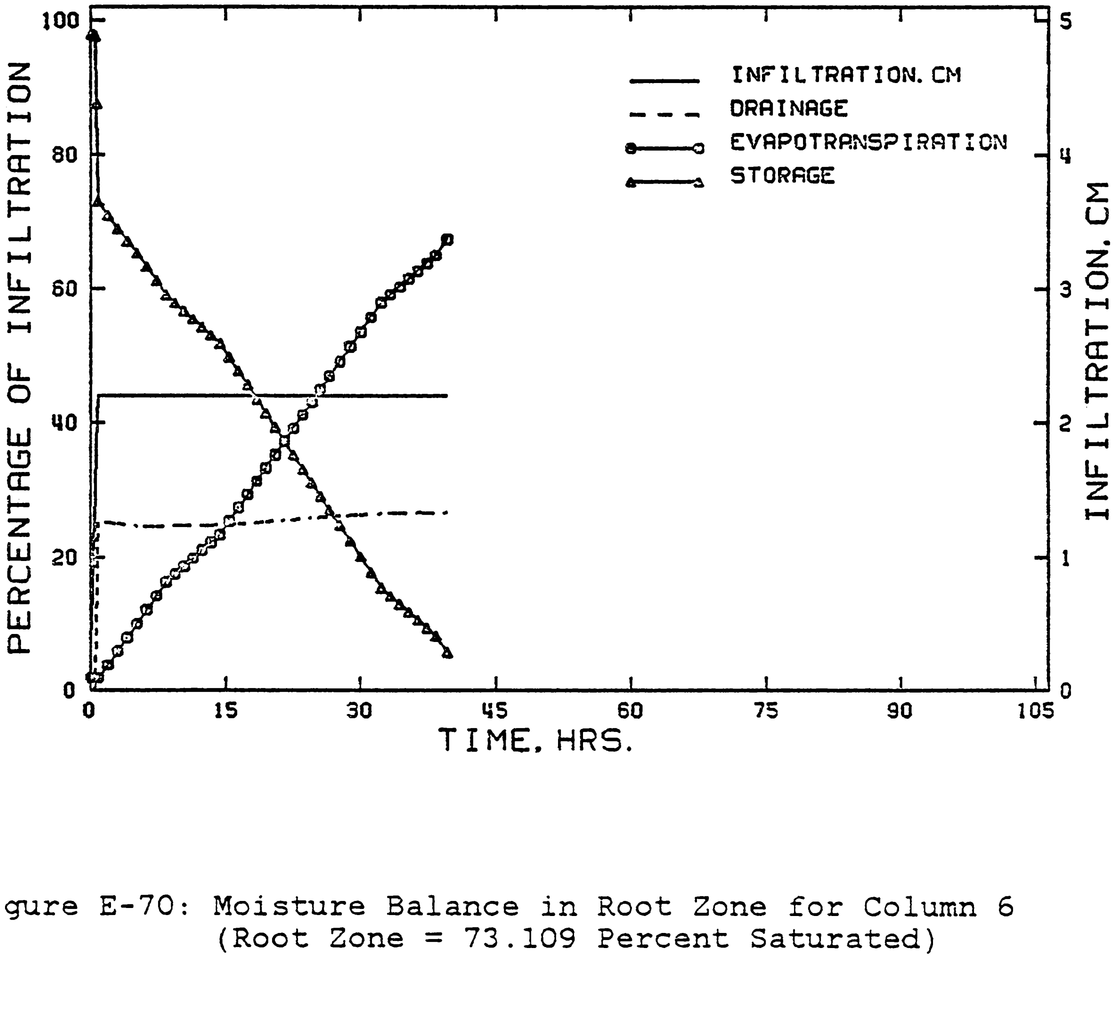

Figure E-70: Moisture Balance in Root Zone for Column 6
(Root Zone = 73.109 Percent Saturated)

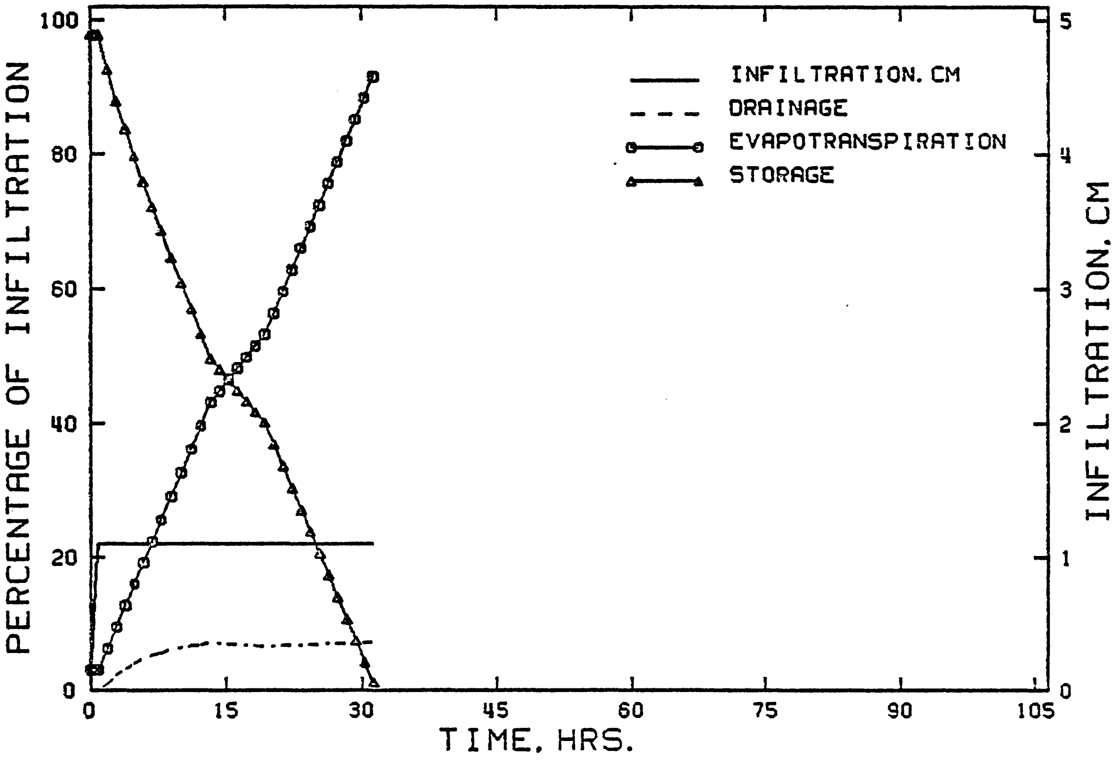

Figure E-71: Moisture Balance in Root Zone for Column 9
(Root Zone = 71.293 Percent Saturated)

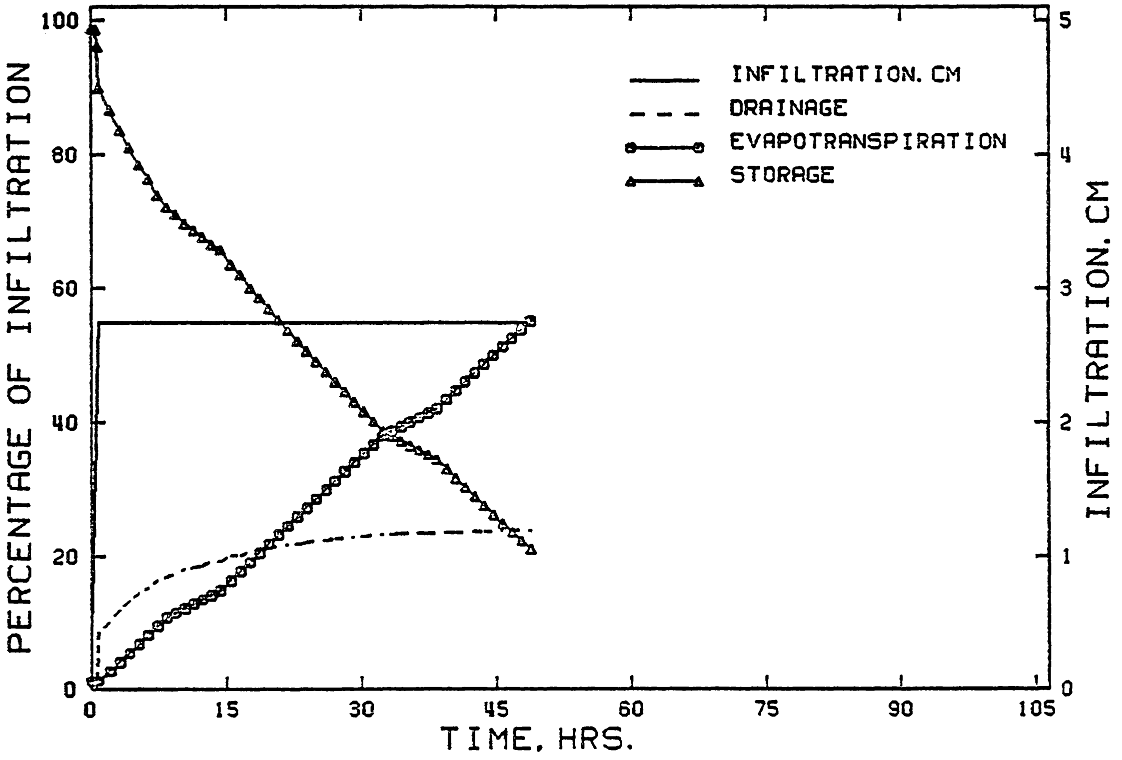

Figure E-72: Moisture Balance in Root Zone for Column 9
(Root Zone = 56.569 Percent Saturated)

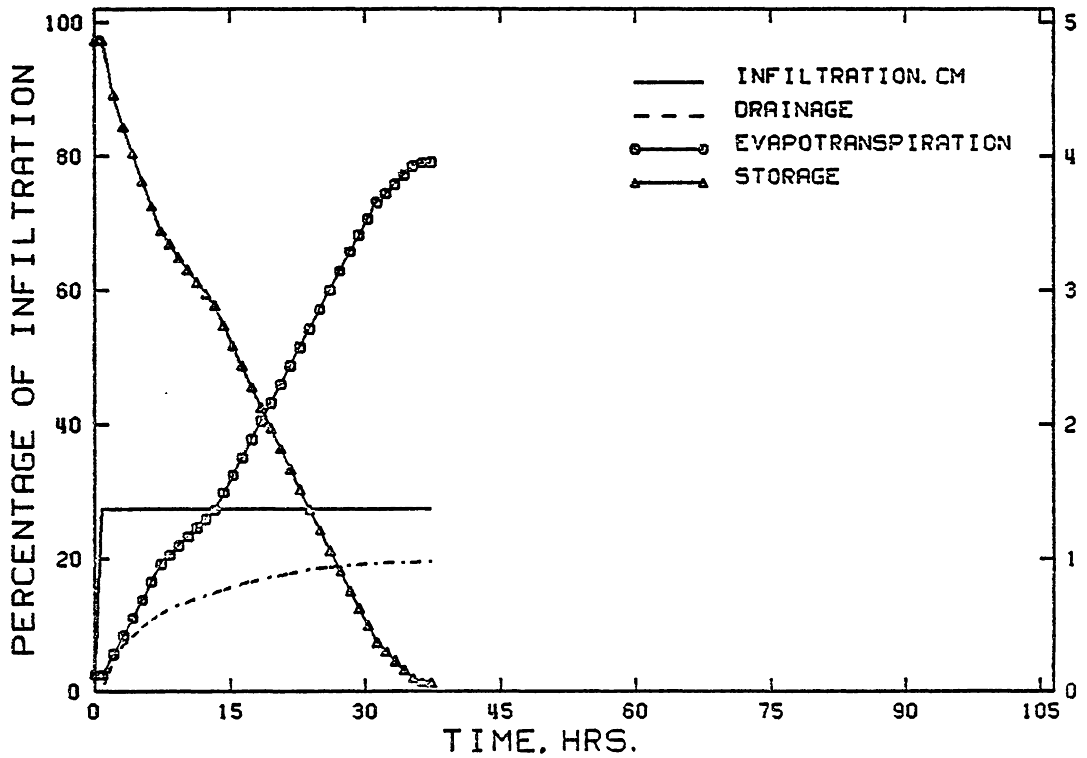

Figure E-73: Moisture Balance in Root Zone for Column 9
(Root Zone = 66.678 Percent Saturated)

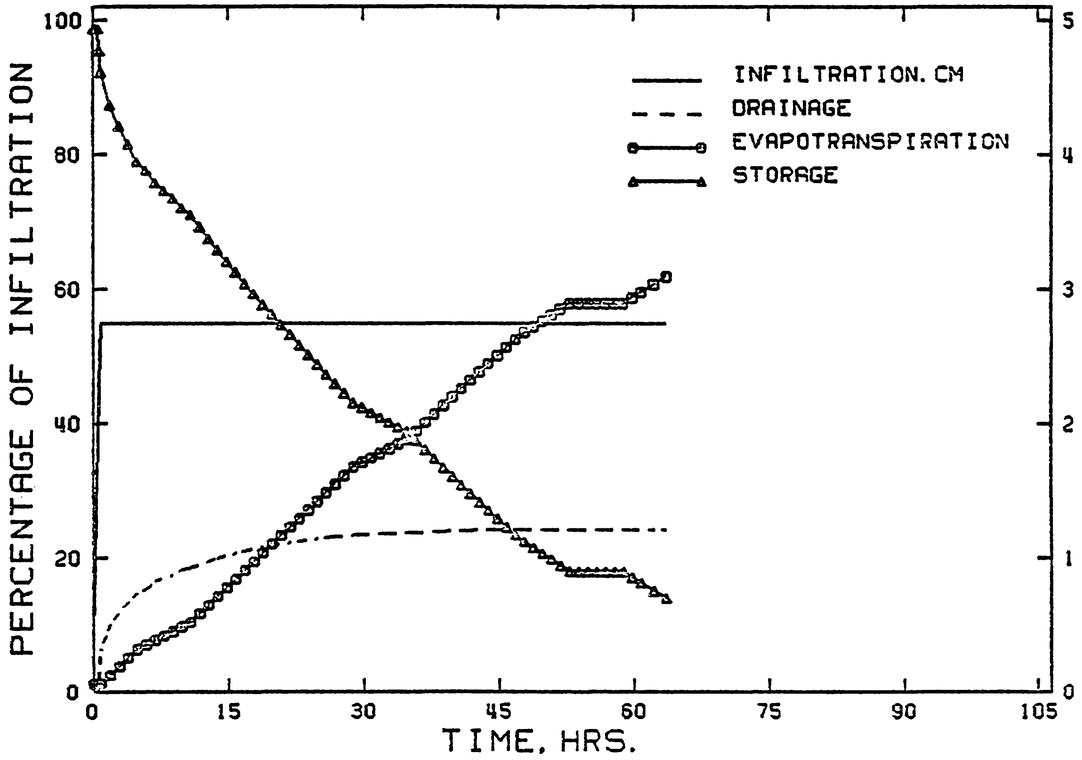

Figure E-74: Moisture Balance in Root Zone for Column 9
(Root Zone = 55.144 Percent Saturated)

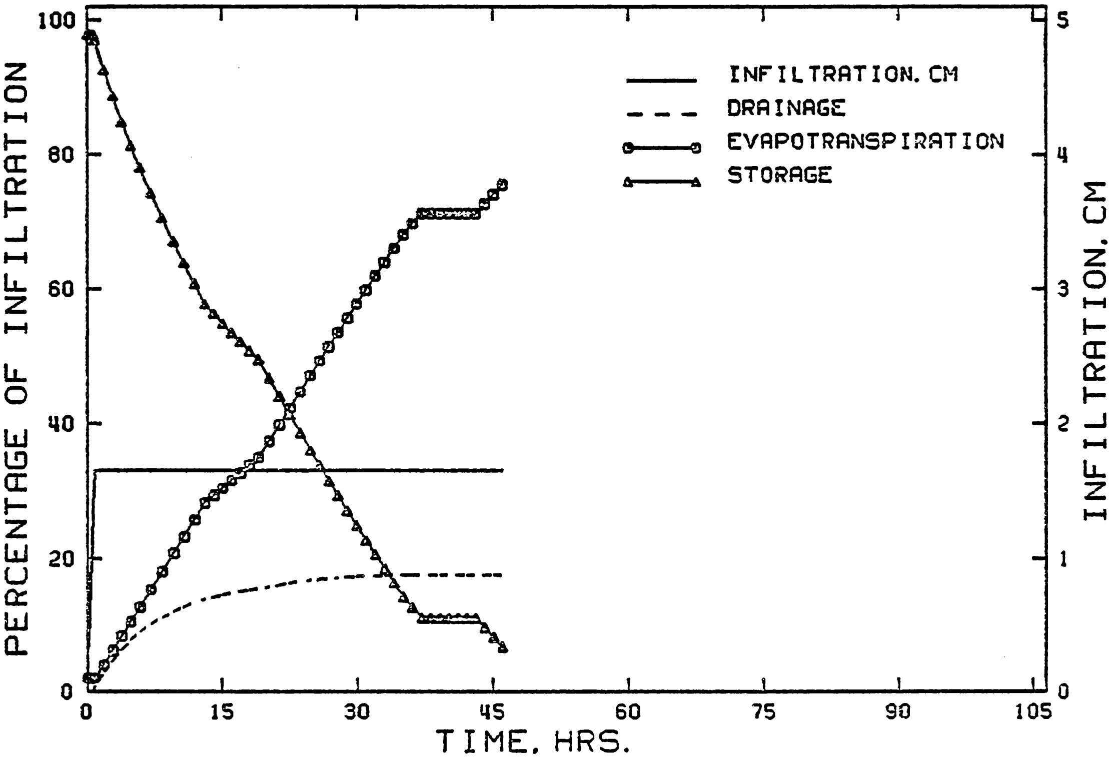

Figure E-75: Moisture Balance in Root Zone for Column 9
(Root Zone = 61.861 Percent Saturated)

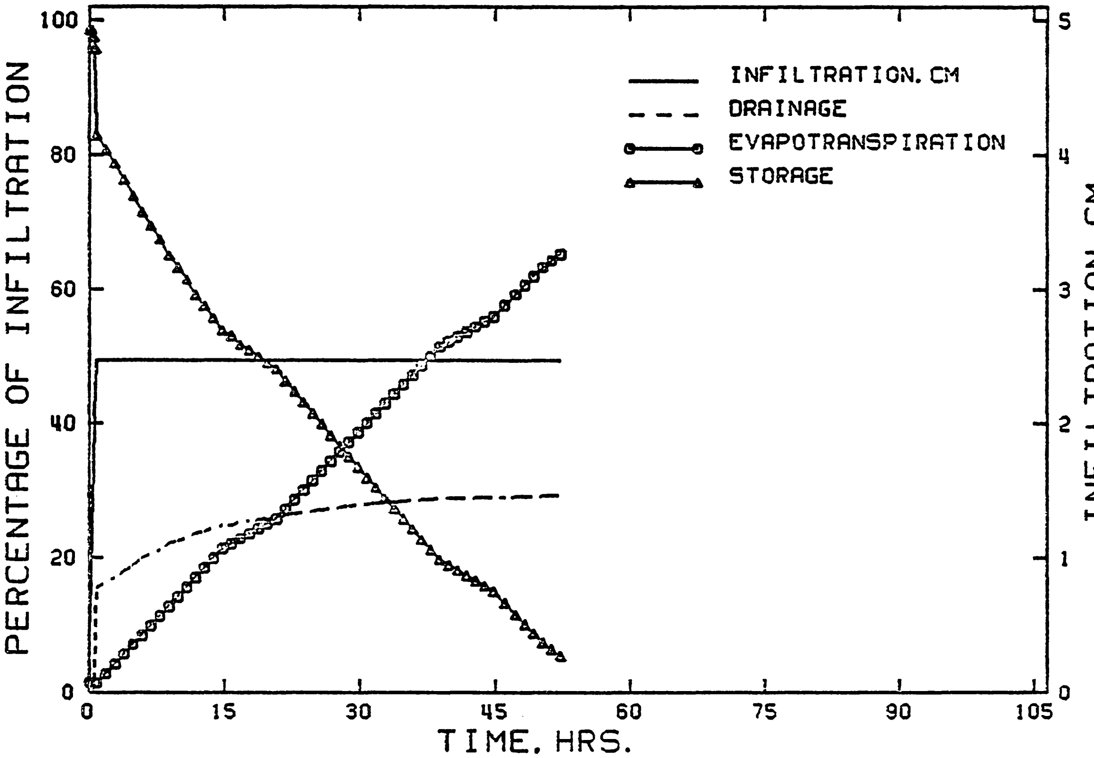

Figure E-76: Moisture Balance in Root Zone for Column 9
(Root Zone = 63.863 Percent Saturated)

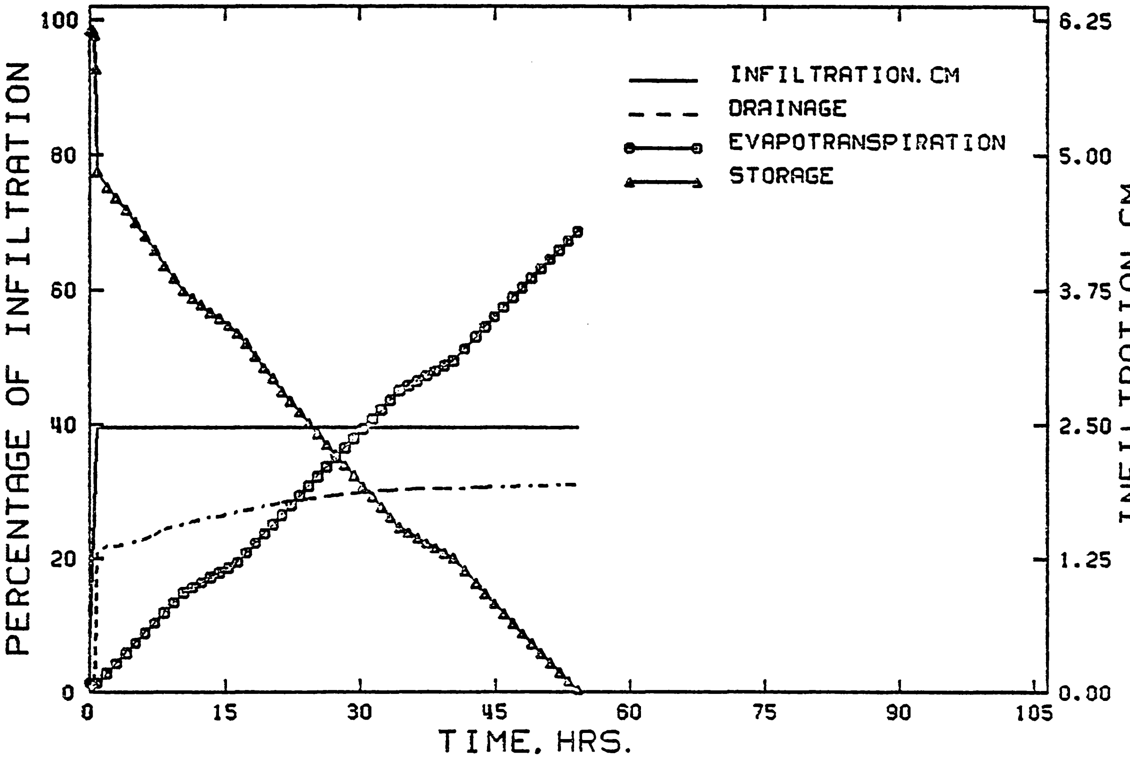

Figure E-77: Moisture Balance in Root Zone for Column 9
(Root Zone = 66.238 Percent Saturated)

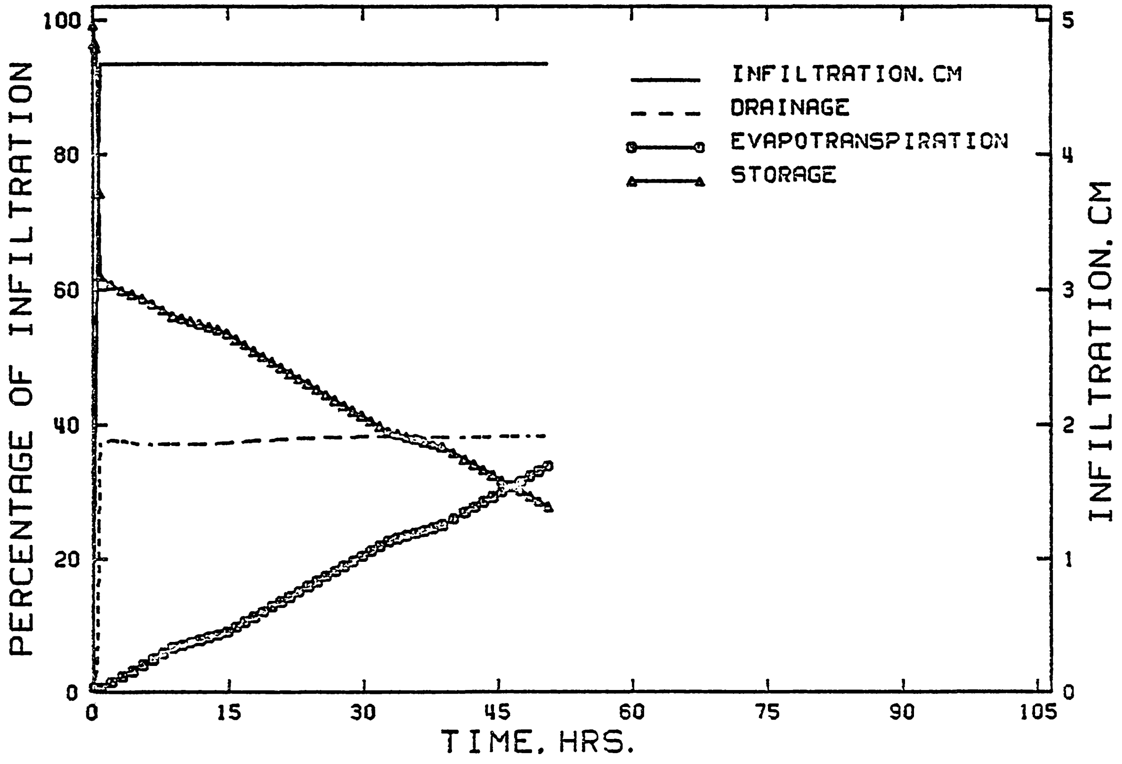

Figure E-78: Moisture Balance in Root Zone for Column 9
(Root Zone = 49.025 Percent Saturated)

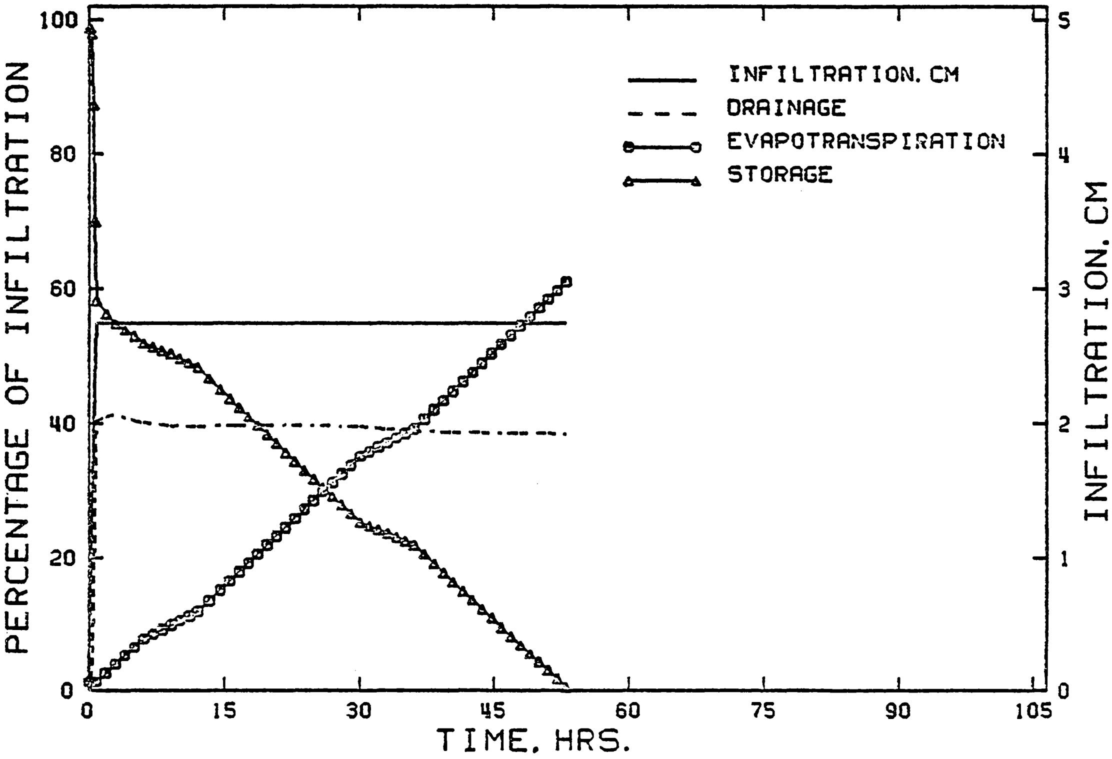

Figure E-79: Moisture Balance in Root Zone for Column 9
(Root Zone = 71.809 Percent Saturated)

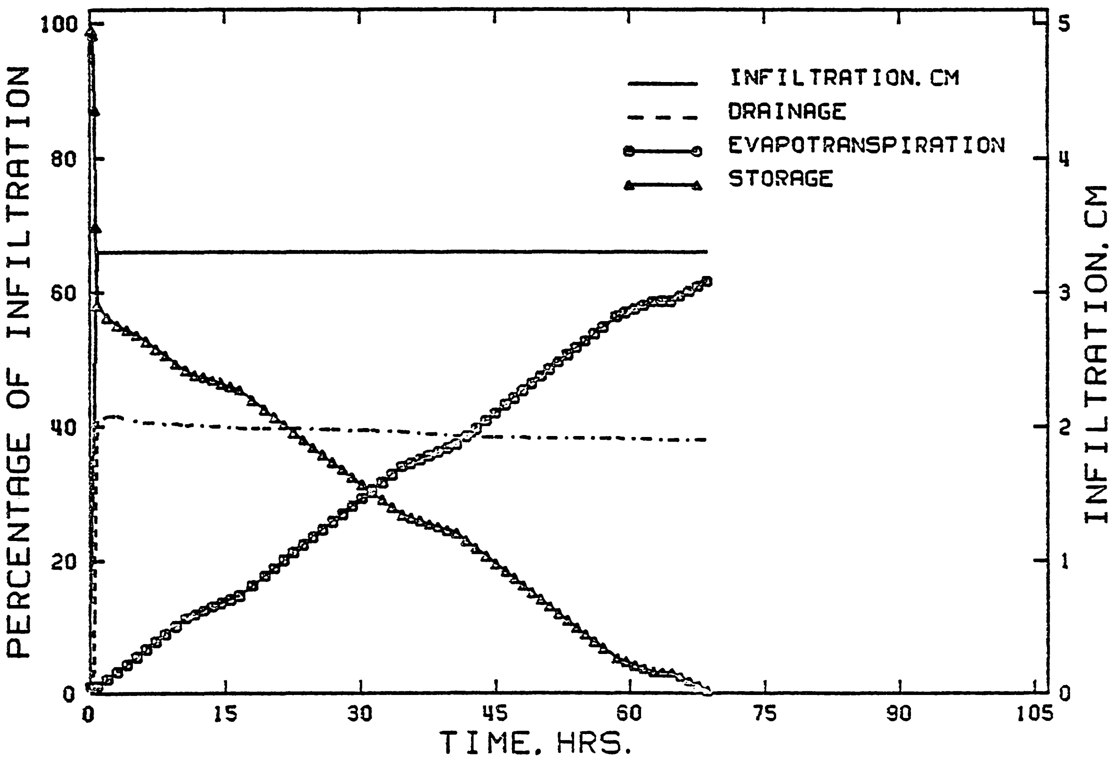

Figure E-80: Moisture Balance in Root Zone for Column 9
(Root Zone = 66.161 Percent Saturated)

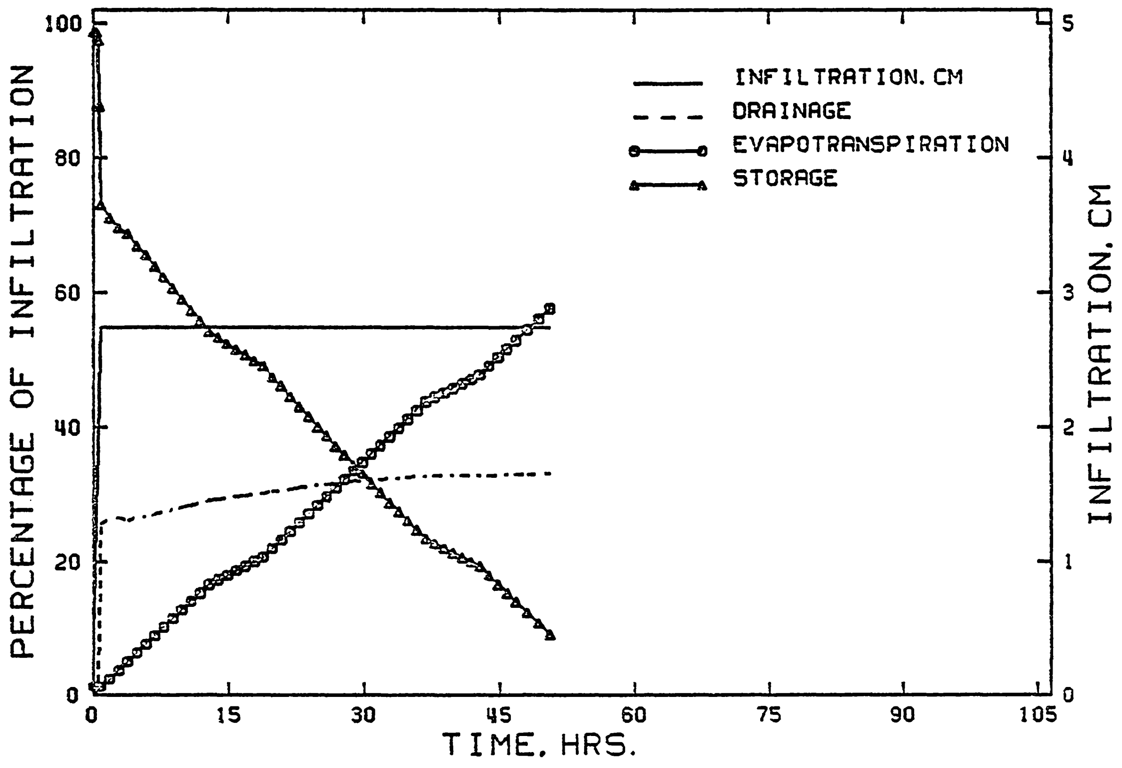

Figure E-81: Moisture Balance in Root Zone for Column 9
(Root Zone = 64.707 Percent Saturated)

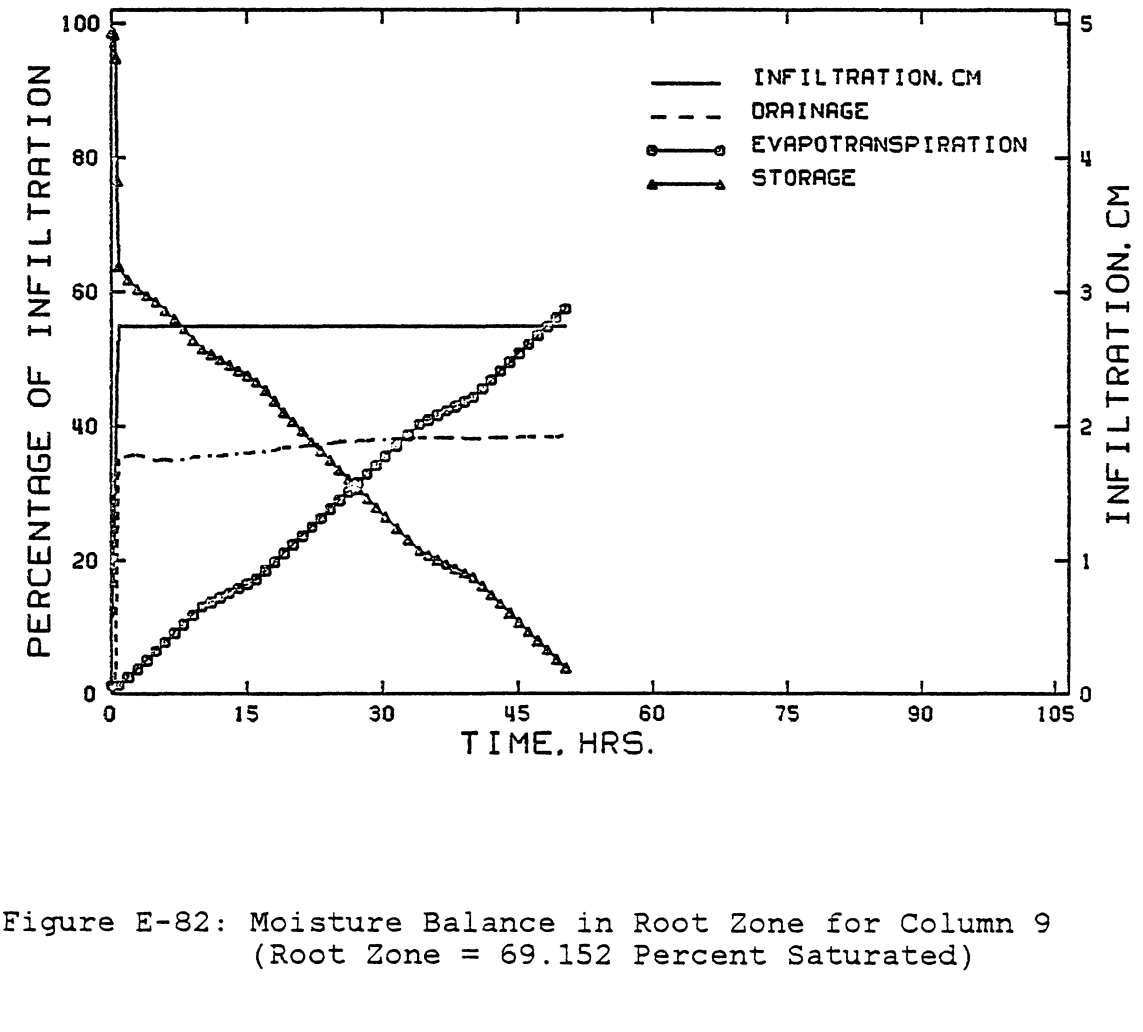

Figure E-82: Moisture Balance in Root Zone for Column 9
(Root Zone = 69.152 Percent Saturated)

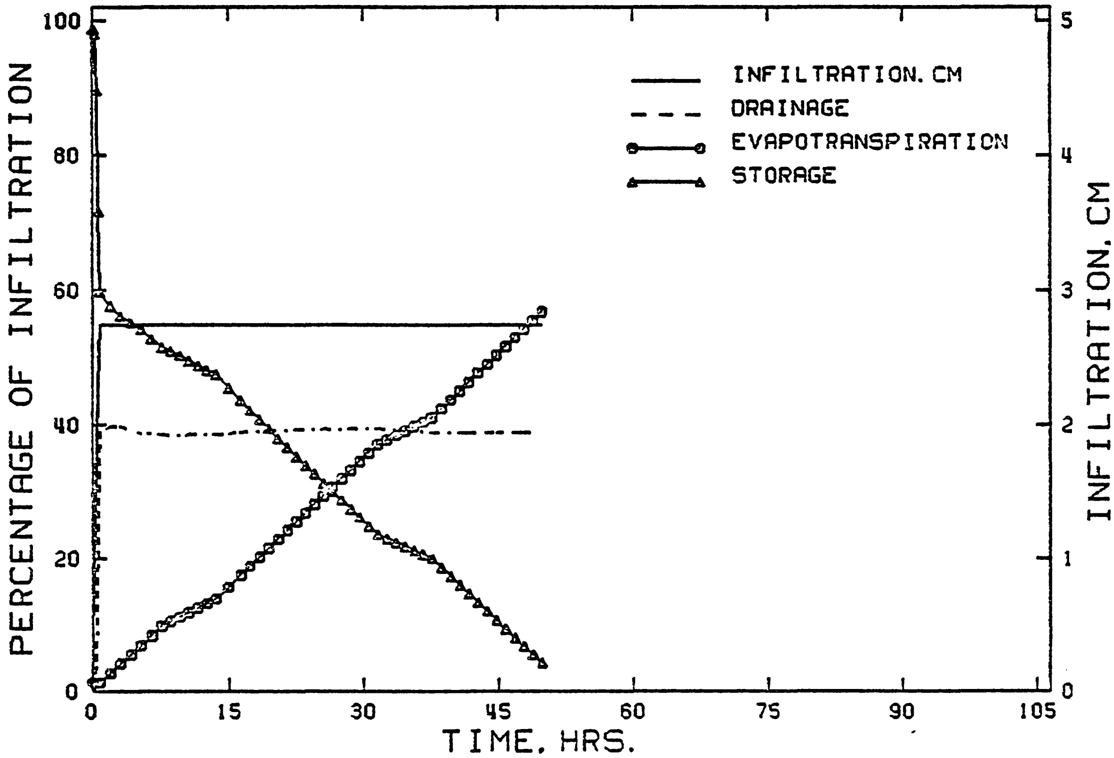

Figure E-83: Moisture Balance in Root Zone for Column 9
(Root Zone = 71.097 Percent Saturated)

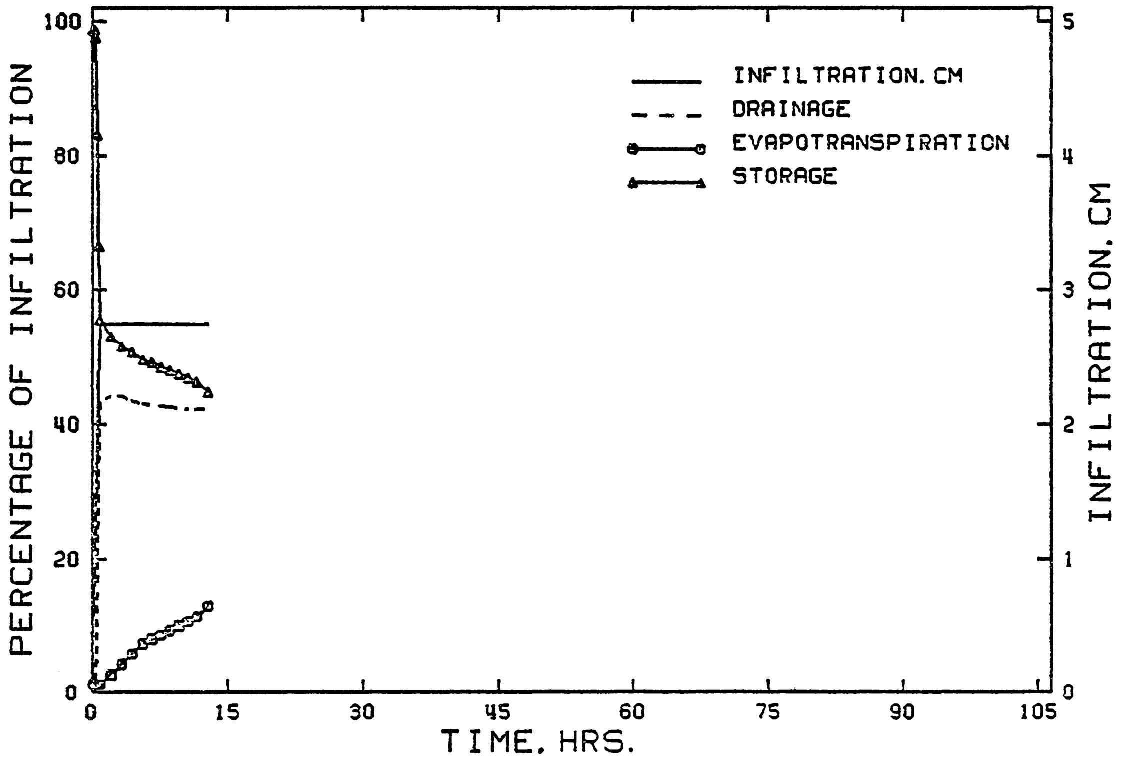

Figure E-84: Moisture Balance in Root Zone for Column 9
(Root Zone = 73.172 Percent Saturated)

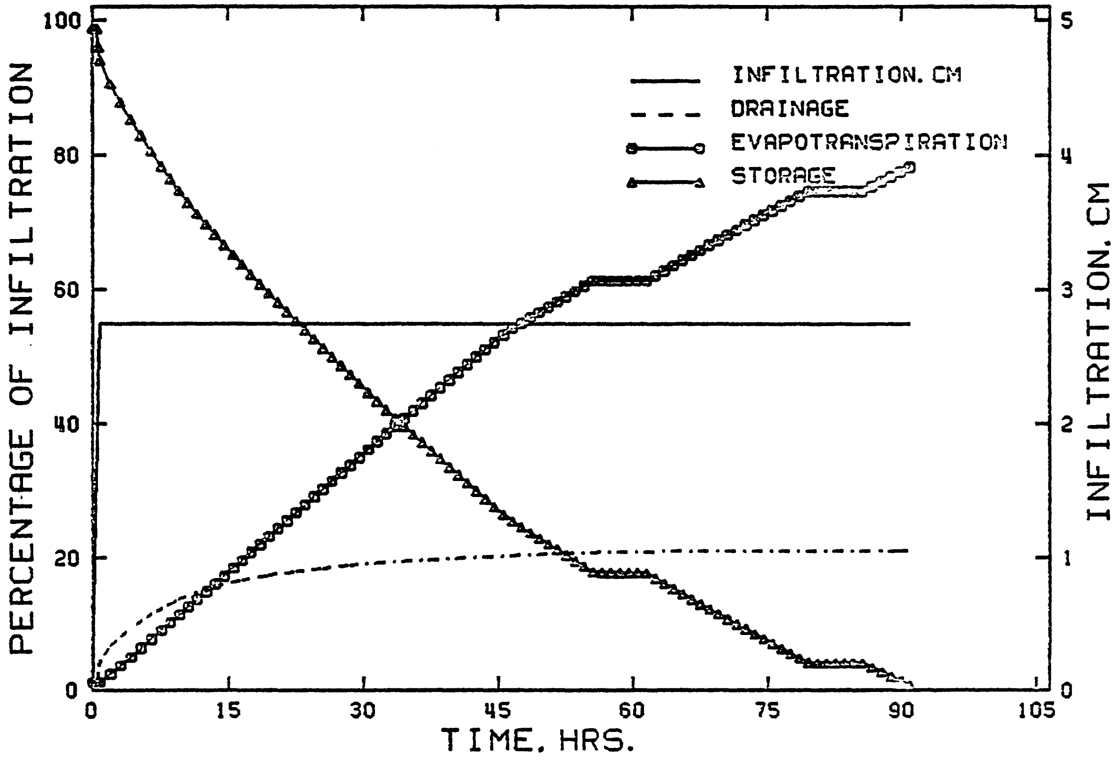

Figure E-85: Moisture Balance in Root Zone for Column 13
(Root Zone = 57.357 Percent Saturated)

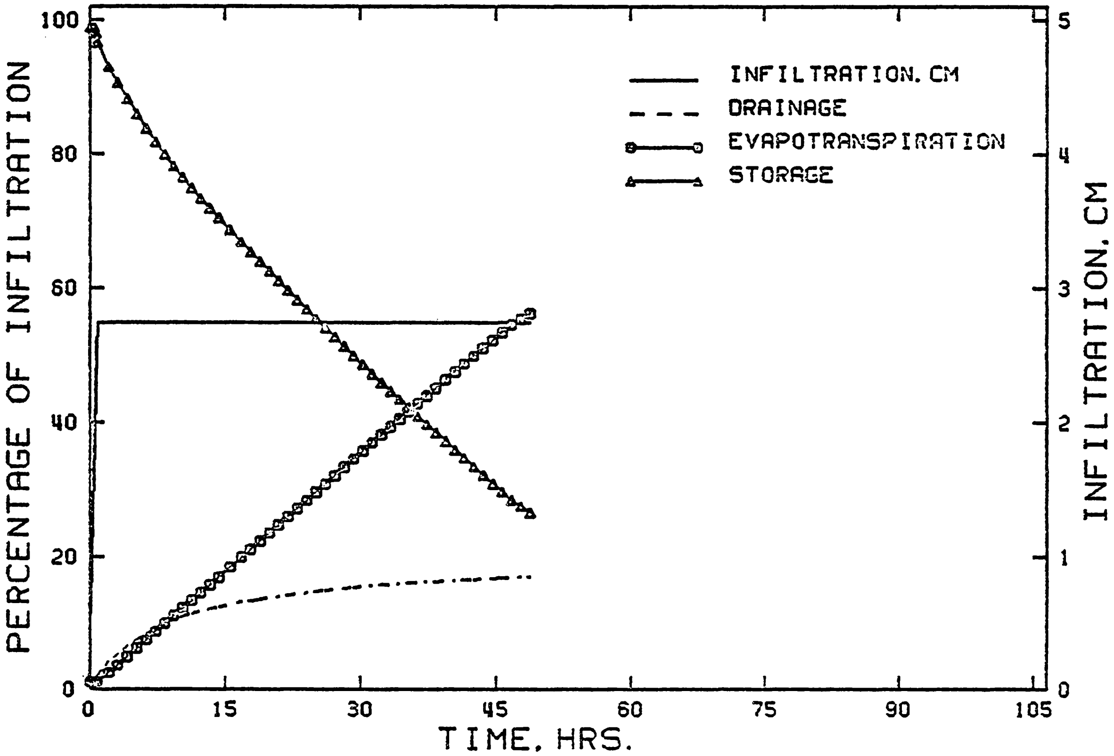

Figure E-86: Moisture Balance in Root Zone for Column 13
(Root Zone = 56.451 Percent Saturated)

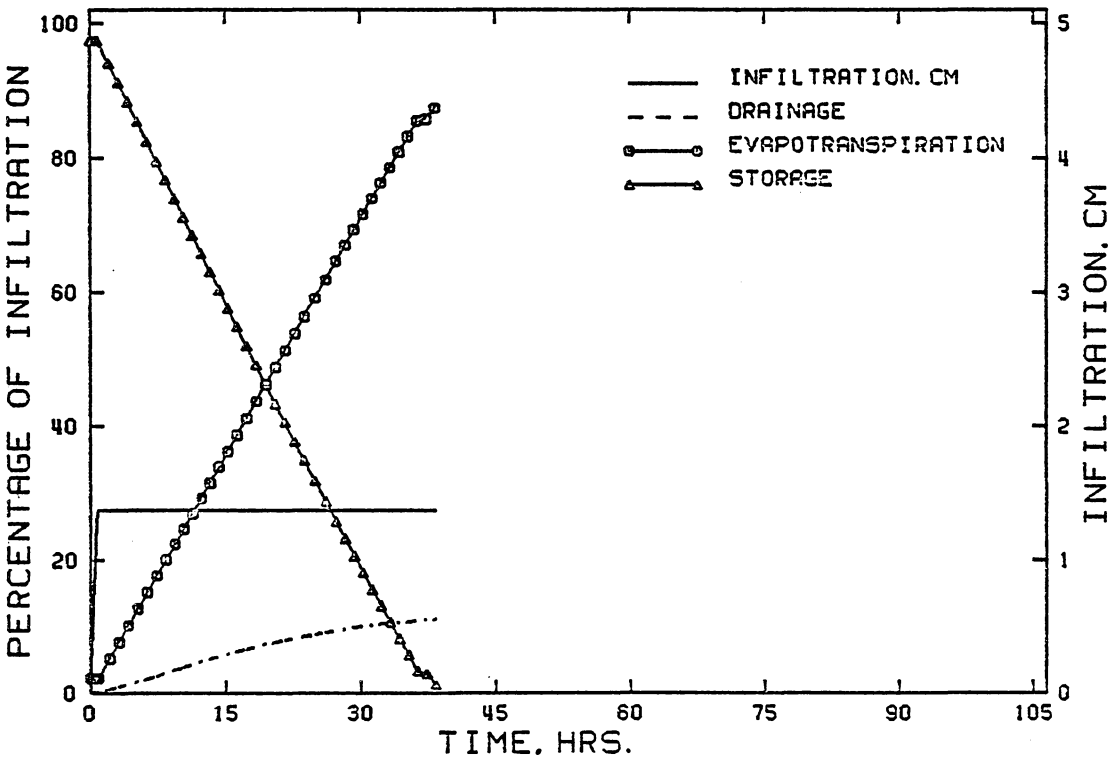

Figure E-87: Moisture Balance in Root Zone for Column 13
(Root Zone = 68.048 Percent Saturated)

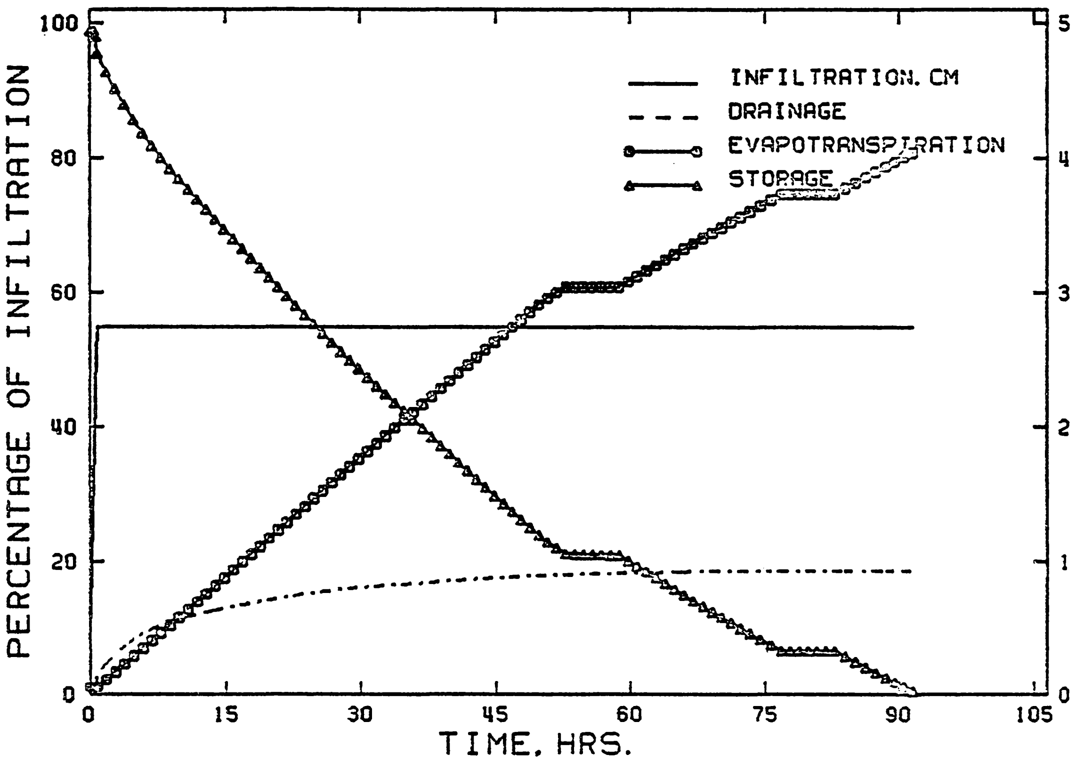

Figure E-88: Moisture Balance in Root Zone for Column 13
(Root Zone = 58.240 Percent Saturated)

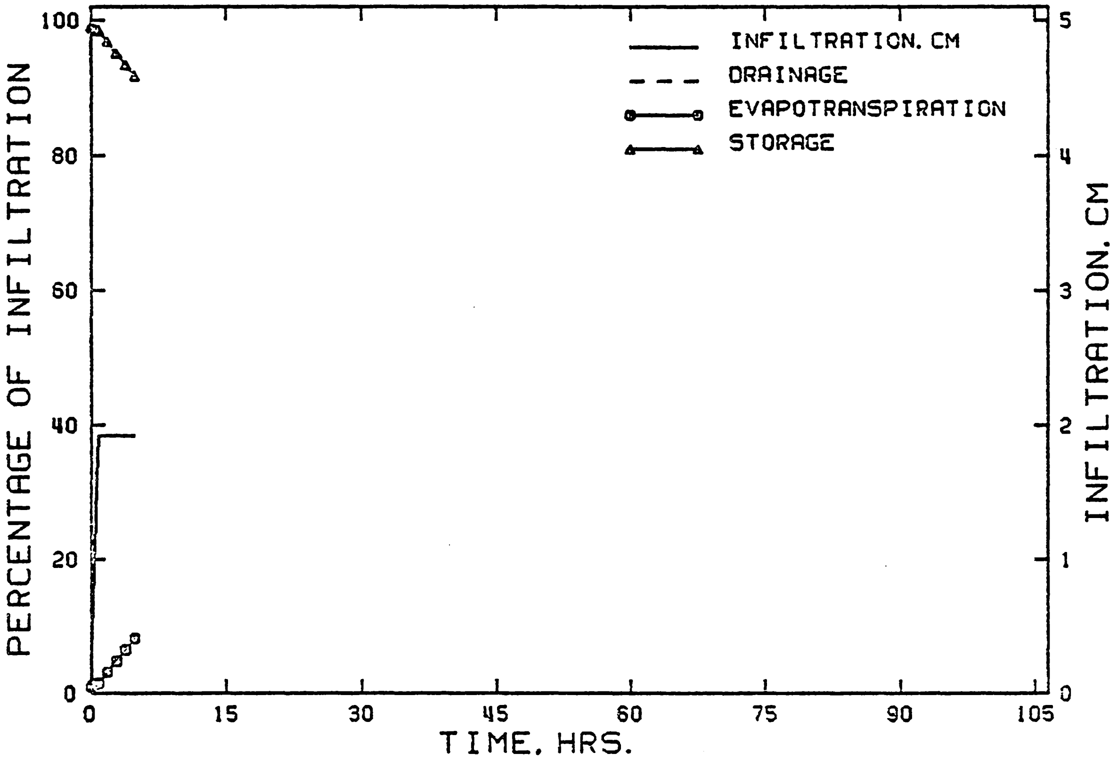

Figure E-89: Moisture Balance in Root Zone for Column 13
(Root Zone = 46.440 Percent Saturated)

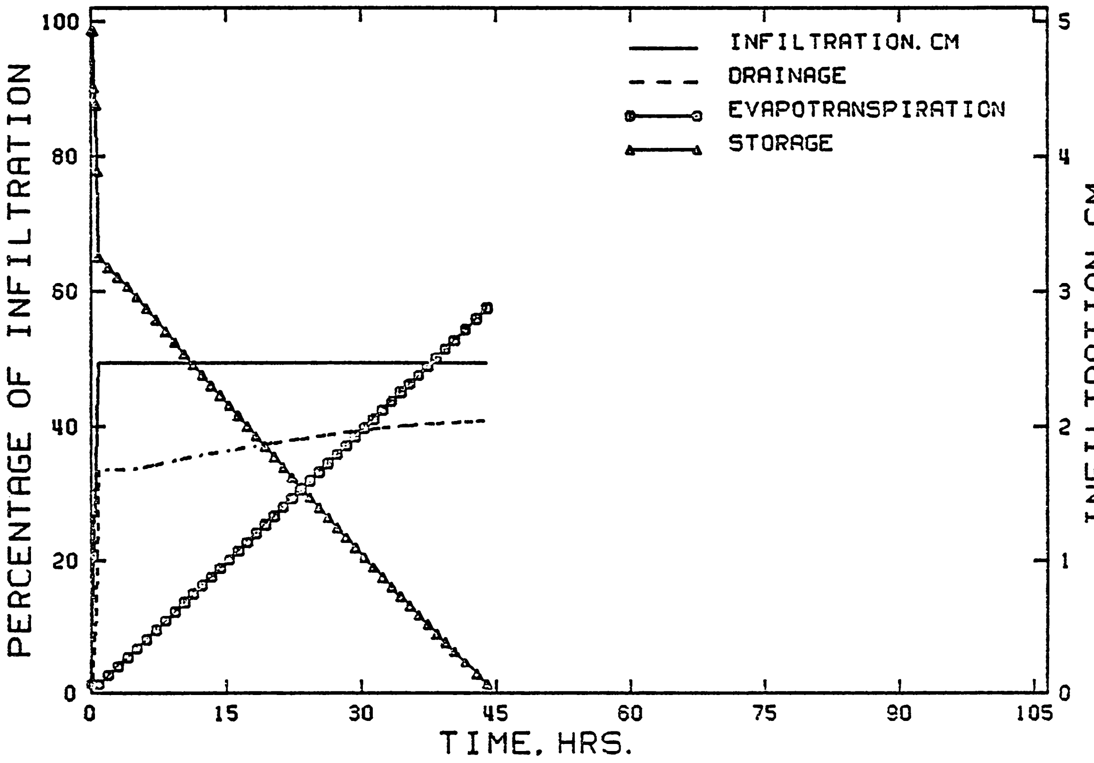

Figure E-90: Moisture Balance in Root Zone for Column 13
(Root Zone = 74.402 Percent Saturated)

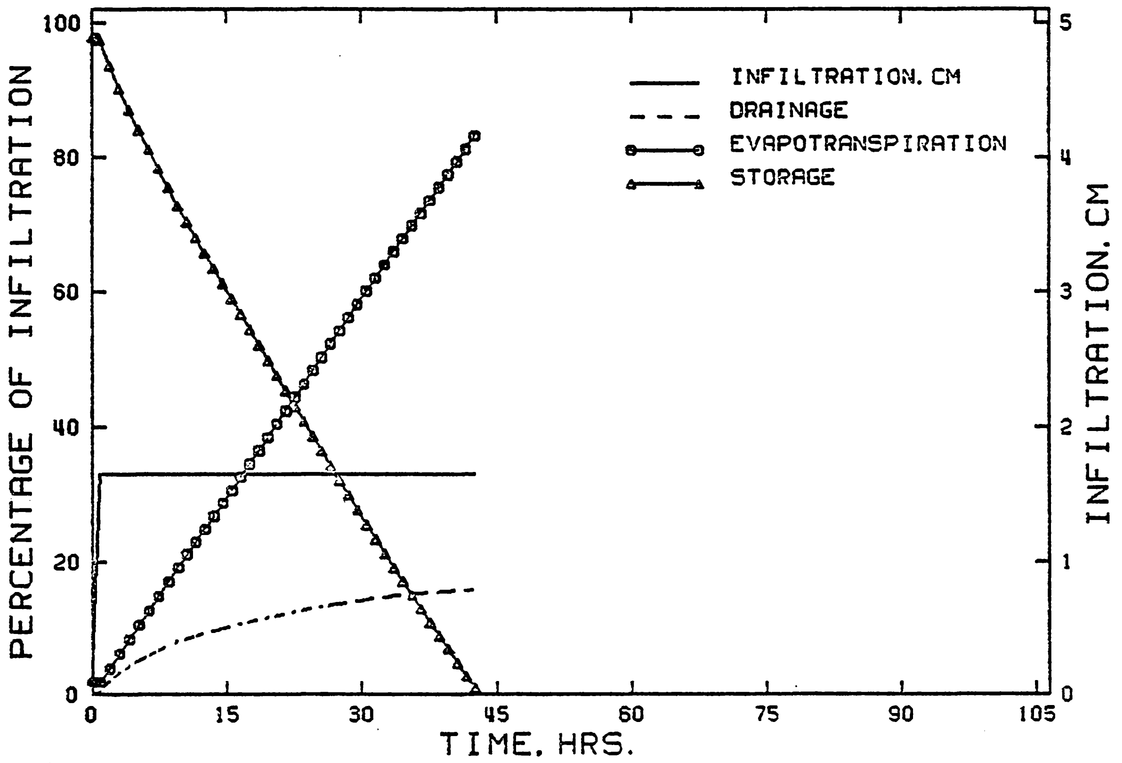

Figure E-91: Moisture Balance in Root Zone for Column 13
(Root Zone = 72.469 Percent Saturated)

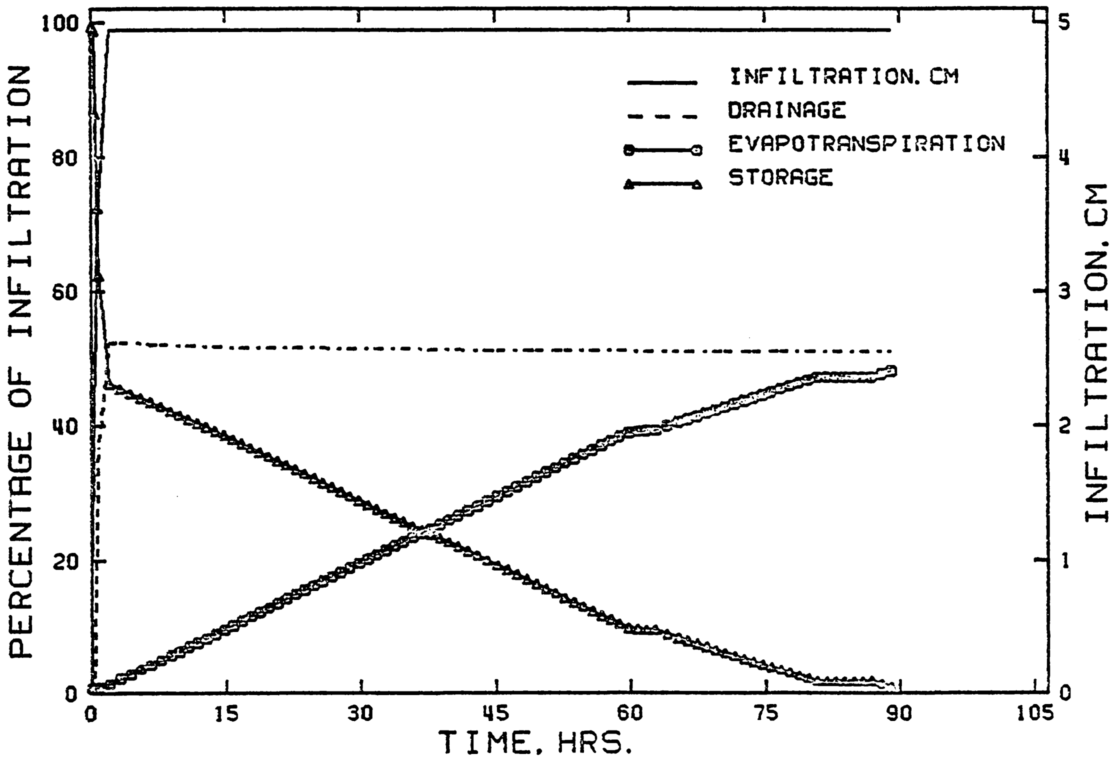

Figure E-92: Moisture Balance in Root Zone for Column 13
(Root Zone = 63.087 Percent Saturated)

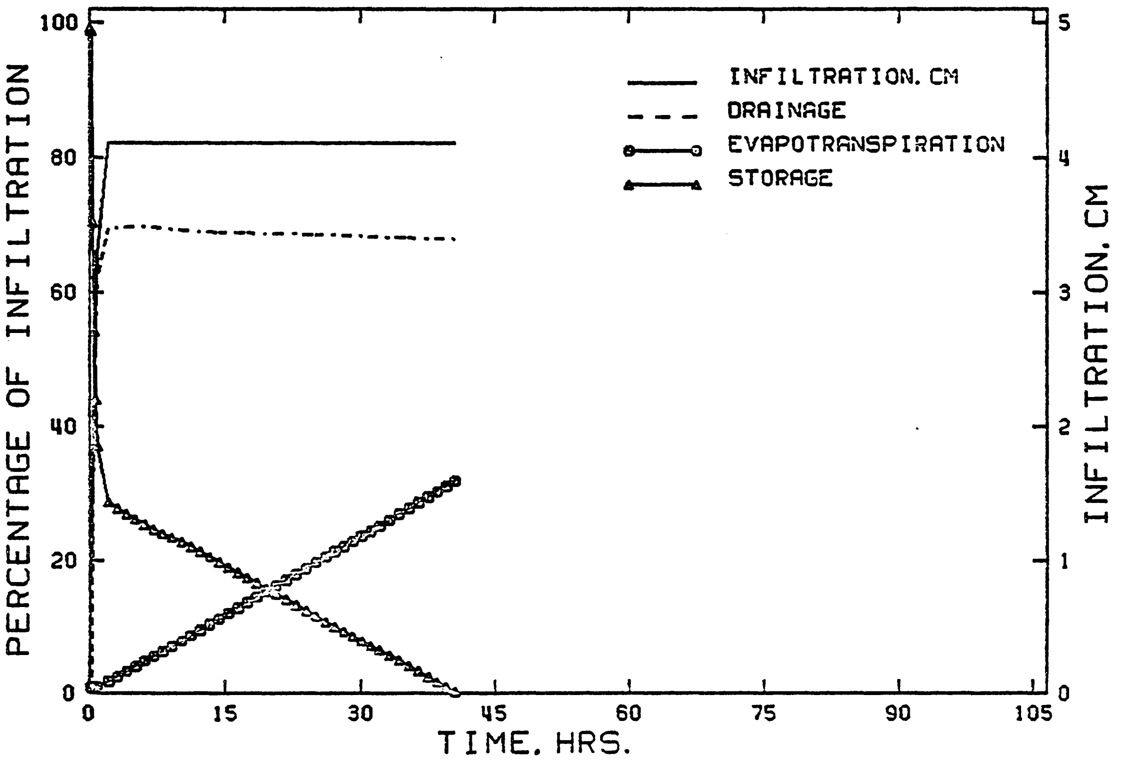

Figure E-93: Moisture Balance in Root Zone for Column 13
(Root Zone = 80.543 Percent Saturated)

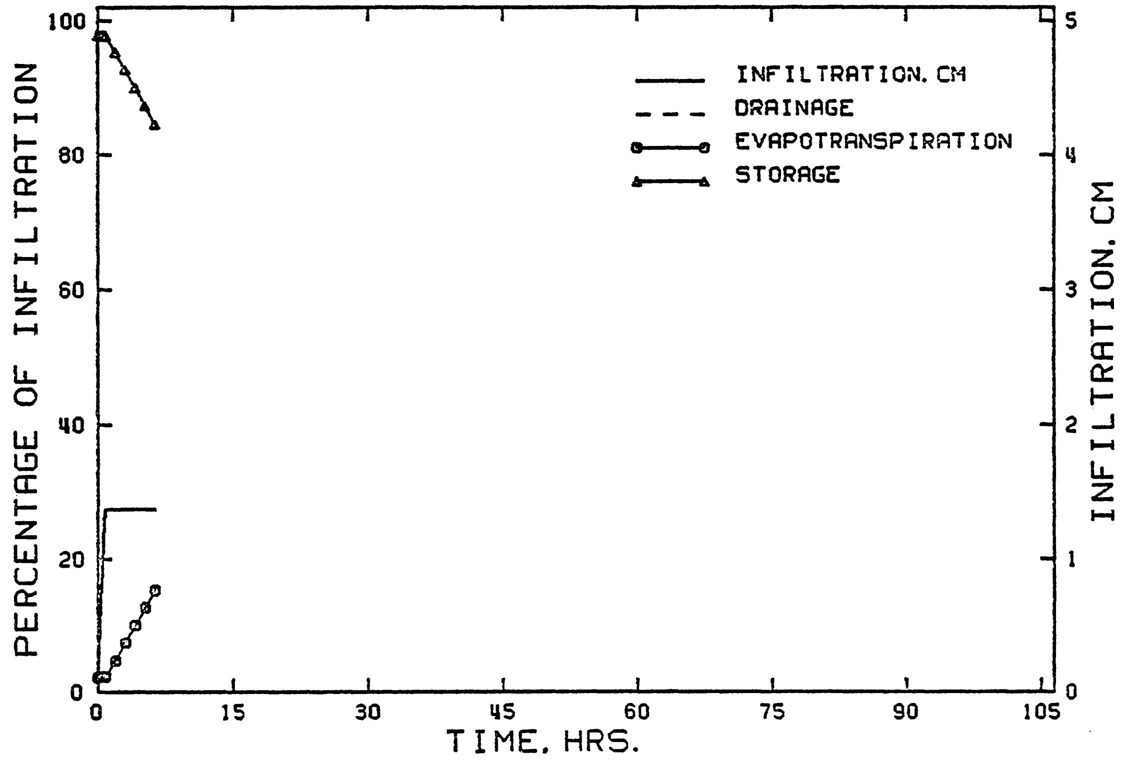

Figure E-94: Moisture Balance in Root Zone for Column 13
(Root Zone = 66.172 Percent Saturated)

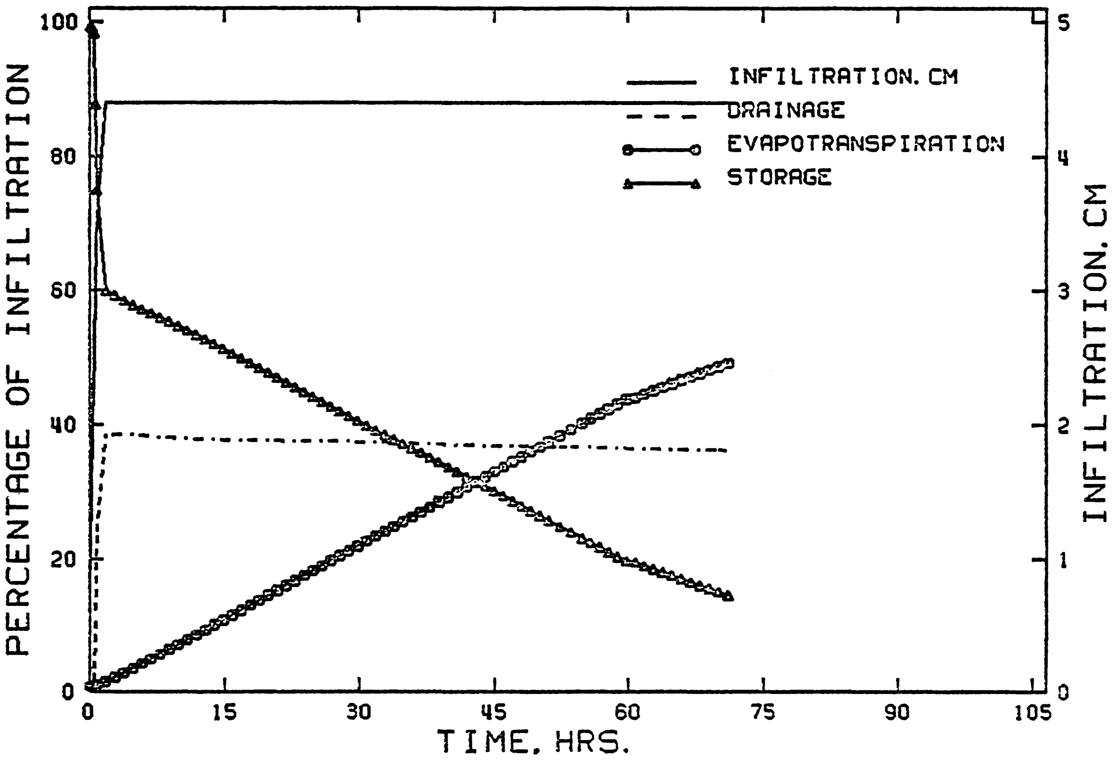

Figure E-95: Moisture Balance in Root Zone for Column 13
(Root Zone = 57.551 Percent Saturated)

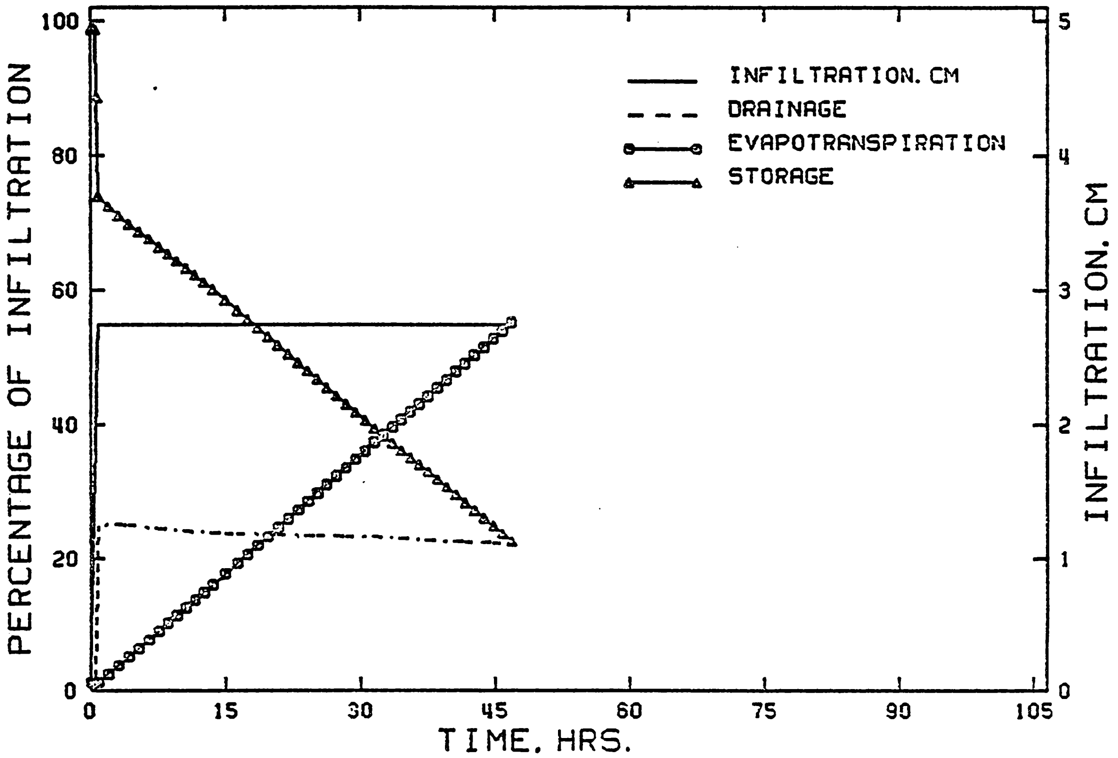

Figure E-96: Moisture Balance in Root Zone for Column 13
(Root Zone = 67.768 Percent Saturated)

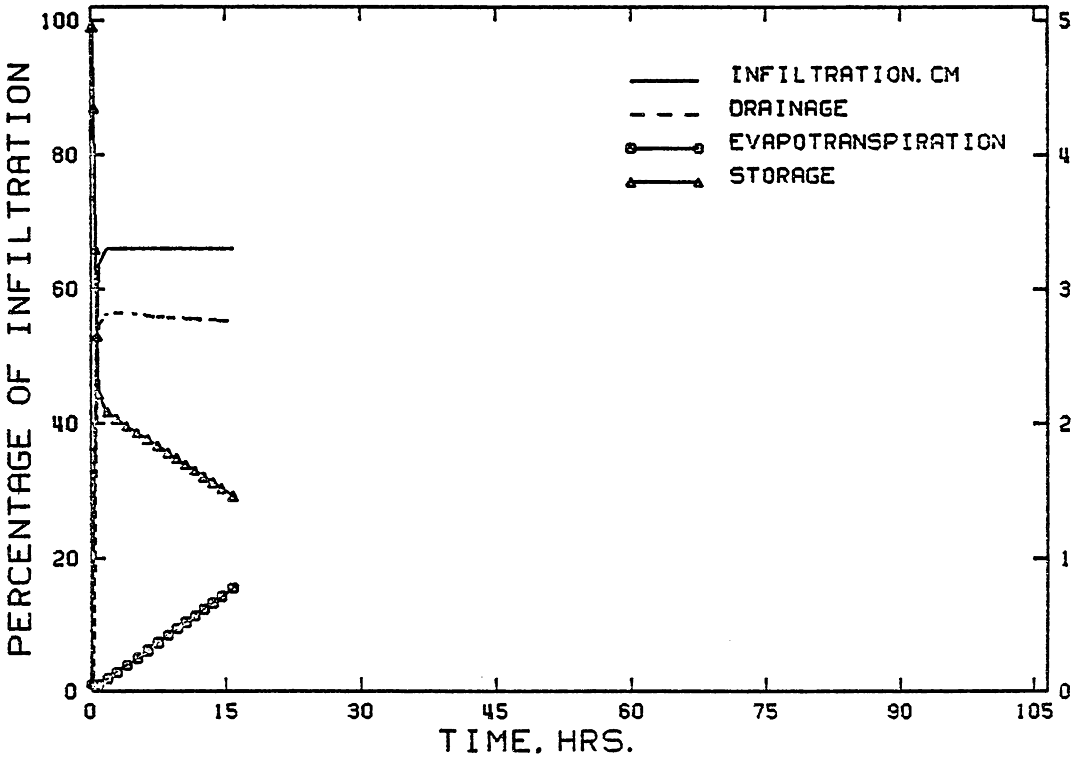

Figure E-97: Moisture Balance in Root Zone for Column 13
(Root Zone = 77.574 Percent Saturated)

Table E-1.
COLUMN 4

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	53.535	0.457	98.029	1.970	0.0
0.166		0.913	97.816	1.970	0.213
0.333		1.370	83.986	1.970	14.042
0.500		1.827	62.989	1.970	35.039
0.666		2.283	50.389	1.970	47.632
0.833		2.740	41.993	1.970	56.029
1.833		2.740	40.067	3.940	55.984
2.833		2.740	38.238	5.910	55.842
3.833		2.740	36.512	7.880	55.598
4.833		2.740	34.882	9.850	55.258
5.833		2.740	33.328	11.820	54.841
6.833		2.740	31.838	13.790	54.361
7.833		2.740	30.265	15.760	53.964
8.833		2.740	28.989	17.337	53.663
9.833		2.740	27.662	18.913	53.413
10.833		2.740	26.305	20.490	53.193
11.833		2.740	24.926	22.067	52.995
12.833		2.740	23.530	23.643	52.812
13.833		2.740	22.123	25.220	52.641
14.833		2.740	20.266	27.190	52.527
15.833		2.740	18.373	29.160	52.449
16.833		2.740	16.455	31.130	52.396
17.833		2.740	14.517	33.098	52.366
18.833		2.740	12.571	35.051	52.359
19.833		2.740	10.638	36.983	52.360
20.833		2.740	8.733	38.893	52.355
21.833		2.740	6.840	40.782	52.358
22.833		2.740	4.964	42.651	52.366
23.833		2.740	3.105	44.499	52.376
24.833		2.740	1.264	46.328	52.388
0.0	64.784	0.457	98.945	1.048	0.006
0.166		0.913	98.598	1.395	0.006
0.333		1.370	98.417	1.576	0.006
0.500		1.827	98.319	1.673	0.006
0.666		2.283	97.660	1.733	0.580
0.833		2.740	93.547	1.772	4.635
2.083		2.740	88.447	4.235	7.262
3.083		2.740	85.969	6.205	7.768
4.083		2.740	83.534	8.175	8.230
5.083		2.740	81.127	10.145	8.667
6.083		2.740	78.796	12.115	9.024
7.083		2.740	76.421	14.085	9.428
8.083		2.740	74.154	16.055	9.721
9.083		2.740	72.298	17.632	9.998
10.083		2.740	70.459	19.208	10.258
11.083		2.740	68.638	20.785	10.502
12.083		2.740	66.833	22.361	10.728
13.083		2.740	65.045	23.938	10.937
14.083		2.740	63.274	25.515	11.129
15.208		2.740	60.858	27.709	11.352

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
16.333		2.740	58.488	29.876	11.554
17.383		2.740	56.315	31.874	11.729
18.433		2.740	54.208	33.849	11.860
19.483		2.740	52.113	35.802	12.002
20.533		2.740	50.044	37.733	12.140
21.583		2.740	48.102	39.547	12.268
22.633		2.740	46.582	40.953	12.382
23.683		2.740	45.093	42.348	12.476
24.733		2.740	43.640	43.731	12.545
25.783		2.740	42.225	45.103	12.587
26.833		2.740	40.861	46.464	12.591
27.883		2.740	39.514	47.811	12.591
28.933		2.740	38.186	49.138	12.592
29.983		2.740	36.876	50.446	12.593
31.033		2.740	35.585	51.736	12.594
32.083		2.740	34.312	53.008	12.595
33.083		2.740	34.311	53.008	12.596
34.083		2.740	34.310	53.008	12.597
35.083		2.740	34.309	53.008	12.598
36.083		2.740	34.308	53.008	12.599
37.083		2.740	34.307	53.008	12.600
38.083		2.740	34.306	53.008	12.600
39.133		2.740	33.050	54.262	12.601
40.183		2.740	31.812	55.499	12.603
41.233		2.740	30.591	56.719	12.604
42.283		2.740	29.387	57.922	12.605
43.333		2.740	28.199	59.108	12.607
44.383		2.740	27.027	60.278	12.609
45.433		2.740	25.871	61.431	12.611
46.483		2.740	24.730	62.569	12.613
47.533		2.740	23.605	63.692	12.616
48.583		2.740	22.495	64.799	12.618
0.0	52.722	0.228	97.607	2.382	0.010
0.167		0.457	96.990	2.998	0.010
0.334		0.685	96.744	3.243	0.010
0.500		0.913	96.591	3.393	0.010
0.667		1.142	96.483	3.500	0.010
0.834		1.370	96.410	3.573	0.010
2.084		1.370	91.466	8.498	0.026
3.133		1.370	87.317	12.635	0.035
4.183		1.370	83.167	16.772	0.046
5.233		1.370	79.016	20.909	0.056
6.283		1.370	74.865	25.046	0.068
7.333		1.370	70.712	29.183	0.080
8.333		1.370	67.544	32.336	0.092
9.333		1.370	64.377	35.490	0.103
10.333		1.370	61.209	38.643	0.114
11.333		1.370	58.041	41.796	0.126
12.333		1.370	54.873	44.950	0.137

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
13.333		1.370	51.706	48.103	0.148
14.333		1.370	47.991	51.804	0.160
15.333		1.370	44.316	55.465	0.172
16.333		1.370	41.601	58.166	0.184
17.405		1.370	38.715	61.037	0.197
18.476		1.370	35.852	63.884	0.210
19.548		1.370	33.014	66.707	0.223
20.619		1.370	30.201	69.506	0.237
21.691		1.370	27.421	72.272	0.250
22.762		1.370	24.681	74.998	0.264
23.833		1.370	21.977	77.685	0.280
25.000		1.370	19.071	80.568	0.301
26.167		1.370	16.208	83.406	0.325
27.333		1.370	13.388	86.200	0.350
28.333		1.370	11.007	88.558	0.373
29.333		1.370	8.656	90.884	0.396
30.333		1.370	6.337	93.180	0.420
31.333		1.370	4.047	95.445	0.444
32.333		1.370	4.023	95.445	0.467
33.333		1.370	4.000	95.445	0.490
34.333		1.370	3.976	95.445	0.513
35.333		1.370	3.953	95.445	0.536
36.333		1.370	3.930	95.445	0.558
37.333		1.370	3.908	95.445	0.580
38.333		1.370	1.649	97.680	0.603
0.0	56.172	0.457	98.952	1.042	0.005
0.167		0.913	98.609	1.385	0.005
0.333		1.370	98.428	1.566	0.005
0.500		1.827	98.331	1.662	0.005
0.667		2.283	98.263	1.724	0.012
0.833		2.740	89.755	1.765	8.326
1.833		2.740	84.944	3.735	11.144
2.833		2.740	82.182	5.705	11.933
3.833		2.740	79.686	7.675	12.458
4.833		2.740	77.339	9.645	12.834
5.833		2.740	75.498	11.222	13.098
6.833		2.740	73.710	12.798	13.309
7.833		2.740	71.958	14.375	13.483
8.833		2.740	70.245	15.951	13.620
9.833		2.740	68.558	17.528	13.730
10.833		2.740	66.892	19.105	13.818
11.833		2.740	64.811	21.075	13.929
12.833		2.740	62.721	23.045	14.049
13.833		2.740	60.650	25.003	14.161
14.833		2.740	58.612	26.939	14.263
15.833		2.740	56.624	28.854	14.336
16.833		2.740	54.690	30.748	14.376
17.833		2.740	52.815	32.621	14.378
18.833		2.740	50.961	34.474	14.378

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
19.833		2.740	49.127	36.307	14.379
20.833		2.740	47.666	37.767	14.380
21.833		2.740	46.328	39.104	14.381
22.833		2.740	45.008	40.423	14.382
23.833		2.740	43.706	41.723	14.383
24.833		2.740	42.421	43.007	14.385
25.833		2.740	41.154	44.272	14.386
26.833		2.740	39.904	45.521	14.388
27.833		2.740	38.670	46.753	14.390
28.833		2.740	37.452	47.968	14.392
29.833		2.740	37.450	47.968	14.394
30.833		2.740	37.448	47.968	14.396
31.833		2.740	37.446	47.968	14.398
32.833		2.740	37.444	47.968	14.400
33.833		2.740	37.442	47.968	14.402
34.833		2.740	37.440	47.968	14.404
35.833		2.740	36.239	49.167	14.406
36.833		2.740	35.053	50.350	14.408
37.833		2.740	33.883	51.518	14.411
38.833		2.740	32.728	52.670	14.414
39.833		2.740	31.589	53.806	14.417
40.833		2.740	30.464	54.928	14.420
41.833		2.740	29.354	56.035	14.423
42.833		2.740	28.258	57.127	14.427
43.833		2.740	27.176	58.205	14.430
44.833		2.740	26.108	59.269	14.434
45.833		2.740	25.054	60.319	14.438
46.833		2.740	24.014	61.356	14.441
47.833		2.740	22.987	62.379	14.445
48.833		2.740	21.973	63.389	14.449
49.833		2.740	20.972	64.386	14.453
50.833		2.740	19.984	65.370	14.456
51.833		2.740	19.009	66.342	14.460
52.833		2.740	18.046	67.302	14.463
53.833		2.740	18.042	67.302	14.467
54.833		2.740	18.039	67.302	14.470
55.833		2.740	18.035	67.302	14.474
56.833		2.740	18.032	67.302	14.477
57.833		2.740	18.028	67.302	14.481
58.833		2.740	18.025	67.302	14.484
59.833		2.740	17.074	68.249	14.488
60.833		2.740	16.135	69.185	14.491
61.927		2.740	15.120	70.195	14.495
63.021		2.740	14.120	71.190	14.500
64.115		2.740	13.132	72.172	14.506
65.208		2.740	12.158	73.139	14.512
66.302		2.740	11.198	74.092	14.519
67.396		2.740	10.251	75.032	14.526
68.490		2.740	9.317	75.959	14.534

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
69.583		2.740	8.395	76.872	14.541
0.0	58.991	0.275	98.307	1.669	0.023
0.166		0.550	97.770	2.206	0.023
0.333		0.825	97.535	2.441	0.023
0.499		1.100	97.370	2.604	0.023
0.666		1.375	97.247	2.726	0.023
0.832		1.650	97.158	2.815	0.023
2.207		1.650	92.656	7.300	0.039
3.582		1.650	88.156	11.784	0.054
4.749		1.650	84.340	15.586	0.067
5.915		1.650	80.526	19.387	0.079
7.082		1.650	76.713	23.188	0.091
8.082		1.650	74.084	25.806	0.102
9.082		1.650	71.455	28.424	0.112
10.082		1.650	68.827	31.042	0.122
11.082		1.650	66.198	33.660	0.133
12.082		1.650	63.569	36.278	0.143
13.082		1.650	60.941	38.897	0.154
14.332		1.650	57.095	42.730	0.166
15.582		1.650	53.303	46.510	0.177
16.582		1.650	51.073	48.731	0.185
17.582		1.650	48.863	50.934	0.193
18.582		1.650	46.672	53.117	0.200
19.623		1.650	44.423	55.359	0.207
20.665		1.650	42.207	57.569	0.214
21.706		1.650	40.023	59.745	0.220
22.748		1.650	37.873	61.890	0.226
23.789		1.650	35.754	64.003	0.231
24.831		1.650	33.666	66.086	0.237
25.872		1.650	31.609	68.138	0.241
26.914		1.650	29.582	70.160	0.246
27.955		1.650	27.585	72.152	0.250
28.997		1.650	25.618	74.116	0.254
30.038		1.650	23.678	76.051	0.257
31.080		1.650	21.767	77.959	0.261
32.080		1.650	21.764	77.959	0.264
33.080		1.650	21.761	77.959	0.267
34.080		1.650	21.758	77.959	0.271
35.080		1.650	21.754	77.959	0.274
36.080		1.650	21.751	77.959	0.277
37.080		1.650	21.748	77.959	0.281
38.080		1.650	19.940	79.763	0.284
39.080		1.650	18.157	81.543	0.286
40.080		1.650	16.400	83.298	0.289
0.0	52.212	0.412	98.018	1.977	0.004
0.167		0.823	97.957	2.036	0.004
0.333		1.235	97.915	2.078	0.003
0.500		1.647	97.888	2.103	0.006
0.666		2.058	90.035	2.119	7.668

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.833		2.470	86.542	2.130	11.147
1.833		2.470	81.448	4.316	14.045
2.833		2.470	78.591	6.501	14.714
3.833		2.470	75.960	8.686	15.160
4.833		2.470	73.345	10.872	15.588
5.833		2.470	70.725	13.057	16.022
6.833		2.470	68.188	15.242	16.373
7.833		2.470	65.667	17.428	16.708
8.833		2.470	63.165	19.613	17.024
9.833		2.470	60.685	21.799	17.317
10.833		2.470	58.205	23.984	17.612
11.833		2.470	55.777	26.169	17.854
12.833		2.470	53.366	28.355	18.079
13.833		2.470	50.969	30.537	18.293
14.833		2.470	48.607	32.696	18.496
15.833		2.470	46.722	34.445	18.632
16.833		2.470	44.886	36.194	18.719
17.833		2.470	43.061	37.943	18.794
18.833		2.470	41.320	39.601	18.877
19.833		2.470	41.240	39.607	18.951
20.833		2.470	41.177	39.613	19.007
21.833		2.470	39.538	41.118	19.142
22.833		2.470	37.910	42.605	19.283
23.833		2.470	36.304	44.079	19.414
24.833		2.470	34.729	45.543	19.525
25.833		2.470	33.184	46.995	19.618
26.833		2.470	31.689	48.436	19.672
27.833		2.470	30.247	49.865	19.684
28.833		2.470	28.827	51.284	19.685
29.833		2.470	27.420	52.691	19.686
30.833		2.470	26.031	54.078	19.687
31.833		2.470	24.662	55.447	19.688
32.833		2.470	23.310	56.797	19.689
33.833		2.470	21.976	58.129	19.690
34.833		2.470	20.660	59.444	19.691
35.833		2.470	19.361	60.742	19.693
36.833		2.470	18.079	62.022	19.694
37.833		2.470	16.813	63.285	19.696
38.833		2.470	15.564	64.532	19.698
39.833		2.470	15.562	64.532	19.701
40.833		2.470	15.560	64.532	19.703
41.833		2.470	15.557	64.532	19.705
42.833		2.470	15.555	64.532	19.707
43.833		2.470	15.553	64.532	19.709
44.833		2.470	15.551	64.532	19.712
46.083		2.470	14.009	66.071	19.714
47.333		2.470	12.492	67.585	19.718
48.333		2.470	11.298	68.776	19.720
49.333		2.470	10.120	69.952	19.723

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
50.333		2.470	8.956	71.112	19.726
51.333		2.470	7.807	72.258	19.730
52.333		2.470	6.672	73.389	19.733
53.383		2.470	5.495	74.562	19.737
54.432		2.470	4.334	75.718	19.741
55.482		2.470	3.189	76.860	19.746
56.532		2.470	2.058	77.986	19.750
57.582		2.470	0.942	79.098	19.754
0.0	52.745	0.433	98.988	1.002	0.010
0.167		0.867	98.605	1.384	0.010
0.333		1.300	98.411	1.579	0.010
0.500		1.733	98.290	1.698	0.010
0.666		2.167	98.216	1.771	0.010
0.833		2.600	94.329	1.822	3.684
1.874		2.600	87.528	3.985	8.321
2.916		2.600	85.364	6.147	8.323
3.957		2.600	83.198	8.310	8.325
4.999		2.600	81.033	10.472	8.328
6.040		2.600	78.866	12.635	8.331
7.082		2.600	76.700	14.798	8.335
8.123		2.600	74.533	16.960	8.339
9.165		2.600	72.366	19.123	8.343
10.206		2.600	70.198	21.285	8.348
11.248		2.600	68.030	23.448	8.353
12.289		2.600	65.862	25.610	8.359
13.331		2.600	63.715	27.751	8.365
14.331		2.600	62.048	29.413	8.370
15.331		2.600	60.380	31.074	8.376
16.331		2.600	58.713	32.736	8.382
17.331		2.600	57.046	34.397	8.387
18.331		2.600	56.908	34.530	8.393
19.331		2.600	56.897	34.534	8.398
20.331		2.600	55.463	35.963	8.404
21.331		2.600	54.044	37.375	8.411
22.331		2.600	52.637	38.776	8.417
23.331		2.600	51.240	40.166	8.424
24.331		2.600	49.854	41.545	8.430
25.331		2.600	48.480	42.912	8.437
26.331		2.600	47.124	44.261	8.444
27.331		2.600	45.786	45.592	8.452
28.331		2.600	44.466	46.904	8.459
29.331		2.600	43.164	48.199	8.466
30.331		2.600	41.878	49.477	8.474
31.331		2.600	40.610	50.737	8.481
32.331		2.600	39.359	51.981	8.488
33.331		2.600	38.122	53.209	8.497
34.331		2.600	36.900	54.420	8.508
35.331		2.600	35.693	55.615	8.519
36.331		2.600	34.500	56.795	8.532

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
37.331		2.600	33.323	57.959	8.545
38.331		2.600	33.309	57.959	8.559
39.331		2.600	33.296	57.959	8.572
40.331		2.600	33.282	57.959	8.585
41.331		2.600	33.269	57.959	8.598
42.331		2.600	33.256	57.959	8.610
43.331		2.600	33.243	57.959	8.623
44.331		2.600	32.081	59.108	8.636
45.331		2.600	30.933	60.242	8.649
46.331		2.600	29.799	61.361	8.663
47.331		2.600	28.680	62.466	8.678
48.331		2.600	27.575	63.556	8.692
49.331		2.600	26.485	64.633	8.706
50.331		2.600	25.408	65.695	8.719
51.331		2.600	24.344	66.744	8.734
52.331		2.600	23.295	67.779	8.748
53.331		2.600	22.260	68.800	8.762
54.331		2.600	21.238	69.807	8.776
55.331		2.600	20.230	70.801	8.790
56.331		2.600	19.236	71.782	8.803
57.331		2.600	18.256	72.749	8.815
58.331		2.600	17.289	73.705	8.826
59.331		2.600	16.336	74.647	8.837
60.331		2.600	15.396	75.577	8.846
61.331		2.600	14.469	76.495	8.855
62.331		2.600	14.461	76.495	8.864
63.331		2.600	14.452	76.495	8.873
64.331		2.600	14.443	76.495	8.882
65.331		2.600	14.434	76.495	8.891
66.331		2.600	14.425	76.495	8.899
67.331		2.600	14.417	76.495	8.908
68.331		2.600	13.503	77.401	8.916
69.331		2.600	12.601	78.295	8.923
70.331		2.600	11.712	79.178	8.930
71.331		2.600	10.834	80.049	8.937
72.331		2.600	9.968	80.909	8.943
73.331		2.600	9.113	81.757	8.949
74.331		2.600	8.270	82.595	8.954
75.331		2.600	7.438	83.422	8.959
76.331		2.600	6.617	84.239	8.964
0.0	65.662	0.822	99.038	0.956	0.005
0.167		1.643	98.972	1.022	0.005
0.334		2.465	92.906	1.046	5.875
0.500		3.287	81.332	1.059	17.477
0.667		4.108	65.117	1.066	33.681
0.833		4.930	54.277	1.071	44.539
2.000		4.930	52.876	2.348	44.662
3.166		4.930	51.712	3.625	44.549
4.333		4.930	50.625	4.903	44.358

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
5.458		4.930	49.637	6.135	44.114
6.583		4.930	48.700	7.366	43.819
7.708		4.930	47.609	8.598	43.679
8.833		4.930	46.455	9.830	43.600
9.833		4.930	45.650	10.706	43.529
10.833		4.930	44.839	11.582	43.464
11.833		4.930	44.023	12.459	43.403
12.833		4.930	43.203	13.335	43.346
13.833		4.930	42.381	14.211	43.291
14.833		4.930	41.557	15.087	43.238
15.833		4.930	40.490	16.182	43.209
16.833		4.930	39.406	17.277	43.198
17.833		4.930	38.315	18.368	43.199
18.833		4.930	37.220	19.448	43.213
19.833		4.930	36.141	20.517	43.224
20.833		4.930	35.069	21.574	43.239
21.833		4.930	34.007	22.619	43.255
22.833		4.930	32.955	23.653	43.272
23.833		4.930	31.915	24.676	43.290
24.833		4.930	30.885	25.688	43.308
25.833		4.930	30.122	26.433	43.325
26.833		4.930	29.366	27.172	43.342
27.833		4.930	28.615	27.906	43.359
28.833		4.930	27.871	28.633	43.376
29.833		4.930	27.133	29.356	43.391
30.833		4.930	26.401	30.073	43.406
31.833		4.930	25.676	30.784	43.420
32.833		4.930	24.957	31.490	43.433
33.833		4.930	24.947	31.490	43.443
34.833		4.930	24.940	31.490	43.450
35.833		4.930	24.935	31.490	43.455
36.833		4.930	24.931	31.490	43.458
37.833		4.930	24.929	31.490	43.460
38.833		4.930	24.928	31.490	43.461
40.083		4.930	24.048	32.367	43.465
41.333		4.930	23.175	33.235	43.469
42.360		4.930	22.466	33.943	43.470
43.388		4.930	21.763	34.646	43.470
44.415		4.930	21.065	35.344	43.470
45.443		4.930	20.374	36.034	43.471
46.470		4.930	19.693	36.714	43.471
47.498		4.930	19.021	37.386	43.471
48.526		4.930	18.358	38.049	43.471
49.553		4.930	17.704	38.702	43.472
50.581		4.930	17.059	39.347	43.472
51.622		4.930	16.414	39.992	43.472
52.664		4.930	15.777	40.628	43.473
53.705		4.930	15.149	41.256	43.473
54.747		4.930	14.529	41.875	43.474

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
55.788		4.930	13.917	42.486	43.474
56.830		4.930	13.314	43.089	43.475
57.830		4.930	13.313	43.089	43.475
58.830		4.930	13.313	43.089	43.476
59.830		4.930	13.312	43.089	43.477
60.830		4.930	13.311	43.089	43.477
61.830		4.930	13.311	43.089	43.478
62.830		4.930	13.310	43.089	43.478
64.080		4.930	12.595	43.803	43.479
65.330		4.930	11.891	44.505	43.480
66.363		4.930	11.319	45.077	43.481
67.396		4.930	10.753	45.641	43.482
68.429		4.930	10.195	46.198	43.483
69.463		4.930	9.644	46.748	43.485
70.496		4.930	9.100	47.290	43.486
71.529		4.930	8.563	47.826	43.487
72.562		4.930	8.033	48.355	43.489
73.595		4.930	7.509	48.877	43.490
74.629		4.930	6.992	49.392	43.492
75.662		4.930	6.482	49.901	43.493
76.695		4.930	5.978	50.404	43.495
77.728		4.930	5.480	50.900	43.496
78.761		4.930	4.988	51.390	43.498
79.795		4.930	4.503	51.874	43.499
80.828		4.930	4.024	52.352	43.500
81.828		4.930	4.022	52.352	43.502
82.828		4.930	4.021	52.352	43.503
83.828		4.930	4.019	52.352	43.505
84.828		4.930	4.018	52.352	43.506
85.828		4.930	4.017	52.352	43.507
86.828		4.930	4.015	52.352	43.509
87.953		4.930	3.500	52.866	43.510
89.078		4.930	2.992	53.372	43.512
0.0	64.814	0.457	98.894	1.101	0.005
0.167		0.913	98.553	1.442	0.005
0.333		1.370	98.382	1.612	0.005
0.500		1.827	98.293	1.701	0.005
0.666		2.283	96.074	1.755	2.154
0.833		2.740	92.007	1.791	6.187
1.916		2.740	88.829	3.925	7.228
2.999		2.740	85.874	6.059	8.045
4.083		2.740	83.016	8.193	8.765
5.166		2.740	80.244	10.328	9.399
6.249		2.740	77.549	12.462	9.957
7.332		2.740	74.919	14.596	10.452
8.416		2.740	72.345	16.730	10.890
9.499		2.740	69.821	18.864	11.280
10.582		2.740	67.340	20.998	11.626
11.582		2.740	65.083	22.968	11.912

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
12.582		2.740	62.858	24.938	12.167
13.582		2.740	60.661	26.908	12.394
14.582		2.740	58.471	28.879	12.613
15.582		2.740	56.349	30.829	12.785
16.582		2.740	54.623	32.405	12.934
17.582		2.740	52.910	33.982	13.070
18.582		2.740	51.206	35.559	13.197
19.582		2.740	49.510	37.135	13.316
20.582		2.740	49.220	37.313	13.428
21.582		2.740	49.068	37.359	13.534
22.618		2.740	47.505	38.797	13.659
23.653		2.740	45.996	40.184	13.781
24.689		2.740	44.485	41.560	13.915
25.725		2.740	42.989	42.926	14.046
26.760		2.740	41.514	44.280	14.166
27.796		2.740	40.064	45.623	14.272
28.832		2.740	38.645	46.956	14.358
29.894		2.740	37.221	48.313	14.426
30.957		2.740	35.845	49.659	14.455
32.019		2.740	34.509	50.994	14.456
33.082		2.740	33.188	52.314	14.456
34.144		2.740	31.886	53.615	14.457
35.207		2.740	30.602	54.898	14.458
36.269		2.740	29.336	56.163	14.459
37.332		2.740	28.088	57.410	14.460
0.0	70.700	0.457	98.071	1.926	0.002
0.167		0.913	98.050	1.945	0.002
0.333		1.370	98.031	1.953	0.013
0.500		1.827	95.659	1.957	2.381
0.666		2.283	77.026	1.960	21.012
0.833		2.740	64.188	1.962	33.848
2.083		2.740	61.802	4.424	33.771
3.083		2.740	60.119	6.001	33.877
4.083		2.740	58.492	7.577	33.928
5.083		2.740	56.931	9.154	33.912
6.083		2.740	55.434	10.731	33.832
7.083		2.740	53.995	12.307	33.694
8.083		2.740	52.604	13.884	33.508
9.458		2.740	50.603	16.593	32.800
10.833		2.740	48.331	19.302	32.362
11.916		2.740	46.394	21.436	32.165
12.999		2.740	44.384	23.570	32.041
14.082		2.740	42.329	25.704	31.960
15.166		2.740	40.244	27.838	31.910
16.249		2.740	38.137	29.972	31.882
17.332		2.740	36.010	32.105	31.877
18.415		2.740	33.883	34.218	31.891
19.499		2.740	31.786	36.305	31.900
20.582		2.740	29.707	38.368	31.916

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
21.682		2.740	27.617	40.437	31.936
22.782		2.740	25.550	42.482	31.958
23.882		2.740	23.506	44.503	31.981
24.981		2.740	21.732	46.253	32.005
26.081		2.740	20.235	47.725	32.029
27.081		2.740	20.232	47.725	32.032
28.081		2.740	20.237	47.725	32.026
29.081		2.740	20.251	47.725	32.012
30.081		2.740	20.270	47.725	31.993
31.081		2.740	20.292	47.725	31.971
32.081		2.740	20.316	47.725	31.947
33.181		2.740	18.858	49.186	31.945
34.281		2.740	17.398	50.635	31.955
35.381		2.740	15.947	52.071	31.971
36.481		2.740	14.503	53.495	31.990
37.581		2.740	13.070	54.907	32.011
38.630		2.740	11.711	56.244	32.033
39.680		2.740	10.365	57.571	32.052
40.730		2.740	9.033	58.887	32.067
41.780		2.740	7.715	60.194	32.078
42.830		2.740	6.403	61.491	32.093
43.879		2.740	5.106	62.778	32.103
44.929		2.740	3.830	64.053	32.103
45.979		2.740	2.573	65.310	32.104
47.029		2.740	1.332	66.550	32.104
48.079		2.740	0.109	67.773	32.104
0.0	68.911	0.275	97.011	2.986	0.002
0.167		0.550	96.897	3.100	0.002
0.333		0.825	96.846	3.148	0.002
0.500		1.100	96.816	3.179	0.002
0.666		1.375	96.797	3.197	0.002
0.833		1.650	96.251	3.210	0.535
1.833		1.650	91.406	6.481	2.102
2.833		1.650	88.158	9.099	2.732
3.833		1.650	84.977	11.718	3.295
4.833		1.650	81.856	14.336	3.797
5.833		1.650	78.801	16.954	4.234
6.833		1.650	75.808	19.572	4.608
7.833		1.650	72.867	22.190	4.931
8.833		1.650	69.289	25.462	5.237
9.833		1.650	65.728	28.733	5.526
10.833		1.650	62.182	32.004	5.800
11.833		1.650	58.652	35.276	6.058
12.833		1.650	55.135	38.547	6.303
13.833		1.650	51.629	41.819	6.537
14.833		1.650	48.162	45.065	6.757
15.833		1.650	44.744	48.275	6.964
16.833		1.650	41.385	51.449	7.149
17.833		1.650	38.084	54.589	7.310

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
18.833		1.650	34.841	57.694	7.447
19.833		1.650	31.655	60.766	7.562
20.833		1.650	28.495	63.804	7.682
21.833		1.650	26.098	66.046	7.837
22.833		1.650	23.718	68.270	7.994
23.833		1.650	21.372	70.476	8.133
24.833		1.650	19.075	72.664	8.241
25.833		1.650	16.835	74.836	8.309
26.833		1.650	16.792	74.836	8.352
27.833		1.650	16.760	74.836	8.384
28.833		1.650	16.739	74.836	8.405
29.833		1.650	16.725	74.836	8.419
30.833		1.650	16.715	74.836	8.428
31.833		1.650	16.709	74.836	8.435
33.333		1.650	13.474	78.069	8.436
34.416		1.650	11.173	80.369	8.437
35.499		1.650	8.906	82.635	8.438
36.582		1.650	6.671	84.868	8.439
37.666		1.650	4.468	87.069	8.441
38.749		1.650	2.298	89.238	8.442
39.832		1.650	0.158	91.375	8.444
0.0	66.817	0.367	97.653	2.343	0.002
0.166		0.733	97.611	2.380	0.002
0.333		1.100	97.588	2.405	0.002
0.499		1.467	97.140	2.417	0.439
0.666		1.833	95.009	2.424	2.561
0.832		2.200	79.690	2.429	17.877
1.832		2.200	77.286	4.883	17.826
2.832		2.200	75.009	7.336	17.649
3.832		2.200	72.844	9.790	17.361
4.832		2.200	70.521	12.243	17.229
5.832		2.200	67.985	14.697	17.311
6.832		2.200	65.376	17.151	17.467
7.832		2.200	62.735	19.604	17.654
8.832		2.200	60.082	22.058	17.854
9.832		2.200	57.425	24.511	18.056
10.832		2.200	55.320	26.475	18.198
11.832		2.200	53.238	28.438	18.315
12.832		2.200	51.175	30.402	18.413
13.832		2.200	49.126	32.366	18.496
14.832		2.200	47.092	34.329	18.566
15.832		2.200	45.069	36.293	18.624
16.832		2.200	42.537	38.737	18.711
17.832		2.200	39.997	41.162	18.827
18.832		2.200	37.487	43.560	18.938
19.832		2.200	35.003	45.931	19.050
20.832		2.200	32.550	48.277	19.158
21.832		2.200	30.129	50.597	19.258
22.832		2.200	27.739	52.892	19.352

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
23.832		2.200	25.382	55.163	19.439
24.832		2.200	23.630	56.836	19.518
25.832		2.200	21.898	58.496	19.590
26.832		2.200	20.186	60.142	19.655
27.832		2.200	18.495	61.776	19.711
28.832		2.200	16.825	63.397	19.760
29.832		2.200	15.176	65.006	19.800
30.832		2.200	13.544	66.603	19.835
31.832		2.200	11.900	68.188	19.894
32.832		2.200	10.269	69.761	19.951
33.832		2.200	8.668	71.323	19.990
34.832		2.200	8.640	71.323	20.018
35.832		2.200	8.622	71.323	20.036
36.832		2.200	8.610	71.323	20.048
37.832		2.200	8.602	71.323	20.056
38.832		2.200	8.597	71.323	20.061
39.832		2.200	8.593	71.323	20.065
40.832		2.200	7.042	72.874	20.065
41.832		2.200	5.505	74.410	20.066
42.832		2.200	3.989	75.925	20.066
43.832		2.200	2.493	77.421	20.067
44.832		2.200	1.016	78.896	20.068
0.0	61.684	0.733	98.882	1.114	0.004
0.166		1.467	98.825	1.171	0.004
0.333		2.200	96.224	1.189	2.567
0.499		2.933	81.749	1.199	17.037
0.666		3.667	65.399	1.204	33.384
0.832		4.400	54.499	1.208	44.282
1.832		4.400	53.285	2.435	44.269
2.832		4.400	52.140	3.662	44.188
3.832		4.400	51.060	4.888	44.041
4.832		4.400	50.039	6.115	43.835
5.832		4.400	49.068	7.342	43.579
6.832		4.400	48.140	8.569	43.280
7.832		4.400	47.348	9.551	43.091
8.832		4.400	46.556	10.532	42.900
9.832		4.400	45.781	11.514	42.694
10.832		4.400	45.024	12.496	42.468
11.832		4.400	44.245	13.478	42.265
12.832		4.400	43.446	14.460	42.081
13.832		4.400	42.360	15.686	41.939
14.832		4.400	41.247	16.913	41.825
15.832		4.400	40.117	18.140	41.728
16.832		4.400	38.973	19.367	41.645
17.832		4.400	37.818	20.593	41.573
18.832		4.400	36.655	21.810	41.519
19.832		4.400	35.501	23.015	41.468
20.832		4.400	34.358	24.206	41.420
21.832		4.400	33.232	25.384	41.368

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
22.832		4.400	32.113	26.549	41.321
23.832		4.400	31.003	27.702	41.279
24.832		4.400	29.902	28.842	41.239
25.832		4.400	29.088	29.693	41.202
26.832		4.400	28.288	30.528	41.167
27.832		4.400	27.493	31.356	41.135
28.832		4.400	26.701	32.177	41.104
29.832		4.400	25.914	32.992	41.076
30.832		4.400	25.131	33.801	41.051
31.832		4.400	25.168	33.801	41.013
32.832		4.400	25.212	33.801	40.970
33.832		4.400	25.262	33.801	40.919
34.832		4.400	25.317	33.801	40.864
35.832		4.400	25.376	33.801	40.805
36.832		4.400	25.438	33.801	40.743
37.832		4.400	24.682	34.604	40.696
38.832		4.400	23.921	35.401	40.659
39.853		4.400	23.144	36.209	40.628
40.874		4.400	22.367	37.011	40.604
41.894		4.400	21.590	37.807	40.585
42.915		4.400	20.815	38.597	40.570
43.936		4.400	20.040	39.381	40.560
44.957		4.400	19.270	40.160	40.551
45.977		4.400	18.502	40.933	40.546
46.998		4.400	17.738	41.701	40.542
48.019		4.400	16.977	42.463	40.541
49.040		4.400	16.220	43.220	40.540
50.060		4.400	15.475	43.967	40.539
51.081		4.400	14.740	44.703	40.537
52.331		4.400	13.851	45.593	40.535
53.581		4.400	12.976	46.469	40.535
54.831		4.400	12.114	47.331	40.535
55.831		4.400	12.114	47.331	40.535
56.831		4.400	12.115	47.331	40.535
57.831		4.400	12.116	47.331	40.533
58.831		4.400	12.120	47.331	40.529
59.831		4.400	12.126	47.331	40.523
60.831		4.400	12.133	47.331	40.516
61.831		4.400	11.460	48.009	40.511
62.831		4.400	10.792	48.678	40.510
63.831		4.400	10.131	49.339	40.509
64.867		4.400	9.455	50.015	40.509
65.902		4.400	8.788	50.682	40.509
66.938		4.400	8.130	51.340	40.509
67.974		4.400	7.480	51.990	40.509
69.009		4.400	6.839	52.631	40.509
70.045		4.400	6.206	53.263	40.509
71.081		4.400	5.581	53.888	40.509
0.0	66.122	0.457	98.274	1.725	0.0

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.167		0.913	98.191	1.807	0.0
0.333		1.370	98.136	1.862	0.0
0.500		1.827	98.047	1.889	0.063
0.666		2.283	94.209	1.905	3.884
0.833		2.740	78.554	1.916	19.528
1.958		2.740	76.392	4.132	19.474
3.083		2.740	74.350	6.348	19.299
4.208		2.740	72.438	8.565	18.995
5.333		2.740	70.638	10.781	18.578
6.458		2.740	68.932	12.997	18.068
7.583		2.740	67.018	15.213	17.765
8.583		2.740	65.662	16.790	17.545
9.583		2.740	64.271	18.367	17.359
10.583		2.740	62.858	19.943	17.194
11.583		2.740	61.434	21.520	17.042
12.583		2.740	60.002	23.097	16.896
13.583		2.740	58.566	24.673	16.754
14.958		2.740	55.968	27.382	16.641
16.333		2.740	53.325	30.091	16.574
17.458		2.740	51.146	32.307	16.537
18.583		2.740	48.955	34.506	16.528
19.708		2.740	46.785	36.679	16.525
20.833		2.740	44.651	38.825	16.512
21.958		2.740	42.538	40.945	16.506
23.083		2.740	40.448	43.039	16.501
0.0	73.109	0.275	96.810	3.271	0.000
0.167		0.550	96.812	3.271	0.000
0.333		0.825	96.812	3.271	0.000
0.500		1.100	94.852	3.271	1.875
0.666		1.375	75.936	3.271	20.790
0.833		1.650	63.280	3.271	33.446
1.904		1.650	59.826	6.777	33.395
2.975		1.650	56.581	10.282	33.134
4.047		1.650	53.533	13.787	32.677
5.118		1.650	50.657	17.292	32.047
6.189		1.650	47.928	20.797	31.271
7.260		1.650	45.323	24.302	30.370
8.332		1.650	42.412	27.807	29.776
9.332		1.650	40.304	30.425	29.265
10.332		1.650	38.149	33.043	28.801
11.332		1.650	35.963	35.662	28.368
12.332		1.650	33.756	38.280	27.956
13.332		1.650	31.533	40.898	27.559
14.332		1.650	29.298	43.516	27.173
15.359		1.650	26.234	46.878	26.872
16.387		1.650	23.109	50.241	26.633
17.415		1.650	19.939	53.603	26.440
18.442		1.650	16.748	56.949	26.285
19.470		1.650	13.549	60.265	26.168

Table E-1, continued.
COLUMN 4

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
20.497		1.650	10.377	63.543	26.061
21.525		1.650	7.252	66.784	25.944
22.552		1.650	4.147	69.989	25.844
23.580		1.650	1.068	73.159	25.754

Table E-2.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	60.123	0.457	98.807	1.198	0.000
0.166		0.913	98.797	1.207	0.000
0.333		1.370	98.793	1.211	0.000
0.500		1.827	98.680	1.212	0.107
0.666		2.283	97.604	1.213	1.182
0.833		2.740	85.221	1.214	13.564
1.833		2.740	83.408	2.431	14.159
2.833		2.740	82.016	3.648	14.333
3.833		2.740	80.569	4.865	14.564
4.833		2.740	78.463	6.082	15.452
5.833		2.740	76.933	7.299	15.764
6.833		2.740	75.309	8.516	16.172
7.833		2.740	73.458	9.733	16.805
8.833		2.740	72.431	10.562	17.004
9.833		2.740	71.389	11.390	17.217
10.833		2.740	70.104	12.219	17.674
11.833		2.740	69.366	13.047	17.583
12.833		2.740	68.137	13.876	17.984
13.833		2.740	67.030	14.704	18.261
14.958		2.740	65.438	16.073	18.484
16.083		2.740	63.748	17.443	18.804
17.133		2.740	62.341	18.721	18.934
18.183		2.740	60.734	19.998	19.262
19.233		2.740	59.429	21.276	19.290
20.283		2.740	57.785	22.554	19.655
21.333		2.740	56.475	23.832	19.687
22.383		2.740	55.023	25.110	19.860
23.433		2.740	53.637	26.388	19.968
24.483		2.740	52.209	27.666	20.119
25.533		2.740	50.843	28.944	20.206
26.583		2.740	49.438	30.222	20.333
27.633		2.740	48.087	31.500	20.406
28.683		2.740	46.703	32.778	20.512
29.733		2.740	45.364	34.056	20.572
30.783		2.740	43.996	35.334	20.662
31.833		2.740	42.667	36.612	20.713
32.833		2.740	41.825	37.440	20.727
33.833		2.740	41.004	38.269	20.718
34.833		2.740	40.188	39.097	20.706
35.833		2.740	39.379	39.925	20.686
36.833		2.740	38.576	40.754	20.660
37.833		2.740	37.780	41.582	20.627
38.883		2.740	36.500	42.860	20.629
39.933		2.740	35.209	44.138	20.641
40.983		2.740	33.909	45.416	20.663
42.033		2.740	32.611	46.694	20.683
43.083		2.740	31.301	47.972	20.715
44.133		2.740	29.997	49.250	20.741
45.183		2.740	28.694	50.528	20.766
46.233		2.740	27.398	51.804	20.786

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
47.283		2.740	26.114	53.071	20.802
48.333		2.740	24.850	54.329	20.808
0.0	71.702	0.228	97.599	2.434	0.000
0.167		0.457	97.597	2.434	0.000
0.334		0.685	97.594	2.434	0.000
0.500		0.913	97.587	2.434	0.000
0.667		1.142	97.538	2.434	0.025
0.834		1.370	97.025	2.434	0.538
2.084		1.370	88.237	5.477	6.283
3.134		1.370	83.900	8.033	8.063
4.184		1.370	79.997	10.589	9.410
5.234		1.370	76.240	13.144	10.610
6.284		1.370	72.727	15.700	11.567
7.334		1.370	69.286	18.256	12.451
8.334		1.370	67.121	19.913	12.960
9.334		1.370	64.871	21.570	13.553
10.334		1.370	62.851	23.227	13.915
11.334		1.370	60.742	24.884	14.367
12.334		1.370	58.826	26.541	14.626
13.334		1.370	56.817	28.198	14.978
14.334		1.370	54.037	30.632	15.324
15.334		1.370	51.231	33.066	15.695
16.334		1.370	48.515	35.500	15.976
17.405		1.370	45.574	38.108	16.309
18.476		1.370	42.701	40.716	16.573
19.548		1.370	39.863	43.324	16.802
20.619		1.370	36.986	45.932	17.072
21.691		1.370	34.157	48.540	17.292
22.762		1.370	31.343	51.148	17.497
23.833		1.370	28.545	53.756	17.687
25.000		1.370	25.546	56.596	17.845
26.167		1.370	22.545	59.436	18.005
27.333		1.370	19.555	62.276	18.155
28.333		1.370	16.996	64.710	18.279
29.333		1.370	14.448	67.144	18.392
30.333		1.370	11.885	69.579	18.520
31.333		1.370	9.339	72.013	18.632
32.333		1.370	7.651	73.670	18.663
33.333		1.370	5.989	75.326	18.668
34.333		1.370	4.342	76.983	18.657
35.333		1.370	2.705	78.640	18.637
36.333		1.370	1.073	80.297	18.612
0.0	58.803	0.457	98.814	1.183	0.003
0.167		0.913	98.796	1.200	0.003
0.333		1.370	98.790	1.206	0.003
0.500		1.827	98.263	1.208	0.527
0.667		2.283	96.852	1.210	1.933
0.833		2.740	88.055	1.211	10.729
1.833		2.740	86.225	2.428	11.342

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
2.833		2.740	83.990	3.645	12.359
3.833		2.740	81.698	4.863	13.434
4.833		2.740	79.687	6.080	14.228
5.833		2.740	78.069	6.908	15.018
6.833		2.740	76.758	7.737	15.500
7.833		2.740	75.138	8.565	16.292
8.833		2.740	73.961	9.394	16.640
9.833		2.740	72.732	10.222	17.040
10.833		2.740	71.409	11.050	17.535
11.833		2.740	69.862	12.268	17.865
12.833		2.740	68.103	13.485	18.406
13.833		2.740	66.736	14.702	18.556
14.833		2.740	64.896	15.919	19.179
15.833		2.740	63.732	17.136	19.126
16.833		2.740	62.053	18.353	19.588
17.833		2.740	60.527	19.570	19.896
18.833		2.740	59.083	20.787	20.123
19.833		2.740	57.618	22.004	20.371
20.833		2.740	56.202	23.221	20.569
21.833		2.740	54.774	24.438	20.780
22.833		2.740	53.383	25.655	20.954
23.833		2.740	51.987	26.872	21.133
24.833		2.740	50.615	28.090	21.288
25.833		2.740	49.245	29.307	21.440
26.833		2.740	47.890	30.524	21.578
27.833		2.740	46.541	31.741	21.710
28.833		2.740	45.202	32.958	21.832
29.833		2.740	44.313	33.786	21.892
30.833		2.740	43.433	34.615	21.943
31.833		2.740	42.562	35.443	21.986
32.833		2.740	41.697	36.272	22.022
33.833		2.740	40.840	37.100	22.050
34.833		2.740	39.991	37.929	22.070
35.833		2.740	38.724	39.146	22.120
36.833		2.740	37.448	40.363	22.178
37.833		2.740	36.166	41.580	22.243
38.833		2.740	34.886	42.797	22.306
39.833		2.740	33.596	44.014	22.378
40.833		2.740	32.314	45.231	22.443
41.833		2.740	31.034	46.448	22.506
42.833		2.740	29.765	47.663	22.560
43.833		2.740	28.517	48.869	22.602
44.833		2.740	27.277	50.066	22.644
45.833		2.740	26.047	51.256	22.685
46.833		2.740	24.828	52.437	22.722
47.833		2.740	23.621	53.610	22.756
48.833		2.740	22.424	54.775	22.788
49.833		2.740	21.235	55.932	22.820
50.833		2.740	20.058	57.081	22.848

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
51.833		2.740	18.892	58.222	22.872
52.833		2.740	17.738	59.356	22.892
53.833		2.740	17.260	59.820	22.906
54.833		2.740	17.239	59.832	22.916
55.833		2.740	17.220	59.843	22.923
56.833		2.740	17.203	59.855	22.928
57.833		2.740	17.187	59.867	22.931
58.833		2.740	17.172	59.880	22.934
59.833		2.740	16.320	60.727	22.938
60.833		2.740	15.485	61.557	22.943
61.875		2.740	14.621	62.418	22.946
62.916		2.740	13.764	63.275	22.946
63.958		2.740	12.912	64.127	22.946
64.999		2.740	12.064	64.975	22.947
66.041		2.740	11.219	65.818	22.947
67.082		2.740	10.379	66.658	22.947
68.124		2.740	9.543	67.493	22.948
69.165		2.740	8.713	68.323	22.949
70.207		2.740	7.889	69.145	22.949
71.248		2.740	7.073	69.961	22.950
72.290		2.740	6.263	70.769	22.951
73.331		2.740	5.461	71.570	22.952
74.498		2.740	4.570	72.459	22.954
75.664		2.740	3.687	73.340	22.955
76.831		2.740	2.813	74.212	22.957
77.831		2.740	2.811	74.212	22.959
78.831		2.740	2.810	74.212	22.960
79.831		2.740	2.808	74.212	22.962
80.831		2.740	2.807	74.212	22.963
81.831		2.740	2.805	74.212	22.965
82.831		2.740	2.803	74.212	22.966
84.081		2.740	1.876	75.137	22.968
85.331		2.740	0.958	76.053	22.970
0.0	59.249	0.275	98.119	1.875	0.006
0.167		0.550	98.066	1.926	0.006
0.333		0.825	98.034	1.957	0.006
0.500		1.100	98.018	1.973	0.006
0.666		1.375	98.009	1.983	0.006
0.833		1.650	98.002	1.989	0.006
1.958		1.650	93.715	4.263	2.014
3.083		1.650	89.972	6.537	3.479
4.104		1.650	87.121	8.600	4.266
5.124		1.650	84.197	10.663	5.126
6.145		1.650	81.249	12.726	6.010
7.166		1.650	78.354	14.789	6.841
8.187		1.650	75.548	16.853	7.583
9.207		1.650	72.841	18.916	8.226
10.228		1.650	70.226	20.979	8.776
11.249		1.650	67.676	23.042	9.263

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
12.270		1.650	65.167	25.105	9.709
13.290		1.650	62.717	27.169	10.095
14.311		1.650	60.318	29.232	10.430
15.332		1.650	57.970	31.295	10.715
16.332		1.650	56.365	32.671	10.943
17.332		1.650	54.790	34.047	11.142
18.332		1.650	53.236	35.422	11.320
19.332		1.650	51.699	36.798	11.482
20.332		1.650	50.176	38.174	11.628
21.332		1.650	48.664	39.550	11.764
22.332		1.650	46.481	41.571	11.926
23.332		1.650	44.322	43.579	12.076
24.332		1.650	42.195	45.574	12.209
25.332		1.650	40.098	47.555	12.325
26.332		1.650	38.031	49.521	12.424
27.332		1.650	35.993	51.475	12.509
28.332		1.650	33.983	53.415	12.578
29.332		1.650	32.002	55.341	12.633
30.332		1.650	30.048	57.255	12.673
31.332		1.650	28.120	59.156	12.700
32.332		1.650	26.197	61.044	12.735
33.332		1.650	24.303	62.919	12.753
34.332		1.650	22.800	64.421	12.754
35.332		1.650	21.419	65.800	12.755
36.332		1.650	20.045	67.173	12.757
37.332		1.650	18.678	68.538	12.758
38.332		1.650	17.318	69.897	12.760
39.332		1.650	15.964	71.249	12.762
40.332		1.650	15.962	71.249	12.764
41.332		1.650	15.960	71.249	12.766
42.332		1.650	15.958	71.249	12.768
43.332		1.650	15.956	71.249	12.769
44.332		1.650	15.954	71.249	12.771
45.332		1.650	15.952	71.249	12.773
46.332		1.650	14.608	72.590	12.775
47.332		1.650	13.275	73.920	12.778
48.394		1.650	11.871	75.321	12.780
49.457		1.650	10.479	76.710	12.783
50.519		1.650	9.100	78.086	12.787
51.582		1.650	7.733	79.449	12.790
52.644		1.650	6.378	80.800	12.793
53.707		1.650	5.034	82.140	12.797
54.769		1.650	3.703	83.467	12.801
55.832		1.650	2.384	84.782	12.805
0.0	59.918	0.412	98.679	1.314	0.005
0.167		0.823	98.661	1.332	0.005
0.333		1.235	98.655	1.338	0.005
0.500		1.647	98.651	1.341	0.005
0.666		2.058	96.530	1.343	2.117

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.833		2.470	94.182	1.344	4.464
1.916		2.470	88.483	2.807	8.696
2.999		2.470	84.952	4.269	10.762
4.083		2.470	81.944	5.732	12.307
5.166		2.470	79.104	7.195	13.685
6.249		2.470	76.624	8.657	14.701
7.332		2.470	74.232	10.120	15.631
8.332		2.470	72.722	11.039	16.222
9.332		2.470	71.103	11.958	16.922
10.332		2.470	69.768	12.877	17.337
11.332		2.470	68.251	13.796	17.935
12.332		2.470	67.040	14.715	18.227
13.332		2.470	65.596	15.634	18.752
14.582		2.470	63.479	17.322	19.181
15.832		2.470	61.287	19.009	19.685
16.832		2.470	59.614	20.360	20.007
17.832		2.470	57.930	21.710	20.341
18.832		2.470	56.295	23.060	20.627
19.832		2.470	54.662	24.410	20.908
20.832		2.470	53.060	25.760	21.161
21.882		2.470	51.390	27.178	21.412
22.932		2.470	49.741	28.595	21.644
23.982		2.470	48.107	30.013	21.860
25.032		2.470	46.487	31.431	22.062
26.081		2.470	44.880	32.848	22.251
27.131		2.470	43.285	34.266	22.428
28.181		2.470	41.714	35.683	22.581
29.231		2.470	40.151	37.101	22.727
30.281		2.470	38.594	38.519	22.865
31.330		2.470	37.040	39.936	23.001
32.330		2.470	36.034	40.855	23.088
33.330		2.470	35.050	41.774	23.153
34.330		2.470	34.080	42.693	23.203
35.330		2.470	33.118	43.612	23.246
36.330		2.470	32.162	44.531	23.282
37.330		2.470	31.209	45.450	23.316
38.330		2.470	29.803	46.793	23.380
39.330		2.470	28.413	48.126	23.436
40.330		2.470	27.028	49.451	23.496
41.330		2.470	25.655	50.765	23.554
42.330		2.470	24.294	52.071	23.609
43.330		2.470	22.946	53.368	23.660
44.330		2.470	21.607	54.656	23.710
45.330		2.470	20.285	55.935	23.754
46.330		2.470	18.977	57.206	23.791
47.330		2.470	17.683	58.468	23.822
48.330		2.470	16.404	59.722	23.847
49.330		2.470	15.296	60.812	23.865
50.330		2.470	14.364	61.734	23.876

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
51.330		2.470	13.439	62.650	23.884
52.330		2.470	12.526	63.562	23.884
53.330		2.470	11.618	64.470	23.885
54.330		2.470	10.714	65.374	23.885
55.330		2.470	9.814	66.273	23.886
56.330		2.470	9.813	66.273	23.887
57.330		2.470	9.812	66.273	23.888
58.330		2.470	9.811	66.273	23.889
59.330		2.470	9.810	66.273	23.889
60.330		2.470	9.809	66.273	23.890
61.330		2.470	9.808	66.273	23.891
62.580		2.470	8.688	67.392	23.892
63.830		2.470	7.575	68.503	23.894
0.0	63.099	0.412	98.651	1.346	0.002
0.166		0.823	98.649	1.348	0.002
0.333		1.235	98.647	1.349	0.002
0.499		1.647	98.064	1.349	0.584
0.666		2.058	96.820	1.349	1.827
0.832		2.470	87.451	1.349	11.196
1.868		2.470	85.355	2.748	11.892
2.904		2.470	82.777	4.146	13.072
3.939		2.470	80.150	5.544	14.300
4.975		2.470	77.799	6.943	15.252
6.011		2.470	75.415	8.341	16.239
7.046		2.470	73.365	9.739	16.890
8.082		2.470	71.059	11.138	17.797
9.118		2.470	69.284	12.536	18.173
10.153		2.470	66.955	13.934	19.104
11.189		2.470	65.252	15.333	19.408
12.225		2.470	63.328	16.731	19.934
13.260		2.470	61.501	18.129	20.362
14.296		2.470	59.678	19.528	20.786
15.332		2.470	57.916	20.926	21.150
16.332		2.470	56.746	21.845	21.400
17.332		2.470	55.568	22.764	21.660
18.332		2.470	54.438	23.683	21.870
19.332		2.470	53.309	24.602	22.080
20.332		2.470	52.213	25.521	22.257
21.332		2.470	51.120	26.440	22.431
22.332		2.470	49.534	27.790	22.666
23.332		2.470	47.983	29.141	22.868
24.332		2.470	46.433	30.491	23.068
25.332		2.470	44.898	31.841	23.252
26.332		2.470	43.371	33.191	23.428
27.332		2.470	41.855	34.541	23.594
28.332		2.470	40.348	35.891	23.751
29.332		2.470	38.850	37.241	23.899
30.332		2.470	37.359	38.591	24.039
31.332		2.470	35.875	39.941	24.173

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
32.332		2.470	34.411	41.292	24.287
33.332		2.470	32.952	42.642	24.396
34.332		2.470	31.495	43.992	24.502
35.332		2.470	30.038	45.342	24.608
36.332		2.470	28.589	46.692	24.706
37.332		2.470	27.134	48.042	24.811
38.332		2.470	25.690	49.392	24.905
39.332		2.470	24.251	50.742	24.994
40.332		2.470	23.285	51.661	25.041
41.332		2.470	22.331	52.580	25.075
42.332		2.470	21.386	53.499	25.101
43.332		2.470	20.445	54.418	25.123
44.332		2.470	19.506	55.337	25.143
45.332		2.470	18.568	56.256	25.161
46.332		2.470	17.227	57.553	25.206
47.332		2.470	15.891	58.841	25.254
48.332		2.470	14.565	60.120	25.300
49.332		2.470	13.251	61.391	25.344
50.332		2.470	11.948	62.653	25.385
51.332		2.470	10.656	63.907	25.422
52.332		2.470	9.529	65.001	25.455
53.332		2.470	8.578	65.923	25.484
54.332		2.470	7.637	66.839	25.509
55.332		2.470	6.706	67.752	25.528
56.332		2.470	5.785	68.660	25.540
57.332		2.470	4.876	69.563	25.546
58.332		2.470	3.975	70.462	25.548
59.332		2.470	3.079	71.357	25.548
60.332		2.470	2.187	72.248	25.549
61.332		2.470	1.300	73.135	25.549
62.332		2.470	0.417	74.017	25.550
0.0	59.707	0.733	99.238	0.758	0.002
0.167		1.467	99.238	0.758	0.002
0.333		2.200	97.281	0.758	1.955
0.500		2.933	80.438	0.758	18.799
0.666		3.667	64.351	0.758	34.887
0.833		4.400	53.626	0.758	45.613
1.999		4.400	52.264	1.642	46.090
3.166		4.400	51.329	2.526	46.140
4.332		4.400	50.707	3.411	45.878
5.457		4.400	50.229	4.263	45.503
6.582		4.400	49.408	5.116	45.471
7.707		4.400	48.764	5.969	45.262
8.832		4.400	47.816	6.821	45.358
9.832		4.400	47.454	7.337	45.203
10.832		4.400	47.145	7.853	44.996
11.832		4.400	46.662	8.369	44.964
12.832		4.400	46.069	8.885	45.041
13.832		4.400	45.733	9.401	44.861

Table E-2, continued.
COLUMN 5

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
14.832		4.400	45.289	9.917	44.789
15.832		4.400	44.510	10.675	44.810
16.832		4.400	43.845	11.432	44.716
17.832		4.400	43.093	12.190	44.711
18.832		4.400	42.327	12.948	44.718
19.832		4.400	41.627	13.706	44.661
20.832		4.400	40.865	14.464	44.665
21.832		4.400	40.167	15.222	44.605
22.832		4.400	39.412	15.980	44.601
23.832		4.400	38.717	16.738	44.538
24.832		4.400	37.967	17.496	44.530
25.832		4.400	37.261	18.254	44.479
26.832		4.400	36.558	19.012	44.423
27.832		4.400	35.817	19.769	44.406
28.832		4.400	35.113	20.527	44.352
29.832		4.400	34.414	21.285	44.293
30.832		4.400	33.684	22.043	44.265
31.832		4.400	32.996	22.801	44.195
32.832		4.400	32.270	23.559	44.163
33.832		4.400	31.860	24.075	44.057
34.832		4.400	31.439	24.591	43.961
35.832		4.400	31.023	25.107	43.861
36.832		4.400	30.609	25.623	43.760
37.832		4.400	30.194	26.138	43.658
38.832		4.400	29.781	26.654	43.555
40.082		4.400	28.905	27.602	43.484
41.332		4.400	28.031	28.549	43.411
42.360		4.400	27.310	29.328	43.352
43.387		4.400	26.587	30.107	43.296
44.415		4.400	25.864	30.886	43.239
45.442		4.400	25.151	31.665	43.174
46.470		4.400	24.430	32.444	43.115
47.498		4.400	23.708	33.223	43.059
48.525		4.400	22.984	34.002	43.003
49.553		4.400	22.260	34.781	42.947
50.580		4.400	21.532	35.560	42.897
51.622		4.400	20.794	36.349	42.845
52.663		4.400	20.046	37.139	42.803
53.705		4.400	19.301	37.928	42.758
54.746		4.400	18.556	38.718	42.714
55.788		4.400	17.814	39.504	42.670
56.829		4.400	17.077	40.284	42.626
57.829		4.400	16.627	40.800	42.559
58.829		4.400	16.182	41.316	42.489
59.829		4.400	15.738	41.832	42.416
60.829		4.400	15.296	42.348	42.343
61.829		4.400	14.853	42.864	42.270
62.829		4.400	14.409	43.380	42.197
64.079		4.400	13.577	44.273	42.135

Table E-2, continued.
COLUMN 5

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
65.329		4.400	12.741	45.160	42.085
66.363		4.400	12.052	45.887	42.047
67.396		4.400	11.484	46.488	42.014
68.429		4.400	10.980	47.022	41.983
69.462		4.400	10.476	47.553	41.956
70.495		4.400	9.972	48.082	41.930
71.529		4.400	9.469	48.609	41.907
72.562		4.400	8.963	49.133	41.889
73.595		4.400	8.458	49.654	41.872
74.628		4.400	7.954	50.173	41.857
75.661		4.400	7.451	50.689	41.845
76.695		4.400	6.947	51.203	41.834
77.728		4.400	6.444	51.714	41.826
78.761		4.400	5.941	52.223	41.820
79.794		4.400	5.438	52.729	41.816
80.827		4.400	4.940	53.234	41.810
81.827		4.400	4.947	53.234	41.803
82.827		4.400	4.957	53.234	41.793
83.827		4.400	4.968	53.234	41.782
84.827		4.400	4.980	53.234	41.770
85.827		4.400	4.993	53.234	41.756
86.827		4.400	5.008	53.234	41.742
87.952		4.400	4.478	53.780	41.724
89.077		4.400	3.952	54.324	41.707
0.0	62.664	0.457	98.832	1.217	0.000
0.166		0.913	98.832	1.217	0.000
0.333		1.370	98.831	1.217	0.000
0.499		1.827	98.516	1.217	0.265
0.666		2.283	95.206	1.217	3.576
0.832		2.740	79.769	1.217	19.013
1.916		2.740	77.822	2.536	19.640
2.999		2.740	76.297	3.854	19.847
4.082		2.740	75.290	5.173	19.535
5.165		2.740	73.735	6.491	19.771
6.249		2.740	72.255	7.810	19.932
7.332		2.740	70.612	9.128	20.257
8.415		2.740	69.025	10.447	20.525
9.498		2.740	67.473	11.765	20.759
10.582		2.740	65.900	13.084	21.012
11.582		2.740	64.401	14.301	21.294
12.582		2.740	63.140	15.518	21.338
13.582		2.740	61.677	16.735	21.583
14.582		2.740	60.158	17.952	21.885
15.582		2.740	58.937	19.169	21.889
16.582		2.740	57.960	19.997	22.038
17.582		2.740	57.050	20.826	22.119
18.582		2.740	56.159	21.654	22.181
19.582		2.740	55.280	22.483	22.232
20.582		2.740	54.410	23.311	22.273

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
21.582		2.740	53.550	24.140	22.304
22.617		2.740	52.203	25.400	22.390
23.653		2.740	50.858	26.661	22.475
24.689		2.740	49.518	27.921	22.554
25.724		2.740	48.152	29.182	22.660
26.760		2.740	46.858	30.443	22.692
27.796		2.740	45.509	31.703	22.780
28.831		2.740	44.202	32.964	22.827
29.894		2.740	42.860	34.257	22.875
30.956		2.740	41.526	35.550	22.916
32.019		2.740	40.199	36.843	22.949
33.081		2.740	38.874	38.136	22.981
34.144		2.740	37.556	39.429	23.005
35.206		2.740	36.239	40.722	23.029
36.269		2.740	34.927	42.016	23.048
37.331		2.740	33.615	43.309	23.066
38.456		2.740	32.249	44.678	23.063
39.581		2.740	30.876	46.047	23.066
40.581		2.740	30.084	46.876	23.029
41.581		2.740	29.312	47.704	22.973
42.581		2.740	28.550	48.532	22.906
43.581		2.740	27.795	49.361	22.832
44.581		2.740	27.043	50.189	22.755
45.581		2.740	26.294	51.018	22.675
46.956		2.740	24.668	52.691	22.628
48.331		2.740	23.013	54.365	22.609
49.414		2.740	21.718	55.678	22.590
50.498		2.740	20.439	56.981	22.566
51.581		2.740	19.162	58.275	22.549
52.664		2.740	17.891	59.559	22.535
53.747		2.740	16.629	60.833	22.523
54.831		2.740	15.375	62.098	22.512
55.914		2.740	14.129	63.353	22.502
56.997		2.740	12.891	64.599	22.494
58.080		2.740	11.656	65.836	22.491
0.0	68.095	0.320	98.312	1.737	0.000
0.166		0.640	98.312	1.737	0.000
0.333		0.960	98.312	1.737	0.000
0.499		1.280	98.296	1.737	0.000
0.666		1.600	97.743	1.737	0.518
0.832		1.920	96.212	1.737	2.049
1.957		1.920	90.276	3.691	6.029
3.082		1.920	86.229	5.645	8.122
4.207		1.920	82.561	7.599	9.836
5.332		1.920	79.421	9.553	11.022
6.332		1.920	77.391	10.735	11.869
7.332		1.920	75.485	11.917	12.593
8.332		1.920	73.702	13.100	13.194
9.332		1.920	71.986	14.282	13.727

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
10.332		1.920	70.343	15.464	14.188
11.332		1.920	68.773	16.647	14.575
12.432		1.920	66.296	18.557	15.141
13.532		1.920	64.029	20.468	15.498
14.632		1.920	61.645	22.378	15.971
15.732		1.920	59.448	24.289	16.257
16.832		1.920	57.147	26.199	16.647
17.832		1.920	55.206	27.936	16.851
18.832		1.920	53.153	29.673	17.166
19.832		1.920	51.260	31.410	17.322
20.832		1.920	49.281	33.147	17.565
21.832		1.920	47.390	34.884	17.718
22.832		1.920	45.448	36.621	17.923
23.832		1.920	43.582	38.357	18.051
24.832		1.920	41.672	40.094	18.225
25.832		1.920	39.827	41.831	18.333
26.832		1.920	37.943	43.568	18.480
27.832		1.920	36.113	45.305	18.572
29.332		1.920	33.328	47.910	18.751
30.332		1.920	32.129	49.093	18.768
31.332		1.920	30.947	50.275	18.768
32.332		1.920	29.776	51.457	18.756
33.332		1.920	28.616	52.639	18.732
34.332		1.920	27.468	53.822	18.698
35.332		1.920	26.329	55.004	18.654
36.332		1.920	24.589	56.741	18.656
37.332		1.920	22.826	58.478	18.682
38.332		1.920	21.056	60.214	18.715
39.332		1.920	19.268	61.951	18.766
40.332		1.920	17.485	63.688	18.812
41.332		1.920	15.706	65.425	18.854
42.332		1.920	13.940	67.154	18.890
43.332		1.920	12.202	68.872	18.910
44.332		1.920	10.472	70.577	18.935
45.332		1.920	8.754	72.271	18.959
46.332		1.920	7.049	73.953	18.982
47.332		1.920	5.357	75.623	19.003
48.332		1.920	3.679	77.282	19.022
49.332		1.920	2.006	78.930	19.047
50.332		1.920	0.349	80.566	19.067
0.0	66.054	0.275	97.984	2.021	0.000
0.167		0.550	97.983	2.021	0.000
0.333		0.825	97.982	2.021	0.000
0.500		1.100	97.982	2.021	0.000
0.666		1.375	97.968	2.021	0.009
0.833		1.650	97.565	2.021	0.411
1.866		1.650	93.062	4.110	2.826
2.899		1.650	89.016	6.198	4.782
3.932		1.650	85.305	8.286	6.404

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
4.966		1.650	81.964	10.375	7.656
5.999		1.650	78.734	12.463	8.798
7.032		1.650	75.717	14.552	9.726
8.065		1.650	72.800	16.640	10.554
9.098		1.650	70.008	18.729	11.257
10.132		1.650	67.287	20.817	11.889
11.165		1.650	64.645	22.906	12.442
12.198		1.650	62.058	24.994	12.940
13.231		1.650	59.525	27.083	13.384
14.264		1.650	57.034	29.171	13.786
15.298		1.650	54.581	31.260	14.150
16.331		1.650	52.161	33.348	14.481
17.331		1.650	50.585	34.724	14.681
18.331		1.650	49.029	36.099	14.861
19.331		1.650	47.500	37.475	15.015
20.331		1.650	45.987	38.851	15.152
21.331		1.650	44.491	40.227	15.272
22.331		1.650	43.013	41.603	15.373
23.331		1.650	40.847	43.624	15.518
24.331		1.650	38.674	45.645	15.670
25.331		1.650	36.505	47.666	15.817
26.331		1.650	34.335	49.687	15.965
27.331		1.650	32.177	51.708	16.101
28.331		1.650	30.009	53.729	16.249
29.331		1.650	27.856	55.750	16.380
30.331		1.650	25.711	57.771	16.504
31.331		1.650	23.583	59.791	16.612
32.331		1.650	21.494	61.796	16.695
33.331		1.650	19.421	63.787	16.776
34.331		1.650	17.367	65.765	16.852
35.331		1.650	15.333	67.728	16.922
36.331		1.650	13.319	69.678	16.986
37.331		1.650	11.318	71.615	17.051
38.331		1.650	9.339	73.539	17.105
39.331		1.650	7.381	75.450	17.152
40.331		1.650	5.443	77.347	17.192
41.331		1.650	4.040	78.723	17.220
42.331		1.650	3.319	79.425	17.239
43.331		1.650	3.284	79.445	17.253
44.331		1.650	3.253	79.466	17.264
45.331		1.650	3.224	79.487	17.271
46.331		1.650	3.197	79.508	17.277
47.331		1.650	1.779	80.915	17.287
48.331		1.650	0.389	82.294	17.298
0.0	65.010	0.457	98.781	1.217	0.0
0.167		0.913	98.781	1.217	0.0
0.333		1.370	98.781	1.217	0.0
0.500		1.827	98.016	1.217	0.765
0.666		2.283	89.681	1.217	9.100

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.833		2.740	74.733	1.217	24.048
1.833		2.740	72.903	2.434	24.660
2.833		2.740	71.418	3.651	24.928
3.833		2.740	70.460	4.868	24.668
4.833		2.740	69.208	6.085	24.704
5.833		2.740	67.885	7.302	24.809
6.833		2.740	66.411	8.520	25.066
7.833		2.740	64.696	9.737	25.564
8.833		2.740	63.333	10.954	25.709
9.833		2.740	61.874	12.171	25.951
10.833		2.740	60.253	13.388	26.355
11.833		2.740	59.068	14.605	26.323
12.833		2.740	57.474	15.822	26.699
13.833		2.740	56.379	16.650	26.966
14.833		2.740	55.540	17.479	26.977
15.833		2.740	54.320	18.307	27.367
16.833		2.740	53.506	19.136	27.353
17.833		2.740	52.603	19.964	27.428
18.833		2.740	51.581	20.793	27.621
19.833		2.740	50.287	22.010	27.698
20.833		2.740	48.772	23.227	27.996
21.833		2.740	47.612	24.444	27.938
22.833		2.740	46.161	25.661	28.172
23.833		2.740	44.771	26.878	28.345
24.833		2.740	43.461	28.095	28.437
25.833		2.740	42.099	29.312	28.582
26.833		2.740	40.798	30.529	28.666
27.833		2.740	39.455	31.747	28.791
28.833		2.740	38.147	32.964	28.882
29.833		2.740	36.864	34.181	28.948
30.833		2.740	35.541	35.398	29.054
31.833		2.740	34.249	36.615	29.129
32.833		2.740	32.959	37.832	29.201
33.833		2.740	31.675	39.049	29.268
34.833		2.740	30.396	40.266	29.330
35.833		2.740	29.120	41.483	29.389
36.833		2.740	27.860	42.700	29.431
37.833		2.740	27.028	43.529	29.434
38.833		2.740	26.212	44.357	29.422
39.833		2.740	25.407	45.185	29.398
40.833		2.740	24.609	46.014	29.367
41.833		2.740	23.818	46.842	29.329
42.833		2.740	23.031	47.671	29.287
43.833		2.740	21.820	48.888	29.281
44.833		2.740	20.586	50.105	29.298
45.833		2.740	19.348	51.322	29.318
46.833		2.740	18.108	52.539	29.342
47.833		2.740	16.872	53.754	29.363
48.833		2.740	15.647	54.960	29.381

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
49.833		2.740	14.439	56.158	29.391
50.833		2.740	13.237	57.347	29.404
51.833		2.740	12.042	58.528	29.417
52.833		2.740	10.855	59.701	29.430
53.833		2.740	9.678	60.866	29.443
54.833		2.740	8.509	62.023	29.454
55.833		2.740	7.344	63.173	29.469
56.833		2.740	6.190	64.314	29.482
57.833		2.740	5.045	65.448	29.493
58.833		2.740	3.908	66.575	29.503
59.833		2.740	3.066	67.407	29.512
60.833		2.740	2.230	68.236	29.521
61.833		2.740	2.225	68.236	29.525
62.833		2.740	2.223	68.236	29.527
63.833		2.740	2.223	68.236	29.527
64.833		2.740	2.225	68.236	29.525
65.833		2.740	2.229	68.236	29.521
66.833		2.740	2.234	68.236	29.516
67.833		2.740	1.410	69.061	29.515
68.833		2.740	0.591	69.882	29.512
0.0	65.285	0.457	98.788	1.217	0.000
0.167		0.913	98.789	1.217	0.000
0.333		1.370	98.786	1.217	0.000
0.500		1.827	98.044	1.217	0.738
0.666		2.283	88.970	1.217	9.811
0.833		2.740	74.142	1.217	24.640
1.856		2.740	72.280	2.462	25.256
2.878		2.740	70.783	3.707	25.508
3.901		2.740	69.817	4.951	25.229
4.924		2.740	68.746	6.196	25.055
5.946		2.740	67.536	7.441	25.021
6.969		2.740	66.111	8.686	25.200
7.992		2.740	64.409	9.930	25.657
9.015		2.740	63.098	11.175	25.723
10.037		2.740	61.711	12.420	25.866
11.060		2.740	60.052	13.664	26.280
12.083		2.740	58.743	14.909	26.343
13.333		2.740	56.999	16.431	26.566
14.583		2.740	55.241	17.952	26.802
15.833		2.740	53.526	19.473	26.996
16.833		2.740	52.636	20.302	27.057
17.833		2.740	51.717	21.130	27.148
18.833		2.740	50.827	21.959	27.208
19.833		2.740	49.964	22.787	27.243
20.833		2.740	49.037	23.616	27.342
21.833		2.740	48.280	24.444	27.270
22.833		2.740	46.911	25.661	27.422
23.833		2.740	45.552	26.878	27.564
24.833		2.740	44.290	28.095	27.608

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
25.868		2.740	42.950	29.356	27.687
26.904		2.740	41.614	30.616	27.763
27.940		2.740	40.253	31.877	27.863
28.975		2.740	38.958	33.137	27.897
30.011		2.740	37.614	34.398	27.981
31.046		2.740	36.305	35.659	28.029
32.082		2.740	34.998	36.919	28.075
33.189		2.740	33.607	38.267	28.118
34.296		2.740	32.223	39.614	28.154
35.403		2.740	30.842	40.962	28.188
36.510		2.740	29.466	42.309	28.216
37.617		2.740	28.091	43.656	28.243
38.724		2.740	26.738	45.004	28.248
39.831		2.740	25.379	46.351	28.260
40.831		2.740	24.580	47.180	28.230
41.831		2.740	23.800	48.008	28.181
42.831		2.740	23.031	48.837	28.121
43.831		2.740	22.269	49.665	28.054
44.831		2.740	21.511	50.494	27.983
45.831		2.740	20.755	51.322	27.910
47.206		2.740	19.121	52.996	27.871
48.581		2.740	17.458	54.669	27.859
49.706		2.740	16.107	56.033	27.846
50.831		2.740	14.772	57.387	27.827
51.956		2.740	13.440	58.731	27.815
53.081		2.740	12.116	60.064	27.805
54.206		2.740	10.801	61.386	27.798
55.331		2.740	9.496	62.699	27.791
0.0	69.710	0.367	98.534	1.516	0.000
0.167		0.733	98.533	1.516	0.000
0.333		1.100	98.531	1.516	0.000
0.500		1.467	98.070	1.516	0.413
0.666		1.833	95.785	1.516	2.698
0.833		2.200	80.514	1.516	17.969
1.904		2.200	78.110	3.140	18.747
2.975		2.200	76.217	4.764	19.016
4.047		2.200	74.894	6.388	18.715
5.118		2.200	72.340	8.012	19.645
6.189		2.200	70.517	9.636	19.842
7.260		2.200	68.434	11.260	20.301
8.332		2.200	66.358	12.884	20.753
9.332		2.200	65.206	13.916	20.873
10.332		2.200	63.610	14.948	21.437
11.332		2.200	62.510	15.980	21.505
12.332		2.200	61.380	17.012	21.603
13.332		2.200	59.916	18.044	22.035
14.332		2.200	58.848	19.075	22.071
15.359		2.200	57.058	20.633	22.303
16.387		2.200	55.292	22.191	22.511

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
17.414		2.200	53.450	23.749	22.795
18.442		2.200	51.759	25.307	22.927
19.470		2.200	49.962	26.865	23.166
20.497		2.200	48.262	28.423	23.308
21.525		2.200	46.531	29.981	23.481
22.552		2.200	44.848	31.539	23.605
23.580		2.200	43.155	33.097	23.740
24.580		2.200	41.532	34.612	23.847
25.580		2.200	39.917	36.128	23.945
26.580		2.200	38.301	37.644	24.045
27.730		2.200	36.479	39.387	24.124
28.880		2.200	34.642	41.131	24.218
30.030		2.200	32.838	42.874	24.279
31.180		2.200	31.049	44.617	24.324
32.330		2.200	29.230	46.360	24.399
33.330		2.200	28.235	47.392	24.363
34.330		2.200	27.246	48.424	24.319
35.330		2.200	26.264	49.455	24.269
36.330		2.200	25.286	50.487	24.215
37.330		2.200	24.312	51.519	24.157
38.330		2.200	23.345	52.551	24.092
39.580		2.200	21.467	54.446	24.074
40.830		2.200	19.577	56.340	24.069

Table E-2, continued.
COLUMN 5

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage

Table E-3.
COLUMN 16

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	52.089	0.412	97.901	2.094	0.005
0.166		0.823	97.807	2.185	0.005
0.333		1.235	97.740	2.252	0.005
0.500		1.647	97.707	2.285	0.005
0.666		2.058	97.685	2.305	0.005
0.833		2.470	95.235	2.318	2.421
1.833		2.470	90.117	4.704	5.139
2.833		2.470	86.956	7.089	5.913
3.833		2.470	84.052	9.474	6.430
4.833		2.470	81.131	11.859	6.964
5.833		2.470	78.205	14.245	7.503
6.833		2.470	75.276	16.630	8.044
7.833		2.470	72.378	19.015	8.555
8.833		2.470	69.516	21.400	9.030
9.833		2.470	66.705	23.785	9.453
10.833		2.470	63.931	26.171	9.840
11.833		2.470	61.191	28.556	10.193
12.833		2.470	58.485	30.941	10.513
13.833		2.470	55.807	33.326	10.805
14.833		2.470	53.156	35.711	11.069
15.833		2.470	51.366	37.311	11.259
16.833		2.470	49.590	38.910	11.434
17.833		2.470	47.826	40.509	11.598
18.833		2.470	46.074	42.108	11.750
19.833		2.470	44.331	43.707	11.892
20.833		2.470	42.598	45.306	12.026
21.833		2.470	40.183	47.538	12.209
22.833		2.470	37.799	49.743	12.388
23.833		2.470	36.008	51.366	12.556
24.833		2.470	34.237	52.975	12.718
25.833		2.470	32.507	54.570	12.852
26.833		2.470	30.820	56.152	12.957
27.833		2.470	29.174	57.720	13.034
28.833		2.470	27.593	59.276	13.059
29.833		2.470	26.049	60.819	13.060
30.833		2.470	24.522	62.345	13.061
31.833		2.470	23.016	63.850	13.062
32.833		2.470	21.533	65.332	13.063
33.833		2.470	20.071	66.793	13.064
34.833		2.470	18.629	68.232	13.066
35.833		2.470	17.209	69.651	13.067
36.833		2.470	15.809	71.049	13.069
37.833		2.470	14.429	72.428	13.070
38.833		2.470	13.068	73.786	13.073
39.833		2.470	13.065	73.786	13.075

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
40.833		2.470	13.063	73.786	13.077
41.833		2.470	13.061	73.786	13.079
42.833		2.470	13.058	73.786	13.081
43.833		2.470	13.056	73.786	13.083
44.833		2.470	13.054	73.786	13.085
46.083		2.470	11.376	75.461	13.088
47.333		2.470	9.727	77.106	13.092
0.0	56.093	0.412	97.805	2.188	0.005
0.166		0.823	97.729	2.260	0.005
0.333		1.235	97.688	2.302	0.005
0.499		1.647	97.668	2.323	0.006
0.666		2.058	96.831	2.335	0.823
0.833		2.470	94.995	2.344	2.648
1.833		2.470	90.378	4.729	4.829
2.833		2.470	86.545	7.114	6.241
3.833		2.470	82.792	9.499	7.598
4.833		2.470	79.147	11.884	8.849
5.883		2.470	75.482	14.389	10.005
6.933		2.470	71.944	16.893	11.033
7.983		2.470	68.528	19.398	11.940
9.033		2.470	65.222	21.902	12.737
10.083		2.470	62.016	24.407	13.435
11.133		2.470	58.900	26.911	14.044
12.183		2.470	55.864	29.416	14.574
13.233		2.470	52.895	31.920	15.036
14.283		2.470	49.986	34.425	15.439
15.333		2.470	47.128	36.929	15.793
16.333		2.470	45.240	38.528	16.080
17.333		2.470	43.381	40.128	16.339
18.333		2.470	41.547	41.727	16.574
19.333		2.470	39.733	43.326	16.788
20.333		2.470	37.938	44.925	16.984
21.333		2.470	36.158	46.524	17.164
22.333		2.470	33.708	48.797	17.341
23.333		2.470	31.312	51.043	17.491
24.333		2.470	28.944	53.262	17.640
25.333		2.470	27.074	54.975	17.796
26.333		2.470	25.304	56.596	17.945
27.333		2.470	23.554	58.203	18.087
28.333		2.470	21.848	59.797	18.200
29.333		2.470	20.188	61.377	18.280
30.333		2.470	18.576	62.944	18.324
31.333		2.470	17.022	64.498	18.324
32.333		2.470	15.482	66.037	18.325
33.333		2.470	13.965	67.552	18.326
34.333		2.470	12.470	69.046	18.327
35.333		2.470	10.997	70.518	18.329
36.333		2.470	9.545	71.968	18.330
37.333		2.470	8.114	73.398	18.331

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
38.333		2.470	6.704	74.807	18.333
39.333		2.470	5.313	76.195	18.334
40.333		2.470	5.312	76.195	18.336
41.333		2.470	5.310	76.195	18.338
42.333		2.470	5.308	76.195	18.339
43.333		2.470	5.306	76.195	18.341
44.333		2.470	5.305	76.195	18.343
45.333		2.470	5.303	76.195	18.344
46.583		2.470	3.589	77.907	18.347
47.833		2.470	1.905	79.587	18.350
0.0	56.877	0.412	97.778	2.216	0.005
0.167		0.823	97.710	2.280	0.005
0.334		1.235	97.675	2.315	0.005
0.500		1.647	97.658	2.333	0.005
0.667		2.058	96.693	2.343	0.954
0.834		2.470	94.996	2.350	2.643
1.869		2.470	90.242	4.820	4.915
2.905		2.470	86.125	7.291	6.550
3.941		2.470	82.156	9.761	8.038
4.976		2.470	78.358	12.232	9.358
6.012		2.470	74.736	14.702	10.504
7.048		2.470	71.272	17.172	11.496
8.084		2.470	67.933	19.643	12.364
9.119		2.470	64.705	22.113	13.120
10.155		2.470	61.576	24.584	13.778
11.191		2.470	58.533	27.054	14.349
12.226		2.470	55.563	29.524	14.849
13.262		2.470	52.652	31.995	15.288
14.298		2.470	49.789	34.465	15.681
15.333		2.470	46.970	36.936	16.028
16.333		2.470	45.089	38.535	16.309
17.333		2.470	43.247	40.134	16.551
18.333		2.470	41.439	41.733	16.760
19.333		2.470	39.658	43.332	16.942
20.333		2.470	37.902	44.931	17.097
21.333		2.470	36.169	46.531	17.231
22.333		2.470	33.742	48.824	17.365
23.333		2.470	31.350	51.090	17.490
24.333		2.470	28.998	53.329	17.603
25.333		2.470	26.688	55.542	17.700
26.333		2.470	24.978	57.173	17.779
27.333		2.470	23.268	58.789	17.873
28.333		2.470	21.553	60.392	17.985
29.333		2.470	19.860	61.981	18.089
30.333		2.470	18.203	63.556	18.169
31.333		2.470	16.588	65.119	18.222
32.333		2.470	15.035	66.669	18.225
33.333		2.470	13.499	68.204	18.225
34.333		2.470	11.986	69.716	18.226

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
35.333		2.470	10.494	71.207	18.227
36.333		2.470	9.024	72.676	18.229
37.333		2.470	7.575	74.123	18.230
38.333		2.470	6.147	75.550	18.231
39.333		2.470	4.739	76.956	18.233
40.333		2.470	4.737	76.956	18.234
41.333		2.470	4.736	76.956	18.235
42.333		2.470	4.735	76.956	18.237
43.333		2.470	4.733	76.956	18.238
44.333		2.470	4.732	76.956	18.240
45.333		2.470	4.730	76.956	18.241
46.333		2.470	3.342	78.342	18.243
47.333		2.470	1.974	79.709	18.244
48.333		2.470	0.625	81.056	18.246
0.0	45.852	0.733	98.810	1.182	0.008
0.167		1.467	98.732	1.259	0.008
0.333		2.200	98.704	1.285	0.009
0.500		2.933	94.335	1.299	4.291
0.667		3.667	88.046	1.307	10.491
0.833		4.400	73.590	1.312	24.967
2.000		4.400	72.005	2.874	24.990
3.167		4.400	70.609	4.436	24.823
4.333		4.400	69.141	5.999	24.730
5.458		4.400	67.533	7.505	24.831
6.583		4.400	65.874	9.011	24.983
7.708		4.400	64.223	10.518	25.128
8.833		4.400	62.567	12.024	25.277
9.833		4.400	61.604	12.922	25.343
10.833		4.400	60.643	13.819	25.406
11.833		4.400	59.692	14.717	25.460
12.833		4.400	58.746	15.615	25.507
13.833		4.400	57.807	16.513	25.549
14.833		4.400	56.873	17.410	25.585
15.833		4.400	55.446	18.749	25.672
16.833		4.400	54.018	20.088	25.762
17.833		4.400	52.590	21.427	25.851
18.833		4.400	51.164	22.766	25.938
19.833		4.400	49.740	24.105	26.022
20.833		4.400	48.334	25.444	26.089
21.833		4.400	46.923	26.783	26.161
22.833		4.400	45.513	28.122	26.232
23.833		4.400	44.105	29.461	26.300
24.833		4.400	42.702	30.800	26.365
25.833		4.400	41.299	32.139	26.428
26.833		4.400	39.893	33.478	26.495
27.833		4.400	38.493	34.805	26.567
28.833		4.400	37.128	36.116	26.622
29.833		4.400	35.780	37.411	26.673
30.833		4.400	34.453	38.691	26.721

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
31.833		4.400	33.144	39.956	26.765
32.833		4.400	31.854	41.206	26.805
33.833		4.400	31.596	41.440	26.829
34.833		4.400	31.574	41.444	26.847
35.833		4.400	31.558	41.448	26.858
36.833		4.400	31.546	41.453	26.866
37.833		4.400	31.536	41.457	26.872
38.833		4.400	31.527	41.462	26.876
40.083		4.400	30.348	42.617	26.898
41.333		4.400	29.187	43.753	26.925
42.361		4.400	28.242	44.676	26.946
43.389		4.400	27.306	45.591	26.967
44.416		4.400	26.379	46.499	26.986
45.444		4.400	25.465	47.399	27.000
46.471		4.400	24.555	48.291	27.017
47.499		4.400	23.650	49.176	27.037
48.527		4.400	22.766	50.053	27.044
49.554		4.400	21.896	50.923	27.044
50.582		4.400	21.038	51.781	27.044
0.0	61.278	0.457	97.866	2.132	0.001
0.167		0.913	97.855	2.141	0.001
0.333		1.370	97.852	2.144	0.001
0.500		1.827	97.485	2.146	0.366
0.666		2.283	96.573	2.146	1.276
0.833		2.740	84.391	2.147	13.458
1.883		2.740	82.052	4.405	13.539
2.932		2.740	79.751	6.662	13.582
3.982		2.740	77.067	8.920	14.008
5.032		2.740	74.344	11.178	14.474
6.082		2.740	71.635	13.435	14.924
7.082		2.740	69.900	14.877	15.218
8.082		2.740	68.178	16.319	15.498
9.082		2.740	66.497	17.760	15.737
10.082		2.740	64.841	19.202	15.951
11.082		2.740	63.211	20.643	16.140
12.082		2.740	61.602	22.085	16.307
13.332		2.740	58.615	24.773	16.606
14.582		2.740	55.649	27.461	16.885
15.615		2.740	53.211	29.682	17.101
16.648		2.740	50.784	31.904	17.306
17.681		2.740	48.368	34.126	17.499
18.715		2.740	45.963	36.348	17.682
19.748		2.740	43.586	38.570	17.837
20.781		2.740	41.214	40.792	17.987
21.814		2.740	38.846	43.013	18.133
22.847		2.740	36.484	45.235	18.272
23.881		2.740	34.132	47.457	18.402
24.914		2.740	31.784	49.679	18.527
25.947		2.740	29.420	51.901	18.669

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
26.980		2.740	27.108	54.096	18.785
28.013		2.740	24.831	56.265	18.893
29.047		2.740	22.593	58.406	18.990
30.080		2.740	20.390	60.521	19.078
31.080		2.740	18.894	61.962	19.132
32.080		2.740	17.967	62.847	19.174
33.080		2.740	17.929	62.855	19.205
34.080		2.740	17.897	62.862	19.229
35.080		2.740	17.790	62.949	19.248
36.080		2.740	17.694	63.029	19.265
37.205		2.740	15.916	64.761	19.310
38.330		2.740	14.225	66.404	19.358
39.580		2.740	12.363	68.211	19.414
40.830		2.740	10.524	69.999	19.464
42.080		2.740	8.712	71.769	19.506
0.0	65.256	0.457	97.796	2.150	0.052
0.167		0.913	97.797	2.150	0.050
0.333		1.370	97.798	2.150	0.050
0.500		1.827	97.503	2.150	0.345
0.666		2.283	90.814	2.150	7.034
0.833		2.740	75.679	2.150	22.170
1.833		2.740	73.438	4.300	22.260
2.833		2.740	71.431	6.451	22.116
3.833		2.740	69.709	8.601	21.688
4.833		2.740	67.420	10.751	21.827
5.833		2.740	65.214	12.901	21.883
6.833		2.740	62.889	15.051	22.057
7.833		2.740	60.597	17.201	22.198
8.833		2.740	58.279	19.352	22.366
9.833		2.740	55.974	21.502	22.521
10.833		2.740	53.668	23.652	22.677
11.833		2.740	51.370	25.802	22.825
12.833		2.740	49.879	27.244	22.874
13.833		2.740	48.405	28.685	22.906
14.833		2.740	46.944	30.127	22.926
15.833		2.740	45.491	31.568	22.937
16.833		2.740	44.045	33.010	22.941
17.833		2.740	42.606	34.452	22.939
18.869		2.740	40.299	36.679	23.019
19.904		2.740	37.977	38.906	23.113
20.940		2.740	35.676	41.132	23.187
21.975		2.740	33.368	43.359	23.267
23.011		2.740	31.055	45.586	23.353
24.047		2.740	28.744	47.813	23.436
25.082		2.740	26.439	50.040	23.514
26.145		2.740	24.074	52.325	23.593
27.207		2.740	21.687	54.609	23.696
28.270		2.740	19.335	56.869	23.787
29.332		2.740	17.036	59.100	23.855

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
30.395		2.740	14.772	61.302	23.916
31.457		2.740	12.538	63.476	23.976
32.520		2.740	10.335	65.624	24.031
33.582		2.740	8.159	67.744	24.086
34.707		2.740	6.453	69.398	24.139
35.832		2.740	4.769	71.035	24.185
36.832		2.740	4.745	71.035	24.208
37.832		2.740	4.731	71.035	24.222
38.832		2.740	4.726	71.035	24.228
39.832		2.740	4.726	71.035	24.228
40.832		2.740	4.730	71.035	24.224
41.832		2.740	4.737	71.035	24.217
43.207		2.740	2.739	73.019	24.231
44.582		2.740	0.755	74.979	24.254
0.0	59.547	0.640	98.487	1.511	0.001
0.167		1.280	98.475	1.522	0.001
0.333		1.920	98.009	1.526	0.462
0.500		2.560	94.054	1.528	4.416
0.666		3.200	75.506	1.530	22.963
0.833		3.840	62.922	1.530	35.546
1.958		3.840	61.150	3.256	35.592
3.083		3.840	59.624	4.982	35.392
4.208		3.840	58.222	6.708	35.067
5.333		3.840	56.486	8.434	35.077
6.333		3.840	55.615	9.463	34.920
7.333		3.840	54.660	10.492	34.845
8.333		3.840	53.759	11.520	34.718
9.333		3.840	52.822	12.549	34.627
10.333		3.840	51.913	13.578	34.507
11.333		3.840	50.984	14.606	34.406
12.433		3.840	49.332	16.294	34.371
13.532		3.840	47.669	17.982	34.347
14.632		3.840	46.006	19.669	34.322
15.732		3.840	44.338	21.357	34.302
16.832		3.840	42.670	23.045	34.282
17.832		3.840	41.152	24.579	34.266
18.832		3.840	39.633	26.113	34.250
19.832		3.840	38.114	27.647	34.235
20.832		3.840	36.593	29.181	34.221
21.832		3.840	35.090	30.716	34.190
22.832		3.840	33.576	32.250	34.170
23.832		3.840	32.058	33.784	34.153
24.832		3.840	30.539	35.318	34.138
25.832		3.840	29.021	36.853	34.120
26.832		3.840	27.502	38.387	34.105
27.832		3.840	25.979	39.921	34.093
29.332		3.840	23.677	42.213	34.103
30.332		3.840	22.699	43.241	34.052
31.332		3.840	21.735	44.270	33.987

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
32.332		3.840	20.780	45.299	33.913
33.332		3.840	19.830	46.327	33.833
34.332		3.840	18.885	47.356	33.750
35.332		3.840	18.018	48.308	33.665
36.332		3.840	16.825	49.556	33.609
37.332		3.840	15.825	50.599	33.566
38.332		3.840	14.823	51.633	33.533
39.332		3.840	13.824	52.658	33.507
40.332		3.840	12.828	53.675	33.486
41.332		3.840	11.835	54.683	33.471
42.332		3.840	10.848	55.683	33.458
43.332		3.840	9.867	56.675	33.447
44.332		3.840	8.891	57.659	33.439
45.332		3.840	7.921	58.635	33.433
46.332		3.840	6.957	59.603	33.429
47.332		3.840	5.997	60.564	33.427
48.332		3.840	5.044	61.517	33.426
49.332		3.840	4.097	62.464	33.427
50.332		3.840	3.156	63.403	33.429
51.332		3.840	2.222	64.335	33.430
52.332		3.840	1.300	65.258	33.430
53.332		3.840	0.390	66.167	33.430
54.332		3.840	0.391	66.167	33.430
55.332		3.840	0.392	66.167	33.429
56.332		3.840	0.394	66.167	33.427
57.332		3.840	0.397	66.167	33.423
58.332		3.840	0.402	66.167	33.419
59.332		3.840	0.408	66.167	33.412
0.0	58.952	0.548	98.254	1.761	0.000
0.167		1.097	98.239	1.776	0.000
0.334		1.645	98.233	1.781	0.000
0.500		2.193	97.991	1.783	0.224
0.667		2.742	89.429	1.785	8.784
0.833		3.290	74.525	1.786	23.688
1.866		3.290	72.188	3.636	24.174
2.899		3.290	70.526	5.487	23.985
3.933		3.290	69.065	7.337	23.596
4.966		3.290	67.236	9.187	23.574
5.999		3.290	65.462	11.038	23.498
7.032		3.290	63.621	12.888	23.488
8.065		3.290	61.796	14.739	23.463
9.099		3.290	59.955	16.589	23.453
10.132		3.290	58.117	18.439	23.440
11.165		3.290	56.277	20.290	23.429
12.198		3.290	54.459	22.140	23.397
13.231		3.290	52.603	23.991	23.402
14.265		3.290	50.761	25.841	23.393
15.298		3.290	48.923	27.691	23.382
16.331		3.290	47.084	29.542	23.369

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
17.331		3.290	45.968	30.743	23.285
18.331		3.290	44.873	31.943	23.179
19.331		3.290	43.785	33.144	23.066
20.331		3.290	42.701	34.344	22.949
21.331		3.290	41.622	35.545	22.827
22.331		3.290	40.549	36.745	22.699
23.331		3.290	38.839	38.536	22.617
24.331		3.290	37.107	40.327	22.558
25.331		3.290	35.363	42.118	22.511
26.331		3.290	33.610	43.908	22.472
27.331		3.290	31.849	45.699	22.442
28.331		3.290	30.069	47.486	22.435
29.331		3.290	28.312	49.254	22.424
30.331		3.290	26.592	51.000	22.398
31.331		3.290	24.891	52.725	22.373
32.331		3.290	23.208	54.430	22.352
33.331		3.290	21.543	56.114	22.332
34.331		3.290	19.896	57.779	22.314
35.331		3.290	18.686	59.007	22.296
36.331		3.290	17.485	60.224	22.280
37.331		3.290	16.290	61.430	22.267
38.331		3.290	15.106	62.626	22.256
39.331		3.290	13.930	63.812	22.245
40.331		3.290	12.762	64.989	22.237
41.331		3.290	12.784	64.989	22.215
42.331		3.290	12.813	64.989	22.185
43.331		3.290	12.851	64.989	22.147
44.331		3.290	12.896	64.989	22.102
45.331		3.290	12.946	64.989	22.052
46.331		3.290	13.001	64.989	21.998
47.331		3.290	11.872	66.156	21.959
48.331		3.290	10.741	67.314	21.932
49.331		3.290	9.609	68.463	21.915
50.331		3.290	8.480	69.603	21.904
51.331		3.290	7.356	70.733	21.897
0.0	62.985	0.457	97.868	2.150	0.000
0.166		0.913	97.867	2.150	0.000
0.333		1.370	97.867	2.150	0.000
0.499		1.827	97.749	2.150	0.099
0.666		2.283	96.319	2.150	1.529
0.832		2.740	80.651	2.150	17.197
1.832		2.740	78.411	4.300	17.287
2.832		2.740	76.404	6.451	17.144
3.832		2.740	74.681	8.601	16.716
4.832		2.740	72.434	10.751	16.812
5.832		2.740	70.264	12.901	16.833
6.832		2.740	67.991	15.051	16.955
7.832		2.740	65.755	17.201	17.041
8.832		2.740	63.497	19.352	17.149

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
9.832		2.740	61.254	21.502	17.241
10.832		2.740	59.013	23.652	17.332
11.832		2.740	56.780	25.802	17.415
12.832		2.740	54.553	27.952	17.491
13.832		2.740	53.135	29.394	17.468
14.832		2.740	51.738	30.835	17.423
15.832		2.740	50.354	32.277	17.365
16.832		2.740	48.980	33.719	17.298
17.832		2.740	47.612	35.160	17.224
18.832		2.740	46.250	36.602	17.144
19.832		2.740	44.099	38.752	17.145
20.832		2.740	41.953	40.902	17.140
21.832		2.740	39.797	43.052	17.146
22.832		2.740	37.634	45.202	17.158
23.832		2.740	35.467	47.353	17.174
24.832		2.740	33.304	49.503	17.186
25.832		2.740	31.140	51.653	17.199
26.832		2.740	28.973	53.803	17.216
27.832		2.740	26.787	55.950	17.255
28.832		2.740	24.633	58.072	17.286
29.832		2.740	22.526	60.169	17.296
0.0	73.271	0.183	94.733	5.356	0.000
0.166		0.367	94.735	5.356	0.000
0.333		0.550	94.736	5.356	0.000
0.499		0.733	94.737	5.356	0.000
0.666		0.917	94.737	5.356	0.000
0.832		1.100	94.727	5.356	0.000
1.832		1.100	88.903	10.712	0.380
2.832		1.100	82.888	16.068	1.040
3.832		1.100	76.813	21.423	1.758
4.832		1.100	70.761	26.779	2.454
5.832		1.100	64.759	32.135	3.100
6.832		1.100	58.815	37.491	3.687
7.832		1.100	54.826	41.082	4.086
8.832		1.100	50.943	44.673	4.377
9.832		1.100	47.134	48.264	4.595
10.832		1.100	43.381	51.855	4.757
11.832		1.100	39.674	55.446	4.873
12.832		1.100	36.017	59.037	4.938
13.832		1.100	30.512	64.392	5.087
14.832		1.100	24.974	69.748	5.268
15.832		1.100	19.431	75.104	5.452
16.832		1.100	13.886	80.460	5.641
17.832		1.100	8.322	85.816	5.848
18.832		1.100	2.808	91.134	6.043
0.0	57.714	0.457	97.945	2.053	0.001
0.166		0.913	97.899	2.097	0.001
0.333		1.370	97.882	2.115	0.001
0.499		1.827	97.873	2.123	0.001

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.666		2.283	97.017	2.129	0.849
0.832		2.740	92.082	2.132	5.781
2.207		2.740	87.843	5.089	7.062
3.582		2.740	83.757	8.045	8.191
4.832		2.740	80.144	10.733	9.116
6.082		2.740	76.690	13.421	9.882
7.332		2.740	73.345	16.108	10.539
8.332		2.740	71.531	17.550	10.911
9.332		2.740	69.762	18.992	11.239
10.332		2.740	68.043	20.433	11.516
11.332		2.740	66.365	21.875	11.753
12.332		2.740	64.721	23.317	11.955
13.332		2.740	63.106	24.758	12.128
14.332		2.740	60.728	26.908	12.356
15.332		2.740	58.359	29.058	12.574
16.332		2.740	56.003	31.209	12.780
17.368		2.740	53.578	33.436	12.978
18.403		2.740	51.183	35.663	13.145
19.439		2.740	48.799	37.890	13.302
20.475		2.740	46.420	40.116	13.454
21.510		2.740	44.051	42.343	13.596
22.546		2.740	41.693	44.570	13.726
23.582		2.740	39.338	46.797	13.853
24.689		2.740	36.811	49.176	14.002
25.796		2.740	34.344	51.522	14.122
26.902		2.740	31.919	53.838	14.231
28.009		2.740	29.542	56.122	14.323
29.116		2.740	27.204	58.377	14.406
30.223		2.740	24.901	60.602	14.483
31.330		2.740	22.759	62.677	14.551
32.330		2.740	22.719	62.677	14.590
33.330		2.740	22.690	62.677	14.618
34.330		2.740	22.671	62.677	14.638
35.330		2.740	22.658	62.677	14.651
36.330		2.740	22.650	62.677	14.659
37.330		2.740	22.645	62.677	14.664
38.705		2.740	20.607	64.686	14.693
40.080		2.740	18.586	66.672	14.728
41.205		2.740	16.954	68.277	14.754
42.330		2.740	15.343	69.867	14.776
43.455		2.740	13.750	71.443	14.793
44.580		2.740	12.163	73.004	14.819
45.705		2.740	10.613	74.551	14.821
46.830		2.740	9.081	76.083	14.821
0.0	61.860	0.367	97.364	2.633	0.001
0.166		0.733	97.339	2.656	0.001
0.333		1.100	97.332	2.663	0.001
0.499		1.467	97.329	2.667	0.001
0.666		1.833	96.984	2.669	0.344

Table D-3, continued.
COLUMN 16

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.832		2.200	96.236	2.670	1.090
1.903		2.200	91.040	5.540	3.413
2.975		2.200	86.602	8.409	4.981
4.046		2.200	82.615	11.278	6.097
5.117		2.200	78.757	14.147	7.086
6.189		2.200	75.144	17.017	7.829
7.260		2.200	71.625	19.886	8.479
8.331		2.200	68.167	22.755	9.067
9.331		2.200	65.952	24.550	9.487
10.331		2.200	63.785	26.346	9.859
11.331		2.200	61.656	28.141	10.191
12.331		2.200	59.566	29.937	10.486
13.331		2.200	57.513	31.732	10.744
14.331		2.200	55.492	33.528	10.969
15.359		2.200	52.484	36.280	11.224
16.386		2.200	49.473	39.032	11.482
17.414		2.200	46.473	41.785	11.729
18.442		2.200	43.488	44.537	11.961
19.469		2.200	40.522	47.289	12.174
20.497		2.200	37.568	50.042	12.375
21.524		2.200	34.600	52.794	12.591
22.552		2.200	31.698	55.517	12.769
23.580		2.200	28.846	58.206	12.932
24.580		2.200	26.120	60.790	13.073
25.580		2.200	23.441	63.344	13.198
26.580		2.200	20.808	65.867	13.308
27.729		2.200	17.831	68.732	13.419
28.879		2.200	15.627	70.843	13.513
30.029		2.200	13.459	72.933	13.590
31.179		2.200	11.329	75.002	13.652
32.329		2.200	9.236	77.050	13.696
33.329		2.200	9.205	77.050	13.727
34.329		2.200	9.180	77.050	13.751
35.329		2.200	9.161	77.050	13.770
36.329		2.200	9.144	77.050	13.787
37.329		2.200	9.131	77.050	13.800
38.329		2.200	9.119	77.050	13.812
39.579		2.200	6.891	79.257	13.833
40.829		2.200	4.705	81.441	13.835

Table E-4.
COLUMN 12

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	65.718	0.057	98.653	1.386	0.000
0.166		0.913	98.654	1.386	0.000
0.333		1.370	98.649	1.386	0.000
0.500		1.827	98.206	1.386	0.407
0.666		2.283	85.233	1.386	13.380
0.833		2.740	71.027	1.386	27.586
1.958		2.740	69.221	2.945	27.833
3.083		2.740	67.643	4.504	27.851
4.208		2.740	66.331	6.062	27.605
5.333		2.740	65.200	7.621	27.176
6.333		2.740	64.177	8.800	27.021
7.333		2.740	63.198	9.979	26.821
8.333		2.740	62.115	1.158	26.725
9.333		2.740	61.104	2.337	26.557
10.333		2.740	60.011	3.515	26.471
11.333		2.740	58.987	4.694	26.316
12.333		2.740	57.606	6.080	26.311
13.333		2.740	56.291	7.466	26.240
14.333		2.740	54.916	8.851	26.229
15.333		2.740	53.587	0.237	26.172
16.333		2.740	52.211	1.623	26.163
17.333		2.740	50.848	3.008	26.140
18.333		2.740	49.485	4.394	26.117
19.333		2.740	48.120	5.780	26.096
20.333		2.740	46.773	7.166	26.057
21.333		2.740	45.396	8.551	26.049
22.333		2.740	44.029	9.937	26.029
23.333		2.740	42.665	1.323	26.008
24.333		2.740	41.301	2.708	25.986
25.333		2.740	39.952	4.094	25.949
26.333		2.740	38.580	5.480	25.936
27.333		2.740	37.214	6.865	25.915
28.333		2.740	35.851	8.251	25.892
29.333		2.740	34.500	9.637	25.857
30.333		2.740	33.386	0.816	25.792
31.333		2.740	32.298	1.994	25.702
32.333		2.740	31.217	3.173	25.603
33.333		2.740	30.143	4.352	25.498
34.333		2.740	29.075	5.531	25.386
35.333		2.740	28.014	6.710	25.268
36.333		2.740	26.713	8.095	25.182
37.333		2.740	25.395	9.481	25.114
38.333		2.740	24.067	0.867	25.056
39.333		2.740	22.732	2.252	25.005
40.333		2.740	21.391	3.638	24.960
41.333		2.740	20.042	5.024	24.923
42.333		2.740	18.684	6.408	24.897
43.333		2.740	17.337	7.780	24.872
44.333		2.740	16.003	9.141	24.845
45.333		2.740	14.680	0.491	24.817

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
46.333		2.740	13.375	1.830	24.783
47.333		2.740	12.078	3.158	24.753
48.333		2.740	10.788	4.475	24.724
49.333		2.740	9.508	5.782	24.698
50.333		2.740	8.236	7.079	24.672
51.333		2.740	6.974	8.365	24.648
52.333		2.740	6.007	9.355	24.625
53.333		2.740	5.084	0.300	24.604
54.333		2.740	5.117	0.300	24.571
55.333		2.740	5.162	0.300	24.526
56.333		2.740	5.214	0.300	24.473
57.333		2.740	5.272	0.300	24.415
58.333		2.740	5.334	0.300	24.353
59.333		2.740	5.398	0.300	24.289
60.395		2.740	4.449	1.298	24.239
61.458		2.740	3.492	2.290	24.203
62.520		2.740	2.533	3.277	24.176
63.583		2.740	1.573	4.257	24.155
64.645		2.740	0.615	5.231	24.139
0.0	63.885	0.457	98.623	1.386	0.000
0.167		0.913	98.623	1.386	0.000
0.334		1.370	98.623	1.386	0.000
0.500		1.827	98.321	1.386	0.292
0.667		2.283	89.808	1.386	8.805
0.834		2.740	74.840	1.386	23.773
1.984		2.740	72.966	2.979	24.053
3.134		2.740	71.375	4.573	24.050
4.284		2.740	70.051	6.166	23.781
5.434		2.740	68.897	7.760	23.340
6.584		2.740	67.330	9.353	23.314
7.584		2.740	66.018	0.739	23.240
8.584		2.740	64.913	1.918	23.166
9.584		2.740	63.822	3.097	23.078
10.584		2.740	62.709	4.276	23.012
11.584		2.740	61.614	5.454	22.929
12.584		2.740	60.506	6.633	22.857
13.584		2.740	59.411	7.812	22.774
14.834		2.740	57.681	9.544	22.771
16.084		2.740	55.960	1.276	22.760
17.117		2.740	54.532	2.708	22.755
18.150		2.740	53.103	4.140	22.752
19.184		2.740	51.674	5.572	22.750
20.217		2.740	50.244	7.004	22.747
21.250		2.740	48.814	8.436	22.745
22.284		2.740	47.385	9.868	22.741
23.317		2.740	45.957	1.300	22.737
24.350		2.740	44.530	2.731	22.733
25.384		2.740	43.103	4.163	22.727
26.417		2.740	41.677	5.595	22.721

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
27.450		2.740	40.252	7.027	22.714
28.484		2.740	38.827	8.459	22.707
29.517		2.740	37.402	9.891	22.699
30.550		2.740	35.989	1.323	22.680
31.584		2.740	34.570	2.755	22.667
32.584		2.740	33.441	3.933	22.617
33.584		2.740	32.332	5.112	22.547
34.584		2.740	31.234	6.291	22.465
35.584		2.740	30.146	7.470	22.373
36.584		2.740	29.065	8.649	22.275
37.584		2.740	27.988	9.828	22.171
38.634		2.740	26.609	1.283	22.095
39.684		2.740	25.209	2.737	22.039
40.734		2.740	23.794	4.192	21.999
41.784		2.740	22.367	5.644	21.974
42.834		2.740	20.950	7.083	21.952
43.884		2.740	19.545	8.510	21.930
44.934		2.740	18.158	9.924	21.902
45.984		2.740	16.779	1.327	21.878
47.034		2.740	15.409	2.718	21.857
48.083		2.740	14.049	4.097	21.837
0.0	70.638	0.228	97.363	2.771	0.000
0.167		0.457	97.364	2.771	0.000
0.333		0.685	97.365	2.771	0.000
0.500		0.913	97.364	2.771	0.000
0.667		1.142	97.358	2.771	0.000
0.833		1.370	97.187	2.771	0.039
2.083		1.370	91.227	6.236	2.534
3.133		1.370	87.383	9.146	3.468
4.183		1.370	83.639	2.056	4.301
5.233		1.370	79.991	4.965	5.039
6.283		1.370	76.426	7.875	5.693
7.333		1.370	72.935	0.785	6.274
8.333		1.370	70.185	3.143	6.667
9.333		1.370	67.502	5.501	6.991
10.333		1.370	64.878	7.858	7.257
11.333		1.370	62.304	0.216	7.474
12.333		1.370	59.772	2.574	7.648
13.333		1.370	57.277	4.931	7.785
14.333		1.370	54.301	7.703	7.989
15.333		1.370	51.327	0.474	8.191
16.333		1.370	48.365	3.246	8.382
17.405		1.370	45.207	6.215	8.571
18.476		1.370	42.062	9.184	8.745
19.548		1.370	38.953	2.154	8.885
20.619		1.370	35.853	5.123	9.014
21.691		1.370	32.759	8.092	9.138
22.762		1.370	29.672	1.062	9.254
23.833		1.370	26.595	4.031	9.362

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
25.000		1.370	23.243	7.264	9.480
26.167		1.370	19.908	0.498	9.581
27.333		1.370	16.555	3.731	9.700
28.333		1.370	13.697	6.496	9.792
29.333		1.370	10.873	9.238	9.874
30.333		1.370	8.096	1.957	9.931
31.333		1.370	5.343	4.655	9.986
32.333		1.370	2.963	7.012	10.008
33.333		1.370	0.612	9.370	10.002
0.0	56.568	0.457	98.690	1.307	0.001
0.167		0.913	98.651	1.344	0.001
0.333		1.370	98.638	1.358	0.001
0.500		1.827	98.627	1.365	0.005
0.666		2.283	97.545	1.369	1.081
0.833		2.740	90.063	1.372	8.561
1.833		2.740	88.445	2.758	8.792
2.833		2.740	86.635	4.143	9.217
3.833		2.740	84.542	5.529	9.924
4.833		2.740	82.508	6.915	10.572
5.833		2.740	80.841	8.094	11.060
6.833		2.740	79.207	9.272	11.515
7.833		2.740	77.644	0.451	11.899
8.833		2.740	76.123	1.630	12.242
9.833		2.740	74.644	2.809	12.542
10.833		2.740	73.199	3.988	12.808
11.833		2.740	71.512	5.373	13.109
12.833		2.740	69.858	6.759	13.377
13.833		2.740	68.220	8.145	13.630
14.833		2.740	66.600	9.530	13.864
15.833		2.740	64.996	0.916	14.082
16.833		2.740	63.407	2.302	14.285
17.833		2.740	61.831	3.688	14.475
18.833		2.740	60.268	5.073	14.652
19.833		2.740	58.717	6.459	14.818
20.833		2.740	57.175	7.845	14.973
21.833		2.740	55.643	9.230	15.119
22.833		2.740	54.120	0.616	15.257
23.833		2.740	52.605	2.002	15.386
24.833		2.740	51.096	3.387	15.509
25.833		2.740	49.595	4.773	15.625
26.833		2.740	48.098	6.159	15.735
27.833		2.740	46.621	7.544	15.827
28.833		2.740	45.144	8.930	15.918
29.833		2.740	43.904	0.109	15.979
30.833		2.740	42.684	1.288	16.019
31.833		2.740	41.479	2.467	16.044
32.833		2.740	40.285	3.645	16.059
33.833		2.740	39.099	4.824	16.066
34.833		2.740	37.919	6.003	16.067

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
35.833		2.740	36.513	7.382	16.094
36.833		2.740	35.105	8.750	16.133
37.833		2.740	33.711	0.108	16.170
38.833		2.740	32.324	1.454	16.210
39.833		2.740	30.948	2.789	16.250
40.833		2.740	29.584	4.114	16.290
41.833		2.740	28.232	5.428	16.328
42.833		2.740	26.892	6.731	16.364
43.833		2.740	25.565	8.024	16.398
44.833		2.740	24.250	9.307	16.430
45.833		2.740	23.272	0.255	16.460
46.833		2.740	22.302	1.196	16.489
47.833		2.740	21.337	2.133	16.517
48.833		2.740	20.381	3.064	16.542
49.833		2.740	19.433	3.989	16.564
50.833		2.740	18.494	4.910	16.582
51.833		2.740	17.564	5.825	16.598
52.833		2.740	16.642	6.735	16.609
53.833		2.740	16.633	6.735	16.618
54.833		2.740	16.626	6.735	16.625
55.833		2.740	16.620	6.735	16.631
56.833		2.740	16.614	6.735	16.636
57.833		2.740	16.610	6.735	16.641
58.833		2.740	16.606	6.735	16.645
59.833		2.740	15.698	7.641	16.647
60.833		2.740	14.797	8.541	16.647
62.208		2.740	13.566	9.773	16.647
63.583		2.740	12.343	0.995	16.648
0.0	62.501	0.275	97.763	2.234	0.001
0.166		0.550	97.728	2.268	0.001
0.333		0.825	97.716	2.279	0.001
0.499		1.100	97.711	2.284	0.001
0.666		1.375	97.708	2.288	0.001
0.832		1.650	97.517	2.290	0.190
1.832		1.650	94.356	4.591	1.047
2.832		1.650	91.315	6.892	1.787
3.832		1.650	88.191	9.193	2.610
4.832		1.650	85.077	1.494	3.422
5.832		1.650	82.033	3.795	4.165
7.082		1.650	78.322	6.672	4.998
8.332		1.650	74.720	9.548	5.723
9.582		1.650	71.210	2.425	6.356
10.749		1.650	67.971	5.109	6.911
11.915		1.650	64.796	7.794	7.400
13.082		1.650	61.678	0.478	7.833
14.082		1.650	59.423	2.436	8.131
15.082		1.650	57.206	4.393	8.390
16.082		1.650	55.016	6.351	8.622
17.082		1.650	52.845	8.309	8.835

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
18.082		1.650	50.692	0.266	9.030
19.082		1.650	48.558	2.224	9.206
20.231		1.650	45.689	4.870	9.427
21.381		1.650	42.821	7.516	9.649
22.531		1.650	39.945	0.163	9.878
23.681		1.650	37.087	2.806	10.092
24.831		1.650	34.286	5.424	10.274
25.852		1.650	31.836	7.727	10.421
26.873		1.650	29.419	0.011	10.554
27.893		1.650	27.035	2.275	10.673
28.914		1.650	24.683	4.522	10.778
29.935		1.650	22.362	6.749	10.871
30.956		1.650	20.071	8.959	10.952
31.976		1.650	17.806	1.150	11.026
32.997		1.650	15.570	3.325	11.087
34.018		1.650	13.916	4.930	11.135
35.039		1.650	12.274	6.525	11.182
36.059		1.650	10.622	8.111	11.248
37.080		1.650	8.985	9.687	11.309
38.080		1.650	8.945	9.687	11.348
39.080		1.650	8.918	9.687	11.376
40.080		1.650	8.897	9.687	11.396
41.080		1.650	8.882	9.687	11.411
42.080		1.650	8.871	9.687	11.422
43.080		1.650	8.862	9.687	11.431
44.080		1.650	7.325	1.223	11.432
45.080		1.650	5.797	2.751	11.432
46.080		1.650	4.278	4.269	11.433
0.0	63.739	0.412	98.461	1.537	0.001
0.166		0.823	98.460	1.537	0.001
0.333		1.235	98.460	1.537	0.001
0.499		1.647	98.063	1.537	0.397
0.666		2.058	97.197	1.537	1.262
0.832		2.470	83.358	1.537	15.102
1.832		2.470	81.549	3.074	15.373
2.832		2.470	79.974	4.611	15.411
3.832		2.470	78.340	6.149	15.508
4.832		2.470	76.264	7.686	16.046
5.832		2.470	74.322	9.223	16.451
6.832		2.470	72.322	0.760	16.913
7.832		2.470	70.382	2.297	17.316
8.832		2.470	68.452	3.834	17.709
9.832		2.470	66.551	5.372	18.072
10.832		2.470	64.672	6.909	18.415
11.832		2.470	62.814	8.446	18.735
12.832		2.470	60.977	9.983	19.035
13.832		2.470	59.158	1.520	19.316
14.832		2.470	57.358	3.057	19.579
15.832		2.470	55.866	4.365	19.763

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
16.832		2.470	54.394	5.673	19.927
17.832		2.470	52.942	6.981	20.072
18.832		2.470	51.506	8.288	20.200
19.832		2.470	50.085	9.596	20.313
20.832		2.470	48.676	0.904	20.414
21.832		2.470	46.993	2.441	20.560
22.832		2.470	45.309	3.978	20.707
23.832		2.470	43.628	5.515	20.850
24.832		2.470	41.954	7.052	20.987
25.832		2.470	40.284	8.589	21.119
26.832		2.470	38.620	0.127	21.246
27.832		2.470	36.977	1.664	21.352
28.832		2.470	35.333	3.201	21.459
29.832		2.470	33.691	4.738	21.563
30.832		2.470	32.053	6.275	21.663
31.832		2.470	30.416	7.812	21.763
32.832		2.470	28.784	9.350	21.857
33.832		2.470	27.161	0.887	21.943
34.832		2.470	25.535	2.424	22.031
35.832		2.470	23.905	3.961	22.124
36.832		2.470	22.293	5.487	22.210
37.832		2.470	20.709	7.000	22.281
38.832		2.470	19.141	8.500	22.348
39.832		2.470	17.784	9.808	22.397
40.832		2.470	16.442	1.116	22.431
41.832		2.470	15.109	2.423	22.457
42.832		2.470	13.780	3.731	22.478
43.832		2.470	13.255	4.239	22.495
44.832		2.470	13.149	4.330	22.510
46.082		2.470	11.691	5.745	22.552
47.332		2.470	10.338	7.053	22.597
0.0	87.899	0.228	97.149	2.755	0.094
0.166		0.457	97.141	2.763	0.094
0.333		0.685	97.138	2.766	0.094
0.499		0.913	97.136	2.767	0.094
0.666		1.142	97.132	2.768	0.097
0.832		1.370	97.070	2.769	0.158
1.832		1.370	92.986	5.540	1.471
2.832		1.370	89.245	8.311	2.441
3.832		1.370	85.529	1.083	3.385
4.832		1.370	81.895	3.854	4.247
0.0	43.468	0.913	99.376	0.618	0.006
0.167		1.827	99.339	0.654	0.006
0.334		2.740	95.558	0.667	3.658
0.500		3.653	87.906	0.673	11.289
0.667		4.567	70.392	0.677	28.826
0.833		5.480	58.660	0.680	40.572
2.000		5.480	57.711	1.488	40.713
3.166		5.480	56.908	2.296	40.707

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
4.333		5.480	56.241	3.105	40.566
5.458		5.480	55.679	3.884	40.349
6.583		5.480	54.928	4.664	40.320
7.708		5.480	54.207	5.443	40.261
8.833		5.480	53.449	6.223	40.239
9.833		5.480	52.932	6.812	40.167
10.833		5.480	52.397	7.401	40.113
11.833		5.480	51.876	7.991	40.045
12.833		5.480	51.349	8.580	39.982
13.833		5.480	50.830	9.170	39.912
14.833		5.480	50.309	9.759	39.843
15.833		5.480	49.650	0.452	39.809
16.833		5.480	48.991	1.145	39.775
17.833		5.480	48.332	1.838	39.741
18.833		5.480	47.679	2.530	39.701
19.833		5.480	47.009	3.223	39.678
20.833		5.480	46.346	3.916	39.648
21.833		5.480	45.683	4.609	39.619
22.833		5.480	45.027	5.302	39.581
23.833		5.480	44.358	5.995	39.558
24.833		5.480	43.692	6.688	39.530
25.833		5.480	43.028	7.380	39.502
26.833		5.480	42.370	8.073	39.466
27.833		5.480	41.701	8.766	39.443
28.833		5.480	41.035	9.459	39.416
29.833		5.480	40.375	0.152	39.383
30.833		5.480	39.705	0.845	39.360
31.833		5.480	39.037	1.537	39.335
32.833		5.480	38.377	2.230	39.302
33.833		5.480	37.836	2.820	39.254
34.833		5.480	37.304	3.409	39.196
35.833		5.480	36.779	3.999	39.131
36.833		5.480	36.257	4.588	39.063
37.833		5.480	35.739	5.177	38.991
38.833		5.480	35.223	5.767	38.917
40.083		5.480	34.425	6.633	38.849
41.333		5.480	33.612	7.499	38.795
42.360		5.480	32.935	8.211	38.760
43.388		5.480	32.259	8.918	38.729
44.415		5.480	31.587	9.619	38.699
45.443		5.480	30.920	0.315	38.671
46.470		5.480	30.257	1.004	38.644
47.498		5.480	29.603	1.688	38.614
48.526		5.480	28.951	2.367	38.588
49.553		5.480	28.303	3.039	38.563
50.581		5.480	27.659	3.706	38.539
51.622		5.480	27.011	4.377	38.516
52.664		5.480	26.474	4.936	38.495
53.705		5.480	26.003	5.428	38.474

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
54.747		5.480	25.533	5.917	38.455
55.788		5.480	25.065	6.403	38.436
56.830		5.480	24.599	6.886	38.420
57.830		5.480	24.620	6.886	38.398
58.830		5.480	24.647	6.886	38.371
59.830		5.480	24.678	6.886	38.341
60.830		5.480	24.711	6.886	38.307
61.830		5.480	24.747	6.886	38.271
62.830		5.480	24.784	6.886	38.234
64.080		5.480	24.243	7.462	38.199
65.330		5.480	23.696	8.035	38.173
0.0	66.246	0.457	98.709	1.386	0.000
0.167		0.913	98.708	1.386	0.000
0.333		1.370	98.698	1.386	0.000
0.500		1.827	98.219	1.386	0.394
0.666		2.283	83.913	1.386	14.700
0.833		2.740	69.927	1.386	28.686
1.869		2.740	68.214	2.821	28.964
2.904		2.740	66.731	4.256	29.012
3.940		2.740	65.479	5.691	28.828
4.975		2.740	64.408	7.126	28.463
6.011		2.740	63.174	8.562	28.261
7.047		2.740	61.837	9.997	28.163
8.082		2.740	60.475	1.432	28.090
9.118		2.740	59.096	2.867	28.033
10.154		2.740	57.712	4.302	27.982
11.189		2.740	56.322	5.738	27.937
12.225		2.740	54.933	7.173	27.890
13.261		2.740	53.540	8.608	27.848
14.296		2.740	52.151	0.043	27.802
15.332		2.740	50.759	1.478	27.758
16.332		2.740	49.697	2.657	27.641
17.332		2.740	48.638	3.836	27.521
18.332		2.740	47.590	5.015	27.390
19.332		2.740	46.546	6.194	27.255
20.332		2.740	45.504	7.372	27.118
21.332		2.740	44.468	8.551	26.975
22.457		2.740	42.996	0.110	26.888
23.582		2.740	41.516	1.669	26.808
24.657		2.740	40.100	3.159	26.735
25.732		2.740	38.680	4.648	26.665
26.807		2.740	37.259	6.138	26.596
27.882		2.740	35.850	7.627	26.516
28.957		2.740	34.416	9.117	26.459
30.032		2.740	32.987	0.607	26.399
31.107		2.740	31.558	2.096	26.338
32.181		2.740	30.143	3.586	26.262
33.256		2.740	28.720	5.076	26.196
34.331		2.740	27.293	6.565	26.133

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
35.331		2.740	25.966	7.951	26.074
36.331		2.740	24.637	9.337	26.016
37.331		2.740	23.308	0.722	25.959
38.331		2.740	21.974	2.108	25.908
39.331		2.740	20.643	3.494	25.852
40.331		2.740	19.549	4.672	25.767
41.331		2.740	18.472	5.851	25.665
42.331		2.740	17.406	7.030	25.552
43.331		2.740	16.347	8.209	25.431
44.331		2.740	15.292	9.388	25.306
45.331		2.740	14.240	0.567	25.179
46.367		2.740	12.958	1.948	25.079
47.403		2.740	11.670	3.318	24.997
48.438		2.740	10.382	4.677	24.925
49.474		2.740	9.098	6.025	24.862
50.510		2.740	7.818	7.361	24.805
51.545		2.740	6.557	8.675	24.752
52.581		2.740	5.628	9.653	24.703
53.831		2.740	4.507	0.826	24.650
55.081		2.740	3.391	1.991	24.601
56.331		2.740	2.280	3.148	24.556
0.0	67.342	0.457	98.710	1.386	0.000
0.167		0.913	98.711	1.386	0.000
0.333		1.370	98.683	1.386	0.000
0.500		1.827	98.100	1.386	0.513
0.666		2.283	81.177	1.386	17.436
0.833		2.740	67.648	1.386	30.965
2.083		2.740	65.636	3.118	31.245
3.333		2.740	63.958	4.850	31.191
4.583		2.740	62.577	6.582	30.839
5.708		2.740	61.360	8.141	30.497
6.833		2.740	59.873	9.700	30.425
7.833		2.740	58.876	0.879	30.243
8.833		2.740	57.807	2.058	30.133
9.833		2.740	56.779	3.236	29.982
10.833		2.740	55.723	4.415	29.859
11.833		2.740	54.691	5.594	29.713
12.833		2.740	53.645	6.773	29.580
14.208		2.740	51.831	8.678	29.488
15.583		2.740	50.015	0.583	29.398
16.666		2.740	48.582	2.085	29.330
17.749		2.740	47.146	3.586	29.265
18.833		2.740	45.708	5.087	29.201
19.916		2.740	44.269	6.588	29.139
20.999		2.740	42.830	8.089	29.077
22.082		2.740	41.390	9.591	29.015
23.166		2.740	39.950	1.092	28.954
24.249		2.740	38.510	2.593	28.892
25.332		2.740	37.070	4.094	28.831

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
26.432		2.740	35.607	5.618	28.769
27.532		2.740	34.144	7.143	28.708
28.632		2.740	32.681	8.667	28.647
29.732		2.740	31.217	0.191	28.586
30.831		2.740	29.752	1.715	28.527
31.831		2.740	28.681	2.894	28.418
32.831		2.740	27.623	4.073	28.297
33.831		2.740	26.574	5.252	28.166
34.831		2.740	25.533	6.431	28.028
35.831		2.740	24.498	7.609	27.884
36.831		2.740	23.468	8.788	27.734
37.956		2.740	22.036	0.347	27.607
39.081		2.740	20.583	1.906	27.500
40.206		2.740	19.116	3.465	27.407
41.331		2.740	17.638	5.024	27.326
42.331		2.740	16.307	6.409	27.271
0.0	75.180	0.457	98.791	1.386	0.000
0.166		0.913	98.791	1.386	0.000
0.333		1.370	98.203	1.386	0.410
0.499		1.827	77.011	1.386	21.603
0.666		2.283	61.608	1.386	37.005
0.832		2.740	51.340	1.386	47.273
1.878		2.740	49.613	2.834	47.551
2.923		2.740	48.120	4.283	47.595
3.969		2.740	46.862	5.732	47.404
5.014		2.740	45.787	7.180	47.031
6.060		2.740	44.526	8.629	46.843
7.105		2.740	43.179	0.078	46.740
8.150		2.740	41.799	1.526	46.672
9.196		2.740	40.409	2.975	46.613
10.241		2.740	39.010	4.424	46.563
11.287		2.740	37.608	5.872	46.516
12.332		2.740	36.205	7.321	46.471
13.332		2.740	35.145	8.500	46.352
14.332		2.740	34.085	9.679	46.233
15.332		2.740	33.033	0.858	46.106
16.332		2.740	31.989	2.036	45.971
17.332		2.740	30.948	3.215	45.833
18.332		2.740	29.909	4.394	45.693
19.332		2.740	28.596	5.780	45.619
20.332		2.740	27.282	7.166	45.548
21.332		2.740	25.981	8.551	45.463
22.332		2.740	24.648	9.937	45.410
23.332		2.740	23.325	1.323	45.348
24.332		2.740	22.017	2.708	45.270
25.332		2.740	20.682	4.094	45.219
26.332		2.740	19.354	5.480	45.161
27.332		2.740	18.041	6.865	45.088
28.332		2.740	16.705	8.251	45.038

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
29.332		2.740	15.373	9.637	44.984
30.332		2.740	14.055	1.022	44.916
31.332		2.740	12.717	2.408	44.868
32.332		2.740	11.398	3.794	44.802
33.332		2.740	10.071	5.179	44.742
34.332		2.740	8.742	6.565	44.685
35.332		2.740	7.412	7.951	44.629
36.332		2.740	6.081	9.337	44.574
37.332		2.740	4.992	0.515	44.484
38.332		2.740	3.923	1.694	44.373
39.332		2.740	2.867	2.873	44.250
40.332		2.740	1.819	4.052	44.119
41.332		2.740	0.775	5.231	43.982
0.0	62.423	0.550	98.861	1.151	0.000
0.166		1.100	98.861	1.151	0.000
0.333		1.650	98.813	1.151	0.036
0.499		2.200	96.610	1.151	2.238
0.666		2.750	77.600	1.151	21.249
0.832		3.300	64.666	1.151	34.182
1.832		3.300	63.286	2.301	34.411
2.832		3.300	62.084	3.452	34.463
3.832		3.300	61.065	4.602	34.331
4.832		3.300	60.190	5.753	34.056
5.832		3.300	59.251	6.903	33.844
6.832		3.300	58.168	8.054	33.777
7.832		3.300	57.094	9.204	33.699
8.832		3.300	55.980	0.355	33.663
9.832		3.300	54.882	1.505	33.610
10.832		3.300	53.999	2.484	33.515
11.832		3.300	53.128	3.463	33.406
12.832		3.300	52.247	4.442	33.309
13.832		3.300	51.388	5.421	33.189
14.832		3.300	50.514	6.399	33.084
15.832		3.300	49.657	7.378	32.962
16.832		3.300	48.564	8.529	32.904
17.832		3.300	47.470	9.679	32.847
18.832		3.300	46.375	0.830	32.792
19.832		3.300	45.277	1.980	32.739
20.832		3.300	44.192	3.131	32.673
21.832		3.300	43.081	4.281	32.634
22.832		3.300	41.979	5.432	32.586
23.832		3.300	40.889	6.583	32.524
24.832		3.300	39.778	7.733	32.485
25.832		3.300	38.672	8.884	32.440
26.832		3.300	37.580	0.034	32.381
27.832		3.300	36.468	1.185	32.342
28.832		3.300	35.361	2.335	32.299
29.832		3.300	34.255	3.486	32.254
30.832		3.300	33.159	4.636	32.200

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
31.832		3.300	32.046	5.787	32.162
32.832		3.300	30.948	6.937	32.109
33.832		3.300	29.846	8.088	32.060
34.832		3.300	28.943	9.067	31.984
35.832		3.300	28.058	0.046	31.890
36.832		3.300	27.184	1.024	31.785
37.832		3.300	26.317	2.003	31.672
38.832		3.300	25.455	2.982	31.554
39.832		3.300	24.596	3.961	31.433
40.832		3.300	23.539	5.111	31.339
41.832		3.300	22.462	6.262	31.265
42.832		3.300	21.373	7.408	31.208
43.832		3.300	20.287	8.545	31.156
44.832		3.300	19.207	9.673	31.108
45.832		3.300	18.134	0.792	31.062
46.832		3.300	17.068	1.902	31.018
47.832		3.300	16.014	3.003	30.971
48.832		3.300	14.965	4.094	30.928
49.832		3.300	13.922	5.178	30.888
50.832		3.300	12.885	6.252	30.851
0.0	69.881	0.640	99.097	0.989	0.000
0.166		1.280	99.049	0.989	0.000
0.333		1.920	89.000	0.989	10.011
0.499		2.560	66.750	0.989	32.261
0.666		3.200	53.400	0.989	45.610
0.832		3.840	44.500	0.989	54.510
1.832		3.840	43.314	1.977	54.708
2.832		3.840	42.281	2.966	54.752
3.832		3.840	41.405	3.955	54.639
4.832		3.840	40.653	4.944	54.402
5.832		3.840	39.846	5.933	54.220
6.832		3.840	38.915	6.921	54.162
7.832		3.840	38.203	7.762	54.033
8.832		3.840	37.444	8.604	53.951
9.832		3.840	36.713	9.445	53.841
10.832		3.840	35.959	0.286	53.753
11.832		3.840	35.227	1.127	53.644
12.832		3.840	34.479	1.968	53.551
13.832		3.840	33.544	2.957	53.497
14.832		3.840	32.598	3.946	53.455
15.832		3.840	31.662	4.934	53.402
16.832		3.840	30.710	5.923	53.364
17.832		3.840	29.780	6.912	53.306
18.832		3.840	28.821	7.901	53.275
19.832		3.840	27.872	8.889	53.236
20.832		3.840	26.923	9.878	53.196
21.832		3.840	25.985	0.867	53.145
22.832		3.840	25.027	1.856	53.114
23.832		3.840	24.075	2.844	53.077

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
24.832		3.840	23.135	3.833	53.028
25.832		3.840	22.178	4.822	52.997
26.832		3.840	21.225	5.811	52.961
27.832		3.840	20.283	6.799	52.914
28.832		3.840	19.326	7.788	52.882
29.832		3.840	18.372	8.777	52.847
30.832		3.840	17.427	9.766	52.803
31.832		3.840	16.657	0.607	52.732
32.832		3.840	15.898	1.448	52.649
33.832		3.840	15.146	2.289	52.559
34.832		3.840	14.401	3.130	52.463
35.832		3.840	13.660	3.971	52.362
36.832		3.840	12.924	4.812	52.257
37.832		3.840	12.015	5.801	52.176
38.832		3.840	11.094	6.790	52.108
39.853		3.840	10.145	7.799	52.047
40.874		3.840	9.189	8.809	51.994
41.894		3.840	8.226	9.818	51.948
42.915		3.840	7.255	0.825	51.911
43.936		3.840	6.292	1.824	51.875
44.957		3.840	5.338	2.814	51.839
45.977		3.840	4.391	3.796	51.803
46.998		3.840	3.457	4.770	51.763
48.019		3.840	2.528	5.736	51.726
49.040		3.840	1.604	6.695	51.692
50.060		3.840	0.686	7.645	51.659
0.0	69.729	0.457	98.729	1.386	0.000
0.166		0.913	98.729	1.386	0.000
0.333		1.370	98.607	1.386	0.006
0.499		1.827	94.022	1.386	4.591
0.666		2.283	75.217	1.386	23.395
0.832		2.740	62.681	1.386	35.932
2.207		2.740	60.504	3.291	36.203
3.582		2.740	58.723	5.196	36.078
4.582		2.740	57.579	6.375	36.044
5.582		2.740	56.593	7.554	35.851
6.582		2.740	55.735	8.733	35.530
7.582		2.740	54.878	9.912	35.208
8.582		2.740	53.855	1.091	35.052
9.582		2.740	52.883	2.269	34.845
10.582		2.740	51.547	3.655	34.796
11.582		2.740	50.272	5.041	34.685
12.582		2.740	48.935	6.426	34.636
13.618		2.740	47.586	7.862	34.549
14.653		2.740	46.202	9.297	34.498
15.689		2.740	44.838	0.732	34.426
16.725		2.740	43.455	2.167	34.374
17.760		2.740	42.084	3.602	34.309
18.796		2.740	40.703	5.038	34.255

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
19.832		2.740	39.328	6.473	34.194
20.939		2.740	37.871	8.007	34.118
22.045		2.740	36.385	9.541	34.069
23.152		2.740	34.910	1.075	34.009
24.259		2.740	33.437	2.609	33.948
25.366		2.740	31.964	4.143	33.887
26.473		2.740	30.491	5.678	33.825
27.580		2.740	29.018	7.212	33.763
28.580		2.740	27.948	8.391	33.655
29.580		2.740	26.897	9.569	33.527
30.580		2.740	25.850	0.748	33.395
31.580		2.740	24.807	1.927	33.258
32.580		2.740	23.769	3.106	33.118
33.580		2.740	22.735	4.285	32.972
34.805		2.740	21.167	5.982	32.842
36.030		2.740	19.576	7.680	32.735
37.037		2.740	18.263	9.075	32.652
38.044		2.740	16.945	0.471	32.574
39.051		2.740	15.618	1.866	32.505
40.058		2.740	14.292	3.262	32.434
41.065		2.740	12.962	4.658	32.368
42.072		2.740	11.624	6.053	32.311
43.079		2.740	10.277	7.445	32.264
0.0	74.669	0.275	97.961	2.301	0.000
0.166		0.550	97.962	2.301	0.000
0.333		0.825	97.963	2.301	0.000
0.499		1.100	97.874	2.301	0.000
0.666		1.375	97.316	2.301	0.381
0.832		1.650	87.022	2.301	10.675
1.904		1.650	84.147	4.767	11.084
2.975		1.650	81.611	7.232	11.154
4.046		1.650	79.040	9.697	11.260
5.118		1.650	76.145	2.163	11.688
6.189		1.650	73.336	4.628	12.032
7.260		1.650	70.515	7.094	12.387
8.331		1.650	67.746	9.559	12.690
9.331		1.650	65.652	1.517	12.826
10.331		1.650	63.576	3.474	12.945
11.331		1.650	61.543	5.432	13.019
12.331		1.650	59.539	7.390	13.065
13.331		1.650	57.564	9.347	13.083
14.331		1.650	55.612	1.305	13.077
15.359		1.650	53.155	3.670	13.169
16.387		1.650	50.715	6.035	13.244
17.414		1.650	48.281	8.400	13.312
18.442		1.650	45.856	0.765	13.372
19.469		1.650	43.439	3.130	13.424
20.497		1.650	41.029	5.495	13.469
21.525		1.650	38.626	7.860	13.506

Table E-4, continued.
COLUMN 12

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
22.552		1.650	36.230	0.225	13.537
23.580		1.650	33.839	2.590	13.562
24.580		1.650	31.518	4.891	13.582
25.580		1.650	29.201	7.192	13.597
26.580		1.650	26.909	9.493	13.588
0.0	82.457	0.183	96.711	3.452	0.000
0.167		0.367	96.710	3.452	0.000
0.333		0.550	96.703	3.452	0.000
0.500		0.733	96.619	3.452	0.000
0.666		0.917	96.082	3.452	0.463
0.833		1.100	90.170	3.452	6.375
2.020		1.100	83.602	7.550	8.843
3.208		1.100	78.385	1.649	9.961
4.395		1.100	73.315	5.748	10.931
5.583		1.100	68.362	9.847	11.785
6.583		1.100	64.980	2.783	12.231
7.583		1.100	61.632	5.720	12.642
8.583		1.100	58.388	8.656	12.950
9.583		1.100	55.198	1.592	13.203
10.583		1.100	52.072	4.529	13.392
11.583		1.100	48.994	7.465	13.534
12.833		1.100	44.343	1.780	13.870
14.083		1.100	39.746	6.094	14.152

Table E-5.
COLUMN 14

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	78.953	0.412	97.939	1.448	0.610
0.166		0.823	97.763	1.448	0.787
0.333		1.235	96.476	1.448	2.070
0.500		1.647	79.980	1.448	18.564
0.666		2.058	63.978	1.448	34.555
0.833		2.470	53.312	1.448	45.205
2.208		2.470	50.810	3.438	45.707
3.583		2.470	48.889	5.429	45.628
0.0	98.119	0.412	26.575	1.448	71.946
0.166		0.823	13.286	1.448	85.231
0.333		1.235	8.862	1.448	89.666
0.500		1.647	6.646	1.448	91.884
0.666		2.058	5.316	1.448	93.214
0.833		2.470	4.430	1.448	94.104
1.927		2.470	2.251	3.031	94.699
3.020		2.470	0.500	4.615	94.867
0.0	66.554	0.457	98.755	1.305	0.000
0.166		0.913	98.755	1.305	0.000
0.333		1.370	98.755	1.305	0.000
0.500		1.827	98.382	1.305	0.312
0.666		2.283	91.894	1.305	6.800
0.833		2.740	76.578	1.305	22.115
2.000		2.740	74.564	2.828	22.607
3.166		2.740	72.914	4.350	22.734
4.333		2.740	71.665	5.873	22.460
5.458		2.740	70.648	7.341	22.009
6.583		2.740	69.061	8.809	22.127
7.708		2.740	67.656	10.277	22.064
8.833		2.740	65.996	11.746	22.255
9.833		2.740	65.310	12.552	22.134
10.833		2.740	64.320	13.359	22.318
11.833		2.740	63.680	14.165	22.151
12.833		2.740	62.617	14.972	22.407
13.833		2.740	62.066	15.778	22.152
14.833		2.740	60.899	16.585	22.512
15.833		2.740	59.694	17.890	22.412
16.833		2.740	58.268	19.195	22.532
17.833		2.740	56.878	20.500	22.617
18.833		2.740	55.486	21.805	22.704
19.833		2.740	54.098	23.110	22.787
20.833		2.740	52.721	24.415	22.858
21.833		2.740	51.340	25.720	22.935
22.833		2.740	49.975	27.026	22.994
23.833		2.740	48.603	28.331	23.061
24.833		2.740	47.265	29.636	23.094
25.833		2.740	45.889	30.941	23.164
26.833		2.740	44.537	32.246	23.211
27.833		2.740	43.206	33.551	23.236
28.833		2.740	41.847	34.856	23.291
29.833		2.740	40.505	36.161	23.327

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
30.833		2.740	39.168	37.466	23.359
31.833		2.740	37.850	38.771	23.372
32.833		2.740	36.507	40.076	23.410
33.833		2.740	35.732	40.883	23.378
34.833		2.740	34.971	41.689	23.332
35.833		2.740	34.217	42.496	23.279
36.833		2.740	33.466	43.302	23.224
37.833		2.740	32.717	44.109	23.166
38.833		2.740	31.970	44.915	23.107
40.083		2.740	30.357	46.547	23.088
41.333		2.740	28.725	48.178	23.088
42.361		2.740	27.383	49.519	23.088
43.388		2.740	26.039	50.861	23.090
44.416		2.740	24.696	52.202	23.092
45.444		2.740	23.349	53.543	23.097
46.472		2.740	22.004	54.885	23.100
47.500		2.740	20.660	56.226	23.103
48.527		2.740	19.315	57.567	23.106
49.555		2.740	17.961	58.909	23.119
50.583		2.740	16.608	60.250	23.130
51.624		2.740	15.249	61.602	23.137
52.666		2.740	13.902	62.945	23.141
53.708		2.740	12.573	64.278	23.136
54.749		2.740	11.251	65.601	23.135
55.791		2.740	9.938	66.914	23.134
56.833		2.740	8.634	68.219	23.133
57.833		2.740	7.842	69.025	23.118
58.833		2.740	7.063	69.832	23.091
59.833		2.740	6.291	70.638	23.056
60.833		2.740	5.522	71.445	23.019
61.833		2.740	5.142	71.865	22.979
62.833		2.740	5.100	71.946	22.940
64.083		2.740	3.991	73.076	22.919
65.333		2.740	2.886	74.187	22.912
66.366		2.740	1.974	75.101	22.910
67.399		2.740	1.064	76.009	22.911
68.433		2.740	0.156	76.914	22.915
0.0	61.231	0.457	98.704	1.295	0.0
0.167		0.913	98.698	1.300	0.0
0.334		1.370	98.697	1.302	0.0
0.500		1.827	98.618	1.302	0.077
0.667		2.283	97.963	1.303	0.732
0.834		2.740	88.818	1.303	9.877
1.917		2.740	86.944	2.717	10.336
3.000		2.740	85.061	4.131	10.805
4.084		2.740	82.543	5.545	11.910
5.167		2.740	80.631	6.959	12.408
6.250		2.740	78.377	8.372	13.247
7.334		2.740	76.520	9.786	13.691

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
8.417		2.740	74.472	11.200	14.325
9.500		2.740	72.652	12.614	14.731
10.584		2.740	70.751	14.028	15.217
11.584		2.740	69.109	15.333	15.554
12.584		2.740	67.438	16.638	15.920
13.584		2.740	65.834	17.943	16.219
14.584		2.740	64.226	19.248	16.521
15.584		2.740	62.657	20.553	16.786
16.584		2.740	61.667	21.360	16.969
17.584		2.740	60.686	22.166	17.143
18.584		2.740	59.728	22.973	17.294
19.584		2.740	58.782	23.779	17.433
20.584		2.740	57.851	24.586	17.558
21.584		2.740	56.930	25.392	17.673
22.619		2.740	55.403	26.744	17.847
23.655		2.740	53.890	28.096	18.009
24.691		2.740	52.381	29.448	18.165
25.726		2.740	50.882	30.799	18.313
26.762		2.740	49.390	32.151	18.453
27.798		2.740	47.905	33.503	18.586
28.833		2.740	46.428	34.854	18.711
29.896		2.740	44.919	36.241	18.833
30.958		2.740	43.417	37.627	18.949
32.021		2.740	41.920	39.014	19.059
33.083		2.740	40.428	40.401	19.164
34.146		2.740	38.951	41.787	19.254
35.208		2.740	37.478	43.174	19.339
36.271		2.740	36.008	44.561	19.422
37.333		2.740	34.537	45.947	19.506
38.458		2.740	32.985	47.415	19.590
39.583		2.740	31.429	48.884	19.678
40.583		2.740	30.586	49.690	19.714
41.583		2.740	29.758	50.497	19.735
42.583		2.740	28.938	51.303	19.748
43.583		2.740	28.124	52.110	19.755
44.583		2.740	27.316	52.916	19.757
45.583		2.740	26.510	53.723	19.756
46.958		2.740	24.716	55.484	19.788
48.333		2.740	22.928	57.229	19.831
49.417		2.740	21.532	58.592	19.864
50.500		2.740	20.145	59.944	19.899
51.583		2.740	18.768	61.287	19.933
52.667		2.740	17.402	62.619	19.965
53.750		2.740	16.045	63.942	20.000
54.833		2.740	14.701	65.256	20.030
55.917		2.740	13.547	66.382	20.058
57.000		2.740	12.558	67.346	20.082
58.083		2.740	11.578	68.305	20.103
0.0	66.266	0.548	98.888	1.087	0.024

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.167		1.097	98.889	1.087	0.023
0.333		1.645	98.730	1.087	0.182
0.500		2.193	95.889	1.087	3.023
0.667		2.742	77.193	1.087	21.719
0.833		3.290	64.327	1.087	34.584
1.958		3.290	62.051	2.310	35.638
3.083		3.290	60.883	3.532	35.582
4.208		3.290	59.931	4.755	35.312
5.333		3.290	59.167	5.978	34.853
6.333		3.290	58.597	6.650	34.751
7.333		3.290	58.113	7.321	34.563
8.333		3.290	57.451	7.993	34.553
9.333		3.290	56.926	8.665	34.407
10.333		3.290	56.212	9.337	34.449
11.333		3.290	55.666	10.008	34.323
12.433		3.290	54.325	11.204	34.468
13.533		3.290	53.150	12.399	34.447
14.633		3.290	51.857	13.595	34.545
15.733		3.290	50.619	14.791	34.587
16.833		3.290	49.363	15.986	34.647
17.833		3.290	48.203	17.073	34.719
18.833		3.290	47.096	18.160	34.740
19.833		3.290	45.953	19.247	34.796
20.833		3.290	44.793	20.334	34.868
21.833		3.290	43.660	21.421	34.914
22.833		3.290	42.524	22.508	34.963
23.833		3.290	41.410	23.594	34.990
24.833		3.290	40.265	24.681	35.048
25.833		3.290	39.140	25.768	35.086
26.833		3.290	38.017	26.855	35.122
27.833		3.290	36.911	27.942	35.141
29.333		3.290	35.222	29.572	35.200
30.333		3.290	34.577	30.244	35.172
31.333		3.290	33.938	30.916	35.139
32.333		3.290	33.305	31.588	35.101
33.333		3.290	32.674	32.259	35.060
34.333		3.290	32.046	32.931	35.017
35.333		3.290	31.418	33.603	34.972
36.333		3.290	30.328	34.690	34.976
37.333		3.290	29.242	35.776	34.974
38.333		3.290	28.135	36.863	34.994
39.333		3.290	27.034	37.950	35.008
40.333		3.290	25.934	39.037	35.021
41.333		3.290	24.844	40.124	35.024
42.333		3.290	23.753	41.211	35.028
43.333		3.290	22.659	42.298	35.034
44.333		3.290	21.566	43.385	35.041
45.333		3.290	20.473	44.471	35.046
46.333		3.290	19.378	45.558	35.054

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
47.333		3.290	18.284	46.645	35.061
48.333		3.290	17.183	47.732	35.074
49.333		3.290	16.094	48.819	35.077
50.333		3.290	14.995	49.906	35.089
51.333		3.290	13.898	50.992	35.099
52.333		3.290	12.812	52.071	35.106
53.333		3.290	11.742	53.142	35.105
54.333		3.290	11.085	53.813	35.090
55.333		3.290	10.440	54.485	35.063
56.333		3.290	9.800	55.157	35.031
57.333		3.290	9.163	55.829	34.997
58.333		3.290	8.528	56.500	34.960
59.333		3.290	7.893	57.172	34.922
60.833		3.290	6.381	58.705	34.901
61.865		3.290	5.345	59.750	34.891
62.896		3.290	4.312	60.788	34.887
63.927		3.290	3.546	61.555	34.885
64.958		3.290	2.782	62.319	34.886
65.990		3.290	2.018	63.078	34.890
67.021		3.290	1.258	63.833	34.895
68.052		3.290	0.502	64.585	34.899
0.0	60.227	0.548	98.928	1.070	0.0
0.166		1.097	98.919	1.079	0.0
0.333		1.645	98.917	1.081	0.0
0.499		2.193	98.399	1.083	0.516
0.666		2.742	91.071	1.084	7.843
0.832		3.290	75.893	1.084	23.021
1.832		3.290	73.846	2.171	23.981
2.832		3.290	72.687	3.258	24.053
3.832		3.290	71.805	4.345	23.847
4.832		3.290	71.070	5.432	23.495
5.832		3.290	69.733	6.519	23.746
6.832		3.290	68.867	7.605	23.525
7.832		3.290	67.516	8.692	23.788
8.832		3.290	66.260	9.779	23.957
9.832		3.290	65.074	10.866	24.057
10.832		3.290	64.319	11.538	24.139
11.832		3.290	63.590	12.210	24.197
12.832		3.290	62.826	12.881	24.289
13.832		3.290	62.113	13.553	24.330
14.832		3.290	61.345	14.225	24.426
15.832		3.290	60.645	14.897	24.454
16.832		3.290	59.389	15.983	24.624
17.832		3.290	58.234	17.070	24.691
18.832		3.290	56.996	18.157	24.843
19.832		3.290	55.835	19.244	24.916
20.832		3.290	54.618	20.331	25.047
21.832		3.290	53.454	21.418	25.123
22.832		3.290	52.258	22.505	25.233

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
23.832		3.290	51.094	23.592	25.309
24.832		3.290	49.915	24.679	25.401
25.832		3.290	48.754	25.765	25.475
26.832		3.290	47.589	26.852	25.553
27.832		3.290	46.433	27.939	25.622
28.832		3.290	45.278	29.026	25.691
29.832		3.290	44.128	30.113	25.753
30.832		3.290	42.980	31.200	25.814
31.832		3.290	41.836	32.287	25.871
32.832		3.290	40.695	33.374	25.925
33.832		3.290	39.556	34.461	25.977
34.832		3.290	38.876	35.132	25.985
35.832		3.290	38.209	35.804	25.980
36.832		3.290	37.547	36.476	25.970
37.832		3.290	36.889	37.147	25.956
38.832		3.290	36.233	37.819	25.940
39.832		3.290	35.580	38.491	25.921
40.832		3.290	34.486	39.578	25.928
41.832		3.290	33.381	40.665	25.946
42.832		3.290	32.271	41.751	25.969
43.832		3.290	31.156	42.838	25.997
44.832		3.290	30.042	43.925	26.024
45.832		3.290	28.928	45.012	26.050
46.832		3.290	27.814	46.099	26.078
47.832		3.290	26.692	47.186	26.113
48.832		3.290	25.572	48.273	26.145
49.832		3.290	24.463	49.353	26.174
50.832		3.290	23.370	50.426	26.194
0.0	72.430	0.275	97.803	2.167	0.028
0.166		0.550	97.802	2.167	0.028
0.333		0.825	97.801	2.167	0.029
0.499		1.100	97.794	2.167	0.037
0.666		1.375	97.541	2.167	0.290
0.832		1.650	96.668	2.167	1.162
1.832		1.650	91.523	4.334	4.140
2.832		1.650	87.254	6.502	6.241
3.832		1.650	83.882	8.669	7.446
4.832		1.650	80.411	10.836	8.750
5.832		1.650	77.279	13.003	9.714
6.832		1.650	74.174	15.170	10.652
7.832		1.650	72.195	16.510	11.291
8.832		1.650	70.209	17.849	11.937
9.832		1.650	68.360	19.189	12.447
10.832		1.650	66.533	20.528	12.934
11.832		1.650	64.782	21.867	13.346
12.832		1.650	63.060	23.207	13.728
13.832		1.650	60.436	25.374	14.185
14.832		1.650	57.866	27.541	14.587
15.832		1.650	55.313	29.708	14.973

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
16.832		1.650	52.792	31.876	15.327
17.832		1.650	50.293	34.043	15.658
18.832		1.650	47.818	36.210	15.966
19.832		1.650	45.364	38.377	16.252
20.832		1.650	42.929	40.544	16.520
21.832		1.650	40.511	42.712	16.770
22.832		1.650	38.110	44.879	17.004
23.832		1.650	35.723	47.046	17.223
24.832		1.650	33.349	49.213	17.430
25.832		1.650	30.987	51.380	17.624
26.832		1.650	28.636	53.548	17.808
27.832		1.650	26.294	55.715	17.982
28.832		1.650	23.961	57.882	18.148
29.832		1.650	21.652	60.049	18.289
30.832		1.650	19.351	62.216	18.422
31.832		1.650	17.931	63.556	18.502
32.832		1.650	16.543	64.895	18.550
33.832		1.650	15.176	66.234	18.577
34.832		1.650	13.825	67.574	18.588
35.832		1.650	12.485	68.913	18.589
36.832		1.650	11.152	70.253	18.582
37.832		1.650	8.952	72.420	18.614
38.832		1.650	6.715	74.587	18.683
39.895		1.650	4.329	76.890	18.766
40.957		1.650	1.954	79.182	18.849
0.0	69.332	0.548	98.877	1.087	0.035
0.166		1.097	98.877	1.087	0.035
0.333		1.645	98.452	1.087	0.460
0.499		2.193	87.685	1.087	11.227
0.666		2.742	70.148	1.087	28.764
0.832		3.290	58.457	1.087	40.455
2.207		3.290	55.808	2.581	41.609
3.582		3.290	54.503	4.076	41.419
4.832		3.290	53.604	5.434	40.959
6.082		3.290	52.466	6.793	40.738
7.332		3.290	51.225	8.152	40.620
8.332		3.290	50.699	8.823	40.475
9.332		3.290	50.125	9.495	40.377
10.332		3.290	49.556	10.167	40.275
11.332		3.290	48.982	10.839	40.177
12.332		3.290	48.371	11.510	40.115
13.332		3.290	47.824	12.182	39.991
14.332		3.290	46.650	13.269	40.077
15.332		3.290	45.713	14.356	39.928
16.332		3.290	44.577	15.443	39.976
17.368		3.290	43.424	16.568	40.004
18.404		3.290	42.322	17.694	39.979
19.439		3.290	41.190	18.820	39.986
20.475		3.290	40.090	19.946	39.960

Table E-5, continued.
COLUMN 14

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
21.511		3.290	38.988	21.071	39.936
22.546		3.290	37.880	22.197	39.918
23.582		3.290	36.748	23.323	39.924
24.689		3.290	35.583	24.526	39.885
25.796		3.290	34.386	25.729	39.879
26.903		3.290	33.225	26.933	39.836
28.010		3.290	32.035	28.136	39.823
29.117		3.290	30.862	29.339	39.792
30.223		3.290	29.705	30.543	39.745
31.330		3.290	28.524	31.746	39.723
32.330		3.290	27.938	32.418	39.637
33.330		3.290	27.361	33.090	39.542
34.330		3.290	26.785	33.761	39.446
35.330		3.290	26.212	34.433	39.347
36.330		3.290	25.641	35.105	39.247
37.330		3.290	25.070	35.776	39.145
38.705		3.290	23.641	37.271	39.080
40.080		3.290	22.202	38.765	39.025
41.205		3.290	21.022	39.988	38.981
42.330		3.290	19.839	41.211	38.941
43.455		3.290	18.669	42.434	38.888
44.580		3.290	17.491	43.656	38.843
45.705		3.290	16.311	44.879	38.799
46.830		3.290	15.131	46.102	38.757
47.893		3.290	14.012	47.257	38.721
48.955		3.290	12.894	48.411	38.684
50.018		3.290	11.774	49.566	38.648
51.080		3.290	10.653	50.721	38.614
52.143		3.290	9.522	51.876	38.590
53.205		3.290	8.393	53.030	38.565
54.268		3.290	7.274	54.176	38.538
55.330		3.290	6.164	55.313	38.510
56.330		3.290	5.546	55.985	38.456
57.330		3.290	4.936	56.657	38.394
58.330		3.290	4.330	57.328	38.328
59.330		3.290	3.727	58.000	38.259
60.330		3.290	3.125	58.672	38.189
61.330		3.290	2.524	59.343	38.118
62.358		3.290	1.520	60.397	38.068
63.386		3.290	0.513	61.443	38.030

Table E-6.
COLUMN 6

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	53.565	0.457	98.625	1.372	0.003
0.166		0.913	98.567	1.423	0.003
0.333		1.370	98.531	1.458	0.003
0.500		1.827	98.512	1.479	0.003
0.666		2.275	97.768	1.497	0.725
0.833		2.713	96.398	1.515	2.075
1.916		2.740	89.711	3.170	7.103
3.000		2.740	87.726	4.840	7.417
4.083		2.740	85.695	6.510	7.778
5.166		2.740	83.653	8.180	8.150
6.250		2.740	81.617	9.850	8.516
7.333		2.740	79.597	11.520	8.865
8.333		2.740	77.749	13.061	9.171
9.333		2.740	76.521	14.006	9.454
10.333		2.740	75.330	14.952	9.699
11.333		2.740	74.167	15.897	9.917
12.333		2.740	73.023	16.842	10.116
13.333		2.740	71.893	17.787	10.300
14.333		2.740	70.775	18.733	10.473
15.583		2.740	68.615	20.660	10.706
16.833		2.740	66.454	22.587	10.940
17.866		2.740	64.672	24.179	11.128
18.900		2.740	62.897	25.772	11.311
19.933		2.740	61.127	27.365	11.487
20.966		2.740	59.365	28.958	11.656
22.000		2.740	57.616	30.551	11.812
23.033		2.740	55.872	32.144	11.963
24.066		2.740	54.134	33.737	12.107
25.099		2.740	52.405	35.330	12.243
26.133		2.740	50.682	36.923	12.373
27.166		2.740	48.964	38.516	12.497
28.199		2.740	47.250	40.108	12.619
29.233		2.740	45.548	41.690	12.739
30.266		2.740	43.868	43.258	12.851
31.299		2.740	42.206	44.812	12.958
32.333		2.740	40.563	46.351	13.061
33.333		2.740	39.528	47.297	13.151
34.333		2.740	38.505	48.242	13.229
35.333		2.740	37.489	49.187	13.299
36.333		2.740	36.481	50.132	13.362
37.333		2.740	36.080	50.477	13.418
38.333		2.740	35.962	50.544	13.470
39.383		2.740	34.725	51.721	13.529
40.433		2.740	33.562	52.824	13.589
41.483		2.740	32.407	53.919	13.649
42.533		2.740	31.260	55.007	13.708
43.583		2.740	30.122	56.089	13.764
44.633		2.740	28.996	57.163	13.816
45.683		2.740	27.881	58.231	13.863
46.733		2.740	26.778	59.292	13.904

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
47.783		2.740	25.680	60.346	13.947
48.833		2.740	24.571	61.394	14.009
0.0	64.784	0.228	96.885	2.953	0.160
0.167		0.457	96.820	3.018	0.160
0.334		0.685	96.798	3.040	0.160
0.500		0.913	96.787	3.050	0.160
0.667		1.142	96.780	3.057	0.160
0.834		1.370	96.774	3.061	0.162
2.084		1.370	92.536	6.915	0.545
3.134		1.370	89.000	10.152	0.843
4.184		1.370	85.434	13.390	1.172
5.234		1.370	81.851	16.627	1.516
6.284		1.370	78.268	19.864	1.861
7.334		1.370	74.691	23.101	2.200
8.334		1.370	72.584	24.992	2.416
9.334		1.370	70.520	26.882	2.590
10.334		1.370	68.448	28.773	2.771
11.334		1.370	66.371	30.663	2.958
12.334		1.370	64.288	32.554	3.150
13.334		1.370	62.200	34.444	3.346
14.334		1.370	58.913	37.527	3.550
15.334		1.370	55.626	40.610	3.753
16.334		1.370	52.318	43.693	3.978
17.405		1.370	48.744	46.997	4.249
18.476		1.370	45.198	50.300	4.491
19.548		1.370	41.637	53.603	4.747
20.619		1.370	38.072	56.906	5.009
21.691		1.370	34.506	60.210	5.271
22.762		1.370	30.960	63.496	5.530
23.834		1.370	27.451	66.753	5.781
25.000		1.370	23.674	70.264	6.046
26.167		1.370	19.950	73.740	6.294
27.333		1.370	16.279	77.181	6.523
28.333		1.370	13.180	80.103	6.700
29.333		1.370	10.111	83.000	6.871
30.333		1.370	7.092	85.873	7.017
31.333		1.370	4.125	88.722	7.135
32.333		1.370	4.036	88.722	7.224
33.333		1.370	3.967	88.722	7.293
34.333		1.370	3.912	88.722	7.348
35.333		1.370	3.868	88.722	7.392
36.333		1.370	3.831	88.722	7.428
37.333		1.370	3.801	88.722	7.459
38.333		1.370	1.682	90.824	7.475
0.0	52.722	0.457	98.621	1.373	0.004
0.167		0.913	98.575	1.417	0.004
0.333		1.370	98.537	1.454	0.004
0.500		1.827	98.516	1.476	0.004
0.667		2.275	97.516	1.495	0.976

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.833		2.713	95.610	1.513	2.857
1.833		2.740	89.024	3.039	7.862
2.833		2.740	87.021	4.581	8.297
3.833		2.740	84.997	6.122	8.777
4.833		2.740	82.968	7.664	9.262
5.833		2.740	81.534	8.609	9.749
6.833		2.740	80.101	9.555	10.233
7.833		2.740	78.675	10.500	10.712
8.833		2.740	77.260	11.445	11.178
9.833		2.740	75.859	12.390	11.630
10.833		2.740	74.476	13.336	12.065
11.833		2.740	72.513	14.877	12.484
12.833		2.740	70.575	16.419	12.879
13.833		2.740	68.661	17.960	13.250
14.833		2.740	66.770	19.502	13.599
15.833		2.740	64.902	21.043	13.925
16.833		2.740	63.056	22.585	14.229
17.833		2.740	61.230	24.126	14.513
18.833		2.740	59.422	25.668	14.778
19.833		2.740	57.632	27.209	15.026
20.833		2.740	55.860	28.751	15.257
21.833		2.740	54.103	30.292	15.471
22.833		2.740	52.361	31.834	15.671
23.833		2.740	50.635	33.375	15.855
24.833		2.740	48.923	34.917	16.025
25.833		2.740	47.224	36.458	16.183
26.833		2.740	45.530	37.995	16.340
27.833		2.740	43.870	39.518	16.477
28.833		2.740	42.231	41.028	16.606
29.833		2.740	41.182	41.973	16.709
30.833		2.740	40.139	42.919	16.806
31.833		2.740	39.101	43.864	16.897
32.833		2.740	38.069	44.809	16.984
33.833		2.740	37.041	45.754	17.067
34.833		2.740	36.161	46.555	17.146
35.833		2.740	35.015	47.616	17.231
36.833		2.740	33.861	48.666	17.334
37.833		2.740	32.721	49.710	17.430
38.833		2.740	31.583	50.747	17.530
39.833		2.740	30.451	51.779	17.631
40.833		2.740	29.328	52.803	17.730
41.833		2.740	28.215	53.822	17.823
42.833		2.740	27.116	54.835	17.910
43.833		2.740	26.030	55.841	17.988
44.833		2.740	24.961	56.842	18.057
45.833		2.740	23.905	57.837	18.118
46.833		2.740	22.871	58.826	18.162
47.833		2.740	21.860	59.810	18.190
48.833		2.740	20.872	60.787	18.200

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
49.833		2.740	19.904	61.754	18.201
50.833		2.740	18.947	62.711	18.201
51.833		2.740	17.999	63.658	18.202
52.833		2.740	17.061	64.596	18.202
53.833		2.740	17.060	64.596	18.203
54.833		2.740	17.060	64.596	18.203
55.833		2.740	17.059	64.596	18.204
56.833		2.740	17.059	64.596	18.204
57.833		2.740	17.058	64.596	18.205
58.833		2.740	17.057	64.596	18.205
59.833		2.740	16.129	65.523	18.206
60.833		2.740	15.210	66.442	18.207
61.927		2.740	14.216	67.435	18.207
63.021		2.740	13.232	68.418	18.208
64.115		2.740	12.259	69.390	18.209
65.208		2.740	11.298	70.351	18.209
66.302		2.740	10.347	71.301	18.210
67.396		2.740	9.406	72.240	18.211
68.490		2.740	8.475	73.169	18.213
69.583		2.740	7.555	74.088	18.214
0.0	56.172	0.275	98.380	1.616	0.004
0.166		0.550	97.965	2.030	0.004
0.333		0.825	97.813	2.177	0.004
0.499		1.100	97.724	2.264	0.004
0.666		1.375	97.666	2.323	0.004
0.832		1.650	97.627	2.363	0.004
2.207		1.650	94.103	5.883	0.008
3.582		1.650	90.577	9.402	0.012
4.749		1.650	87.586	12.389	0.017
5.915		1.650	84.593	15.375	0.022
7.082		1.650	81.581	18.362	0.046
8.082		1.650	79.799	19.932	0.256
9.082		1.650	77.935	21.501	0.549
10.082		1.650	76.059	23.071	0.852
11.082		1.650	74.186	24.641	1.155
12.082		1.650	72.339	26.210	1.428
13.082		1.650	70.509	27.780	1.688
14.232		1.650	67.414	30.724	1.838
15.382		1.650	64.431	33.668	1.875
16.532		1.650	61.482	36.612	1.880
17.681		1.650	58.532	39.556	1.884
18.831		1.650	55.582	42.499	1.889
19.831		1.650	53.017	45.059	1.893
20.831		1.650	50.456	47.614	1.898
21.831		1.650	47.919	50.146	1.903
22.859		1.650	45.332	52.725	1.908
23.886		1.650	42.769	55.281	1.914
24.914		1.650	40.228	57.815	1.920
25.942		1.650	37.709	60.327	1.926

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
26.969		1.650	35.212	62.816	1.932
27.997		1.650	32.737	65.284	1.939
29.024		1.650	30.283	67.731	1.945
30.052		1.650	28.180	69.827	1.952
31.080		1.650	26.385	71.615	1.959
32.080		1.650	26.378	71.615	1.966
33.080		1.650	26.371	71.615	1.972
34.080		1.650	26.365	71.615	1.979
35.080		1.650	26.358	71.615	1.986
36.080		1.650	26.351	71.615	1.992
37.080		1.650	26.344	71.615	1.999
38.080		1.650	24.617	73.335	2.006
39.080		1.650	22.908	75.037	2.012
40.080		1.650	21.217	76.721	2.019
41.205		1.650	19.335	78.595	2.027
42.330		1.650	17.475	80.447	2.035
43.455		1.650	15.636	82.277	2.043
44.580		1.650	13.820	84.085	2.051
45.705		1.650	12.025	85.871	2.059
46.830		1.650	10.250	87.637	2.068
0.0	58.991	0.412	98.334	1.654	0.011
0.167		0.823	98.316	1.667	0.011
0.333		1.235	98.303	1.681	0.011
0.500		1.647	98.297	1.689	0.011
0.666		2.058	94.887	1.693	3.372
0.833		2.470	92.570	1.696	5.686
1.868		2.470	88.480	3.467	7.999
2.904		2.470	85.731	5.238	8.975
3.940		2.470	83.022	7.009	9.912
4.975		2.470	80.347	8.780	10.803
6.011		2.470	77.694	10.551	11.645
7.046		2.470	75.096	12.322	12.434
8.082		2.470	72.550	14.093	13.170
9.082		2.470	70.803	15.142	13.827
10.082		2.470	69.108	16.191	14.450
11.082		2.470	67.459	17.239	15.040
12.082		2.470	65.843	18.288	15.601
13.082		2.470	64.255	19.336	16.136
14.082		2.470	62.694	20.385	16.644
15.082		2.470	60.502	22.095	17.124
16.082		2.470	58.343	23.805	17.571
17.082		2.470	56.216	25.515	17.986
18.082		2.470	54.120	27.225	18.369
19.082		2.470	52.037	28.935	18.742
20.082		2.470	50.005	30.645	19.061
21.082		2.470	47.990	32.355	19.365
22.082		2.470	45.993	34.065	19.649
23.082		2.470	44.014	35.775	19.917
24.082		2.470	42.052	37.485	20.169

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
25.082		2.470	40.118	39.195	20.392
26.082		2.470	38.197	40.905	20.603
27.082		2.470	36.289	42.614	20.800
28.082		2.470	34.409	44.310	20.983
29.082		2.470	32.556	45.992	21.155
30.082		2.470	30.731	47.658	21.313
31.082		2.470	28.921	49.311	21.470
32.082		2.470	27.139	50.949	21.614
33.082		2.470	26.004	51.997	21.700
34.082		2.470	24.880	53.046	21.775
35.082		2.470	23.760	54.095	21.845
36.082		2.470	23.287	54.501	21.911
37.082		2.470	23.221	54.505	21.973
38.082		2.470	23.158	54.508	22.032
39.332		2.470	21.565	55.978	22.156
40.582		2.470	19.977	57.432	22.289
41.582		2.470	18.719	58.586	22.393
42.582		2.470	17.471	59.734	22.493
43.582		2.470	16.235	60.874	22.589
44.582		2.470	15.008	62.007	22.682
45.582		2.470	13.801	63.134	22.763
46.632		2.470	12.557	64.310	22.831
47.682		2.470	11.338	65.479	22.881
48.732		2.470	10.147	66.640	22.910
49.781		2.470	8.984	67.794	22.918
50.831		2.470	7.841	68.937	22.919
51.881		2.470	6.710	70.067	22.919
52.931		2.470	5.592	71.184	22.920
53.981		2.470	4.486	72.289	22.921
55.030		2.470	3.392	73.382	22.921
56.080		2.470	2.310	74.464	22.922
57.080		2.470	2.309	74.464	22.923
58.080		2.470	2.308	74.464	22.923
59.080		2.470	2.307	74.464	22.924
60.080		2.470	2.306	74.464	22.925
61.080		2.470	2.305	74.464	22.925
62.080		2.470	2.305	74.464	22.926
63.080		2.470	1.285	75.482	22.927
64.080		2.470	0.276	76.491	22.927
0.0	52.124	0.412	98.524	1.470	0.005
0.166		0.823	98.458	1.535	0.005
0.333		1.235	98.409	1.579	0.005
0.499		1.647	98.377	1.612	0.005
0.666		2.058	98.359	1.632	0.005
0.832		2.470	96.663	1.645	1.674
1.868		2.470	92.246	3.416	4.307
2.903		2.470	89.543	5.187	5.235
3.939		2.470	87.229	6.958	5.777
4.975		2.470	85.092	8.729	6.142

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
6.010		2.470	83.032	10.500	6.431
7.046		2.470	80.979	12.271	6.712
8.082		2.470	78.919	14.042	7.000
9.117		2.470	76.861	15.813	7.286
10.153		2.470	74.808	17.585	7.568
11.189		2.470	72.733	19.356	7.872
12.224		2.470	70.702	21.127	8.131
13.260		2.470	68.649	22.898	8.412
14.296		2.470	66.643	24.669	8.646
15.331		2.470	64.644	26.440	8.874
16.331		2.470	63.415	27.489	9.054
17.331		2.470	62.202	28.537	9.217
18.331		2.470	60.985	29.586	9.386
19.331		2.470	59.779	30.634	9.543
20.331		2.470	58.579	31.683	9.694
21.331		2.470	57.377	32.732	9.847
22.331		2.470	55.484	34.442	10.029
23.331		2.470	53.600	36.152	10.202
24.331		2.470	51.713	37.862	10.379
25.331		2.470	49.842	39.565	10.547
26.331		2.470	47.991	41.253	10.709
27.331		2.470	46.161	42.927	10.864
28.331		2.470	44.352	44.587	11.014
29.331		2.470	42.564	46.232	11.157
30.331		2.470	40.797	47.863	11.292
31.331		2.470	39.053	49.480	11.419
32.331		2.470	37.331	51.084	11.538
33.331		2.470	35.632	52.674	11.645
34.331		2.470	34.153	54.050	11.749
35.331		2.470	32.902	55.215	11.835
36.331		2.470	31.676	56.373	11.903
37.331		2.470	30.476	57.524	11.951
38.331		2.470	29.305	58.667	11.979
39.331		2.470	28.162	59.803	11.986
40.331		2.470	28.157	59.803	11.991
41.331		2.470	28.153	59.803	11.994
42.331		2.470	28.151	59.803	11.997
43.331		2.470	28.149	59.803	11.998
44.331		2.470	28.148	59.803	12.000
45.331		2.470	28.147	59.803	12.000
46.331		2.470	27.022	60.928	12.001
47.331		2.470	25.909	62.040	12.001
48.331		2.470	24.807	63.140	12.002
49.331		2.470	23.718	64.229	12.003
50.331		2.470	22.639	65.307	12.003
51.331		2.470	21.572	66.373	12.004
52.331		2.470	20.517	67.428	12.005
53.331		2.470	19.472	68.472	12.005
54.331		2.470	18.438	69.505	12.006

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
55.331		2.470	17.414	70.528	12.007
56.331		2.470	16.402	71.540	12.008
57.331		2.470	15.399	72.541	12.009
58.331		2.470	14.407	73.532	12.011
59.331		2.470	13.425	74.512	12.012
60.331		2.470	12.452	75.483	12.013
61.331		2.470	11.490	76.444	12.015
62.331		2.470	10.537	77.395	12.017
63.331		2.470	9.595	78.336	12.018
64.331		2.470	9.593	78.336	12.020
65.331		2.470	9.591	78.336	12.022
66.331		2.470	9.589	78.336	12.023
67.331		2.470	9.588	78.336	12.025
68.331		2.470	9.586	78.336	12.027
69.331		2.470	9.584	78.336	12.028
70.331		2.470	8.651	79.268	12.030
71.331		2.470	7.727	80.190	12.032
72.331		2.470	6.812	81.103	12.034
73.331		2.470	5.906	82.006	12.036
74.331		2.470	5.009	82.901	12.038
75.331		2.470	4.121	83.786	12.041
76.331		2.470	3.242	84.663	12.043
77.331		2.470	2.372	85.531	12.045
78.331		2.470	1.510	86.390	12.048
0.0	52.745	0.868	99.230	0.765	0.002
0.166		1.717	99.199	0.797	0.002
0.333		2.169	98.774	0.955	0.267
0.499		2.607	96.479	1.065	2.437
0.666		3.045	92.653	1.143	6.187
0.832		3.484	81.175	1.201	17.594
1.999		5.210	53.464	1.749	44.765
3.165		5.210	52.564	2.695	44.718
4.332		5.210	51.724	3.641	44.612
5.457		5.210	50.938	4.553	44.486
6.582		5.210	50.072	5.465	44.440
7.707		5.210	49.180	6.377	44.420
8.832		5.210	48.275	7.289	44.412
9.832		5.210	47.802	7.786	44.388
10.832		5.210	47.337	8.283	44.357
11.832		5.210	46.875	8.780	44.321
12.832		5.210	46.416	9.277	44.283
13.832		5.210	45.959	9.774	44.243
14.832		5.210	45.502	10.271	44.202
15.832		5.210	44.712	11.082	44.182
16.832		5.210	43.911	11.893	44.172
17.832		5.210	43.105	12.704	44.167
18.832		5.210	42.297	13.514	44.164
19.832		5.210	41.487	14.325	44.164
20.832		5.210	40.676	15.136	44.164

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
21.832		5.210	39.864	15.946	44.165
22.832		5.210	39.051	16.757	44.166
23.832		5.210	38.239	17.568	44.168
24.832		5.210	37.426	18.378	44.171
25.832		5.210	36.612	19.189	44.173
26.832		5.210	35.798	20.000	44.176
27.832		5.210	34.988	20.811	44.176
28.832		5.210	34.178	21.621	44.175
29.832		5.210	33.366	22.432	44.176
30.832		5.210	32.554	23.243	44.177
31.832		5.210	31.741	24.053	44.179
32.832		5.210	30.929	24.864	44.180
33.832		5.210	30.442	25.361	44.170
34.832		5.210	29.963	25.858	44.151
35.832		5.210	29.491	26.355	44.125
36.832		5.210	29.024	26.852	44.095
37.832		5.210	28.561	27.350	44.061
38.832		5.210	28.101	27.847	44.024
40.082		5.210	27.125	28.853	43.993
41.332		5.210	26.147	29.851	43.973
42.359		5.210	25.343	30.666	43.962
43.387		5.210	24.542	31.473	43.956
44.415		5.210	23.749	32.272	43.949
45.442		5.210	22.961	33.065	43.944
46.470		5.210	22.178	33.851	43.941
47.497		5.210	21.401	34.630	43.938
48.525		5.210	20.631	35.403	43.936
49.552		5.210	20.061	35.973	43.935
50.580		5.210	19.495	36.540	43.934
51.622		5.210	18.925	37.111	43.934
52.663		5.210	18.358	37.678	43.934
53.705		5.210	17.794	38.241	43.934
54.746		5.210	17.233	38.801	43.935
55.788		5.210	16.675	39.357	43.936
56.829		5.210	16.121	39.910	43.937
57.829		5.210	16.123	39.910	43.935
58.829		5.210	16.128	39.910	43.930
59.829		5.210	16.136	39.910	43.922
60.829		5.210	16.147	39.910	43.911
61.829		5.210	16.159	39.910	43.899
62.829		5.210	16.173	39.910	43.885
64.079		5.210	15.525	40.570	43.873
65.329		5.210	14.877	41.225	43.866
0.0	65.662	0.457	98.487	1.542	0.000
0.166		0.913	98.486	1.542	0.000
0.333		1.370	98.486	1.542	0.000
0.499		1.813	98.351	1.553	0.094
0.666		2.251	91.189	1.563	7.246
0.832		2.690	76.332	1.570	22.097

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
1.868		2.740	73.547	3.138	23.313
2.903		2.740	71.988	4.735	23.276
3.939		2.740	70.526	6.331	23.141
4.975		2.740	69.158	7.928	22.912
6.010		2.740	67.700	9.524	22.773
7.046		2.740	66.166	11.121	22.711
8.082		2.740	64.598	12.718	22.682
9.117		2.740	63.012	14.314	22.671
10.153		2.740	61.415	15.911	22.671
11.189		2.740	59.813	17.507	22.677
12.224		2.740	58.206	19.104	22.687
13.260		2.740	56.597	20.700	22.699
14.295		2.740	54.986	22.297	22.713
15.331		2.740	53.375	23.894	22.728
16.331		2.740	52.452	24.839	22.705
17.331		2.740	51.550	25.784	22.662
18.331		2.740	50.659	26.729	22.607
19.331		2.740	49.776	27.675	22.545
20.331		2.740	48.897	28.620	22.478
21.331		2.740	48.022	29.565	22.408
22.456		2.740	46.327	31.299	22.369
23.581		2.740	44.610	33.034	22.351
24.656		2.740	42.959	34.691	22.345
25.731		2.740	41.301	36.348	22.345
26.806		2.740	39.646	38.005	22.343
27.881		2.740	37.989	39.662	22.342
28.956		2.740	36.328	41.319	22.345
30.031		2.740	34.666	42.976	22.350
31.106		2.740	33.003	44.633	22.356
32.181		2.740	31.339	46.291	22.362
33.256		2.740	29.676	47.948	22.367
34.331		2.740	28.013	49.605	22.372
35.331		2.740	26.465	51.146	22.378
36.331		2.740	24.916	52.688	22.385
37.331		2.740	23.371	54.222	22.396
38.331		2.740	21.831	55.745	22.412
39.331		2.740	20.304	57.257	22.428
40.331		2.740	19.368	58.202	22.418
41.331		2.740	18.445	59.147	22.395
42.331		2.740	17.533	60.093	22.362
43.331		2.740	16.628	61.038	22.321
44.331		2.740	15.729	61.983	22.274
45.331		2.740	14.835	62.928	22.223
46.366		2.740	13.383	64.417	22.186
47.402		2.740	11.934	65.893	22.159
48.438		2.740	10.864	66.982	22.140
49.473		2.740	9.796	68.064	22.125
50.509		2.740	8.732	69.138	22.115
51.545		2.740	7.672	70.206	22.107

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
52.580		2.740	6.616	71.268	22.101
53.643		2.740	5.538	72.350	22.097
54.705		2.740	4.465	73.425	22.095
55.768		2.740	3.397	74.493	22.094
56.830		2.740	2.335	75.555	22.094
57.893		2.740	1.279	76.610	22.095
58.955		2.740	0.227	77.659	22.097
0.0	64.814	0.457	98.459	1.542	0.000
0.166		0.913	98.459	1.542	0.000
0.333		1.370	98.459	1.542	0.000
0.499		1.816	98.353	1.551	0.095
0.666		2.254	93.338	1.562	5.099
0.832		2.692	78.146	1.569	20.284
2.082		2.740	75.087	3.468	21.443
3.082		2.740	73.987	4.414	21.598
4.082		2.740	72.929	5.359	21.711
5.082		2.740	71.925	6.304	21.768
6.082		2.740	70.979	7.249	21.770
7.082		2.740	70.087	8.195	21.716
8.082		2.740	69.246	9.140	21.611
9.457		2.740	67.565	11.260	21.173
10.832		2.740	65.608	13.379	21.010
11.915		2.740	64.010	15.049	20.938
12.999		2.740	62.382	16.719	20.895
14.082		2.740	60.737	18.389	20.870
15.165		2.740	59.082	20.059	20.855
16.248		2.740	57.419	21.729	20.848
17.332		2.740	55.752	23.399	20.845
18.415		2.740	54.081	25.069	20.845
19.498		2.740	52.408	26.739	20.848
20.581		2.740	50.733	28.409	20.853
21.681		2.740	49.031	30.105	20.859
22.781		2.740	47.328	31.800	20.866
23.881		2.740	45.624	33.496	20.874
24.981		2.740	43.919	35.192	20.883
26.081		2.740	42.214	36.887	20.893
27.081		2.740	41.294	37.833	20.867
28.081		2.740	40.392	38.778	20.823
29.081		2.740	39.500	39.723	20.769
30.081		2.740	38.617	40.668	20.707
31.081		2.740	37.740	41.614	20.638
32.081		2.740	36.868	42.559	20.564
33.081		2.740	35.379	44.100	20.512
34.081		2.740	33.875	45.642	20.474
35.081		2.740	32.361	47.183	20.446
36.081		2.740	30.840	48.725	20.424
37.081		2.740	29.313	50.266	20.409
38.081		2.740	27.781	51.808	20.399
39.081		2.740	26.247	53.346	20.395

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
40.081		2.740	24.713	54.876	20.398
41.081		2.740	23.190	56.394	20.403
42.081		2.740	21.677	57.900	20.409
43.081		2.740	20.183	59.393	20.411
44.081		2.740	18.700	60.874	20.413
45.081		2.740	17.230	62.341	20.416
46.081		2.740	15.772	63.796	20.419
47.081		2.740	14.326	65.239	20.421
48.081		2.740	12.893	66.670	20.423
0.0	70.701	0.183	96.260	3.781	0.000
0.167		0.367	96.234	3.811	0.000
0.333		0.550	96.227	3.820	0.000
0.500		0.733	96.225	3.825	0.000
0.666		0.917	96.223	3.828	0.000
0.833		1.100	96.222	3.830	0.000
1.833		1.100	92.379	7.670	0.000
2.833		1.100	89.984	10.024	0.000
3.833		1.100	87.575	12.379	0.041
4.833		1.100	85.156	14.733	0.106
5.833		1.100	82.729	17.088	0.178
6.833		1.100	80.299	19.443	0.253
7.833		1.100	77.869	21.797	0.328
8.833		1.100	73.912	25.637	0.445
9.833		1.100	69.925	29.477	0.592
10.833		1.100	65.920	33.316	0.757
11.833		1.100	61.904	37.156	0.933
12.833		1.100	57.882	40.996	1.114
13.833		1.100	53.858	44.836	1.298
14.833		1.100	49.834	48.676	1.482
15.833		1.100	45.811	52.515	1.664
16.833		1.100	41.791	56.355	1.844
17.833		1.100	37.784	60.195	2.011
18.833		1.100	33.779	64.035	2.175
19.833		1.100	29.781	67.875	2.333
20.833		1.100	25.786	71.714	2.487
21.833		1.100	21.790	75.554	2.643
22.833		1.100	17.802	79.381	2.803
23.833		1.100	13.852	83.175	2.960
24.833		1.100	9.942	86.936	3.107
25.833		1.100	6.076	90.664	3.245
26.833		1.100	3.617	93.019	3.349
27.833		1.100	1.183	95.373	3.428
0.0	68.911	0.183	96.189	3.757	0.052
0.167		0.367	96.147	3.798	0.052
0.333		0.550	96.133	3.812	0.052
0.500		0.733	96.126	3.819	0.052
0.666		0.917	96.122	3.823	0.052
0.833		1.100	96.119	3.826	0.052
1.866		1.100	92.050	7.794	0.152

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
2.899		1.100	87.977	11.761	0.257
3.932		1.100	83.869	15.729	0.397
4.966		1.100	79.731	19.697	0.567
5.999		1.100	75.569	23.665	0.761
7.032		1.100	71.389	27.633	0.972
8.065		1.100	67.197	31.600	1.196
9.098		1.100	62.997	35.568	1.427
10.132		1.100	58.795	39.536	1.662
11.165		1.100	54.593	43.504	1.896
12.198		1.100	50.393	47.471	2.127
13.231		1.100	46.199	51.439	2.353
14.264		1.100	42.010	55.407	2.573
15.298		1.100	37.829	59.375	2.786
16.331		1.100	33.656	63.343	2.991
17.331		1.100	31.118	65.697	3.174
18.331		1.100	28.600	68.052	3.337
19.331		1.100	26.095	70.406	3.486
20.331		1.100	23.602	72.761	3.624
21.331		1.100	21.122	75.115	3.749
22.331		1.100	18.654	77.470	3.862
23.331		1.100	14.768	81.237	3.980
24.331		1.100	10.916	84.971	4.097
25.331		1.100	7.100	88.674	4.210
26.331		1.100	3.324	92.344	4.316
0.0	66.817	0.367	98.009	1.920	0.070
0.167		0.733	98.007	1.920	0.071
0.333		1.100	98.006	1.920	0.073
0.500		1.467	97.968	1.920	0.110
0.666		1.833	97.708	1.920	0.370
0.833		2.200	90.166	1.920	7.913
1.833		2.200	88.203	3.840	7.955
2.833		2.200	86.087	5.760	8.151
3.833		2.200	83.762	7.680	8.556
4.833		2.200	81.384	9.599	9.014
5.833		2.200	79.007	11.519	9.471
6.833		2.200	76.647	13.439	9.911
7.833		2.200	74.312	15.359	10.326
8.833		2.200	72.001	17.279	10.716
9.833		2.200	69.715	19.199	11.082
10.833		2.200	68.235	20.376	11.385
11.833		2.200	66.795	21.554	11.648
12.833		2.200	65.383	22.731	11.882
13.833		2.200	63.994	23.908	12.094
14.833		2.200	62.625	25.085	12.286
15.833		2.200	61.273	26.263	12.460
16.833		2.200	59.156	28.182	12.657
17.833		2.200	57.033	30.102	12.860
18.833		2.200	54.912	32.022	13.061
19.833		2.200	52.797	33.942	13.256

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
20.833		2.200	50.689	35.862	13.444
21.833		2.200	48.588	37.782	13.624
22.833		2.200	46.494	39.702	13.798
23.833		2.200	44.407	41.622	13.965
24.833		2.200	42.327	43.542	14.125
25.833		2.200	40.261	45.462	14.271
26.833		2.200	38.202	47.381	14.409
27.833		2.200	36.147	49.301	14.544
28.833		2.200	34.097	51.221	14.674
29.833		2.200	32.053	53.141	14.797
30.833		2.200	30.012	55.061	14.917
31.833		2.200	27.975	56.981	15.034
32.833		2.200	25.939	58.901	15.150
33.833		2.200	23.914	60.814	15.262
34.833		2.200	22.647	61.991	15.351
35.833		2.200	21.399	63.168	15.421
36.833		2.200	20.165	64.345	15.477
37.833		2.200	18.942	65.523	15.523
38.833		2.200	17.727	66.700	15.560
39.833		2.200	16.520	67.877	15.590
40.833		2.200	14.650	69.701	15.635
41.833		2.200	12.790	71.510	15.686
42.833		2.200	10.947	73.303	15.736
43.833		2.200	9.117	75.082	15.787
44.833		2.200	7.752	76.395	15.839
45.833		2.200	6.396	77.699	15.889
46.833		2.200	5.050	78.996	15.939
47.833		2.200	3.714	80.285	15.986
48.833		2.200	2.387	81.566	16.031
49.833		2.200	1.071	82.839	16.075
0.0	61.684	0.450	98.432	1.564	0.004
0.167		0.900	98.430	1.564	0.003
0.333		1.350	98.431	1.564	0.002
0.500		1.800	98.325	1.564	0.109
0.666		2.238	97.916	1.572	0.509
0.833		2.676	85.624	1.578	12.796
1.833		2.700	83.532	3.129	13.337
2.833		2.700	81.997	4.693	13.308
3.833		2.700	80.526	6.257	13.214
4.833		2.700	78.861	7.822	13.314
5.833		2.700	77.131	9.386	13.480
6.833		2.700	75.374	10.950	13.672
7.833		2.700	73.608	12.515	13.873
8.833		2.700	71.841	14.079	14.076
9.833		2.700	70.076	15.643	14.276
10.833		2.700	68.317	17.208	14.472
11.833		2.700	66.563	18.772	14.661
12.833		2.700	64.816	20.337	14.843
13.833		2.700	63.076	21.901	15.018

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
14.833		2.700	61.982	22.860	15.153
15.833		2.700	60.911	23.819	15.265
16.833		2.700	59.856	24.779	15.360
17.833		2.700	58.813	25.738	15.444
18.833		2.700	57.780	26.697	15.518
19.833		2.700	56.754	27.656	15.584
20.833		2.700	55.098	29.221	15.676
21.833		2.700	53.431	30.785	15.778
22.854		2.700	51.725	32.382	15.887
23.874		2.700	50.018	33.979	15.997
24.895		2.700	48.311	35.576	16.107
25.916		2.700	46.613	37.173	16.208
26.937		2.700	44.918	38.770	16.305
27.957		2.700	43.223	40.367	16.402
28.978		2.700	41.531	41.964	16.497
29.999		2.700	39.841	43.561	16.590
31.020		2.700	38.155	45.158	16.678
32.040		2.700	36.472	46.755	16.764
33.061		2.700	34.790	48.352	16.848
34.082		2.700	33.110	49.949	16.931
35.332		2.700	31.055	51.895	17.039
36.582		2.700	29.023	53.824	17.141
37.832		2.700	27.022	55.733	17.234
38.832		2.700	26.003	56.692	17.293
39.832		2.700	25.001	57.651	17.335
40.832		2.700	24.007	58.611	17.370
41.832		2.700	23.021	59.570	17.397
42.832		2.700	22.039	60.529	17.419
43.832		2.700	21.063	61.488	17.436
44.832		2.700	19.799	62.723	17.465
45.832		2.700	18.699	63.789	17.499
46.832		2.700	17.605	64.848	17.533
47.868		2.700	16.478	65.939	17.570
48.903		2.700	15.357	67.022	17.607
49.939		2.700	14.243	68.099	17.644
50.974		2.700	13.136	69.169	17.681
52.010		2.700	12.037	70.233	17.716
53.046		2.700	10.946	71.290	17.750
54.081		2.700	9.863	72.340	17.782
0.0	66.122	0.228	96.942	2.956	0.101
0.166		0.457	96.879	3.019	0.099
0.333		0.685	96.860	3.041	0.097
0.499		0.913	96.850	3.051	0.096
0.666		1.142	96.845	3.058	0.095
0.832		1.370	96.841	3.062	0.094
1.957		1.370	93.191	6.530	0.276
3.082		1.370	89.545	9.999	0.453
4.207		1.370	85.850	13.467	0.679
5.332		1.370	82.118	16.936	0.942

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
6.457		1.370	78.361	20.404	1.230
7.582		1.370	74.588	23.872	1.535
8.582		1.370	72.430	25.763	1.801
9.582		1.370	70.279	27.653	2.061
10.582		1.370	68.138	29.544	2.312
11.582		1.370	66.007	31.434	2.552
12.582		1.370	63.889	33.325	2.779
13.582		1.370	61.784	35.215	2.994
14.957		1.370	57.241	39.455	3.297
16.332		1.370	52.701	43.694	3.598
17.457		1.370	48.993	47.162	3.837
18.582		1.370	45.297	50.631	4.064
19.707		1.370	41.609	54.099	4.283
20.832		1.370	37.932	57.567	4.490
21.957		1.370	34.263	61.036	4.690
23.082		1.370	30.602	64.501	4.885
0.0	73.109	0.367	97.884	1.920	0.195
0.166		0.733	97.886	1.920	0.193
0.333		1.100	97.878	1.920	0.200
0.499		1.467	97.623	1.920	0.455
0.666		1.833	87.606	1.920	10.472
0.832		2.200	73.005	1.920	25.073
1.904		2.200	70.911	3.977	25.110
2.975		2.200	68.928	6.034	25.035
4.046		2.200	67.076	8.091	24.830
5.118		2.200	65.280	10.148	24.569
6.189		2.200	63.277	12.205	24.514
7.260		2.200	61.190	14.262	24.544
8.331		2.200	59.058	16.319	24.619
9.331		2.200	57.838	17.496	24.661
10.331		2.200	56.628	18.674	24.694
11.331		2.200	55.421	19.851	24.724
12.331		2.200	54.215	21.028	24.752
13.331		2.200	53.010	22.205	24.780
14.331		2.200	51.807	23.383	24.806
15.359		2.200	49.758	25.356	24.881
16.387		2.200	47.687	27.329	24.978
17.414		2.200	45.608	29.302	25.084
18.442		2.200	43.524	31.276	25.195
19.469		2.200	41.438	33.249	25.307
20.497		2.200	39.353	35.222	25.418
21.525		2.200	37.270	37.195	25.528
22.552		2.200	35.188	39.169	25.637
23.580		2.200	33.107	41.142	25.744
24.580		2.200	31.085	43.062	25.846
25.580		2.200	29.065	44.982	25.946
26.580		2.200	27.055	46.901	26.036
27.730		2.200	24.744	49.109	26.138
28.880		2.200	22.434	51.317	26.240

Table E-6, continued.
COLUMN 6

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
30.029		2.200	20.125	53.525	26.340
31.179		2.200	17.820	55.733	26.437
32.329		2.200	15.518	57.941	26.530
33.329		2.200	14.287	59.118	26.583
34.329		2.200	13.075	60.295	26.616
35.329		2.200	11.879	61.472	26.635
36.329		2.200	10.693	62.650	26.643
37.329		2.200	9.517	63.827	26.641
38.329		2.200	8.349	65.004	26.631
39.579		2.200	5.964	67.373	26.648
40.829		2.200	3.575	69.722	26.687

Table E-7.
COLUMN 9

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	71.293	0.183	97.889	3.197	0.000
0.166		0.367	97.875	3.197	0.000
0.333		0.550	97.862	3.197	0.000
0.500		0.733	97.846	3.197	0.000
0.666		0.917	97.819	3.197	0.000
0.833		1.100	97.753	3.197	0.000
1.833		1.100	92.658	6.393	0.944
2.833		1.100	87.971	9.590	2.434
3.833		1.100	83.785	12.786	3.424
4.833		1.100	79.699	15.983	4.312
5.833		1.100	75.915	19.179	4.899
6.833		1.100	72.132	22.376	5.485
7.833		1.100	68.648	25.573	5.772
8.933		1.100	64.653	29.089	6.250
10.033		1.100	60.864	32.605	6.523
11.133		1.100	57.082	36.121	6.788
12.233		1.100	53.371	39.638	6.982
13.333		1.100	49.686	43.154	7.151
14.333		1.100	48.084	44.827	7.079
15.333		1.100	46.472	46.499	7.019
16.333		1.100	44.876	48.172	6.941
17.333		1.100	43.285	49.845	6.859
18.333		1.100	41.698	51.517	6.773
19.333		1.100	40.117	53.190	6.681
20.333		1.100	36.830	56.387	6.771
21.333		1.100	33.611	59.583	6.793
22.333		1.100	30.362	62.780	6.844
23.333		1.100	27.112	65.977	6.896
24.333		1.100	23.866	69.173	6.945
25.333		1.100	20.608	72.370	7.006
26.333		1.100	17.321	75.566	7.096
27.333		1.100	14.061	78.763	7.159
28.333		1.100	10.806	81.959	7.217
29.333		1.100	7.565	85.155	7.261
30.333		1.100	4.357	88.327	7.298
31.333		1.100	1.198	91.474	7.309
0.0	56.569	0.457	98.770	1.224	0.005
0.166		0.913	98.737	1.254	0.005
0.333		1.370	98.727	1.264	0.005
0.500		1.827	98.686	1.269	0.042
0.666		2.283	96.058	1.272	2.663
0.833		2.740	89.951	1.273	8.766
2.083		2.740	86.635	2.878	10.474
3.133		2.740	83.667	4.225	12.095
4.183		2.740	81.046	5.573	13.368
5.233		2.740	78.455	6.920	14.611
6.283		2.740	76.362	8.267	15.357
7.333		2.740	73.909	9.615	16.461
8.333		2.740	72.149	10.898	16.938
9.333		2.740	71.033	11.570	17.382

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
10.333		2.740	69.662	12.241	18.082
11.333		2.740	68.678	12.913	18.394
12.333		2.740	67.665	13.584	18.736
13.333		2.740	66.503	14.256	19.226
14.333		2.740	65.702	14.927	19.355
15.458		2.740	63.529	16.371	20.084
16.583		2.740	62.007	17.815	20.163
17.633		2.740	60.005	19.162	20.817
18.683		2.740	58.555	20.510	20.919
19.733		2.740	56.897	21.857	21.230
20.783		2.740	55.305	23.205	21.473
21.833		2.740	53.715	24.552	21.716
22.883		2.740	52.155	25.900	21.928
23.933		2.740	50.605	27.247	22.130
24.983		2.740	49.073	28.595	22.314
26.033		2.740	47.553	29.942	22.487
27.083		2.740	46.045	31.289	22.647
28.133		2.740	44.547	32.637	22.798
29.183		2.740	43.078	33.984	22.918
30.233		2.740	41.608	35.332	23.041
31.283		2.740	40.143	36.679	23.157
32.333		2.740	38.681	38.027	23.271
33.333		2.740	37.947	38.698	23.334
34.333		2.740	37.233	39.370	23.377
35.333		2.740	36.529	40.041	23.408
36.333		2.740	35.832	40.713	23.434
37.333		2.740	35.138	41.384	23.456
38.333		2.740	34.446	42.056	23.476
39.383		2.740	33.050	43.402	23.525
40.433		2.740	31.659	44.738	23.580
41.483		2.740	30.280	46.063	23.634
42.533		2.740	28.915	47.378	23.684
43.583		2.740	27.564	48.682	23.730
44.632		2.740	26.228	49.977	23.772
45.682		2.740	24.903	51.261	23.813
46.732		2.740	23.596	52.535	23.846
47.782		2.740	22.305	53.799	23.871
48.832		2.740	21.033	55.054	23.889
0.0	66.678	0.228	97.380	2.567	0.050
0.167		0.457	97.383	2.567	0.047
0.333		0.685	97.385	2.567	0.045
0.500		0.913	97.386	2.567	0.044
0.667		1.142	97.383	2.567	0.047
0.833		1.370	97.275	2.567	0.155
2.083		1.370	89.177	5.775	5.044
3.133		1.370	84.442	8.470	7.083
4.183		1.370	80.402	11.165	8.429
5.233		1.370	76.276	13.860	9.858
6.283		1.370	72.551	16.555	10.888

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
7.333		1.370	68.854	19.249	11.890
8.333		1.370	66.910	20.593	12.490
9.333		1.370	64.907	21.936	13.151
10.333		1.370	63.078	23.279	13.636
11.333		1.370	61.233	24.622	14.137
12.333		1.370	59.487	25.965	14.541
13.333		1.370	57.748	27.308	14.937
14.333		1.370	54.702	29.874	15.416
15.333		1.370	51.712	32.441	15.839
16.333		1.370	48.743	35.008	16.240
17.405		1.370	45.599	37.758	16.634
18.476		1.370	42.525	40.508	16.957
19.548		1.370	39.458	43.257	17.274
20.619		1.370	36.413	46.007	17.567
21.690		1.370	33.381	48.757	17.849
22.762		1.370	30.347	51.507	18.132
23.833		1.370	27.350	54.257	18.379
24.958		1.370	24.265	57.145	18.576
26.083		1.370	21.210	60.018	18.757
27.208		1.370	18.201	62.867	18.916
28.333		1.370	15.238	65.691	19.054
29.333		1.370	12.642	68.182	19.159
30.333		1.370	10.071	70.654	19.259
31.333		1.370	7.539	73.107	19.337
32.333		1.370	6.141	74.450	19.392
33.333		1.370	4.755	75.793	19.434
34.333		1.370	3.377	77.136	19.469
35.333		1.370	2.004	78.479	19.499
36.333		1.370	1.455	79.001	19.526
37.333		1.370	1.399	79.033	19.550
0.0	55.144	0.457	98.788	1.200	0.011
0.167		0.913	98.749	1.232	0.011
0.333		1.370	98.733	1.249	0.012
0.500		1.827	98.724	1.258	0.013
0.667		2.283	95.418	1.263	3.298
0.833		2.740	92.212	1.266	6.496
1.833		2.740	87.321	2.549	10.099
2.833		2.740	84.182	3.833	11.955
3.833		2.740	81.478	5.116	13.376
4.833		2.740	78.883	6.399	14.687
5.833		2.740	77.569	7.071	15.329
6.833		2.740	75.702	7.742	16.524
7.833		2.740	74.586	8.414	16.969
8.833		2.740	73.434	9.085	17.450
9.833		2.740	71.992	9.757	18.220
10.833		2.740	70.975	10.429	18.565
11.833		2.740	69.173	11.712	19.083
12.833		2.740	67.416	12.995	19.557
13.833		2.740	65.744	14.278	19.946

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
14.833		2.740	64.031	15.562	20.376
15.833		2.740	62.460	16.845	20.663
16.833		2.740	60.780	18.128	21.059
17.833		2.740	59.287	19.412	21.269
18.833		2.740	57.647	20.695	21.626
19.833		2.740	56.197	21.978	21.793
20.833		2.740	54.613	23.262	22.093
21.833		2.740	53.173	24.545	22.249
22.833		2.740	51.653	25.828	22.486
23.833		2.740	50.213	27.111	22.643
24.833		2.740	48.744	28.395	22.828
25.833		2.740	47.309	29.678	22.980
26.833		2.740	45.889	30.961	23.116
27.833		2.740	44.477	32.245	23.244
28.833		2.740	43.071	33.528	23.367
29.833		2.740	42.319	34.199	23.447
30.833		2.740	41.589	34.871	23.505
31.833		2.740	40.869	35.542	23.553
32.833		2.740	40.159	36.214	23.592
33.833		2.740	39.453	36.886	23.625
34.833		2.740	38.752	37.557	23.655
35.833		2.740	37.402	38.840	23.721
36.833		2.740	36.051	40.124	23.789
37.833		2.740	34.720	41.398	23.845
38.833		2.740	33.398	42.664	23.902
39.833		2.740	32.089	43.919	23.955
40.833		2.740	30.794	45.165	24.003
41.833		2.740	29.514	46.402	24.047
42.833		2.740	28.244	47.630	24.089
43.833		2.740	26.992	48.848	24.122
44.833		2.740	25.756	50.058	24.148
45.833		2.740	24.537	51.259	24.167
46.833		2.740	23.335	52.451	24.176
47.833		2.740	22.306	53.476	24.181
48.833		2.740	21.430	54.351	24.181
49.833		2.740	20.559	55.221	24.182
50.833		2.740	19.692	56.087	24.183
51.833		2.740	18.829	56.949	24.184
52.833		2.740	17.971	57.805	24.185
53.833		2.740	17.970	57.805	24.186
54.833		2.740	17.969	57.805	24.187
55.833		2.740	17.968	57.805	24.188
56.833		2.740	17.967	57.805	24.189
57.833		2.740	17.966	57.805	24.190
58.833		2.740	17.965	57.805	24.191
59.833		2.740	17.112	58.657	24.192
60.833		2.740	16.266	59.501	24.193
62.208		2.740	15.114	60.651	24.195
63.583		2.740	13.976	61.786	24.198

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	61.861	0.275	97.924	2.067	0.006
0.166		0.550	97.889	2.099	0.006
0.333		0.825	97.879	2.110	0.006
0.499		1.100	97.875	2.115	0.006
0.666		1.375	97.871	2.118	0.006
0.832		1.650	96.986	2.120	0.887
1.832		1.650	92.661	4.251	3.076
2.832		1.650	88.716	6.382	4.889
3.832		1.650	84.873	8.514	6.600
4.832		1.650	81.398	10.645	7.943
5.832		1.650	78.030	12.776	9.180
7.082		1.650	74.263	15.439	10.282
8.332		1.650	70.568	18.103	11.313
9.582		1.650	67.039	20.767	12.178
10.749		1.650	63.854	23.253	12.876
11.915		1.650	60.759	25.740	13.484
13.082		1.650	57.734	28.226	14.023
14.082		1.650	56.290	29.341	14.352
15.082		1.650	54.869	30.456	14.657
16.082		1.650	53.481	31.571	14.930
17.082		1.650	52.125	32.686	15.170
18.082		1.650	50.793	33.802	15.386
19.082		1.650	49.485	34.917	15.579
20.231		1.650	46.771	37.367	15.842
21.381		1.650	44.053	39.818	16.108
22.531		1.650	41.333	42.269	16.377
23.681		1.650	38.645	44.720	16.614
24.831		1.650	36.012	47.170	16.796
25.831		1.650	33.749	49.289	16.939
26.831		1.650	31.518	51.392	17.067
27.831		1.650	29.319	53.479	17.178
28.859		1.650	27.093	55.608	17.276
29.886		1.650	24.892	57.720	17.364
30.914		1.650	22.730	59.816	17.430
31.941		1.650	20.602	61.896	17.478
32.969		1.650	18.509	63.961	17.506
33.997		1.650	16.434	66.010	17.532
35.024		1.650	14.396	68.043	17.536
36.052		1.650	12.743	69.695	17.537
37.079		1.650	11.247	71.189	17.539
38.079		1.650	11.246	71.189	17.540
39.079		1.650	11.244	71.189	17.541
40.079		1.650	11.243	71.189	17.543
41.079		1.650	11.241	71.189	17.544
42.079		1.650	11.240	71.189	17.546
43.079		1.650	11.238	71.189	17.547
44.079		1.650	9.790	72.635	17.549
45.079		1.650	8.350	74.073	17.551
46.079		1.650	6.917	75.504	17.553

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	63.863	0.412	98.572	1.424	0.003
0.166		0.823	98.572	1.424	0.003
0.333		1.235	98.572	1.424	0.003
0.499		1.647	97.517	1.424	1.055
0.666		2.058	95.758	1.424	2.815
0.832		2.470	82.948	1.424	15.625
1.832		2.470	80.787	2.847	16.362
2.832		2.470	78.696	4.271	17.028
3.832		2.470	76.310	5.694	17.991
4.832		2.470	73.959	7.118	18.918
5.832		2.470	71.518	8.541	19.936
6.832		2.470	69.440	9.965	20.590
7.832		2.470	67.426	11.389	21.180
8.832		2.470	65.025	12.812	22.157
9.832		2.470	63.241	14.236	22.517
10.832		2.470	61.416	15.659	22.919
11.832		2.470	59.188	17.083	23.723
12.832		2.470	57.544	18.507	23.943
13.832		2.470	55.738	19.930	24.325
14.832		2.470	53.839	21.354	24.801
15.832		2.470	53.054	22.099	24.840
16.832		2.470	51.706	22.844	25.443
17.832		2.470	50.931	23.589	25.474
18.832		2.470	50.002	24.333	25.657
19.832		2.470	48.998	25.078	25.916
20.832		2.470	48.143	25.823	26.027
21.832		2.470	46.333	27.247	26.413
22.832		2.470	44.774	28.670	26.548
23.832		2.470	43.135	30.094	26.763
24.832		2.470	41.506	31.518	26.968
25.832		2.470	39.889	32.941	27.161
26.832		2.470	38.250	34.365	27.376
27.832		2.470	36.662	35.788	27.540
28.832		2.470	35.076	37.212	27.703
29.832		2.470	33.504	38.636	27.851
30.832		2.470	31.939	40.059	27.993
31.832		2.470	30.405	41.483	28.102
32.832		2.470	28.868	42.906	28.216
33.832		2.470	27.335	44.330	28.324
34.832		2.470	25.803	45.753	28.433
35.832		2.470	24.264	47.177	28.548
36.832		2.470	22.740	48.600	28.648
37.832		2.470	21.225	50.024	28.739
38.832		2.470	19.724	51.447	28.817
39.832		2.470	18.943	52.192	28.853
40.832		2.470	18.169	52.937	28.882
41.832		2.470	17.399	53.682	28.907
42.832		2.470	16.632	54.427	28.929
43.832		2.470	15.865	55.172	28.951

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
44.832		2.470	15.099	55.917	28.972
46.082		2.470	13.339	57.619	29.029
47.332		2.470	11.592	59.305	29.090
48.332		2.470	10.210	60.643	29.134
49.332		2.470	8.836	61.971	29.179
50.332		2.470	7.480	63.289	29.217
51.332		2.470	6.475	64.264	29.248
52.332		2.470	5.482	65.233	29.272
0.0	66.238	0.412	98.541	1.424	0.034
0.166		0.823	98.542	1.424	0.033
0.333		1.235	98.541	1.424	0.033
0.499		1.647	97.813	1.424	0.762
0.666		2.058	92.734	1.424	5.840
0.832		2.470	77.467	1.424	21.107
1.888		2.470	75.221	2.926	21.850
2.943		2.470	73.658	4.429	21.910
3.999		2.470	71.937	5.932	22.128
5.054		2.470	70.062	7.434	22.500
6.110		2.470	68.033	8.937	23.026
7.165		2.470	65.939	10.440	23.617
8.220		2.470	63.581	11.942	24.472
9.276		2.470	61.767	13.445	24.783
10.331		2.470	59.853	14.948	25.194
11.331		2.470	58.779	15.693	25.522
12.331		2.470	57.757	16.437	25.800
13.331		2.470	56.610	17.182	26.202
14.331		2.470	55.829	17.927	26.237
15.331		2.470	54.708	18.672	26.613
16.331		2.470	53.577	19.417	26.999
17.331		2.470	52.032	20.841	27.121
18.331		2.470	50.252	22.264	27.477
19.331		2.470	48.403	23.688	27.903
20.331		2.470	46.921	25.112	27.960
21.331		2.470	44.964	26.535	28.494
22.331		2.470	43.516	27.959	28.518
23.331		2.470	41.862	29.382	28.748
24.331		2.470	40.233	30.806	28.953
25.331		2.470	38.655	32.229	29.108
26.331		2.470	37.020	33.653	29.319
27.331		2.470	35.493	35.077	29.422
28.331		2.470	33.856	36.500	29.635
29.331		2.470	32.362	37.924	29.706
30.331		2.470	30.739	39.347	29.905
31.331		2.470	29.251	40.771	29.969
32.331		2.470	27.659	42.194	30.137
33.331		2.470	26.161	43.618	30.212
34.331		2.470	24.642	45.042	30.307
35.331		2.470	23.847	45.786	30.356
36.331		2.470	23.074	46.531	30.384

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
37.331		2.470	22.313	47.276	30.399
38.331		2.470	21.559	48.021	30.408
39.331		2.470	20.810	48.766	30.412
40.331		2.470	20.064	49.511	30.413
41.581		2.470	18.215	51.290	30.482
42.831		2.470	16.355	53.070	30.563
43.864		2.470	14.823	54.541	30.623
44.898		2.470	13.312	56.004	30.670
45.931		2.470	11.810	57.456	30.720
46.964		2.470	10.321	58.897	30.768
47.997		2.470	8.847	60.326	30.813
49.030		2.470	7.388	61.745	30.853
50.064		2.470	5.944	63.152	30.890
51.097		2.470	4.511	64.549	30.925
52.130		2.470	3.096	65.935	30.954
53.163		2.470	1.699	67.310	30.975
54.196		2.470	0.319	68.676	30.990
0.0	49.025	0.778	99.281	0.711	0.007
0.166		1.557	96.470	0.707	2.799
0.333		2.335	95.878	0.722	3.379
0.499		3.113	92.183	0.730	7.060
0.666		3.892	74.382	0.734	24.862
0.832		4.670	61.986	0.738	37.257
1.999		4.670	60.715	1.616	37.648
3.165		4.670	59.873	2.494	37.610
4.332		4.670	59.316	3.373	37.289
5.457		4.670	58.660	4.220	37.097
6.582		4.670	57.845	5.067	37.065
7.707		4.670	56.980	5.914	37.082
8.832		4.670	56.104	6.761	37.112
9.832		4.670	55.760	7.155	37.062
10.832		4.670	55.351	7.549	37.076
11.832		4.670	54.919	7.943	37.114
12.832		4.670	54.478	8.337	37.161
13.832		4.670	54.028	8.731	37.217
14.832		4.670	53.518	9.125	37.333
15.832		4.670	52.617	9.878	37.481
16.832		4.670	51.839	10.631	37.506
17.832		4.670	50.910	11.384	37.681
18.832		4.670	50.152	12.137	37.687
19.832		4.670	49.331	12.890	37.754
20.832		4.670	48.462	13.643	37.870
21.832		4.670	47.684	14.396	37.895
22.832		4.670	46.834	15.149	37.993
23.832		4.670	46.075	15.902	37.998
24.832		4.670	45.274	16.655	38.046
25.832		4.670	44.444	17.407	38.123
26.832		4.670	43.673	18.160	38.141
27.832		4.670	42.870	18.913	38.191

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
28.832		4.670	42.097	19.666	38.211
29.832		4.670	41.327	20.419	38.227
30.832		4.670	40.557	21.172	38.245
31.832		4.670	39.756	21.925	38.292
32.832		4.670	38.989	22.678	38.307
33.832		4.670	38.624	23.072	38.277
34.832		4.670	38.250	23.466	38.257
35.832		4.670	37.889	23.860	38.225
36.832		4.670	37.513	24.254	38.206
37.832		4.670	37.157	24.648	38.168
38.832		4.670	36.783	25.042	38.148
40.082		4.670	35.832	25.983	38.158
41.332		4.670	34.873	26.924	38.175
42.359		4.670	34.088	27.698	38.186
43.387		4.670	33.303	28.472	38.197
44.415		4.670	32.515	29.246	38.211
45.442		4.670	31.729	30.020	38.223
46.470		4.670	30.936	30.794	38.242
47.497		4.670	30.147	31.567	38.257
48.525		4.670	29.361	32.341	38.269
49.552		4.670	28.580	33.112	38.279
50.580		4.670	27.813	33.877	38.281
0.0	71.809	0.457	98.739	1.283	0.000
0.166		0.913	98.735	1.283	0.000
0.333		1.370	97.896	1.283	0.820
0.499		1.827	87.364	1.283	11.351
0.666		2.283	69.891	1.283	28.824
0.832		2.740	58.244	1.283	40.471
1.882		2.740	56.227	2.631	41.140
2.932		2.740	54.696	3.978	41.323
3.981		2.740	53.865	5.326	40.806
5.031		2.740	52.934	6.673	40.390
6.081		2.740	51.841	8.021	40.135
7.081		2.740	51.343	8.692	39.961
8.081		2.740	50.775	9.364	39.857
9.081		2.740	50.328	10.035	39.632
10.081		2.740	49.621	10.707	39.668
11.081		2.740	48.996	11.378	39.621
12.081		2.740	48.362	12.050	39.583
13.331		2.740	46.717	13.654	39.623
14.581		2.740	45.013	15.258	39.723
15.614		2.740	43.677	16.584	39.733
16.648		2.740	42.317	17.910	39.766
17.681		2.740	41.003	19.236	39.753
18.714		2.740	39.711	20.562	39.719
19.747		2.740	38.382	21.888	39.722
20.780		2.740	37.035	23.215	39.742
21.814		2.740	35.650	24.541	39.801
22.847		2.740	34.384	25.867	39.740

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
23.880		2.740	33.051	27.193	39.748
24.913		2.740	31.807	28.519	39.665
25.946		2.740	30.499	29.845	39.646
26.980		2.740	29.149	31.171	39.669
28.013		2.740	27.907	32.497	39.585
29.046		2.740	26.570	33.823	39.596
30.079		2.740	25.305	35.149	39.534
31.079		2.740	24.759	35.821	39.409
32.079		2.740	24.205	36.492	39.292
33.079		2.740	23.646	37.164	39.178
34.079		2.740	23.087	37.835	39.066
35.079		2.740	22.524	38.507	38.957
36.079		2.740	21.962	39.178	38.847
37.204		2.740	20.569	40.622	38.796
38.329		2.740	19.122	42.066	38.799
39.404		2.740	17.778	43.445	38.763
40.479		2.740	16.425	44.825	38.736
41.554		2.740	15.070	46.204	38.711
42.629		2.740	13.719	47.584	38.683
43.704		2.740	12.382	48.963	38.639
44.779		2.740	11.034	50.343	38.608
45.854		2.740	9.683	51.722	38.579
46.929		2.740	8.330	53.102	38.551
48.004		2.740	6.970	54.481	38.531
49.079		2.740	5.596	55.861	38.526
50.079		2.740	4.324	57.144	38.514
51.079		2.740	3.054	58.428	38.501
52.079		2.740	1.789	59.707	38.487
53.079		2.740	0.535	60.976	38.471
0.0	66.161	0.550	98.936	1.066	0.000
0.166		1.100	98.936	1.066	0.000
0.333		1.650	98.271	1.066	0.662
0.499		2.200	87.173	1.066	11.760
0.666		2.750	69.738	1.066	29.195
0.832		3.300	58.115	1.066	40.818
1.903		3.300	56.240	2.207	41.551
2.975		3.300	55.078	3.349	41.571
4.046		3.300	54.344	4.490	41.163
5.117		3.300	53.558	5.632	40.808
6.189		3.300	52.655	6.774	40.568
7.260		3.300	51.531	7.915	40.551
8.331		3.300	50.588	9.057	40.352
9.456		3.300	49.301	10.256	40.440
10.581		3.300	48.339	11.454	40.203
11.581		3.300	47.615	12.012	40.370
12.581		3.300	47.342	12.570	40.084
13.581		3.300	46.868	13.127	40.001
14.581		3.300	46.387	13.685	39.924
15.581		3.300	45.904	14.242	39.849

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
16.581		3.300	45.418	14.800	39.778
17.956		3.300	43.971	16.265	39.760
19.331		3.300	42.503	17.730	39.762
20.414		3.300	41.348	18.884	39.762
21.498		3.300	40.265	20.039	39.691
22.581		3.300	39.086	21.193	39.715
23.664		3.300	38.014	22.347	39.632
24.747		3.300	36.848	23.502	39.644
25.831		3.300	35.777	24.656	39.560
26.914		3.300	34.622	25.810	39.561
27.997		3.300	33.550	26.965	39.478
29.080		3.300	32.404	28.119	39.470
30.180		3.300	31.314	29.291	39.387
31.280		3.300	30.158	30.463	39.371
32.380		3.300	29.047	31.635	39.310
33.480		3.300	27.920	32.807	39.264
34.580		3.300	26.819	33.979	39.192
35.580		3.300	26.358	34.537	39.097
36.580		3.300	25.905	35.094	38.991
37.580		3.300	25.451	35.652	38.888
38.580		3.300	24.995	36.210	38.786
39.580		3.300	24.536	36.767	38.688
40.580		3.300	24.075	37.325	38.590
41.680		3.300	22.953	38.497	38.540
42.779		3.300	21.790	39.669	38.531
43.879		3.300	20.665	40.841	38.484
44.979		3.300	19.525	42.013	38.450
46.079		3.300	18.383	43.185	38.420
47.079		3.300	17.346	44.250	38.392
48.079		3.300	16.301	45.316	38.370
49.079		3.300	15.258	46.382	38.348
50.079		3.300	14.201	47.447	38.340
51.079		3.300	13.148	48.513	38.327
52.079		3.300	12.098	49.578	38.312
53.079		3.300	11.052	50.638	38.297
54.079		3.300	10.016	51.690	38.281
55.079		3.300	8.993	52.734	38.260
56.079		3.300	7.971	53.771	38.245
57.079		3.300	6.955	54.799	38.232
58.579		3.300	5.436	56.328	38.222
59.579		3.300	4.904	56.886	38.196
60.579		3.300	4.381	57.443	38.162
61.579		3.300	3.862	58.001	38.123
62.579		3.300	3.344	58.558	38.084
63.579		3.300	3.275	58.666	38.045
64.579		3.300	3.296	58.680	38.009
65.579		3.300	2.566	59.426	37.994
66.579		3.300	1.845	60.153	37.987
67.579		3.300	1.121	60.876	37.989

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
68.579		3.300	0.398	61.595	37.993
0.0	60.211	0.367	98.444	1.553	0.001
0.166		0.733	98.421	1.576	0.001
0.333		1.100	98.413	1.583	0.001
0.499		1.467	98.409	1.587	0.001
0.666		1.833	97.725	1.589	0.682
0.832		2.200	96.351	1.591	2.056
1.865		2.200	90.955	3.242	5.799
2.898		2.200	87.299	4.894	7.802
3.932		2.200	84.040	6.546	9.409
4.965		2.200	80.926	8.197	10.872
5.998		2.200	78.321	9.849	11.825
7.031		2.200	75.587	11.500	12.907
8.064		2.200	73.354	13.152	13.488
9.098		2.200	70.734	14.803	14.457
10.131		2.200	68.809	16.455	14.729
11.164		2.200	66.210	18.106	15.676
12.197		2.200	64.511	19.758	15.724
13.230		2.200	62.225	21.410	16.358
14.264		2.200	60.125	23.061	16.806
15.297		2.200	58.132	24.713	17.147
16.330		2.200	56.133	26.364	17.494
17.330		2.200	55.115	27.201	17.676
18.330		2.200	54.061	28.037	17.894
19.330		2.200	53.064	28.873	18.053
20.330		2.200	52.055	29.710	18.227
21.330		2.200	51.078	30.546	18.366
22.330		2.200	50.099	31.383	18.509
23.330		2.200	48.293	32.981	18.717
24.330		2.200	46.502	34.579	18.909
25.330		2.200	44.740	36.177	19.073
26.330		2.200	42.983	37.776	19.231
27.330		2.200	41.232	39.374	19.383
28.330		2.200	39.484	40.972	19.533
29.330		2.200	37.749	42.571	19.669
30.330		2.200	36.007	44.169	19.813
31.330		2.200	34.281	45.767	19.940
32.330		2.200	32.573	47.365	20.050
33.330		2.200	30.895	48.959	20.134
34.330		2.200	29.231	50.541	20.215
35.330		2.200	27.587	52.111	20.290
36.330		2.200	25.962	53.669	20.357
37.330		2.200	24.356	55.215	20.416
38.330		2.200	22.764	56.749	20.473
39.330		2.200	21.195	58.273	20.519
40.330		2.200	19.647	59.785	20.555
41.330		2.200	18.784	60.621	20.581
42.330		2.200	17.928	61.457	20.600
43.330		2.200	17.197	62.173	20.616

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
44.330		2.200	17.165	62.191	20.630
45.330		2.200	17.134	62.210	20.642
46.330		2.200	17.105	62.229	20.652
47.330		2.200	15.980	63.344	20.662
48.330		2.200	14.886	64.434	20.666
49.330		2.200	13.801	65.518	20.666
50.330		2.200	12.722	66.597	20.666
51.330		2.200	11.648	67.670	20.667
0.0	64.707	0.457	98.713	1.283	0.001
0.166		0.913	98.714	1.283	0.001
0.333		1.370	98.678	1.283	0.037
0.499		1.827	97.514	1.283	1.199
0.666		2.283	87.625	1.283	11.088
0.832		2.740	73.020	1.283	25.694
1.832		2.740	71.072	2.567	26.358
2.832		2.740	69.555	3.850	26.591
3.832		2.740	68.705	5.133	26.158
4.832		2.740	66.934	6.416	26.646
5.832		2.740	65.582	7.700	26.713
6.832		2.740	63.832	8.983	27.180
7.832		2.740	62.292	10.266	27.436
8.832		2.740	60.650	11.550	27.795
9.832		2.740	59.016	12.833	28.146
10.832		2.740	57.395	14.116	28.482
11.832		2.740	55.795	15.400	28.799
12.832		2.740	54.211	16.683	29.099
13.832		2.740	53.320	17.354	29.319
14.832		2.740	52.447	18.026	29.520
15.832		2.740	51.573	18.697	29.722
16.832		2.740	50.757	19.369	29.867
17.832		2.740	49.862	20.041	30.090
18.832		2.740	49.116	20.712	30.164
19.832		2.740	47.408	21.995	30.589
20.832		2.740	46.202	23.279	30.511
21.832		2.740	44.585	24.562	30.845
22.832		2.740	43.030	25.845	31.117
23.832		2.740	41.648	27.129	31.216
24.832		2.740	40.100	28.412	31.480
25.832		2.740	38.780	29.695	31.516
26.832		2.740	37.209	30.978	31.804
27.832		2.740	35.950	32.262	31.779
28.832		2.740	34.364	33.545	32.083
29.832		2.740	33.139	34.828	32.024
30.832		2.740	31.569	36.112	32.310
31.832		2.740	30.335	37.395	32.260
32.832		2.740	28.817	38.678	32.496
33.832		2.740	27.542	39.962	32.487
34.832		2.740	26.144	41.245	32.601
35.832		2.740	24.776	42.528	32.686

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
36.832		2.740	23.413	43.811	32.765
37.832		2.740	22.705	44.483	32.801
38.832		2.740	22.017	45.154	32.817
39.832		2.740	21.339	45.826	32.824
40.832		2.740	20.666	46.497	32.824
41.832		2.740	19.997	47.169	32.822
42.832		2.740	19.329	47.840	32.819
43.832		2.740	18.007	49.124	32.857
44.832		2.740	16.676	50.407	32.904
45.832		2.740	15.363	51.683	32.941
46.832		2.740	14.055	52.949	32.982
48.082		2.740	12.434	54.519	33.033
49.332		2.740	10.832	56.074	33.080
50.582		2.740	9.250	57.615	33.121
0.0	69.152	0.457	98.675	1.283	0.040
0.166		0.913	98.674	1.283	0.041
0.333		1.370	98.281	1.283	0.434
0.499		1.827	94.776	1.283	3.939
0.666		2.283	76.526	1.283	22.189
0.832		2.740	63.770	1.283	34.945
1.860		2.740	61.782	2.602	35.613
2.887		2.740	60.387	3.921	35.689
3.915		2.740	59.436	5.240	35.320
4.942		2.740	58.515	6.559	34.922
5.970		2.740	57.140	7.878	34.978
6.998		2.740	55.913	9.197	34.886
8.025		2.740	54.428	10.516	35.051
9.053		2.740	52.791	11.835	35.370
10.080		2.740	51.431	13.154	35.410
11.080		2.740	50.616	13.825	35.554
12.080		2.740	49.860	14.497	35.638
13.080		2.740	49.067	15.168	35.760
14.080		2.740	48.250	15.840	35.905
15.080		2.740	47.519	16.511	35.964
16.080		2.740	46.586	17.183	36.226
17.080		2.740	45.317	18.466	36.211
18.080		2.740	43.785	19.750	36.459
19.101		2.740	42.061	21.060	36.873
20.122		2.740	40.721	22.370	36.903
21.143		2.740	39.283	23.680	37.031
22.163		2.740	37.700	24.990	37.303
23.184		2.740	36.354	26.300	37.339
24.205		2.740	34.925	27.610	37.457
25.226		2.740	33.425	28.920	37.647
26.246		2.740	32.091	30.230	37.671
27.267		2.740	30.634	31.540	37.817
28.288		2.740	29.250	32.850	37.891
29.309		2.740	27.844	34.160	37.987
30.329		2.740	26.458	35.470	38.062

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
31.579		2.740	24.770	37.074	38.147
32.829		2.740	23.083	38.678	38.228
34.079		2.740	21.407	40.282	38.300
35.079		2.740	20.753	40.954	38.283
36.079		2.740	20.097	41.625	38.267
37.079		2.740	19.440	42.297	38.253
38.079		2.740	18.789	42.968	38.232
39.079		2.740	18.138	43.640	38.211
40.079		2.740	17.490	44.311	38.187
41.079		2.740	16.188	45.595	38.205
42.079		2.740	14.875	46.878	38.235
43.079		2.740	13.558	48.161	38.268
44.115		2.740	12.187	49.490	38.309
45.151		2.740	10.804	50.820	38.362
46.186		2.740	9.431	52.149	38.406
47.222		2.740	8.064	53.478	38.444
48.258		2.740	6.708	54.802	38.476
49.293		2.740	5.374	56.116	38.495
50.329		2.740	4.047	57.419	38.519
0.0	71.097	0.457	98.706	1.283	0.009
0.167		0.913	98.703	1.283	0.012
0.333		1.370	97.998	1.283	0.717
0.500		1.827	89.587	1.283	9.128
0.666		2.283	71.668	1.283	27.047
0.833		2.740	59.725	1.283	38.990
1.958		2.740	57.603	2.727	39.667
3.083		2.740	56.166	4.171	39.660
4.208		2.740	55.159	5.614	39.224
5.333		2.740	54.193	7.058	38.745
6.458		2.740	52.727	8.502	38.767
7.583		2.740	51.522	9.946	38.528
8.583		2.740	50.933	10.617	38.446
9.583		2.740	50.308	11.289	38.399
10.583		2.740	49.501	11.960	38.534
11.583		2.740	48.814	12.632	38.549
12.583		2.740	48.103	13.303	38.589
13.583		2.740	47.501	13.975	38.519
14.958		2.740	45.541	15.739	38.714
16.333		2.740	43.625	17.504	38.865
17.374		2.740	42.156	18.841	38.997
18.416		2.740	40.811	20.177	39.005
19.458		2.740	39.404	21.514	39.075
20.499		2.740	37.943	22.851	39.199
21.541		2.740	36.606	24.188	39.198
22.582		2.740	35.176	25.524	39.292
23.582		2.740	33.926	26.808	39.258
24.582		2.740	32.617	28.091	39.283
25.582		2.740	31.251	29.374	39.366
26.582		2.740	29.991	30.658	39.342

Table E-7, continued.
COLUMN 9

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
27.582		2.740	28.711	31.941	39.339
28.582		2.740	27.377	33.224	39.389
29.582		2.740	26.134	34.508	39.349
30.582		2.740	24.811	35.791	39.388
31.582		2.740	23.546	37.074	39.370
32.582		2.740	22.971	37.746	39.273
33.582		2.740	22.375	38.417	39.198
34.582		2.740	21.786	39.089	39.115
35.582		2.740	21.194	39.760	39.035
36.582		2.740	20.603	40.432	38.954
37.582		2.740	20.011	41.103	38.874
38.610		2.740	18.684	42.422	38.883
39.637		2.740	17.373	43.741	38.874
40.665		2.740	16.056	45.060	38.872
41.692		2.740	14.758	46.379	38.851
42.720		2.740	13.446	47.698	38.844
43.748		2.740	12.131	49.017	38.839
44.775		2.740	10.818	50.336	38.833
45.803		2.740	9.499	51.655	38.832
46.830		2.740	8.183	52.974	38.829
47.830		2.740	6.889	54.257	38.840
48.830		2.740	5.601	55.540	38.845
49.830		2.740	4.317	56.823	38.845
0.0	73.172	0.457	98.797	1.283	0.000
0.166		0.913	98.791	1.283	0.000
0.333		1.370	97.644	1.283	1.071
0.499		1.827	83.112	1.283	15.603
0.666		2.283	66.488	1.283	32.227
0.832		2.740	55.407	1.283	43.308
2.020		2.740	53.006	2.807	44.184
3.207		2.740	51.570	4.331	44.096
4.395		2.740	50.696	5.855	43.446
5.582		2.740	49.562	7.379	43.057
6.582		2.740	49.189	8.051	42.757
7.582		2.740	48.536	8.722	42.739
8.582		2.740	48.059	9.394	42.545
9.582		2.740	47.526	10.065	42.405
10.582		2.740	46.941	10.737	42.319
11.582		2.740	46.323	11.408	42.266
12.832		2.740	44.743	13.012	42.240
14.082		2.740	43.125	14.616	42.254

Table E-8.
COLUMN 13

Summed Time	% Root Zone Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.0	57.357	0.457	98.862	1.134	0.0
0.166		0.913	98.844	1.150	0.0
0.333		1.370	98.836	1.156	0.0
0.500		1.827	98.829	1.163	0.001
0.666		2.283	96.040	1.167	2.764
0.833		2.740	94.075	1.169	4.727
1.958		2.740	90.552	2.499	6.912
3.083		2.740	87.884	3.830	8.240
4.208		2.740	85.331	5.160	9.457
5.333		2.740	82.889	6.490	10.562
6.458		2.740	80.557	7.820	11.561
7.583		2.740	78.333	9.151	12.451
8.583		2.740	76.476	10.300	13.158
9.583		2.740	74.687	11.450	13.796
10.583		2.740	72.965	12.600	14.368
11.583		2.740	71.307	13.749	14.876
12.583		2.740	69.713	14.899	15.321
13.583		2.740	68.178	16.049	15.705
14.583		2.740	66.651	17.231	16.049
15.583		2.740	65.153	18.413	16.365
16.583		2.740	63.688	19.596	16.648
17.583		2.740	62.239	20.778	16.914
18.583		2.740	60.815	21.961	17.155
19.583		2.740	59.413	23.143	17.375
20.583		2.740	58.039	24.326	17.565
21.583		2.740	56.665	25.508	17.757
22.583		2.740	55.299	26.690	17.940
23.583		2.740	53.942	27.873	18.114
24.583		2.740	52.595	29.055	18.279
25.583		2.740	51.256	30.238	18.435
26.583		2.740	49.930	31.420	18.579
27.583		2.740	48.608	32.603	18.718
28.583		2.740	47.290	33.785	18.853
29.583		2.740	45.977	34.968	18.984
30.583		2.740	44.668	36.150	19.110
31.583		2.740	43.363	37.332	19.232
32.583		2.740	42.106	38.482	19.339
33.583		2.740	40.862	39.632	19.433
34.583		2.740	39.628	40.781	19.517
35.583		2.740	38.403	41.931	19.591
36.583		2.740	37.185	43.081	19.660
37.583		2.740	35.972	44.230	19.722
38.583		2.740	34.756	45.376	19.792
39.583		2.740	33.543	46.515	19.866
40.583		2.740	32.336	47.647	19.940
41.583		2.740	31.137	48.772	20.015
42.583		2.740	29.946	49.890	20.088
43.583		2.740	28.765	51.001	20.158
44.583		2.740	27.593	52.105	20.226
45.583		2.740	26.431	53.202	20.290

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
46.583		2.740	25.432	54.140	20.351
47.583		2.740	24.568	54.947	20.408
48.583		2.740	23.712	55.751	20.460
49.583		2.740	22.864	56.550	20.508
50.583		2.740	22.024	57.347	20.552
51.583		2.740	21.193	58.139	20.590
52.583		2.740	20.369	58.929	20.624
53.583		2.740	19.536	59.714	20.672
54.583		2.740	18.701	60.497	20.725
55.583		2.740	17.868	61.275	20.779
56.583		2.740	17.829	61.275	20.818
57.583		2.740	17.800	61.275	20.846
58.583		2.740	17.778	61.275	20.868
59.583		2.740	17.760	61.275	20.886
60.583		2.740	17.746	61.275	20.900
61.583		2.740	17.735	61.275	20.911
62.583		2.740	16.942	62.051	20.928
63.583		2.740	16.151	62.824	20.946
64.583		2.740	15.365	63.593	20.963
65.583		2.740	14.587	64.358	20.976
66.583		2.740	13.819	65.121	20.981
67.583		2.740	13.059	65.880	20.981
68.583		2.740	12.302	66.636	20.982
69.583		2.740	11.549	67.390	20.982
70.583		2.740	10.801	68.137	20.982
71.583		2.740	10.058	68.880	20.983
72.583		2.740	9.321	69.616	20.983
73.583		2.740	8.589	70.347	20.984
74.583		2.740	7.863	71.072	20.984
75.583		2.740	7.142	71.792	20.985
76.583		2.740	6.427	72.507	20.986
77.583		2.740	5.718	73.216	20.986
78.583		2.740	5.013	73.919	20.987
79.583		2.740	4.314	74.618	20.987
80.583		2.740	4.313	74.618	20.988
81.583		2.740	4.312	74.618	20.989
82.583		2.740	4.312	74.618	20.989
83.583		2.740	4.311	74.618	20.990
84.583		2.740	4.310	74.618	20.991
85.583		2.740	4.310	74.618	20.991
86.645		2.740	3.572	75.354	20.992
87.708		2.740	2.841	76.085	20.993
88.770		2.740	2.115	76.810	20.993
89.833		2.740	1.395	77.529	20.994
90.895		2.740	0.680	78.243	20.995
0.0	56.451	0.457	98.897	1.099	0.003
0.166		0.913	98.867	1.125	0.003
0.333		1.370	98.849	1.144	0.003
0.500		1.827	98.840	1.154	0.003

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.666		2.283	97.998	1.159	0.832
0.833		2.740	96.663	1.163	2.163
2.083		2.740	92.978	2.641	4.363
3.083		2.740	90.608	3.824	5.542
4.145		2.740	88.219	5.080	6.671
5.208		2.740	85.956	6.336	7.673
6.270		2.740	83.804	7.593	8.569
7.333		2.740	81.746	8.849	9.369
8.333		2.740	79.887	10.032	10.045
9.333		2.740	78.147	11.181	10.634
10.333		2.740	76.482	12.331	11.150
11.333		2.740	74.889	13.480	11.593
12.333		2.740	73.364	14.630	11.967
13.333		2.740	71.900	15.780	12.280
14.333		2.740	70.476	16.929	12.554
15.583		2.740	68.655	18.407	12.896
16.833		2.740	66.857	19.885	13.215
17.866		2.740	65.388	21.107	13.462
18.900		2.740	63.948	22.329	13.678
19.933		2.740	62.506	23.551	13.899
20.966		2.740	61.083	24.773	14.099
22.000		2.740	59.660	25.995	14.300
23.033		2.740	58.246	27.217	14.492
24.066		2.740	56.843	28.438	14.672
25.100		2.740	55.450	29.660	14.843
26.133		2.740	54.066	30.882	15.005
27.166		2.740	52.696	32.104	15.153
28.200		2.740	51.329	33.326	15.298
29.233		2.740	49.966	34.548	15.439
30.266		2.740	48.608	35.770	15.574
31.299		2.740	47.255	36.991	15.705
32.333		2.740	45.907	38.213	15.831
33.333		2.740	44.651	39.363	15.938
34.333		2.740	43.408	40.512	16.030
35.333		2.740	42.175	41.662	16.113
36.333		2.740	40.950	42.812	16.188
37.333		2.740	39.731	43.961	16.256
38.333		2.740	38.517	45.111	16.319
39.383		2.740	37.238	46.316	16.394
40.433		2.740	35.962	47.513	16.472
41.483		2.740	34.693	48.701	16.552
42.533		2.740	33.432	49.883	16.632
43.583		2.740	32.181	51.056	16.709
44.633		2.740	30.940	52.222	16.784
45.683		2.740	29.710	53.381	16.855
46.733		2.740	28.491	54.532	16.923
47.783		2.740	27.575	55.383	16.988
48.833		2.740	26.668	56.230	17.048
0.0	68.048	0.228	97.456	2.341	0.200

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.167		0.457	97.446	2.353	0.198
0.334		0.685	97.445	2.357	0.196
0.500		0.913	97.445	2.359	0.194
0.667		1.142	97.445	2.360	0.192
0.834		1.370	97.443	2.361	0.193
2.084		1.370	94.051	5.317	0.629
3.134		1.370	91.232	7.800	0.964
4.184		1.370	88.348	10.283	1.365
5.234		1.370	85.416	12.766	1.813
6.284		1.370	82.455	15.249	2.290
7.334		1.370	79.477	17.733	2.784
8.334		1.370	76.714	20.032	3.247
9.334		1.370	73.960	22.331	3.702
10.334		1.370	71.217	24.630	4.145
11.334		1.370	68.491	26.930	4.572
12.334		1.370	65.784	29.229	4.979
13.334		1.370	63.100	31.528	5.364
14.334		1.370	60.358	33.893	5.740
15.334		1.370	57.627	36.258	6.106
16.334		1.370	54.907	38.623	6.460
17.405		1.370	52.008	41.157	6.825
18.476		1.370	49.123	43.690	7.176
19.548		1.370	46.252	46.224	7.512
20.619		1.370	43.395	48.758	7.835
21.691		1.370	40.552	51.292	8.144
22.762		1.370	37.722	53.826	8.439
23.834		1.370	34.901	56.359	8.726
25.000		1.370	31.850	59.118	9.017
26.167		1.370	28.814	61.877	9.293
27.334		1.370	25.788	64.636	9.560
28.334		1.370	23.211	66.997	9.777
29.334		1.370	20.660	69.342	9.982
30.334		1.370	18.138	71.673	10.172
31.334		1.370	15.647	73.989	10.348
32.334		1.370	13.192	76.288	10.504
33.334		1.370	10.750	78.587	10.645
34.334		1.370	8.320	80.886	10.776
35.334		1.370	5.899	83.186	10.898
36.334		1.370	3.485	85.485	11.012
37.334		1.370	3.037	85.825	11.121
38.334		1.370	1.300	87.454	11.228
0.0	58.240	0.457	98.868	1.129	0.002
0.167		0.913	98.847	1.145	0.002
0.333		1.370	98.837	1.158	0.002
0.500		1.827	98.831	1.164	0.002
0.667		2.283	97.999	1.168	0.828
0.833		2.740	95.530	1.170	3.293
1.833		2.740	92.729	2.353	4.905
2.833		2.740	90.179	3.535	6.266

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
3.833		2.740	87.838	4.717	7.422
4.833		2.740	85.654	5.900	8.422
5.833		2.740	83.657	7.049	9.268
6.833		2.740	81.797	8.199	9.978
7.833		2.740	80.054	9.349	10.570
8.833		2.740	78.385	10.498	11.090
9.833		2.740	76.850	11.648	11.473
10.833		2.740	75.356	12.798	11.813
11.833		2.740	73.843	13.980	12.144
12.833		2.740	72.344	15.163	12.460
13.833		2.740	70.861	16.345	12.759
14.833		2.740	69.392	17.527	13.046
15.833		2.740	67.935	18.710	13.319
16.833		2.740	66.487	19.892	13.584
17.833		2.740	65.055	21.075	13.834
18.833		2.740	63.631	22.257	14.075
19.833		2.740	62.217	23.440	14.306
20.833		2.740	60.806	24.622	14.534
21.833		2.740	59.409	25.804	14.749
22.833		2.740	58.022	26.987	14.953
23.833		2.740	56.646	28.169	15.147
24.833		2.740	55.278	29.352	15.332
25.833		2.740	53.919	30.534	15.509
26.833		2.740	52.567	31.717	15.678
27.833		2.740	51.223	32.899	15.840
28.833		2.740	49.885	34.082	15.995
29.833		2.740	48.605	35.231	16.125
30.833		2.740	47.338	36.381	16.242
31.833		2.740	46.081	37.530	16.349
32.833		2.740	44.833	38.680	16.447
33.833		2.740	43.592	39.830	16.538
34.833		2.740	42.356	40.979	16.623
35.833		2.740	41.083	42.162	16.714
36.833		2.740	39.806	43.344	16.808
37.833		2.740	38.529	44.525	16.904
38.833		2.740	37.254	45.701	17.002
39.833		2.740	35.989	46.870	17.098
40.833		2.740	34.735	48.031	17.191
41.833		2.740	33.490	49.185	17.281
42.833		2.740	32.257	50.332	17.368
43.833		2.740	31.033	51.472	17.451
44.833		2.740	29.821	52.604	17.531
45.833		2.740	28.618	53.730	17.608
46.833		2.740	27.427	54.848	17.681
47.833		2.740	26.246	55.960	17.750
48.833		2.740	25.075	57.065	17.815
49.833		2.740	23.916	58.163	17.877
50.833		2.740	22.854	59.167	17.934
51.833		2.740	21.994	59.974	17.987

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
52.833		2.740	21.142	60.778	18.035
53.833		2.740	21.100	60.778	18.077
54.833		2.740	21.062	60.778	18.115
55.833		2.740	21.028	60.778	18.149
56.833		2.740	20.996	60.778	18.180
57.833		2.740	20.967	60.778	18.210
58.833		2.740	20.940	60.778	18.237
59.833		2.740	20.113	61.578	18.264
60.833		2.740	19.292	62.374	18.288
61.875		2.740	18.439	63.200	18.315
62.916		2.740	17.577	64.023	18.355
63.958		2.740	16.713	64.841	18.400
64.999		2.740	15.852	65.656	18.446
66.041		2.740	14.998	66.467	18.489
67.082		2.740	14.152	67.274	18.527
68.124		2.740	13.318	68.078	18.557
69.165		2.740	12.497	68.878	18.578
70.207		2.740	11.691	69.674	18.588
71.248		2.740	10.897	70.467	18.588
72.290		2.740	10.107	71.257	18.588
73.331		2.740	9.322	72.041	18.589
74.498		2.740	8.451	72.912	18.589
75.664		2.740	7.586	73.776	18.590
76.831		2.740	6.730	74.631	18.591
77.831		2.740	6.729	74.631	18.591
78.831		2.740	6.729	74.631	18.592
79.831		2.740	6.728	74.631	18.592
80.831		2.740	6.727	74.631	18.593
81.831		2.740	6.727	74.631	18.593
82.831		2.740	6.726	74.631	18.594
83.981		2.740	5.889	75.467	18.595
85.131		2.740	5.059	76.296	18.595
86.281		2.740	4.237	77.118	18.596
87.430		2.740	3.422	77.932	18.597
88.580		2.740	2.613	78.740	18.597
89.580		2.740	1.916	79.436	18.598
90.580		2.740	1.225	80.127	18.599
91.580		2.740	0.538	80.812	18.600
0.0	46.440	0.320	99.130	0.860	0.009
0.167		0.640	98.844	1.146	0.009
0.333		0.960	98.719	1.270	0.009
0.500		1.280	98.634	1.350	0.009
0.666		1.600	98.572	1.412	0.009
0.833		1.920	98.527	1.458	0.009
1.833		1.920	96.835	3.142	0.014
2.833		1.920	95.145	4.827	0.019
3.833		1.920	93.454	6.512	0.026
4.833		1.920	91.760	8.197	0.033
0.0	74.402	0.412	98.674	1.311	0.012

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.167		0.823	98.667	1.311	0.020
0.333		1.235	90.170	1.312	8.340
0.500		1.647	87.651	1.312	10.896
0.666		2.058	77.820	1.312	20.595
0.833		2.470	65.044	1.312	33.415
1.888		2.470	63.522	2.696	33.549
2.944		2.470	62.093	4.081	33.589
3.999		2.470	60.705	5.465	33.589
5.054		2.470	59.141	6.850	33.765
6.110		2.470	57.496	8.234	34.023
7.165		2.470	55.812	9.619	34.319
8.221		2.470	54.112	11.004	34.631
9.276		2.470	52.407	12.388	34.951
10.331		2.470	50.702	13.773	35.269
11.331		2.470	49.154	15.048	35.540
12.331		2.470	47.626	16.323	35.792
13.331		2.470	46.112	17.599	36.030
14.331		2.470	44.610	18.874	36.256
15.331		2.470	43.119	20.149	36.472
16.331		2.470	41.639	21.424	36.676
17.331		2.470	40.106	22.736	36.897
18.331		2.470	38.568	24.048	37.122
19.331		2.470	37.032	25.360	37.346
20.331		2.470	35.500	26.671	37.567
21.331		2.470	33.969	27.983	37.786
22.331		2.470	32.445	29.295	37.998
23.331		2.470	30.927	30.606	38.204
24.331		2.470	29.416	31.918	38.403
25.331		2.470	27.912	33.230	38.595
26.331		2.470	26.405	34.541	38.790
27.331		2.470	24.907	35.853	38.976
28.331		2.470	23.417	37.165	39.154
29.331		2.470	21.933	38.477	39.326
30.331		2.470	20.456	39.788	39.492
31.331		2.470	18.983	41.100	39.652
32.331		2.470	17.525	42.412	39.799
33.331		2.470	16.069	43.723	39.943
34.331		2.470	14.616	45.035	40.083
35.331		2.470	13.220	46.310	40.204
36.331		2.470	11.839	47.585	40.309
37.331		2.470	10.470	48.861	40.402
38.331		2.470	9.113	50.136	40.484
39.331		2.470	7.764	51.411	40.556
40.331		2.470	6.423	52.687	40.621
41.581		2.470	4.688	54.326	40.716
42.831		2.470	2.948	55.966	40.816
43.981		2.470	1.351	57.467	40.910
0.0	72.469	0.275	97.830	1.964	0.204
0.167		0.550	97.832	1.964	0.202

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.333		0.825	97.834	1.964	0.200
0.500		1.100	97.835	1.964	0.199
0.666		1.375	97.761	1.964	0.273
0.833		1.650	97.441	1.964	0.593
1.927		1.650	93.653	4.111	2.232
3.020		1.650	90.234	6.259	3.503
4.114		1.650	87.056	8.407	4.533
5.208		1.650	84.034	10.554	5.406
6.302		1.650	81.117	12.702	6.175
7.395		1.650	78.273	14.849	6.871
8.489		1.650	75.483	16.997	7.512
9.583		1.650	72.739	19.145	8.108
10.583		1.650	70.351	21.054	8.587
11.583		1.650	68.008	22.963	9.020
12.583		1.650	65.701	24.872	9.417
13.583		1.650	63.424	26.781	9.784
14.583		1.650	61.175	28.690	10.124
15.583		1.650	58.950	30.599	10.439
16.583		1.650	56.661	32.563	10.764
17.583		1.650	54.375	34.526	11.086
18.583		1.650	52.096	36.490	11.401
19.583		1.650	49.828	38.454	11.704
20.583		1.650	47.573	40.417	11.994
21.583		1.650	45.329	42.381	12.273
22.583		1.650	43.096	44.344	12.542
23.583		1.650	40.873	46.308	12.801
24.583		1.650	38.655	48.271	13.054
25.583		1.650	36.446	50.235	13.300
26.583		1.650	34.247	52.199	13.534
27.583		1.650	32.057	54.162	13.760
28.583		1.650	29.879	56.126	13.974
29.583		1.650	27.710	58.089	14.178
30.583		1.650	25.542	60.053	14.381
31.583		1.650	23.384	62.016	14.576
32.583		1.650	21.233	63.980	14.762
33.583		1.650	19.091	65.943	14.941
34.583		1.650	17.033	67.852	15.089
35.583		1.650	14.996	69.762	15.216
36.583		1.650	12.974	71.671	15.328
37.583		1.650	10.966	73.580	15.426
38.583		1.650	8.969	75.489	15.513
39.583		1.650	6.981	77.398	15.591
40.583		1.650	4.966	79.322	15.681
41.583		1.650	2.954	81.236	15.778
42.583		1.650	0.950	83.138	15.879
0.0	63.087	0.823	99.334	0.656	0.009
0.167		1.647	99.303	0.656	0.040
0.334		2.165	98.802	0.748	0.449
0.500		2.683	86.448	0.805	12.746

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
0.667		3.201	72.454	0.843	26.700
0.833		3.719	62.361	0.871	36.765
2.000		4.940	46.234	1.421	52.334
3.166		4.940	45.452	2.186	52.349
4.333		4.940	44.731	2.951	52.304
5.458		4.940	44.089	3.689	52.208
6.583		4.940	43.494	4.427	52.064
7.708		4.940	42.844	5.165	51.977
8.833		4.940	42.153	5.903	51.930
9.833		4.940	41.560	6.540	51.885
10.833		4.940	40.969	7.178	51.839
11.833		4.940	40.377	7.816	51.792
12.833		4.940	39.786	8.453	51.746
13.833		4.940	39.195	9.091	51.699
14.833		4.940	38.605	9.729	51.651
15.833		4.940	37.977	10.384	51.623
16.833		4.940	37.342	11.040	51.603
17.833		4.940	36.702	11.696	51.586
18.833		4.940	36.061	12.352	51.572
19.833		4.940	35.418	13.008	51.559
20.833		4.940	34.774	13.664	51.547
21.833		4.940	34.129	14.319	51.536
22.833		4.940	33.483	14.975	51.526
23.833		4.940	32.836	15.631	51.517
24.833		4.940	32.189	16.287	51.508
25.833		4.940	31.541	16.943	51.500
26.833		4.940	30.893	17.599	51.493
27.833		4.940	30.243	18.255	51.486
28.833		4.940	29.594	18.910	51.480
29.833		4.940	28.944	19.566	51.474
30.833		4.940	28.293	20.222	51.469
31.833		4.940	27.642	20.878	51.464
32.833		4.940	26.990	21.534	51.460
33.833		4.940	26.370	22.171	51.442
34.833		4.940	25.758	22.809	51.417
35.833		4.940	25.152	23.447	51.385
36.833		4.940	24.548	24.084	51.351
37.833		4.940	23.947	24.722	51.314
38.833		4.940	23.348	25.360	51.275
39.833		4.940	22.721	26.015	51.246
40.833		4.940	22.088	26.671	51.223
41.916		4.940	21.397	27.382	51.203
42.999		4.940	20.702	28.092	51.187
44.082		4.940	20.004	28.803	51.174
45.166		4.940	19.306	29.513	51.161
46.249		4.940	18.607	30.224	51.150
47.332		4.940	17.905	30.934	51.141
48.415		4.940	17.202	31.645	51.133
49.499		4.940	16.497	32.355	51.127

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
50.582		4.940	15.792	33.062	51.125
51.623		4.940	15.118	33.739	51.123
52.665		4.940	14.447	34.410	51.122
53.706		4.940	13.780	35.078	51.122
54.748		4.940	13.117	35.741	51.121
55.789		4.940	12.459	36.400	51.120
56.831		4.940	11.806	37.054	51.119
57.831		4.940	11.177	37.692	51.111
58.831		4.940	10.553	38.329	51.097
59.831		4.940	9.932	38.967	51.080
60.831		4.940	9.789	39.128	51.061
61.831		4.940	9.737	39.201	51.040
62.831		4.940	9.689	39.271	51.018
64.081		4.940	9.077	39.902	51.000
65.331		4.940	8.530	40.461	50.987
66.364		4.940	8.079	40.920	50.979
67.397		4.940	7.627	41.378	50.973
68.430		4.940	7.176	41.833	50.969
69.464		4.940	6.727	42.286	50.965
70.497		4.940	6.278	42.737	50.962
71.530		4.940	5.831	43.186	50.961
72.563		4.940	5.385	43.633	50.960
73.596		4.940	4.940	44.078	50.959
74.630		4.940	4.497	44.521	50.959
75.663		4.940	4.056	44.962	50.959
76.696		4.940	3.616	45.401	50.960
77.729		4.940	3.177	45.839	50.961
78.762		4.940	2.740	46.274	50.962
79.796		4.940	2.305	46.708	50.964
80.829		4.940	1.871	47.139	50.966
81.829		4.940	1.871	47.139	50.966
82.829		4.940	1.872	47.139	50.965
83.829		4.940	1.875	47.139	50.962
84.829		4.940	1.879	47.139	50.958
85.829		4.940	1.884	47.139	50.953
86.829		4.940	1.889	47.139	50.948
87.954		4.940	1.425	47.607	50.943
89.079		4.940	0.962	48.073	50.940
0.0	63.841	0.457	98.827	1.182	0.00
0.167		0.913	98.827	1.182	0.00
0.333		1.370	98.827	1.182	0.00
0.500		1.827	98.771	1.182	0.045
0.666		2.283	98.409	1.182	0.407
0.833		2.740	82.919	1.182	15.897
1.916		2.740	81.494	2.463	16.041
2.999		2.740	80.165	3.744	16.088
4.083		2.740	78.939	5.025	16.034
5.166		2.740	77.809	6.306	15.883
6.249		2.740	76.667	7.587	15.743

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
7.332		2.740	75.373	8.868	15.756
8.416		2.740	74.029	10.149	15.818
9.499		2.740	72.661	11.430	15.905
10.582		2.740	71.280	12.711	16.005
11.582		2.740	70.000	13.894	16.102
12.582		2.740	68.718	15.076	16.202
13.582		2.740	67.436	16.259	16.301
14.582		2.740	66.154	17.441	16.400
15.582		2.740	64.874	18.623	16.498
16.582		2.740	63.662	19.773	16.560
17.582		2.740	62.466	20.923	16.607
18.582		2.740	61.281	22.072	16.642
19.582		2.740	60.103	23.222	16.670
20.582		2.740	58.933	24.372	16.690
21.582		2.740	57.768	25.521	16.705
22.618		2.740	56.502	26.746	16.747
23.653		2.740	55.226	27.971	16.798
24.689		2.740	53.946	29.195	16.853
25.725		2.740	52.666	30.420	16.908
26.760		2.740	51.386	31.645	16.963
27.796		2.740	50.107	32.869	17.017
28.832		2.740	48.830	34.094	17.069
29.894		2.740	47.521	35.350	17.122
30.957		2.740	46.214	36.607	17.172
32.019		2.740	44.907	37.863	17.222
33.082		2.740	43.603	39.119	17.270
34.144		2.740	42.299	40.375	17.318
35.207		2.740	41.001	41.632	17.358
36.269		2.740	39.703	42.888	17.400
37.332		2.740	38.406	44.144	17.440
0.0	80.543	0.685	99.180	0.788	0.031
0.167		1.216	98.724	0.888	0.387
0.333		1.734	70.333	0.934	28.731
0.500		2.252	54.151	0.959	44.888
0.666		2.771	44.023	0.975	55.001
0.833		3.289	37.086	0.985	61.927
2.083		4.110	28.733	1.774	69.492
3.083		4.110	27.822	2.540	69.637
4.083		4.110	26.955	3.307	69.737
5.083		4.110	26.143	4.073	69.783
6.083		4.110	25.385	4.839	69.774
7.083		4.110	24.677	5.606	69.716
8.083		4.110	24.014	6.372	69.611
9.124		4.110	23.456	7.193	69.348
10.166		4.110	22.802	8.014	69.181
11.207		4.110	22.080	8.836	69.082
12.249		4.110	21.331	9.657	69.010
13.290		4.110	20.567	10.478	68.953
14.332		4.110	19.793	11.299	68.906

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
15.373		4.110	19.012	12.120	68.865
16.415		4.110	18.227	12.941	68.828
17.456		4.110	17.439	13.762	68.795
18.498		4.110	16.649	14.584	68.764
19.539		4.110	15.856	15.405	68.736
20.581		4.110	15.062	16.226	68.708
21.681		4.110	14.223	17.093	68.680
22.780		4.110	13.383	17.960	68.653
23.880		4.110	12.542	18.827	68.627
24.980		4.110	11.700	19.694	68.601
26.080		4.110	10.858	20.561	68.576
27.080		4.110	10.134	21.328	68.533
28.080		4.110	9.421	22.094	68.480
29.080		4.110	8.714	22.861	68.421
30.080		4.110	8.010	23.627	68.357
31.080		4.110	7.310	24.394	68.292
32.080		4.110	6.611	25.160	68.224
33.180		4.110	5.797	26.027	68.171
34.280		4.110	4.975	26.894	68.125
35.380		4.110	4.148	27.761	68.085
36.479		4.110	3.317	28.628	68.048
37.579		4.110	2.483	29.495	68.015
38.579		4.110	1.724	30.284	67.985
39.579		4.110	0.965	31.072	67.956
40.579		4.110	0.205	31.860	67.927
0.0	66.172	0.228	97.904	2.256	0.000
0.166		0.457	97.849	2.311	0.000
0.333		0.685	97.830	2.329	0.000
0.499		0.913	97.820	2.338	0.000
0.666		1.142	97.813	2.343	0.000
0.832		1.370	97.808	2.347	0.000
1.932		1.370	95.317	4.948	0.000
3.032		1.370	92.695	7.550	0.000
4.132		1.370	90.024	10.151	0.000
5.232		1.370	87.308	12.752	0.000
6.332		1.370	84.557	15.354	0.084
0.0	57.551	0.733	99.283	0.713	0.0
0.167		1.467	99.273	0.725	0.0
0.333		2.004	99.110	0.800	0.088
0.500		2.522	98.398	0.849	0.749
0.666		3.041	87.755	0.882	11.360
0.833		3.559	74.977	0.906	24.115
1.833		4.400	59.956	1.469	38.573
2.833		4.400	59.174	2.205	38.618
3.833		4.400	58.447	2.941	38.609
4.833		4.400	57.773	3.678	38.547
5.833		4.400	57.147	4.414	38.436
6.833		4.400	56.566	5.150	38.280
7.833		4.400	55.947	5.866	38.184

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
8.833		4.400	55.314	6.582	38.101
9.833		4.400	54.668	7.298	38.031
10.833		4.400	54.017	8.014	37.966
11.833		4.400	53.364	8.730	37.903
12.833		4.400	52.709	9.446	37.842
13.833		4.400	52.010	10.182	37.805
14.833		4.400	51.302	10.919	37.776
15.833		4.400	50.590	11.655	37.752
16.833		4.400	49.876	12.391	37.729
17.833		4.400	49.161	13.128	37.708
18.833		4.400	48.444	13.864	37.688
19.833		4.400	47.728	14.600	37.668
20.833		4.400	47.011	15.337	37.649
21.833		4.400	46.293	16.073	37.630
22.833		4.400	45.576	16.809	37.611
23.833		4.400	44.858	17.546	37.592
24.833		4.400	44.140	18.282	37.574
25.833		4.400	43.422	19.018	37.555
26.833		4.400	42.704	19.755	37.537
27.833		4.400	41.986	20.491	37.518
28.833		4.400	41.268	21.227	37.500
29.833		4.400	40.550	21.964	37.482
30.833		4.400	39.831	22.700	37.464
31.833		4.400	39.150	23.416	37.429
32.833		4.400	38.479	24.132	37.384
33.833		4.400	37.813	24.848	37.334
34.833		4.400	37.153	25.564	37.278
35.833		4.400	36.494	26.279	37.221
36.833		4.400	35.838	26.995	37.161
37.833		4.400	35.150	27.732	37.112
38.833		4.400	34.454	28.468	37.072
39.853		4.400	33.739	29.220	37.035
40.874		4.400	33.021	29.971	37.001
41.895		4.400	32.300	30.723	36.969
42.916		4.400	31.577	31.475	36.941
43.936		4.400	30.853	32.226	36.913
44.957		4.400	30.128	32.978	36.886
45.978		4.400	29.403	33.730	36.859
46.999		4.400	28.678	34.481	36.832
48.019		4.400	27.951	35.233	36.807
49.040		4.400	27.223	35.985	36.783
50.061		4.400	26.493	36.736	36.762
51.082		4.400	25.762	37.484	36.744
52.332		4.400	24.873	38.395	36.723
53.582		4.400	23.990	39.298	36.702
54.832		4.400	23.114	40.194	36.682
55.832		4.400	22.425	40.910	36.655
56.832		4.400	21.743	41.626	36.620
57.832		4.400	21.066	42.342	36.581

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
58.832		4.400	20.392	43.058	36.539
59.832		4.400	19.720	43.774	36.495
60.832		4.400	19.563	43.977	36.448
61.832		4.400	18.990	44.588	36.411
62.832		4.400	18.519	45.090	36.379
63.832		4.400	18.047	45.591	36.350
64.867		4.400	17.558	46.107	36.324
65.903		4.400	17.068	46.620	36.300
66.939		4.400	16.579	47.131	36.278
67.974		4.400	16.090	47.640	36.258
69.010		4.400	15.602	48.147	36.239
70.045		4.400	15.116	48.651	36.221
71.081		4.400	14.631	49.153	36.204
0.0	67.768	0.457	98.885	1.182	0.000
0.166		0.913	98.885	1.182	0.000
0.333		1.370	98.886	1.182	0.000
0.499		1.827	98.723	1.182	0.093
0.666		2.283	88.668	1.182	10.148
0.832		2.740	73.890	1.182	24.926
1.957		2.740	72.414	2.513	25.072
3.082		2.740	71.042	3.843	25.113
4.207		2.740	69.780	5.173	25.044
5.332		2.740	68.621	6.503	24.873
6.457		2.740	67.553	7.834	24.610
7.582		2.740	66.384	9.164	24.449
8.582		2.740	65.351	10.314	24.332
9.582		2.740	64.307	11.463	24.227
10.582		2.740	63.256	12.613	24.128
11.582		2.740	62.201	13.762	24.033
12.582		2.740	61.146	14.912	23.939
13.582		2.740	60.091	16.062	23.844
14.957		2.740	58.537	17.688	23.772
16.332		2.740	56.966	19.313	23.716
17.457		2.740	55.678	20.644	23.674
18.582		2.740	54.386	21.974	23.635
19.707		2.740	53.093	23.304	23.598
20.832		2.740	51.798	24.634	23.562
21.957		2.740	50.503	25.965	23.527
23.082		2.740	49.207	27.295	23.493
24.145		2.740	47.983	28.551	23.460
25.207		2.740	46.759	29.808	23.428
26.270		2.740	45.534	31.064	23.396
27.332		2.740	44.309	32.320	23.364
28.395		2.740	43.085	33.577	23.332
29.457		2.740	41.859	34.833	23.301
30.520		2.740	40.634	36.089	23.270
31.582		2.740	39.408	37.346	23.239
32.582		2.740	38.314	38.495	23.183
33.582		2.740	37.236	39.645	23.112

Table E-8, continued.
COLUMN 13

Summed Time	Root Zone % Saturated	Summed Infiltration	Percent Storage	% ET	Percent Drainage
34.582		2.740	36.167	40.794	23.031
35.582		2.740	35.105	41.944	22.942
36.582		2.740	34.048	43.094	22.850
37.582		2.740	32.995	44.243	22.753
38.610		2.740	31.859	45.459	22.672
39.637		2.740	30.712	46.674	22.604
40.665		2.740	29.557	47.889	22.543
41.693		2.740	28.397	49.104	22.488
42.720		2.740	27.230	50.320	22.438
43.748		2.740	26.062	51.535	22.391
44.775		2.740	24.892	52.750	22.345
45.803		2.740	23.723	53.966	22.299
46.830		2.740	22.551	55.181	22.255
0.0	77.574	0.550	99.105	0.982	0.000
0.166		1.100	99.057	0.982	0.000
0.333		1.618	86.930	1.001	12.068
0.499		2.136	65.844	1.011	33.143
0.666		2.655	52.991	1.017	45.991
0.832		3.173	44.336	1.021	54.641
1.832		3.300	41.711	1.964	56.324
2.832		3.300	40.668	2.945	56.385
3.982		3.300	39.565	4.074	56.359
5.132		3.300	38.553	5.203	56.241
6.282		3.300	37.625	6.332	56.041
7.432		3.300	36.673	7.462	55.863
8.582		3.300	35.627	8.591	55.780
9.582		3.300	34.751	9.545	55.702
10.582		3.300	33.873	10.500	55.624
11.582		3.300	32.994	11.454	55.548
12.582		3.300	32.115	12.409	55.473
13.582		3.300	31.236	13.363	55.397
14.582		3.300	30.359	14.318	55.320
15.832		3.300	29.187	15.545	55.264
17.082		3.300	28.003	16.772	55.221

Appendix F

NUTRIENT REMOVAL DATA - SOIL WATER SAMPLES

Table F.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
4(17.8)	122180	4.00	0.77	0.90	.	15.00
4(17.8)	1 281	8.00	0.77	0.22	.	13.50
4(17.8)	1 681	23.00	0.77	1.35	.	10.00
4(17.8)	11181	18.00	0.77	1.80	.	19.00
4(17.8)	81581	21.22	1.12	0.85	5.51	16.00
4(17.8)	82281	60.55	1.12	0.70	6.01	3.00
4(17.8)	9 181	35.85	0.90	0.47	5.57	19.00
4(17.8)	91081	15.89	0.86	0.60	5.45	27.00
4(17.8)	91681	38.30	0.64	0.49	6.40	10.00
4(17.8)	92481	23.82	0.43	0.36	6.18	19.00
4(17.8)	93081	22.58	1.50	0.39	6.90	13.00
4(17.8)	10 781	20.77	1.05	0.41	5.65	14.00
4(17.8)	101781	23.21	0.67	0.47	5.88	16.00
4(17.8)	102481	26.61	0.86	0.43	6.08	36.00
4(17.8)	103181	20.94	1.10	0.47	5.97	18.00
5(17.8)	122180	14.00	0.77	0.45	.	11.50
5(17.8)	1 281	9.00	0.77	0.22	.	7.50
5(17.8)	1 681	19.00	0.77	0.22	.	7.00
5(17.8)	11181	22.00	0.77	0.22	.	14.50
5(17.8)	81581	7.04	0.92	0.89	6.22	4.00
5(17.8)	82281	12.03	.	.	.	3.00
5(17.8)	9 281	31.61	0.73	0.54	4.93	4.00
5(17.8)	91681	75.41	.	.	.	1.00
5(17.8)	93081	53.33	1.34	0.46	5.61	4.00
5(17.8)	10 781	62.53	1.12	0.73	4.67	4.00
5(17.8)	101781	46.83	0.53	0.64	5.08	6.00
5(17.8)	102481	28.58	0.74	0.47	5.23	8.00
16(17.8)	121880	5.00	0.77	4.06	.	17.50
16(17.8)	122280	4.00	0.77	1.80	.	12.00
16(17.8)	1 281	15.00	0.77	2.93	.	17.00
16(17.8)	1 681	11.00	0.77	2.93	.	8.00
16(17.8)	11181	11.00	0.77	0.22	.	15.50
16(17.8)	81581	4.52	0.71	0.88	6.25	6.00
16(17.8)	82281	14.51	0.49	0.78	6.41	11.50
16(17.8)	9 281	26.52	0.43	2.61	6.45	11.00
16(17.8)	91081	30.50	0.34	0.86	6.47	10.00
16(17.8)	91681	42.00	0.25	0.39	3.84	8.00
16(17.8)	92481	47.72	0.56	0.90	6.56	16.00
16(17.8)	93081	46.25	0.72	0.78	8.91	11.00
16(17.8)	10 781	50.30	0.90	1.02	6.84	7.00
16(17.8)	101781	76.88	0.45	1.05	5.37	10.00
16(17.8)	102481	116.14	1.00	1.04	6.44	7.00
16(17.8)	103181	146.77	0.31	1.58	7.02	3.50

Table F, continued.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
11(17.8)	1 681	45.00	0.77	0.22	.	5.50
11(17.8)	11181	34.00	0.77	0.22	.	12.50
11(17.8)	81581	2.89	.	87.69	.	11.00
11(17.8)	82281	30.27	0.78	3.19	5.96	7.50
11(17.8)	9 281	35.41	0.64	0.44	6.30	10.00
11(17.8)	91181	23.50	0.40	0.52	5.85	12.00
11(17.8)	92081	31.28	0.19	0.54	6.12	8.00
11(17.8)	92981	27.24	0.52	0.64	6.83	8.00
11(17.8)	93081	32.94	1.01	0.51	6.39	6.00
11(17.8)	10 781	59.72	.	0.97	.	2.00
11(17.8)	10 881	31.33	.	0.62	.	3.00
11(17.8)	101881	31.75	0.58	0.56	6.28	8.00
11(17.8)	102581	33.94	0.54	0.68	6.42	8.00
11(17.8)	11 181	30.41	0.57	0.66	6.16	8.00
12(17.8)	1 681	9.00	0.77	0.22	.	19.00
12(17.8)	11181	23.00	0.77	0.22	.	23.00
12(17.8)	81581	4.97	0.59	0.37	5.05	6.50
12(17.8)	82281	13.73	0.92	0.40	5.17	5.00
12(17.8)	9 281	29.69	0.34	0.45	4.88	20.00
12(17.8)	91181	27.69	0.37	0.32	4.78	19.00
12(17.8)	92081	38.61	0.14	0.42	4.98	17.00
12(17.8)	92981	51.67	0.50	0.42	5.14	12.00
12(17.8)	93081	34.92	1.13	0.40	6.18	12.00
12(17.8)	10 781	30.03	1.03	0.44	4.90	11.00
12(17.8)	10 881	56.08	0.73	0.61	9.50	6.00
12(17.8)	101881	49.00	0.28	0.58	4.57	14.00
12(17.8)	102581	61.11	0.53	0.57	4.81	17.00
12(17.8)	11 181	67.66	0.46	0.51	4.48	16.00
14(17.8)	92981	33.86	0.21	0.36	4.63	14.00
14(17.8)	93081	36.58	0.69	0.26	4.67	17.00
14(17.8)	10 781	11.56	0.92	0.33	5.08	23.00
14(17.8)	10 881	37.83	0.42	0.48	5.12	10.00
14(17.8)	101881	25.94	0.15	0.37	4.56	30.00
14(17.8)	102581	39.82	0.41	0.42	4.60	34.00
14(17.8)	103181	38.13	0.33	0.34	4.45	15.00
14(17.8)	11 181	43.96	0.34	0.42	4.35	.
6(17.8)	121680	13.00	.	.	.	3.00
6(17.8)	11181	15.00	0.77	0.22	.	7.00
6(17.8)	81581	4.95	1.34	0.67	5.70	4.50
6(17.8)	82281	14.32	0.84	0.58	6.00	11.00
6(17.8)	9 281	34.52	1.08	0.68	5.99	6.00
6(17.8)	91281	61.36	1.25	0.98	5.14	4.00
6(17.8)	92081	82.39	0.19	0.82	6.74	4.00

Table F, continued.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
6(17.8)	93081	53.22	0.44	0.42	5.87	5.00
6(17.8)	10 881	38.30	1.00	0.58	6.44	15.00
6(17.8)	101981	83.50	.	0.83	.	3.00
6(17.8)	11 281	43.77	0.83	0.47	5.36	6.00
9(17.8)	121780	10.00	0.77	0.90	.	18.00
9(17.8)	122080	8.00	0.77	0.67	.	.
9(17.8)	122280	10.00	0.77	0.90	.	14.00
9(17.8)	1 681	4.00	0.77	0.22	.	7.00
9(17.8)	11181	16.00	0.77	1.35	.	29.00
9(17.8)	81581	2.39	0.59	0.78	6.03	6.50
9(17.8)	82281	16.55	0.59	0.66	5.90	7.50
9(17.8)	9 281	42.03	0.52	0.78	6.38	19.00
9(17.8)	91181	22.44	0.43	0.86	6.29	18.00
9(17.8)	92081	30.89	0.17	0.70	6.80	17.00
9(17.8)	93081	36.50	0.30	0.51	6.26	11.00
9(17.8)	10 881	32.94	0.65	0.76	6.29	16.00
9(17.8)	101981	42.77	0.69	0.76	6.69	15.00
9(17.8)	102681	44.60	0.65	0.71	6.80	24.00
9(17.8)	11 281	32.78	0.76	0.58	5.97	15.00
10(17.8)	81581	12.28	0.41	0.98	6.75	45.00
10(17.8)	82281	44.00	0.38	1.00	6.66	40.00
10(17.8)	9 281	31.10	0.72	0.88	6.77	38.00
10(17.8)	91181	30.13	0.33	0.63	6.16	26.00
10(17.8)	92081	40.44	0.32	0.61	6.43	31.00
10(17.8)	93081	57.38	0.23	0.55	6.30	20.00
10(17.8)	10 881	50.30	0.80	0.71	6.03	37.00
10(17.8)	101981	45.11	0.75	0.39	7.11	28.00
10(17.8)	102681	60.60	0.58	1.51	7.11	38.00
10(17.8)	11 281	42.69	0.58	0.80	5.55	24.00

Appendix G

NUTRIENT REMOVAL DATA - EFFLUENT SAMPLES

Table G.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
4(70.0)	122980	5.00	0.78	0.22	.	280.00
4(70.0)	11981	5.00	0.78	2.03	.	56.00
4(70.0)	12681	9.00	0.78	32.29	.	10.00
4(70.0)	2 481	7.00	0.78	1.12	.	105.00
4(70.0)	2 981	2.00	0.78	1.12	.	85.00
4(70.0)	21781	9.00	0.78	8.80	.	29.00
4(70.0)	22381	7.00	0.78	5.19	.	30.00
4(70.0)	3 981	4.00	0.78	2.48	.	43.00
4(70.0)	72081	1.53	0.78	1.32	1.86	150.00
4(70.0)	72781	1.85	0.47	0.64	1.80	210.00
4(70.0)	81481	2.46	4.26	0.85	1.79	205.00
4(70.0)	81981	5.31	0.51	1.54	1.61	105.00
4(70.0)	83181	2.91	11.81	7.23	1.25	25.00
4(70.0)	9 881	1.81	0.39	2.41	1.42	74.00
4(70.0)	91081	1.56	4.07	2.86	1.05	42.00
4(70.0)	91481	0.60	0.73	0.73	1.20	84.00
4(70.0)	91681	9.43	3.27	43.63	.	6.00
4(70.0)	92181	3.86	3.18	8.80	1.14	17.00
4(70.0)	92881	1.96	1.62	4.17	1.15	44.00
4(70.0)	10 581	3.30	2.07	5.06	1.16	31.00
4(70.0)	10 781	3.12	0.74	2.30	1.15	65.00
4(70.0)	101681	5.03	1.29	2.50	1.17	66.00
4(70.0)	102281	.	.	9.17	.	22.00
4(70.0)	102781	2.58	.	0.95	4.32	142.00
4(70.0)	11 581	3.98	1.24	2.73	1.35	91.00
4(70.0)	11 681	3.30	0.70	3.00	8.43	14.00
4(70.0)	11 781	3.04	0.48	2.85	7.85	51.00
4(70.0)	11 881	3.74	0.42	2.00	8.62	17.00
4(70.0)	111081	3.52	0.63	2.06	8.60	29.00
5(70.0)	122980	4.00	0.78	0.22	.	280.00
5(70.0)	11981	15.00	0.78	0.67	.	112.00
5(70.0)	12681	4.00	0.78	4.51	.	42.00
5(70.0)	2 481	2.00	0.78	2.48	.	58.00
5(70.0)	2 981	2.00	0.78	1.12	.	82.00
5(70.0)	21781	3.00	0.78	16.48	.	20.00
5(70.0)	22381	6.00	0.78	3.38	.	38.00
5(70.0)	3 981	6.00	0.78	0.90	.	182.00
5(70.0)	72081	2.03	0.05	1.12	1.91	215.00
5(70.0)	72781	6.24	0.25	0.63	1.83	265.00
5(70.0)	81481	3.11	1.24	0.56	1.87	265.00
5(70.0)	81981	2.62	0.92	0.98	1.70	158.00
5(70.0)	83181	1.78	1.62	2.06	1.35	73.00
5(70.0)	9 881	2.91	0.30	0.90	1.54	200.00

Table G, continued.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
5(70.0)	91081	2.16	1.02	0.48	1.20	105.00
5(70.0)	91481	0.77	0.41	0.43	1.08	100.00
5(70.0)	91681	3.86	0.68	6.40	.	11.00
5(70.0)	92181	4.39	0.35	6.56	1.18	22.00
5(70.0)	92881	3.36	0.14	3.81	1.16	46.00
5(70.0)	10 581	3.54	0.14	2.48	1.24	65.00
5(70.0)	10 781	3.11	0.09	1.58	1.24	84.00
5(70.0)	101681	5.36	0.09	1.92	1.28	88.00
5(70.0)	102281	3.38	0.73	5.58	8.30	45.00
5(70.0)	102781	4.62	0.64	0.73	1.54	217.00
5(70.0)	11 581	7.16	0.17	1.83	1.40	115.00
5(70.0)	11 681	4.11	0.16	1.62	8.38	23.00
5(70.0)	11 781	3.62	0.18	1.59	8.14	45.00
5(70.0)	11 881	4.04	0.16	1.58	8.16	21.00
5(70.0)	111081	4.94	0.10	1.51	8.67	34.00
16(70.0)	122980	2.00	1.56	0.45	.	280.00
16(70.0)	11981	.	0.78	.	.	3.00
16(70.0)	12681	3.00	0.78	100.71	.	6.00
16(70.0)	2 481	7.00	0.78	0.90	.	140.00
16(70.0)	2 981	3.00	0.78	6.32	.	31.00
16(70.0)	21781	6.00	0.78	.	.	5.00
16(70.0)	22381	18.00	0.78	.	.	2.00
16(70.0)	3 981	22.00	0.78	.	.	2.00
16(70.0)	72081	1.69	0.02	6.75	1.24	25.00
16(70.0)	81981	3.28	3.25	2.66	1.39	33.00
16(70.0)	83181	2.75	4.55	6.93	1.24	27.00
16(70.0)	9 881	.	.	142.02	.	1.00
16(70.0)	91081	4.21	1.57	5.32	1.06	25.00
16(70.0)	91481	6.54	1.65	12.44	0.95	17.00
16(70.0)	91681	3.37	0.52	1.07	1.18	86.00
16(70.0)	92181	4.50	0.88	1.18	1.11	68.00
16(70.0)	92881	5.44	1.95	3.20	1.14	37.00
16(70.0)	10 581	7.19	5.24	19.08	0.87	14.00
16(70.0)	102281	3.89	1.66	11.46	8.71	22.00
11(70.0)	121780	4.00	3.11	30.25	.	335.00
11(70.0)	122980	5.00	0.78	0.22	.	490.00
11(70.0)	11981	4.00	0.78	0.22	.	285.00
11(70.0)	12681	1.00	0.78	1.12	.	62.00
11(70.0)	2 981	14.00	0.78	2.93	.	43.00
11(70.0)	21781	7.00	0.78	4.51	.	41.00
11(70.0)	22381	4.00	0.78	1.12	.	97.00
11(70.0)	3 981	208.00	0.78	6.54	.	21.00
11(70.0)	72081	4.95	0.07	17.16	1.12	12.00

Table G, continued.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
11(70.0)	72781	4.99	0.47	0.61	1.76	220.00
11(70.0)	81481	3.12	0.80	0.77	1.78	195.00
11(70.0)	81981	19.58	0.26	1.77	1.52	97.00
11(70.0)	83181	2.41	0.86	3.86	1.34	42.00
11(70.0)	9 881	3.50	0.94	3.42	1.28	47.00
11(70.0)	91481	4.56	1.49	16.33	0.95	11.00
11(70.0)	92181	3.07	1.07	3.48	1.17	28.00
11(70.0)	92881	2.97	0.38	10.70	1.21	32.00
11(70.0)	10 581	3.35	2.07	2.90	1.03	54.00
11(70.0)	10 781	4.34	1.32	5.10	1.08	32.00
11(70.0)	101681	4.92	1.47	2.30	1.22	88.00
11(70.0)	102481	5.93	5.16	7.15	.	10.00
11(70.0)	11 681	6.67	0.67	6.99	1.14	29.00
12(70.0)	121780	4.00	3.11	18.96	.	215.00
12(70.0)	122980	5.00	1.56	0.67	.	280.00
12(70.0)	11981	4.00	0.78	0.22	.	345.00
12(70.0)	12681	6.00	0.78	6.77	.	20.00
12(70.0)	2 981	2.00	0.78	0.45	.	180.00
12(70.0)	21781	.	0.78	0.90	.	3.00
12(70.0)	22381	5.00	0.78	3.83	.	37.00
12(70.0)	72081	2.70	0.02	3.54	1.30	38.00
12(70.0)	81481	2.63	0.70	0.92	1.74	175.00
12(70.0)	81981	6.14	1.30	1.87	1.62	78.00
12(70.0)	83181	1.87	5.00	3.14	1.30	40.00
12(70.0)	9 881	4.61	12.16	9.48	1.09	12.00
12(70.0)	92181	4.46	12.00	32.02	0.93	9.00
12(70.0)	92881	3.44	8.72	19.00	1.01	15.00
12(70.0)	10 581	7.42	38.31	53.55	0.84	8.00
12(70.0)	102481	3.30	3.71	5.49	.	12.00
12(70.0)	11 681	4.58	14.02	10.46	1.12	20.00
14(70.0)	11981	10.00	0.78	148.58	.	50.00
14(70.0)	12681	1.00	0.78	0.22	.	300.00
14(70.0)	2 981	2.00	0.78	0.22	.	305.00
14(70.0)	21781	14.00	0.78	3.38	.	10.00
14(70.0)	22381	3.00	0.78	4.51	.	33.00
14(70.0)	3 981	5.00	0.78	0.90	.	112.00
14(70.0)	72081	26.44	0.57	4.56	1.29	31.00
14(70.0)	81981	1.99	0.28	10.54	1.21	18.00
14(70.0)	83181	12.87	.	.	.	3.00
14(70.0)	9 881	12.90	101.24	566.47	.	2.50
14(70.0)	92181	.	.	508.11	.	2.00
14(70.0)	92881	.	.	275.22	.	3.00
14(70.0)	10 581	.	.	656.70	.	3.00

Table G, continued.

Column & (Depth, cm)	Date	Cl^- mg/L	NH_4^+-N mg/L	NO_3^--N mg/L	pH	Volume mL
6(70.0)	122980	5.00	1.56	0.22	.	485.00
6(70.0)	11981	5.00	0.78	156.26	.	22.00
6(70.0)	12681	5.00	0.78	6.09	.	25.00
6(70.0)	2 481	10.00	0.78	3.83	.	50.00
6(70.0)	21781	17.00	0.78	106.35	.	6.00
6(70.0)	72081	7.58	0.02	8.10	1.38	22.00
6(70.0)	81481	4.19	1.09	0.73	1.79	175.00
6(70.0)	81981	10.81	1.27	1.98	1.53	125.00
6(70.0)	83181	2.26	3.10	1.14	1.48	122.00
6(70.0)	9 881	8.22	2.60	4.35	1.36	55.00
6(70.0)	91481	6.21	3.53	5.67	1.01	26.00
6(70.0)	92181	5.55	4.64	4.74	1.18	33.00
6(70.0)	92881	8.31	3.48	6.32	1.10	33.00
6(70.0)	10 581	.	97.57	151.72	.	4.00
9(70.0)	122980	4.00	0.78	3.61	.	120.00
9(70.0)	11981	13.00	0.78	32.06	.	34.00
9(70.0)	12681	2.00	0.78	1.80	.	450.00
9(70.0)	2 481	3.00	0.78	2.25	.	215.00
9(70.0)	2 981	2.00	0.78	1.58	.	200.00
9(70.0)	21781	4.00	0.78	2.25	.	92.00
9(70.0)	22381	5.00	0.78	5.19	.	38.00
9(70.0)	3 981	44.00	0.78	1.35	.	127.00
9(70.0)	72081	16.83	0.01	15.65	1.24	11.00
9(70.0)	81481	1.14	0.98	1.05	1.71	120.00
9(70.0)	81981	249.17	0.31	10.29	1.29	26.00
9(70.0)	83181	1.57	0.76	6.76	1.26	29.00
9(70.0)	9 881	3.13	1.59	11.97	1.17	30.00
9(70.0)	91481	6.21	3.53	5.67	1.01	26.00
9(70.0)	92181	5.55	4.64	4.74	1.18	38.00
9(70.0)	92881	2.24	1.90	4.19	1.12	41.00
9(70.0)	10 581	5.77	11.06	64.13	0.94	7.00
9(70.0)	111181	2.24	1.75	1.29	1.53	132.00
10(70.0)	72081	1.25	0.52	1.03	1.58	135.00
10(70.0)	72781	13.29	0.31	1.08	1.60	110.00
10(70.0)	81481	2.35	0.63	0.90	1.70	160.00
10(70.0)	81981	5.29	0.28	1.82	1.48	77.00
10(70.0)	83181	2.09	0.52	2.42	1.36	58.00
10(70.0)	9 881	2.65	0.28	1.79	1.32	94.00

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WASTEWATER TREATMENT IN SOIL: EFFECT OF RESIDENCE TIME

by

William Lawson Magette

(ABSTRACT)

A laboratory study was conducted to determine nitrogen removal rates from a land-applied wastewater as a function of the length of time the wastewater remained in the root zone. A digital simulation model was used as an aid in describing soil water (and wastewater) movement through the root zone under wet conditions (i.e. root zone 50-75% saturated). A procedure was developed to predict the rate and volume of drainage as a function of initial soil moisture content, amount of liquid applied, and time after liquid application. An exact relationship between nitrogen removals and wastewater residence time in the root zone could not be developed. However, removals of up to 95% of applied NH_4-N were demonstrated in an 18-cm deep root zone with residence times as short as 2 hours. The exact nature of these removals was not determined.